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Gopal Sekar, Kuperan Viswanathan & Murali Sambasivan

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Effects of Project-Related and Organizational-Related Factors on Five Dimensions of Project Performance: A Study Across the Construction Sectors in Malaysia

Gopal Sekar, Muhibah Engineering (M) Bhd and Universiti Utara Malaysia
Kuperan Viswanathan, Universiti Utara Malaysia
Murali Sambasivan, Taylor's University Lakeside Campus

Abstract: The objective of this research is to analyze the relationships of project-related and organizational-related factors with five dimensions of project performance across different sectors of the construction industry. Data collected from the project managers and directors of 360 construction firms in Malaysia were analyzed using multiple-regression technique with size of the organization as a control variable. The important finding is that the effects of project-related and organizational-related factors differ by sector type and by dimensions of project performance. The findings of this study can help project managers devise and implement appropriate strategies to support project success.

Keywords: Construction Industry, Project-Related, Organizational-Related, Performance

EMJ Focus Areas: Program & Project Management

Many studies have been conducted globally over the last four decades on factors that influence project performance. Despite proliferation of research, issues such as project delays, cost overruns, quality issues, project abandonment, and project failures have not abated. Pinto (2013) and Bronte (2015) have provided interesting examples of project overrun in terms of cost and time. The Channel Tunnel of the United Kingdom was over budget by $21.1 billion and took 20% more time to complete, the Three Gorges Dam built by China was over budget by $6.1 billion and completed behind schedule, and the final cost of London Olympics project was six times more than the initial budget. According to Memon, Rahman, and Aziz (2012), the cost overrun in construction projects of Malaysia was up by 15% for the vast majority of small projects (72%) and more than 15% for the remaining 28%. Similarly, in the case of large projects, the cost overrun was up by 15% for nearly all large projects (89%) and more than 15% for remaining 11%. Some researchers estimate that only about 30% of the projects across the world are completed within the budgeted cost and time (Pinto, 2013; Sambasivan & Soon, 2007). Even though the actual success rate of project completion can be contentious, the fact remains that a large percentage of projects are not completed within the budgeted time and cost or to quality specifications (Bronte, 2015). This research was conducted in the Malaysian construction sector. This sector contributes significantly to the gross domestic product (GDP) of Malaysia, and the gross output of the industry in 2015 was MYR 177.9 billion (1 USD = 4.00 MYR) (Department of Statistics, Malaysia 2016).

Three critical terms are used to evaluate project performance in this research. First, project-related factors are the factors that have a direct relationship with the day-to-day functioning and successful completion of the project (Sambasivan & Soon, 2007). The project-related factors considered are client-related, contractor-related, consultant-related, material-related, labor and equipment-related, contract management-related, external-related, and use of project management tools and techniques. Second, organizational-related factors are factors that are management-related and play a crucial supportive role in ensuring successful completion of projects (Arditi, Nayak, & Damci, 2017; De Valence, 2010; Nixon, Harrington, & Parker, 2012). The organizational-related factors considered are leadership, organizational culture, innovation, and learning organization. Third, project performance is assessed on five dimensions: time, cost, quality, safety, and financial (Sambasivan & Soon, 2007; Tabish & Jha, 2015). It is important to understand the differences between cost performance and financial performance. Cost performance deals with completing the project within the budgeted cost (includes direct and indirect costs), raising cost claims to the client promptly, timely certification of cost claims by the client, managing costs related to change orders in the project, and settling of cost-related disputes with the clients. Financial performance deals with earning profits from the project, achieving return on investment (ROI), achieving return on assets (ROA), achieving return on equity (ROE) from the project, and the project's contribution to organization's overall financial performance.

The research question addressed in this study is how significant are the relationships of project-related and organizational-related factors with five dimensions of project performance across different sectors of the construction industry. Addressing this question is important from two perspectives. First, the factors in this study considered are comprehensive and applicable to the construction industry in Malaysia and other developing countries. By addressing this question, academicians and researchers can get a better understanding of the factors that affect the construction industry and therefore can suggest better solutions to handle the problems that distress the industry. Second, the findings of this study can assist engineering managers working in different sectors to better understand project performance factors and the probable solutions that are unique to their sector.

