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Project Management and Construction Project's Completion: Evidence from Malaysian Small, Medium and Large Firms

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Abstract: This research examined the practice of project management in facilitating construction project's completion in Malaysia. Data from small (G2), medium (G4) and large (G7) construction firms were analysed using the Structural Equation Modeling's (SEM), Partial Least Square (PLS). The result showed similarities and differences of practices between the three sized firms. Large firms seem to be executing more elements of project management than the small and medium sized firms and this seem to lead to higher completion estimations. In summary, Malaysian construction firms are users of project management framework, amidst differing importance level. It is proposed that the government pushes the right button to centralise and formalise project management usage by construction firms of all sizes.

Key words: Project management, construction projects, lifecycle, SEM-PLS, Malaysia, medium and large firms

INTRODUCTION

The growth of an economy is contingent upon numerous factors. Stimulus projects such as construction are known to be such a factor. Stimulus projects are often plagued by non-completion problem, characterised by off the scope, schedule and budget issues (Alinaitwe *et al*., 2013; Akanni *et al*., 2015; Kwatsima, 2015). Construction projects in Malaysia are not exempted in this context.

Since mid-1990s, numerous construction project failure cases have been reported in Malaysia. The abandonment of the RM1.5 billion Plaza Rakyat Project in 1998 (Jayaraj, 2009), stoppage of major housing projects valued in billions of Ringgit (Rahman *et al*., 2009), delays (Endut *et al*., 2009) and massive cost overrun of public facility projects (Memon *et al*., 2011; Nie, 2013) have been extensively highlighted. Problems in construction projects are not only felt by investors but also buyers (Perumal, 2009), creditors (Kong, 2009) and government (Rahman *et al*., 2016).

Academics sought to explore why abandonment, delays and cost overrun takes the centre stage in Malaysian construction projects. Issues such as shoddy workmanship (Endut *et al*., 2009; Memon *et al*., 2011; Memon and Rahman, 2014), weak scheduling (Zin *et al*., 2008; Elias and Ismail, 2012), poor procurement process (Takim and Adnan, 2008; Jaffar and Radzi, 2013; Chong and Preece, 2014) and weak risk management analysis (Yusuman *et al*., 2008; Adnan *et al*., 2008; Siang and Yih, 2012; Rahman *et al*., 2016) were found to be among the key reasons for failures. These issues predominantly are elements of a project management framework. Does this mean, that Malaysian construction firms are non-committed to efficient project management?

Project management offers various tools, techniques and knowledge in planning, managing and controlling a project's lifecycle (Scott, 2016). The application of project management tools, techniques and knowledge is intended to eliminate potential problems and challenges before the implementation of a project. When projects are underway, the application of project management tools, techniques and knowledge will control problems that arise and in turn minimise adverse implications (Archibald and Archibald, 2016; Turner, 2016).

The application of project management in Malaysian construction projects began since the commencement of several mega projects (such as the Petronas Twin Towers and Kuala Lumpur International Airport) in 1990's. In fact, the Malaysian government have adopted project management framework in their stimulus project's strategic planning (Ting *et al*., 2009). Nevertheless, recent literature (Srivannaboon and Milosevic, 2006) suggests infancy adoption of project management framework to facilitate completion of construction projects by the industry players. This is quite the opposite of the

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practices elsewhere in which construction projects is tightly underpinned by project management and its framework.

This research thus aims to examine the role of project management's framework in facilitating successful completion of construction projects in Malaysia. Such an examination will be done with construction firms of different sizes, namely small, medium and large. In other words, this research will examine the extent small, medium and large construction firms are employing project management's framework in construction undertaking.

MATERIALS AND METHODS

This research employed the quantitative research approach with survey as the primary tool. The sampling for the research was done by using the classification of construction company contractor's grade as shown in Table 1.

For the purpose of this research, G2, G4 and G7 contractors (classified based on their tendering capacity) are termed as small, medium and large firms. The contractors were sampled using Raosoft (with a margin of error of 5%) and were sized as follows:

- G2 (small): 370 construction firms
- G4 (medium): 342 construction firms
- G7 (large): 354 construction firms

A systematic random sampling gap procedure was used to select the samples. The nth company of 25th, 9th and 12th interval were selected for G2, G4 and G7, respectively.

The measurement scales were underpinned within the Project Management Body of Knowledge's (PMBOK) framework. A total of 31 items were used in the questionnaire and framed within the following constructs:

- Project integration
- Project scope management
- Time management
- Cost management
- Quality management
- Human resource management
- Communication management
- Risk management
- Procurement management
- Safety management
- Environmental management
- Financial management
- Claim management

Table 1: Classification of construction company contractors and their registration with CIDB

Grades	Tendering capacity	No. of contractors
G2	Not exceeding RM500,000	9,436
G4	Not exceeding RM3,000,000	3,096
G7	No limit	4,473

The key informant data collection approach was used with one senior management team personality became the contact point and the respondent as well. A survey package (with return self-addressed envelope) was sent to the respondents on 15th April, 2016.

