Journal of Engineering and Applied Sciences 12 (Special Issue 3): 6456-6461, 2017
ISSN: 1816-949X

Determining Success Factors Influencing Construction Project in Northern Malaysia

[1]Chan Hun Beng, [1]Nor Janna Binti Tammy, [1]Norhalifah Binti Ramlee
[2]Siti Rashidah Binti Mohd Nasir, [1]Raja Nor Husna, [1]Binti Raja Mohd Noor,
[1]Adhilla Binti Ainun Musir and [1]Nurulzatushima Binti Abdul Karim
[1]Faculty of Civil Engineering, Universiti Teknologi Mara Cawangan Pulau Pinang,
13500 Permatang Pauh, Pulau Pinang, Malaysia
[2]Faculty of Civil Engineering, Universiti Teknologi Mara (UiTM),
40450 Shah Alam, Selangor, Malaysia

Abstract: Unsuccessful construction projects will affect the reputation of contractors as they give negative impacts to the other players in construction industry. Thus, in order to avoid this problem in the future, it is necessary to find the solution for project success. The objectives of this research are to identify the Critical Success Factors (CSFs) that influence the success of construction projects in Northern Malaysia and determine the relationships among the success factors and success criteria. Quantitative method was adopted and questionnaires were sent to the construction's players. Partial Least Square (SmartPLS 3.0); Structural Equation Modeling (SEM) was used to determine the most significant factors that influenced the construction project success. At the end of this study, the success factors model for construction projects will be determined. This model can help to evaluate the prediction of construction projects success and also could help the construction's players to investigate the probability of the construction projects success. This model also can assist the Malaysian construction industry in the future to avoid the problem of project not complete on time, over budget or project subjected to termination. This research also intended to help in reducing a project cost as the model output can be used as a benchmark when the contractors analyze the factors of a project success. Finally, it may reduce the number of incomplete projects in the future.

Key words: Success factors, construction project success, structural equation modeling, critical success factors, significant factors, model

INTRODUCTION

Malaysia faces a serious issue on the success of construction projects as around 417(17.3%) of government projects were not completed on time and 177(2.7%) of residential projects were not completed or abandoned from Jan 2003 to June 2012, while there were 191 residential projects were delayed in 2013 (Rahman *et al*., 2013). Even though the total number of housing projects not completed on time is small, they give negative impacts to the achievement and sosio-economic development of Malaysian (Rahman *et al*., 2013). So, in-depth research on the success factors is necessary in order to get a better understanding in solving the problem of construction completion on time.

For this research, Northern Malaysia was chosen as the research area in order to determine the success factors for construction projects. Northern Malaysia is one of the developing areas and the construction industry in this area is rapidly growth thus, the perspective of construction project success in this area is important to be considered. The Malaysian Government is currently pumping in RM20 billion worth of construction investments into Koridor Utara to improve international and regional connectivity.

Project success performance and success factors: The project success performance and the success factors are depend on the project objectives, project nature and the project environment (Gunathilaka *et al*., 2013). Project success performance is a dominating performance indicators of the "Iron-triangle" cost, time and quality (Gunathilaka *et al*., 2013; Alzahrani and Emsley, 2013). Some researchers (Steinfort and Walker, 2007) categorized these success criteria into four groups which are time dependent: internal project objectives (efficiency during

Corresponding Author: Chan Hun Beng, Faculty of Civil Engineering, Universiti Teknologi Mara Cawangan Pulau Pinang, 13500 Permatang Pauh, Pulau Pinang, Malaysia

Table 1: Main success performance (DV)