The contributions of this research are threefold. First, our framework combines both the project-related and organizational-related factors. Prior research has predominantly considered these factors in isolation. For example, Sambasivan and Soon (2007) and Marzouk and El-Rasas (2014) considered the relationships of project-related factors with project delays, Nixon et al., (2012) studied the relationship of leadership with project performance, Arditi et al. (2017) explored the link between organizational culture and delays in construction

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projects, and De Valence (2010) studied the impact of innovation in the construction industry. Second, this study considers five dimensions of project performance: time, cost, quality, safety, and financial (Sambasivan & Soon, 2007; Tabish & Jha, 2015). Prior work primarily utilized cost, time, and quality to measure project performance (Jha & Iyer, 2006; Memon, Rahman, Abdullah, & Aziz, 2014; Sambasivan, Deepak, Ali, & Ponniah, 2017), while a few studies examined safety as a project performance indicator (Tabish & Jha, 2015). Third, most of the previous studies dealt with the construction industry in general. In this study, the relationships of project-related and organizational-related factors with project performance are analyzed in the context of four different sectors including (1) civil, building, and infrastructure, (2) marine, (3) oil and gas (O&G), and (4) multidiscipline. Combining the four sectors into a single sample can potentially confound the results and make the findings less applicable to project managers.

Literature Review

Project-Related Factors

In the last two decades, numerous research studies have been carried out across the world on various causes of project success and their effects in terms of time and cost. These studies have revealed that multiple factors related to time, cost, and quality impact project performance in the construction industry, and most of the studies dealt with project-related factors. Sambasivan et al. (2017) provide a detailed review of literature on the causes (project-related factors) and effects of delays in the construction industry. Four relevant studies are not included in the Sambasivan et al. (2017) review and are briefly discussed next. Tawil et al. (2013) found that contractors' inability to manage working capital, delay in advance payment by client, delay in approvals by client and consultants, scarcity of construction materials, contractors' poor site management practices, and additional scope of works given by the client are the factors that lead to delays in government construction projects in Malaysia. Truman (2014) found that failure of the project management team to adequately plan, inadequate human resources, failure to control cost, and scope changes throughout the project are some of the factors leading to poor project performance. Raw material price fluctuation, cash flow and financial difficulties faced by contractors, shortage of workers, lack of communication, and incorrect planning are the factors found to affect project performance in Malaysian construction companies by Memon et al. (2014). Olaniran (2015) determined that selection of contractors based on lower cost is the primary reason for poor project performance.

Organizational-Related Factors

Pollack (2007) stated that traditionally project management is deeply rooted in project-related factors such as clients, consultants, suppliers, subcontractors, labor and equipment, contract management, external factors, and project management tools/techniques. However, recently theoretical frameworks on organizational factors such as leadership, organizational culture, innovation, learning organization, and communication and their impacts on project management have gained prominence. The organizational-related factors considered in this research have been studied in isolation in the existing construction literature as summarized in the remainder of this section.

Leadership. Belout and Gauvreau (2004) argued that top management support and leadership are important for a project's success. Earlier studies on project success had largely ignored the leadership roles of project managers and leadership styles (Turner & Müller, 2005). Ananatatmula (2010) and Oliveira, Valentina, and Possamai (2012) showed that a leadership style that combines agility and builds trust among the team members significantly contributes to achieving the highest project performance. Researchers are of the view that no single leadership style is suitable for the entire life cycle of a project, and leadership styles and models should be modified to suit the project performance outcomes and requirements based on each situation (Nixon et al., 2012).

Organizational culture. Belout and Gauvreau (2004) found that organizational structure and culture of an organization are significantly related to a project's success. Researchers have empirically tested and determined that organizational culture has a significant relationship with project performance (Belassi, Kondra, & Tukel, 2007; Yazici, 2009). Yazici's (2009) study provides clear picture on the relationship of type of culture with project performance and found that among the four culture types (adhocracy, clan, market, and hierarchy), clan orientation culture with its focus on shared values and cohesion has the strongest association with effective and efficient projects. According to Vaidyanathan (2016), culture was recognized as a contributing factor for organizational project outcomes and successes.

Innovation. According to Davies (2014), the positive link between the management of projects and innovation was well understood in the 1950s. However, this link was evident in complex and highly uncertain research and development projects in technologically advanced weapons and defense-related industries. The construction industry reveals a different scenario and researchers have divergent views. Dubois and Gadde (2002) made an interesting observation about the innovation in the construction industry when they stated that the construction industry's pattern of connections, short-term productivity, government regulations, industry standards, and fast decision-making hamper innovation. They have also observed that, in the construction industry, not much attention is paid to innovation. Egbu (2004) argues the role of innovation as a major source of competitive advantage and a prerequisite for success and survival of construction industry. In addition, innovation is recognized as a strategic option for complex projects in the construction industry (De Valence, 2010), and according to Walker (2016), innovation has a dominating role to play in the construction industry.