The Structural Equation Modelling (SEM) Partial Least Square (PLS) analytics was used to analyse the data. Three separate estimation models were designed to fit small, medium and large construction firms.

Theoretical framework: Projects have been defined differently by various researchers over the years (Ohara, 2005; Kerzner, 2009). In this study, a project is defined as a temporary group of activities designed to produce a unique product, service or result (Project Management Institute, 2013). A project is temporary in nature because it has a definite beginning and finish time, defined scope and limited resources. A project is also unique in that, it is not a routine operation but a specific set of operations designed to accomplish a singular goal.

The success of a project is contingent upon effective project management. Project management is applied on projects to optimise efficiency and effectiveness. Efficiency looks at maximising output for a given level of input and effectiveness means achieving the goals or objectives; both are goal-oriented practices related to achieving success (Belout, 1998). Thus, project management is a specialised form of management, similar to other functional strategies that are used to accomplish a series of business goals, strategies and work tasks within a well-defined schedule and budget (Srivannaboon and Milosevic, 2006).

Several empirical studies showed the importance of project management implementation toward successful completion of construction projects (Hills *et al*., 2008; Shehu *et al*., 2016; Koon, 2016; Eynon, 2016). The general consensus in these studies is the deployment of issues such as revision of a project's scope to avoid delays (Ranns and Ranns, 2016); effective procurement of essential material and machineries and its delivery to the site; timely payments to vendors and claims from subcontractors; inspection and quantities verified (Cunningham, 2016; Ward, 2016). In addition, the importance of the human resources department in

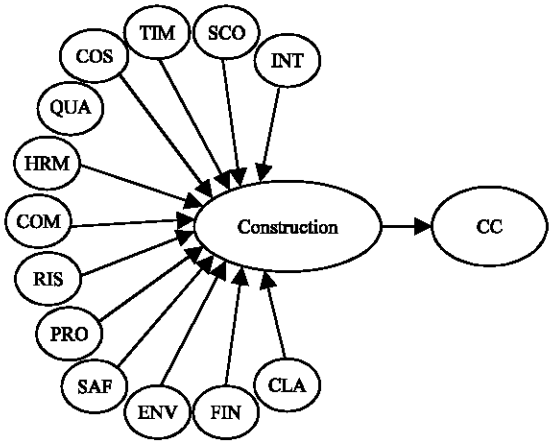

Fig. 1: The research model

ensuring employees sufficiency has also been mentioned. Important resources maintenance and adherence to construction safety were predominantly spoken of too (Wanberg *et al*., 2013; Love *et al*., 2016). Based on this background, the following hypothesis is assumed for this research purpose (Fig. 1):

- H_1: all the 13 project management elements have significant influences for construction project's success and will differ according to the size of operation

RESULTS AND DISCUSSION

By 20th August 2016, the following response rates were obtained:

- G2: 60 respondents (16%)
- G4: 68 respondents (19%)
- G7: 74 respondents (20%)

The SEM-PLS estimation models showed varying results. Only 24 elements of PMBOK's project management's framework seemed to be vital for small (G2) and medium sized construction firms (G4) as opposed to 28 elements for large (G7) firms. This was denoted by the factor loadings value of more than 0.707. The analysis then measured the significance and impact of each of these elements (in each firm cohort) toward successful completion of construction projects (the dependent factor) (Table 2-4).

In terms of the dependent variables outer model estimation, the composite reliability values were more than 0.80 with the AVE values above 0.50. Hence, this indicates a good relationship between the constructs and their indicators in all cohorts. The AVE^2 values were higher than the values of the correlations, indicating that the constructs were valid and reliable (Table 5-7).

The inner model estimations for G2, G4 and G7 are given in Table 8-10. Note that Y refers to the construction activity and CC infers completion of the

Table 2: Outer model estimation for independent items for G2 firms

Items	Load	Composite reliability	AVE	AVE^2
Construction completion (DV)				
YA3	0.801	0.971	0.597	0.772
YA4	0.726	-	-	-
YC6	0.782	-	-	-
YD3	0.780	-	-	-
YE2	0.718	-	-	-
YE3	0.742	-	-	-
YF2	0.801	-	-	-
YF3	0.739	-	-	-
YF4	0.797	-	-	-
YG5	0.902	-	-	-
YH2	0.730	-	-	-
YH6	0.866	-	-	-
YI2	0.770	-	-	-
YI3	0.730	-	-	-
YI4	0.789	-	-	-
YJ2	0.866	-	-	-
YJ3	0.809	-	-	-
YK2	0.727	-	-	-
YK3	0.700	-	-	-
YL2	0.726	-	-	-
YL3	0.732	-	-	-
YM1	0.718	-	-	-
YM2	0.789	-	-	-