Items	Criteria	Mean
TIME3	The importcent of work approval during pre-construction (time planning)	4.63
TIME1	A good time management by contractor to reduce the risk of time overrun (time management)	4.60
TIME2	The accuracy of project time estimation (time planning)	4.52
COST4	The contractor's ability in managing cost can affect the project cost (cost management)	4.51
TIME7	Contractor must follow the planning and schedule to ensure the smoothness of project (schedule management)	4.47
TIME6	Follow the schedule time is very important in construction project to avoid the time overrun (schedule management)	4.46
TIME5	The design changes during construction affect the construction progress (schedule management)	4.45
QUAL3	The commitment by contractors during construction leads to the quality of workmanship (service quality)	4.44
COST1	Deficiency in cost estimates preparation by quantity surveyor can affect the construction cost	4.39
TIME4	Consultant commitment in design preparation (time planning)	4.35

the project); benefit to customers (effectiveness in the short term); direct contribution (in the medium term) and future opportunities (in the long term). The overall achievement of project goals contributed to construction project success. However, client satisfaction was also considered as an important priority in the success criterion of any construction project success.

The success performance for this study is focus on cost, time and quality from the perspective of clients, consultants and contractors. This success performance is considered as Dependent Variable (DV). Most criterions in project success were evaluated by cost, time and quality (Gunathilaka *et al*., 2013). Based on previous studies of the success factors, 28 criteria were identified. Further, mean rank analysis shortlisted 10 main criteria (Gunathilaka *et al*., 2013; Alzahrani and Emsley, 2013; Steinfort and Walker, 2007; Alias *et al*., 2014; Tmeemy *et al*., 2011; Rad, 2003; Han *et al*., 2011; Takim, 2009). Then, these 10 main success criteria were considered as Dependent Variables (DV) are shown in Table 1.

The project success factors are elements that affecting the construction project (Gunathilaka *et al*., 2013). The success factors are classified as contribution factors in order to ensure the successful completion of the construction project (Steinfort and Walker, 2007). Table 2 shows the success factors and the critical success factors. Critical Success Factors (CSFs) is the term which is defined as factors to predict projects success and critical in projects delivery (Sanvido *et al*., 1992). CSFs are a special class of Project Success Factors (PSFs) and CSFs particularly depend on the project objectives

Table 2: Critical success factors (IV)

Items	Factors
MGT1	The construction project that complete on time, budget and specification can satisfy the client
MGT2	Client's expectations on quality should be focus by the project team in order to meet client satisfaction
MGT3	The contractor's abilities to cooperate will satisfied the client
MGT4	The skills of contractors workers will satisfied the client
MGT5	The commitment of project manager is very important in determine the project run smoothly
MGT6	The good relationship between project manager and stakeholders can ensure the project run smoothly
MGT7	The project manager with adequate technical skills can contribute to the project success
MGT8	The contractor should provide the adequate resources for construction project to ensure the project run smoothly
MGT9	The good communication between project manager and team members affect the construction progress
MGT10	The establishment of the company involvement in construction shows the maturity and experience of company
MGT11	The good image from company reputation contribute to the project success
MGT12	The company experience on type and size of previous project affect project progress
MGT13	Commitment of the organization in managing construction project is very important to ensure the project success
RES1	The availability of the required technology and expertise to accomplish the specific technical actions is a factor of project success
RES2	The product functionality approved by clients achieve the technology requirement
RES3	The best technology involve in construction project ensure the progress run smoothly
RES4	The good technique guide by contractor in construction ensure the quality of worker's productivity
RES5	The lack of skilled workers can affect the construction progress
RES6	Poor labor productivity can reduce a cost of the project
RES7	Allocate right workers at the right job can help the project complete on time
RES8	The inadequate plant on site affect the construction progress
RES9	Inadequate material at site can affect the construction progress
RES10	The re-utilizing of resources at site can reduce a cost of construction project
ENV1	The construction project with no legal claim due to accident at site can ensure the project to complete on time
ENV2	The frequency of accident occurs on site can effect the construction project delay
ENV3	The safety aspect during construction is important to be applied by workers
ENV4	Implement an effective safety program can increase the workers knowledge
ENV5	Implement an effective quality assurance program can ensure the workers safety at site
ENV6	The good waste management at site helps the construction project run smoothly
ENV7	The environmental plan during construction is important to ensure the construction project run smoothly
ENV8	Effective implementation of the regulations on environmental management affect the construction progress