Learning organization. Senge (1990) defined a learning organization as an "organization with an ingrained philosophy for anticipating, reacting and responding to change, complexity and uncertainty" (p. 3). It has argued that learning and application of that learning must become an integral part of an organization's fabric to achieve continued success in the construction industry (Love, Huang, Edwards, & Irani, 2004). Others highlight the challenges of the learning organization from the perspectives of construction projects (Chan, Cooper, & Tzortzopoulos, 2005). Chinowsky, Molenaar, and Realph (2007) succinctly stated that "for the construction industry to adopt a learning organization culture, the concept of continuous learning and personal advancement must become a fundamental operating concept within organizations at every level and

throughout every project and business process" (p. 33). The impact of learning organization was studied in the supply chain of construction industry in UK and resulted in a framework to evaluate the efficacy of a learning organization (Tennant & Fernie, 2013).

Project performance indicators. Many of the previous studies have mainly focused on project performance indicators such as time, cost, and safety performance (e.g., Memon et al., 2014; Mosly, 2015; Sambasivan et al., 2017; Sambasivan & Soon, 2007). There are a few studies that have looked at quality performance in the construction industry (e.g., Cheung, Suen, & Cheung, 2004; Jha & Iyer, 2006). However, there is a shortage of studies related to simultaneous evaluation of all the five indicators (time, cost, safety, quality, and financial) in the construction industry. Simultaneous evaluation can provide understanding of the relative impacts of these multiple indicators.

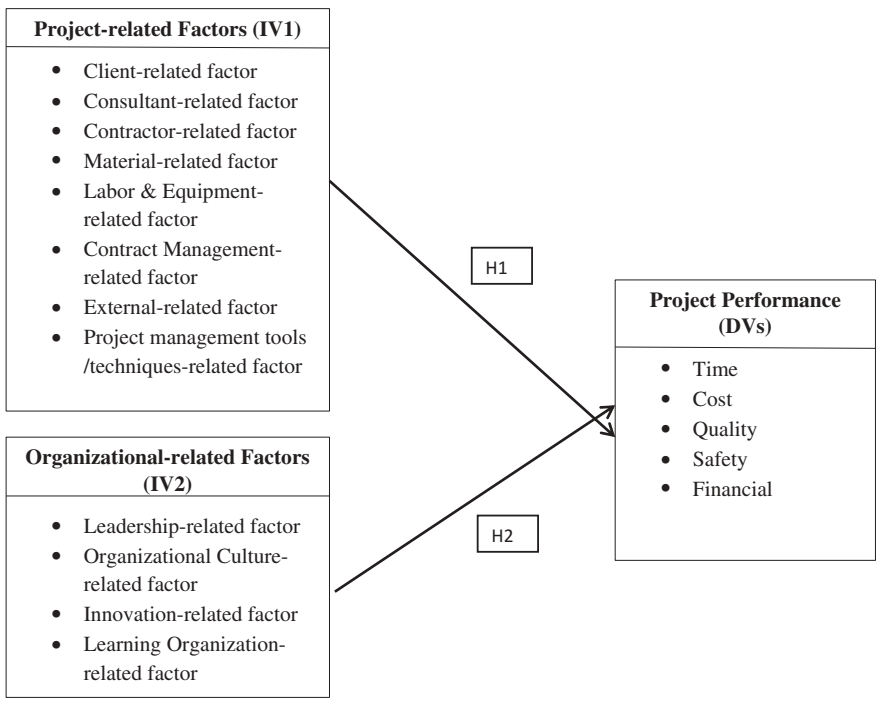
Hypotheses Development

The integrated framework used in this research is shown in Exhibit 1. The framework has two constructs (project-related and organizational-related) as independent variables, and five dimensions of project performance as a dependent variable. To recap, the project-related factors considered in this research are related to the client, contractor, consultant material, labor and equipment, contract management, external impact, and project management tool, and the organizational-related factors are leadership, organizational culture, innovation, and learning organization. This research analyzes the relationships of project-related and organizational-related factors with project performance in four different sectors of the construction industry: (1) civil, building, and infrastructure, (2) marine, (3) O&G, and (4) multidiscipline. The size of the organizations varies within each sector, and therefore the size of the organization is used as the control variable.

Project-Related Factors vs Performance

Construction projects in general constitute a large number of activities and transactions at various stages of their life cycle. According to transaction cost economics (TCE) theory (Williamson, 1989), governance structure of transaction cost in a project between the buyer and seller for goods and services is a major factor which contributes significantly to project performance. Poor transaction governance is likely to heavily increase project transaction costs. Project-related factors refer to different types of transactions in a project and are more likely to have significant relationships with project performance. Few scholars like Winch (1989) and Lua, Zhang, and Pan (2014) have used TCE theory and Game theory to understand the relationships among different stakeholders in the construction industry. A recent study by Sambasivan et al. (2017) established a strong link between project-related factors and performance using TCE by assimilating the arguments from earlier studies. Based on the finding of the prior literature, we posit the following hypothesis:

Exhibit 1. Research Framework



Note: Size of the Organization is the **Control Variable** (**CV**)

H1: Project-related factors have significant relationships with project performance in the construction industry.