Table 3: Outer model estimation for independent items for G4 firms

Items	Load	Composite reliability	AVE	AVE^2
Construction completion (DV)				
YA3	0.845	0.977	0.644	0.802
YA4	0.788	-	-	-
YA5	0.770	-	-	-
YC6	0.789	-	-	-
YD3	0.819	-	-	-
YE2	0.777	-	-	-
YE3	0.790	-	-	-
YF2	0.845	-	-	-
YF3	0.756	-	-	-
YF4	0.802	-	-	-
YG5	0.906	-	-	-
YH2	0.754	-	-	-
YH6	0.867	-	-	-
YI2	0.832	-	-	-
YI3	0.790	-	-	-
YI4	0.797	-	-	-
YJ2	0.878	-	-	-
YJ3	0.778	-	-	-
YK2	0.742	-	-	-
YK3	0.745	-	-	-
YL2	0.788	-	-	-
YL3	0.774	-	-	-
YM1	0.812	-	-	-
YM2	0.797	-	-	-

Table 4: Outer model estimation for independent items for G7 firms

Items	Load	Composite reliability	AVE	AVE^2
Construction completion (DV)				
YA4	0.848	0.98	0.643	0.802
YA5	0.842	-	-	-
YA6	0.813	-	-	-
YB4	0.788	-	-	-
YB5	0.806	-	-	-
YC8	0.830	-	-	-
YC9	0.833	-	-	-
YD3	0.823	-	-	-
YE2	0.827	-	-	-
YE3	0.737	-	-	-
YF2	0.812	-	-	-
YF3	0.718	-	-	-
YF4	0.766	-	-	-
YG2	0.824	-	-	-
YG3	0.750	-	-	-
YH2	0.813	-	-	-
YH6	0.810	-	-	-
YI3	0.811	-	-	-
YI4	0.807	-	-	-
YI5	0.861	-	-	-
YJ2	0.809	-	-	-
YJ3	0.809	-	-	-
YK2	0.771	-	-	-
YK3	0.737	-	-	-
YL2	0.815	-	-	-
YM3	0.832	-	-	-
YM4	0.742	-	-	-

Table 5: Outer model estimation of dependent variable for G2 firms

Items	Load	Composite reliability	AVE	AVE^2
Construction completed (DV)				
CC2	0.786	0.889	0.617	0.785
CC3	0.793	-	-	-
CC4	0.797	-	-	-
CC5	0.811	-	-	-
CC7	0.741	-	-	-

Table 6: Outer model estimation of dependent variable for G4 firms

Items	Load	Composite reliability	AVE	AVE^2
Construction completed (DV)				
CC2	0.870	0.911	0.674	0.821
CC3	0.848	-	-	-
CC4	0.830	-	-	-
CC5	0.839	-	-	-
CC7	0.709	-	-	-

Table 7: Outer model estimation of dependent variable for G7 firms

Items	Load	Composite reliability	AVE	AVE^2
Construction completed (DV)				
CC1	0.813	0.942	0.622	0.789
CC2	0.844	-	-	-
CC3	0.797	-	-	-
CC4	0.821	-	-	-
CC5	0.773	-	-	-
CC6	0.797	-	-	-
CC7	0.758	-	-	-
CC8	0.772	-	-	-
CC9	0.790	-	-	-
CC10	0.712	-	-	-

projects. It is evident that, the path relationships between the independent and dependent variables in all the three size varying construction firms are statistically significant as indicated by the beta (i.e., more than 0.30 values). The estimated models are stable

Table 8: Inner model estimation for G2 firms

Path hypothesis test	Y→CC
β	0.72
t-value	14.56
R^2	0.51
Q^2	0.60
Redundancy	0.42
GoF	0.55

Table 9: Inner model estimation for G4 firms

Path hypothesis test	Y→CC
β	0.61
t-value	7.18
R^2	0.37
Q^2	0.64
Redundancy	0.23
GoF	0.49

Table 10: Inner model estimation for G7 firms

Path hypothesis test	Y→CC
β	0.82
t-value	17.40
R^2	0.66
Q^2	0.62
Redundancy	0.40
GoF	0.64

and have valid goodness of fit. This infers that the essential independent indicators (i.e., 24 elements for G2 and G4 and 28 elements for G7) have had significant influence toward construction project's completion. Table 11 shows the summary of the importance elements within the 13 project management core areas.