and scopes. Table 2 is the summary of 31 project success factors based on previous researches and they were used as Independent Variables (IV) and considered as secondary interest (Takim *et al*., 2003; Alzahrani and Emsley, 2013; Alias *et al*., 2014; Rad, 2003; Yong and Mustaffa, 2012; Salem *et al*., 2013; Takim and Adnan, 2009; Micheal *et al*., 2014; Salleh, 2009; Shenhar *et al*., 2001). These 31 factors were then grouped under three constructs that are Management factors (MGT1-MGT12), Resources factors (RES1-10) and site Environment factors (ENV1-8) as shown in Table 2.

METERIALS AND METHODS

Quantitative method is used as the method design in which questionnaire surveys were conducted in Northern Malaysia. The questionnaires were distributed to 321 respondents. The profiles of respondents are based on CIDB Northern Malaysia, Malaysian's Institute of Engineer (IEM) and local authority. There are 235 (73.21%) set of data collected from 321 samples. Most of the questionnaire surveys in the construction industry had a return rate of 20- 30% (Takim *et al*., 2003). From the 321 sample size, only 235 samples were successfully returned the questionnaire with the response rate 73.21%. This survey is considered reliable because the response rate of 73.21% is more than the normal 20-30% of most questionnaire surveys in the construction industry.

SmartPLS-SEM3.0 Software was used to analyze the data collected from respondents in this research and also to determine the factors that affected the construction projects success in Northern Malaysia. PLS-SEM focuses in predicting and explaining the variance of construct (success criteria) by different explanatory construct (management factors, resources factors and site environment factors) and it is suitable for the small sample size (Hair *et al*., 2014).

RESULTS AND DISCUSSION

The success factors of management factors, resources factors and site environment factors which influence the success criteria in construction projects were used as a basis to develop the conceptual framework for this study. Success performance is the Dependent Variable (DV) and the variances which were explained through the factors were used as the Independent Variables (IV) that formed the conceptual framework of this study as shown in Fig. 1. The PLS-SEM used in this study focused on predicting and explaining the variance in the construct (success performance) using different explanatory construct (management factors, resources factors and site environment factors). Figure 2 shows the results of path analysis of success factors affected the success performance based on â values and factor loadings.

The structural model's quality was evaluated by a non-parametrical test, which is the endogenous variable's determination coefficient (R^2) as a logical metric for judging the structural (inner) model. R^2 is always a value between 0 and 1 where when the larger of value, the percentage of variance also greater explained. Figure 2 shows R^2 value is 0.578 which suggests that 57.8% of the variance in extent of project success performance can be explained by the management, resources and site environment factors. R^2 value of 0.25, 0.50 and 0.75 indicate the endogenous latent variable is weak, moderate or strong in respective (Hair *et al*., 2014). For the model in this study, the endogenous latent variables (success factors) have substantially influenced the latent exogenous variable (project success criteria). The R^2 value indicates the level of prediction accuracy that the higher the value, the better the estimation of the path model. Figure 3 shows the results of structural model of the path analysis for success factors that affected the project success criteria with t-value between construct.

The quantitative analysis results of the hypotheses testing are presented in Table 3. H_1-H_3 examine the relationships between each construct (management factors, resources factors and site environment factors) and project success based on the questionnaires.

Based on the results in Table 3, H_1-H_3 each has a significant positive relationship between the success factors and the project success criteria in the construction sector in Penang. The management factors ($a = 0.492$, $p<0.01$); resources factors ($a = 0.104$, $p<0.01$) and site environment factors ($a = 0.264$, $p<0.01$) were positively related to the project success factors which explained the 57.8% of the variance thus, supporting H_1-H_3 in this study.