Organizational-Related Factors vs Performance

Construction organizations need: (1) proper leadership at the top to ensure things are happening as planned (Oliveira et al., 2012), (2) a good organizational culture to ensure that project management teams perform to expected levels (Saunila, 2014), (3) to find innovative ways to competitively carry out project tasks in order to save cost and time and in a safe manner (Saunila, 2014), and (4) to learn from past projects and other means to establish a learning organizational culture to sustain and grow the business (Hardness, Nilsson, & Nuldén, 2005).

According to the leadership theory, transformational leadership can bring quantum changes in organizations (Bass, 1985), while transactional leadership brings in efficiency and effectiveness in operations (Burns, 1998). Similarly, other leadership theories such as servant leadership, path-goal leadership, situational leadership, evolutionary leadership, outstanding leadership, implicit leadership, and community leadership are distinctively associated with different environments. Nixon et al. (2012) stated that no single leadership style is suitable for the entire life cycle of a project, and leadership styles and models should be modified to suit the project performance outcomes and requirements throughout the cycle. The authors stressed that a project manager's leadership performance is crucial for overall project success.

The significance of organizational culture in enhancing the performance of project managers was highlighted three decades ago (Elmes & Wilemon, 1988). This led researchers to empirically test the link between organizational culture and project performance (Belassi et al., 2007; Yazici, 2009) and reveal the strong relationship between these two constructs. Yazici (2009), in particular, demonstrated the relationship of different types of culture with project performance. A recent study by Vaidyanathan (2016) confirmed the relationship between culture and project outcomes and successes.

The role of innovation in the construction industry has been studied by multiple researchers and argued to be a vital component in the modern construction industry. Dubois and Gadde (2002) highlighted that processes and systems in the construction industry hamper innovation. More recently, researchers found a positive relationship between innovation and project performance (De Valence, 2010; Walker, 2016).

Learning from the experience of past projects and improving continuously are vital to achieve project success (Cooke-Davies, 2002). A learning organization helps the project team to learn from a project's experience (exploratory learning) and implement the learned knowledge in other projects (exploitive learning) (Brady and Davies, 2004). According to Chinowsky et al. (2007), the construction industry must adopt a learning culture across all levels in the organization and throughout every project and business process. This capability can enhance the ultimate performance of projects (Tennant & Fernie, 2013). Based on the arguments presented, we posit as follows:

H2: Organizational-related factors have significant relationships with project performance in the construction industry.

Methodology

This research uses a quantitative research approach to identify the factors (project-related and organizational-related) that have significant relationships with project performance (cost, time, safety, quality, and financial). A survey research design method was used to collect the data from the targeted population.

Population and Sample

The construction industry in Malaysia is represented by an apex organization known as the Construction Industry Development Board (CIDB), which is a government organization representing the government and industry. Construction companies in Malaysia are required to register with CIDB as a contractor depending upon their capabilities from grades G1 to G7. The G7 is the highest grade of construction companies that are eligible to carry out projects with individual project value of more than RM 10 million (USD 1 = RM 4.4). The G7 companies vary from small and medium (SME), large, and very large companies. These classifications are based on the number of employees: SME – less than 200, large – 201 to 500 and very large – more than 500. The population for this study is 5,134 currently active G7 construction companies. The list published by CIDB was used as the sampling frame and includes 4,004 firms (78%) in the civil, building, and infrastructure sector, 53 firms (1%) in the marine sector, 102 firms (2%) in the O&G sector, and 975 firms (19%) in the multidiscipline sector (CIDB Malaysia, 2015). The sampling procedure adopted was the stratified random sampling, and a sample size calculator (http://www.raosoft.com/samplesize.html) suggested a sample size of 358. Considering the response rate, questionnaires were sent to 1,070 (approximately 358 times 3) G7 companies. One of the authors on this work is a senior employee in a G7 company and was therefore able to obtain the sampling frame. Since the number of firms in the marine and O&G sectors were low, the questionnaire was sent to all 155 (53 and 102 respectively) of these firms. Out of the remaining 915 questionnaires, 730 questionnaires (80%) were sent to randomly selected firms in the civil, building, and infrastructure sector, and 185 questionnaires (20%) were sent to randomly selected firms in the multidiscipline sector.

Measures

The measures used in this study were taken from established sources. Exhibit 2 provides the source and range of reliability scores reported by the prior studies that utilized the measures. The questionnaire consists of five sections: Section 1) Demographic factors about the respondent (11 items), Section 2) Organization details (10 items), Section 3) Project-related factors (35 items), Section 4) Organizational-related factors (73 items), and Section 5) Project performance (24 items). The items in all the constructs were measured using a 5-point Likert scale.