Summary: The following summary (Table 12) is observed of the SEM-PLS estimations. It is evident, through the t-statistics value that the 28 elements inherent within the 13 project management framework seemed to have played different roles in completion of the projects carried out by the small, medium and large construction firms in Malaysia. G7 firms (large) have the highest t-statistics (i.e., 17.4) while G4 (medium) is with the lowest (i.e., 7.18). This infers that the 28 items within the 13 project management framework have contributed more toward the successful completion of construction projects than G2 and G4. Analysis of the differences between the three firms indicates the following:

- G7 firms execute project scope management while G2 and G4 are not carrying this out
- G7 firms are focussed on two additional activities within communication management. These activities are related to information distribution and performance reporting. G2 and G4 are only into performance reporting
- G7 firms are undertaking claim prevention and claim resolution activities within their project management while G2 and G4 are not

Table 11: Summary of core elements

Project management elements	Important factors for G2 firm's completion of projects	Important factors for G4 firm's completion of projects	Important factors for G7 firm's completion of projects
Project integration management	Direct and manage project execution Monitor and control project work	Direct and manage project Execution Monitor and control project work Integrated change control	Direct and manage project Execution Monitor and control project work Integrated change control
Project scope management	NA	NA	Scope verification Scope change control
Project time management	Schedule control Progress monitoring	Schedule control Progress monitoring	Schedule control Progress monitoring
Project cost management	Cost control	Cost control	Cost control
Project quality management	Performance quality assurance Perform quality control	Perform quality assurance Perform quality control	Perform quality assurance Perform quality control
Project human resource management	Acquire project team Develop project team Manage project team	Acquire project team Develop project team Manage project team	Acquire project team Develop project team Manage project team
Project communication management	Performance reporting	Performance reporting	Information distribution Performance reporting
Project risk management	Risks identification Risk monitoring and control	Risks identification Risk monitoring and control	Risks identification
Project procurement management	Select sellers Contract administration Contract closure	Select sellers Contract administration Contract closure	Request sellers responses Select sellers Contract administration
Project safety management	Perform safety assurance Perform safety control	Perform safety assurance Perform safety control	Perform safety assurance Perform safety control
Project environmental management	Perform environmental assurance Perform environmental control	Perform environmental assurance Perform environmental control	Perform environmental assurance Perform environmental control
Project financial management	Perform financial control Perform financial administration and records	Perform financial control Perform financial administration and records	Perform financial control
Project claim management	Claim identification Claim quantification	Claim identification Claim quantification	Claim prevention Claim resolution

Table 12: Summary of SEM-PLS estimations

Variables	G2	G4	G7
Beta	0.72	0.61	0.82
t-statistics	14.56	7.18	17.4
No of important elements	24	24	28
Project integration	2	4	4
Project scope	-	-	2
Time management	2	2	2
Cost management	1	1	1
Quality management	2	2	2
Human resource management	3	3	3
Communication management	1	1	2
Risk management	2	2	1
Procurement management	3	3	3
Safety management	2	2	2
Environment management	2	2	2
Financial management	2	2	1
Claim management	2	2	2

CONCLUSION

This research has identified that project management does contribute to construction project's success. Taking from Pareto's principles, 80% of the solution is in 20% of the issues. Project management knowledge could be the 20% which is missing in the Malaysian construction companies. Therefore, when construction companies start using these knowledge assets in the construction activities, it can be assured that the problems currently of cost overrun, project delays, abandonment and scope creep would significantly be reduced.

The research also found that construction project's project management practice in Malaysia differs based on the size of the firm. While the small and medium sized firms seem to have limited differences in their practice, large firms certainly undertake more activities of project management. The small and medium and sized construction companies do not carry out concept and detailed design. As the findings indicate, the cohorts could have been sub-contractors or specialised contractors. In the case of government-awarded contracts, the detailed design stage is to have been carried out by the main contractor and/or consultants.

In essence, small and medium sized firms should emulate the specific practices undertaken by large construction firms with a view of enhancing the successful completion of the projects. This is because project management is a strategic asset. Organisations, project teams, project managers and executives, must learn how to focus on the construction project execution

to achieve the business results for the organisation which include improved profit, additional growth and improved market position.

LIMITATIONS

The central limitations of this research revolve around the collection of data that involved large, medium and small construction companies. There is a possibility that the project management processes might have varied slightly or to a certain extent should there have been sufficient responses from large construction companies. In view of this, future research is advocated, commencing with an application of the current framework to assess and compare variances to the findings in this study.

RECOMMENDATIONS

In practice the following initiatives are proposed, especially in relation to small and medium sized firms: all government construction projects should be awarded to construction companies with certified and registered project managers only.

The government should incentivise the contractors by accounting and itemising the cost of engaging competent construction project managers into the bills of quantities. This arrangement will not affect the profit margin of the contractors while at the same time the public, who are the end users will benefit from better infrastructure which completes on time or even ahead of time.

Intensify project management courses throughout Malaysia for construction personnel's. A merit system can be adopted to compel construction companies to send their personnel's for periodic training. The trainings should lead to a competency certification to augment the participant's interest. Contractors operating as private project developers should be encouraged to adopt and apply proper project management.

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