The aim of this study is to determine the significance success factors. So, it is important to understand the components of success factors and how it contributes to the project success performance in construction industry. As shown in Table 3, the 3 components of the success factors have significant relationship with the success performance in construction project.

From the 10 project success criteria measurements, only 4 items are significant to success performance as revealed by the PLS-SEM analysis which are good time management by contractor to reduce the risk of time overrun (time management) consultant commitment in design preparation (time planning), follow the schedule

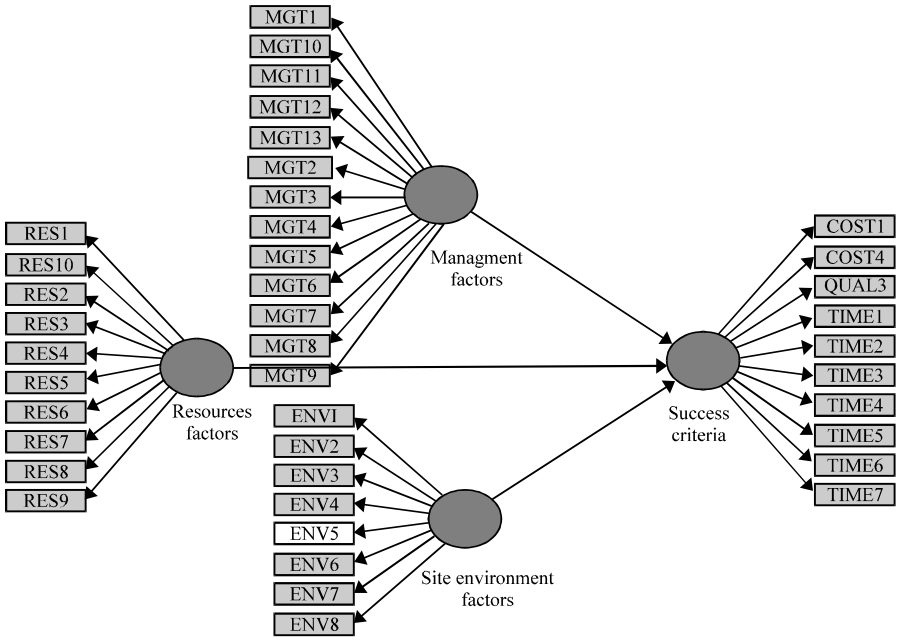

Fig. 1: Research model

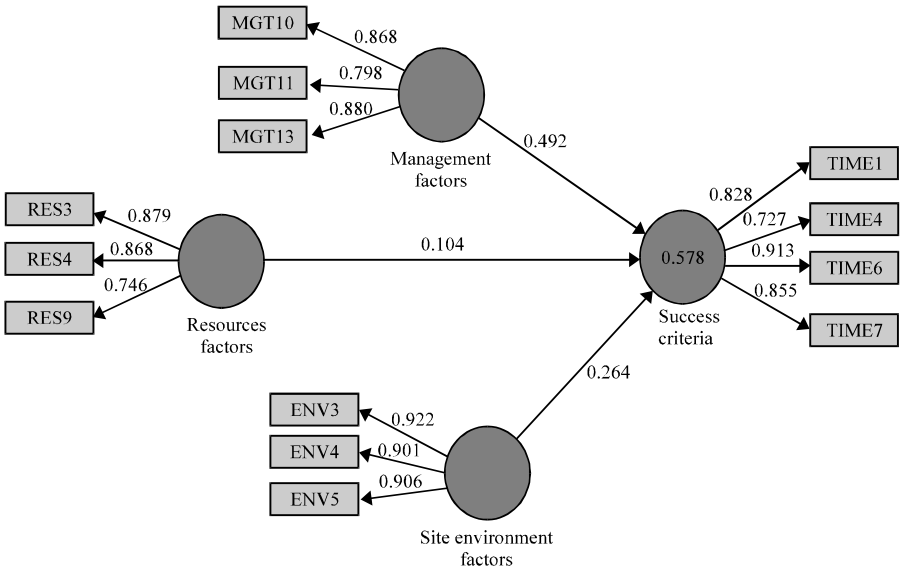

Fig. 2: Loadings and a value

Table 3: Hypotheses testing

Hypothesis relationship	β	SE	t-values	Support
H_1; Management factors>success criteria	0.49	0.306	9.302	Yes
H_2; Resources factors->success criteria	0.104	0.369	4.066	Yes
H_3; Site environment factors->success criteria	0.264	0.324	5.714	Yes