Pilot Study

Prior to the full-scale survey administration, face validity of the questionnaire was evaluated by distributing the questionnaire to 30 construction industry and academic experts. The questionnaire was then distributed to 30 project managers from the construction industry. The survey responses from both test groups were evaluated to ensure that the questionnaire was relevant to the study. Since both the expert and project manager

Exhibit 2. Research Questionnaire Sources

Variable	Author	Source of the questionnaire	Reliability
Project-related factors	Sambasivan & Soon (2007)	Causes and effects of Malaysian construction industry	0.88 – 0.97
Organizational-related factors: Leadership	Antonakis, Avolio & Sivasubramaniam (2003)	Context and leadership: An examination of the nine-factor full-range leadership theory using the multifactor leadership questionnaire	0.71 – 0.90
Organizational-related factors: Organizational culture	Rashid, Sambasivan & Rahman (2004)	The influence of organizational culture on attitudes toward organizational change	0.67 – 0.92
Organizational-related factors: Innovation	Trigo, Calapez & Santos (2009)	SMEs and internationalization: An empirical study of SMEs in Portugal	0.64 – 0.82
Organizational-related factors: Learning organization	Song (2009)	The dimensions of learning organization questionnaire (DLOQ): A validation study in a Korean context	0.71 – 0.91
Project performance-related factors	Cheung, Suen & Cheung (2004)	PPMS: A web-based construction project performance monitoring system	0.72 – 0.83

test groups were in agreement with the questionnaire items, no changes were made and the questionnaire was distributed to the 1,070 companies.

Reliability and Validity

The reliability of the construct dimensions were assessed with Cronbach Alpha scores. The validity of the dimensions (convergent and discriminant) were assessed using the composite reliability (CR) and average variance extracted (AVE). The reliability and validity values are given in Exhibit 3. According to Hair, Black, Babin, and Anderson (2014), there are three guidelines for the reliability and validity of each variable: (1) CR scores must be above 0.7, (2) AVE values need to be above 0.50, and (3) square-root of AVE scores for each variable must be more than the correlations of that variable with other variables. The AVE scores of organizational-related constructs are

Exhibit 3. Correlation Table

Factor	CR	AVE/square-root of AVE	Client	Contr	Cons	Matl	Laeq	Contract	Extern	PMtool	Leader	OrCult	Inno	Learn
Client	0.84	0.56/0.75	1											
Contr	0.88	0.54/0.74	**0.63**	1										
Cons	0.88	0.64/0.80	**0.38**	**0.51**	1									
Matl	0.84	0.58/0.76	**0.36**	**0.49**	**0.49**	1								
Laeq	0.87	0.59/0.77	**0.41**	**0.57**	**0.43**	**0.53**	1							
Contract	0.84	0.52/0.72	**0.47**	**0.54**	**0.49**	**0.54**	**0.61**	1						
Extern	0.85	0.59/0.77	**0.21**	**0.30**	**0.35**	**0.32**	**0.23**	**0.29**	1					
PMtool	0.91	0.71/0.84	−0.01	0.06	**0.18**	**0.19**	**0.11**	**0.12**	**0.28**	1				
Leader	0.93	0.46/0.68	0.07	0.03	**0.19**	**0.11**	0.07	**0.10**	**0.17**	**0.10**	1			
OrCult	0.93	0.46/0.68	0.02	−0.01	**0.12**	**0.19**	0.07	0.05	**0.19**	**0.33**	**0.45**	1		
Inno	0.87	0.46/0.67	0.07	0.09	**0.13**	**0.12**	0.06	0.09	**0.19**	**0.17**	**0.49**	**0.51**	1	
Learn	0.92	0.45/0.67	0.02	0.01	0.07	**0.11**	−0.01	−0.03	**0.12**	**0.34**	**0.21**	**0.47**	**0.40**	1
Time	0.87	0.65/0.81	0.01	0.11	0.10	**0.11**	0.03	0.05	0.07	**0.31**	**0.15**	**0.43**	**0.21**	**0.42**
Cost	0.83	0.50/0.71	0.02	0.05	0.01	0.05	0.03	0.04	0.03	**0.25**	**0.24**	**0.48**	**0.30**	**0.42**
Qlty	0.92	0.68/0.82	0.00	0.01	0.09	**0.10**	0.03	0.05	0.03	**0.27**	**0.12**	**0.34**	**0.14**	**0.35**
Safety	0.89	0.62/0.79	0.07	0.04	**0.21**	**0.12**	0.05	0.02	**0.12**	**0.33**	**0.14**	**0.31**	**0.11**	**0.32**
Fin	0.89	0.68/0.82	0.01	0.04	0.05	**0.10**	0.05	0.07	0.05	**0.19**	**0.22**	**0.39**	**0.31**	**0.43**