t-values>1.96 *(p<0.05); t-values>2.33**(p<0.01)

time is very important in construction project to avoid the time overrun (schedule management) and contractor must follow the planning and schedule to ensure the smoothness of project (schedule management). Then, for management factors, only 3 items have significantly influenced the success criteria as confirmed by PLS-SEM path modeling which are rank as follow: the establishment of the company involvement in construction shows the

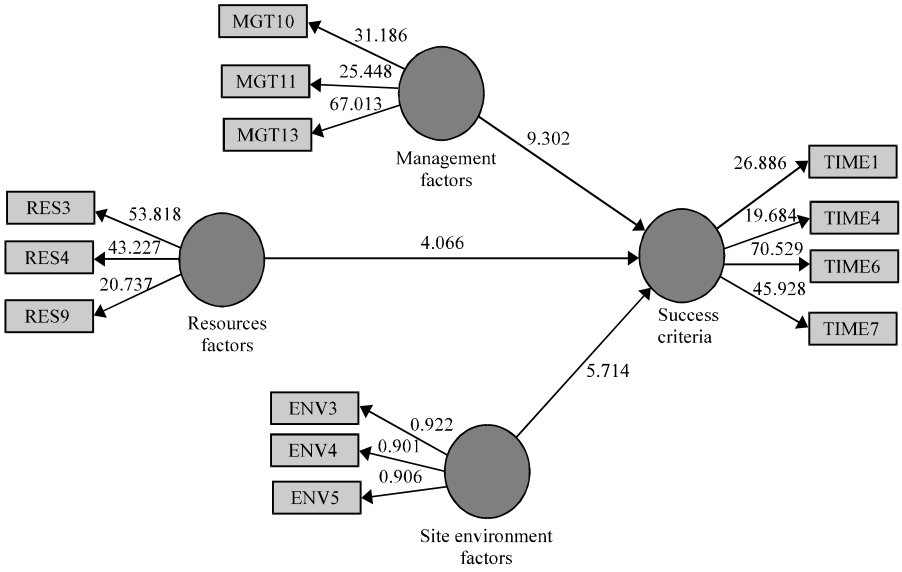

Fig. 3: t-values between construct

maturity and experience of company, the good image from company reputation contribute to the project success and commitment of the organization in managing construction project is very important to ensure the project success.

There were 10 items initially used as measurements of resources factors. However, only 3 items that significantly influenced the project success performance. The 3 items are the best technology involve in construction project, the good technique guide by contractor in construction ensure the quality of worker's productivity and the worker's skills. Lastly, there are 3 items from the total of 8 items in site environment factors which significant to project success performance and rank as follow: the safety aspect during construction is important to be applied by workers, implement an effective safety program can increase the workers knowledge and implement an effective quality assurance program can ensure the workers safety at site.

CONCLUSION

Three success factors which are management factors, resources factors and site environment factors had significantly influenced the project success performance of construction projects in Northern Malaysia. This study gives several contributions to the construction industry players. The findings show that the PLS-SEM path modeling developed in this study contributed to the method of analysis with respect to small sample size. The PLS-SEM path analysis has validated the significant success factors that influenced the project success criteria in term of both measurement and structural model based on the results of reliability and validity. Thus, this project success factors model could be used by construction's players as a guide of measurement in order to predict the construction project success in the future.