Note: Client – client-related, Contr – contractor-related, Cons – consultant-related, Matl – material-related, Laeq – labor & equipment-related, Contract – contract-related, Extern – external-related, PMtool – PM tools/techniques-related, Leader – leadership, OrCult– organizational culture, Inno – innovation, Learn – learning organization, Time – time performance, Cost – cost performance, Qlty – quality performance, Safety – safety performance, Fin – financial performance. Bold numbers denote significance at 0.05 level; values below the diagonal denote correlations.

less than 0.50. The square-root of AVE scores of organizational-related variables (factors) is greater than the correlations as shown in Exhibit 3. Therefore, no issues related to the reliability and validity of the factors is identified.

Results

Descriptive Statistics

Out of the 1070 distributed questionnaires, 360 completed questionnaires were rt. After eliminating questionnaires with missing information, 342 questionnaires remained for further analysis with 139 from civil, building and infrastructure sector, 40 from marine sector, 82 from the O&G sector, and 81 from the multidiscipline sector (overall response rate = 31.93%). All the questionnaires were completed by project managers/directors. This is a valuable sample considering the fact that most prior work obtained responses from project stakeholders such as clients, contractors, and consultants. The majority of the respondents (52%) have more than 11 years of experience as project managers/directors in the construction industry. Approximately 64% of the respondents have handled more than six projects to successful completion. Nearly one-third (32%) of the respondents are from SMEs, 11% from large companies, and 57% from very large companies. Descriptive statistics of various constructs (mean, standard deviation, skewness, and kurtosis statistics) are given in Exhibit 4. The overall mean scores of factors indicate 'medium' or 'high' level of presence for each factor. For example, a score of 4.02 for safety performance indicate that the perception of achievement of safety in the construction sector is 'high'. Since the skewness and kurtosis scores are between +2 and −2, the data distribution for each factor satisfies the property of normal distribution which is fundamental for running statistical tests (George & Mallery, 2010).

Hypothesis Testing

Hierarchical regression (Hair et al., 2014) was used to test Hypotheses 1 and 2 with size of organization as a control variable (block 1), project-related and organizational-related factors (block 2) as independent variables, and five dimensions of project performance as dependent variables. Before running the regression models, collinearity diagnostics were performed. The variance inflation factor (VIF) varied between 1.295 and 2.371 suggesting that multicollinearity effect was not a concern. The regression analyses were carried separately for the four construction industry sectors: civil, building, and infrastructure; marine, O&G; and multidiscipline. The regression results for each sector are given in Exhibits 5, 6, 7, and 8 respectively. Since all project-related and organizational-related factors do not have significant relationships with all factors of performance, hypotheses H1 and H2 are not supported completely and in fact, the factors that have significant relationships are different for different sectors. The important results are discussed for each sector.

Civil, building and infrastructure sector. Exhibit 5 presents the regression results for the civil, building and infrastructure sector. The results show that client-, contractor-, consultant-, material-, labor and equipment-, and contract-related factors do not have significant relationships with any of the five performance measures (time, cost, quality, safety, or financial). The external-related factor has a significant relationship with cost performance, and project management tools-related factor has significant relationships with both quality and safety performances.

Exhibit 4. Descriptive Statistics

Factor	# of Items Captured Under the Factor	Overall Mean of the Factor	Standard Deviation	Skewness	Kurtosis
Client-related	4	3.53	1.52	−0.66	0.40
Contractor-related	6	3.80	1.57	−0.85	0.89
Consultant-related	4	3.79	1.22	−0.735	0.725
Material-related	4	3.75	1.45	−0.45	0.22
Labor and equipment-related	4	3.78	1.38	−0.553	0.167
Contract-related	5	3.67	1.40	−0.260	−0.172
External-related	4	3.45	1.34	−0.205	0.197
PM tools/ techniques-related	4	3.66	1.34	−0.365	0.123
Leadership	18	3.07	1.56	0.151	1.397
Organizational culture	23	2.42	1.26	0.211	0.238
Innovation	12	2.49	1.12	0.445	0.568
Learning organization	20	3.05	1.87	−0.660	1.252
Time performance	5	2.83	1.154	−0.162	0.123
Cost performance	5	3.34	1.22	−0.036	0.457
Quality performance	5	3.56	1.34	−0.412	0.869
Safety performance	5	4.02	1.29	−0.377	0.549
Financial performance	4	3.68	1.12	0.024	0.351

Item scores captured based on Likert scale 1 to 5.

Among the organizational-related factors, the organizational culture-related factor has significant relationships with all five performance measures and the learning organization-related factor has significant relationships with four dimensions of performance (time, cost, quality, and financial). Leadership-related and innovation-related factors do not have significant relationships with any of five performance measures.

Marine sector. Exhibit 6 presents the regression results for the marine sector. The results show that client-related, labor and equipment-related, contract-related, external-related, and project management tools-related factors do not have significant relationships with any of the five performance

Exhibit 5. Regression Analysis – Civil, Building and Infrastructure Construction Sector's Project Performance with Control Variable

	Dependent Variable				
Independent Variable	Time	Cost	Quality	Safety	Financial
Project-related Factors (IV1)					
Client-related factor	0.024	0.002	−0.078	−0.075	0.099
Contractor-related factor	−0.086	0.120	0.230	0.165	−0.097
Consultant-related factor	0.076	0.014	−0.153	0.190	0.039
Material-related factor	−0.018	0.088	0.002	−0.024	0.074
Labor and equipment-related factor	−0.068	−0.078	−0.144	−0.124	−0.070
Contract-related factor	−0.005	−0.087	0.164	−0.072	0.001
External-related factor	0.009	−0.198**	−0.079	0.140	−0.001
Project management tools/techniques-related factor	0.090	0.104	0.249**	0.178**	0.019
Organizational-related Factors (IV2)					
Leadership-related factor	−0.054	0.070	0.138	0.050	−0.003
Organizational culture-related factor	0.259**	0.429**	0.210**	0.214**	0.269**
Innovation-related factor	0.061	0.046	−0.117	−0.043	0.078
Learning organization-related factor	0.310**	0.234**	0.250**	0.174	0.299**
Control Variable (Size of the Organization)	0.023	0.062	0.066	−0.181**	0.018
R^2 Value (%age of variance in the dependent variable explained by the independent variables)	0.308	0.464	0.321	0.348	0.327
F Value(indicates significance of overall model fit)	4.287	8.309	4.541	5.138	4.670
P Value (indicates significance of overall model fit)	0.000**	0.000**	0.000**	0.000**	0.000**

**Coefficients significant at 0.05 level of significance, n = 139.

measures (time, cost, quality, safety, or financial). The contractor-related factor has significant relationships with both time and safety performances, the consultant-related factor has significant relationships with four of the performance measures (time, quality, safety, and financial), and the material-related factor has a significant relationship with safety performance. Among the organizational-related factors, the leadership-related factor has a significant relationship with quality performance, the organizational culture-related factor has a significant relationship with safety, the innovation-related factor has a significant relationship with quality performance, and the learning organization-related factor has significant relationships with both quality and financial performances.

O&G sector. Exhibit 7 presents the regression results for the O&G sector. The results show that client-related, consultant-related, material-related, labor and equipment-related, contract-related, and project-management tools-related factors do not have significant relationships with any of the five performance measures (time, cost, quality, safety, or financial). The contractor-related factor has a significant relationship with financial performance. Among the organizational-related factors, leadership has a significant relationship with cost performance, organizational culture has significant relationships with time, cost, and quality performances, innovation has significant relationships with financial performance, and the learning organization-related factor has significant relationships with time, quality, and safety performances.

Multidiscipline sector. Exhibit 8 presents the regression results for the multidiscipline sector. The results show that consultant-related, material-related, labor and equipment-related, contract-related, and external-related factors do not have significant relationships with any of the five performance factors (time, cost, quality, safety, or financial). The client-related factor has a significant relationship with safety performance, the contractor-related factor has significant relationships with both time and safety performances, and the project management tools-related factor has a significant relationship with cost performance. Among the organizational-related factors, leadership has a significant relationship with cost performance and the learning organization-related factor has significant relationships with both quality and financial performances.

Discussion

The objective of this research is to analyze the relationships of project-related and organizational-related factors with five dimensions of project performance across the different sectors of the construction industry in Malaysia. The framework used and the salient findings of this study can be relevant to the different sectors of construction industry in developing economies. As stated earlier, this study has deviated from previous studies by analyzing (1) factors related to project and organization, (2) five dimensions of performance, and (3) multiple sectors within the construction industry. Another valuable feature

Exhibit 6. Regression Analysis – Marine Construction Sector's Project Performance with Control Variable