ACKNOWLEDGEMENTS

Researchers would like to thank the Research Acculturation Grants UiTM (RAGS/1/2014/TK08/UITM/9) for the financial support in this research and also to the Faculty of Civil Engineering and Institute of Research Management and Innovation (IRMIs), Universiti Teknologi MARA for the technical support. We also grateful to the experts from Penang CIDB and other parties participated in this research.

REFERENCES

Alias, Z., E.M.A. Zawawi, K. Yusof and N.M. Aris, 2014. Determining critical success factors of project management practice: A conceptual framework. Procedia Soc. Behav. Sci., 153: 61-69.

Alzahrani, J.I. and M.W. Emsley, 2013. The impact of contractors attributes on construction project success: A post construction evaluation. Int. J. Project Manage., 31: 313-322.

Gunathilaka, S., M.M. Tuuli and A.R. Dainty, 2013. Critical analysis of research on project success. Constr. Manage. J., 7: 979-988.

Hair, Jr. J.F., M. Sarstedt, L. Hopkins and V.G. Kuppelwieser, 2014. Partial Least Squares Structural Equation Modeling (PLS-SEM): An emerging tool in business research. Eur. Bus. Rev., 26: 106-121.

Han, W.S., A.M. Yusof, S. Ismail and N.C. Aun, 2012. Reviewing the notions of construction project success. Int. J. Bus. Manage., 7: 90-101.

Micheal, J., T.J. Deepak and I.S.Y. Tong, 2014. Ranking the factors that influence the construction project management success: Malaysian perspective. Civil Environ. Res., 6: 80-88.

Rad, P.F., 2003. Project success attributes. Cost Eng. Morgantown, 45: 23-29.

Rahman, H.A., A.M. Alashwal, M. Ayub and A.A. Abdullah, 2013. Abandoned housing projects in malaysia: Pressing issues during the rehabilitation process. Rent Parked, 7: 65-73.

Salem, B.S., M.N. Huq, A. Dahlan and A. Rahman, 2013. Project implementation success and change management practices in Malaysian Government-linked companies (GLCs). J. Soc. Dev. Sci., 4: 357-363.

Salleh, R., 2009. Critical success factors of project management for Brunei construction projects: Improving project performance. Ph.D Thesis, Queensland University of Technology, Brisbane, Queensland.

Sanvido, V., F. Grobler, K. Parfitt, M. Guvenis and M. Coyle, 1992. Critical success factors for construction projects. J. Constr. Eng. Manage., 118: 94-111.

Shenhar, A.J., D. Dvir and O. Levy, 2001. Mapping Dimensions of Projects Success PMJ 1997. MAC Cosmetics Company, New York, USA.

Steinfort, P. and D.H.T.T. Walker, 2007. Critical success factors in project management globally and how they may be applied to aid projects. Proceedings of the 4th Annual Conference on PMOZ Achieving Excellence Project Management, August 28-31, 2007, Invoke Publisher, Brisbane, Australia, pp: 1-15.

Takim, R. and H. Adnan, 2009. Analysis of effectiveness measures of construction project success in Malaysia. Asian Soc. Sci., 4: 74-91.

Takim, R., 2009. The management of stakeholders needs and expectations in the development of construction project in Malaysia. Mod. Appl. Sci., 3: 167-175.

Takim, R., A. Akintoye and J. Kelly, 2003. Performance measurement systems in construction. Proceedings of the 19th Annual Conference on Association of Researchers in Construction Management (ARCOM), September 3-5, 2003, University of Brighton, Brighton, UK., pp: 423-432.

Tmeemy, A.S.M.H.M., A.H. Rahman and Z. Harun, 2011. Future criteria for success of building projects in Malaysia. Int. J. Project Manage., 29: 337-348.

Yong, Y.C. and E.N. Mustaffa, 2012. Analysis of factors critical to construction project success in Malaysia. Eng. Constr. Archit. Manage., 19: 543-556.