	Dependent Variable				
Independent Variable	Time	Cost	Quality	Safety	Financial
Project-related Factors (IV1)					
Client-related factor	0.203	−0.342	−0.127	−0.188	0.209
Contractor-related factor	−0.607**	0.178	−0.013	−0.508**	−0.202
Consultant-related factor	0.440**	0.078	0.366**	0.671**	0.540**
Material-related factor	0.216	−0.423	0.166	0.389**	−0.263
Labor and equipment-related factor	−0.085	0.313	−0.084	0.003	−0.269
Contract-related factor	−0.115	−0.293	−0.055	−0.289	0.000
External-related factor	−0.004	0.330	−0.197	−0.101	−0.046
Project management tools/techniques-related factor	0.029	−0.146	−0.100	−0.184	0.105
Organizational-related Factors (IV2)					
Leadership-related factor	0.056	0.075	0.394**	0.123	−0.04
Organizational culture-related factor	0.203	0.428	0.218	0.403**	0.064
Innovation-related factor	0.104	−0.065	−0.291**	−0.107	0.199
Learning organization-related factor	0.045	0.289	0.297**	0.200	0.434**
Control Variable (Size of the Organization)	0.462**	0.409	0.503**	0.280	−0.152
R^2 Value (%age of variance in the dependent variable explained by the independent variables)	0.737	0.452	0.700	0.739	0.602
F Value (indicates significance of overall model fit)	5.607	1.648	4.672	5.674	3.021
P Value (indicates significance of overall model fit)	0.000**	0.100	0.000**	0.000**	0.015**

** Coefficients significant at 0.05 level of significance, $n = 40$.

of this research is the occupation level of the respondents who are all either project managers or project directors as compared to the majority of prior work which obtained responses from project clients, consultants, and/or contractors (Assaf & Al-Hejji, 2006; Sambasivan et al., 2017; Sambasivan & Soon, 2007). This study has clearly indicated the factors that affect different dimensions of project performance in different sectors of the construction industry. It is essential for the managers and decision-makers to understand the differences to enable them plan and execute the projects better.

Civil, Building, and Infrastructure Sector

The civil, building and infrastructure construction sector is the largest sector in the Malaysian construction industry based on the growth of value of the sector. This sector's year-on-year growth was 33.2% for the year 2017 amidst challenges posed by declining oil prices, escalation of construction material costs, labor shortage, and the government's fiscal policies (https://www.export.gov/article?id=Malaysia-Engineering-Construction). The significant relationships of project-related and organizational-related factors on dimensions of project performance for civil, building, and infrastructure sector are discussed in detail in the following paragraphs.

Among the project-related factors, the use of project management tools/techniques has a significantly positive relationship with the quality and safety dimensions of performance. This finding supports prior research findings that reduced usage of project management tools/techniques is a key reason for poor project performance of construction companies (White & Fortune, 2002), and proper usage of project management tools/techniques is essential for the success of the projects (Murphy & Ledwith, 2007). According to Hendrickson and Au (2008), safety and quality of construction projects are influenced during the design and the planning process when project management tools and techniques typically play a major role. Construction companies in Malaysia are required to obtain quality accreditation (ISO 9000, ISO 21,500) (Keng & Kamal, 2016) and occupational safety and health (OSH) accreditation to bid for national and international construction projects. These accreditations encourage construction firms to use relevant project management tools and techniques to effectively plan, design, control, and monitor the projects.

A negative relationship of external-related factor with cost performance in the civil, building and infrastructure sector indicates that increased external problems such as those related to weather, regulatory enforcements, and other unforeseen conditions during the project are related to increased failures in achieve cost performance goals. For example, inclement weather in the project site can result in equipment or materials damage, halting work, and leading to increased costs. Prior research has confirmed a significant relationship between external-related factors and project cost in Malaysian construction industry (Baria, Yusuf, Ismail, Jappara, & Ahmad, 2012; Musa, Amirudin, Sofield, & Musa, 2015; Sambasivan & Soon, 2007).

Among the organizational-related factors, organizational culture-related and learning organization-related factors have significant positive relationships with time, cost, quality and financial performances. It is the organizational culture that

Exhibit 7. Regression Analysis – Oil & Gas Construction Sector's Project Performance with Control Variable

	Dependent Variable				
Independent Variable	Time	Cost	Quality	Safety	Financial
Project-related Factors (IV1)					
Client-related factor	−0.011	0.021	−0.048	0.127	0.093
Contractor-related factor	−0.146	−0.195	−0.239	0.017	−0.476**
Consultant-related factor	−0.152	−0.103	0.021	−0.033	0.101
Material-related factor	0.031	0.046	0.153	−0.104	−0.183
Labor and equipment-related factor	0.004	0.075	−0.104	−0.009	0.294
Contract-related factor	0.071	−0.143	−0.009	−0.049	0.153
External-related factor	0.076	0.036	−0.146	−0.010	−0.121
Project management tools/techniques-related factor	0.148	0.077	0.151	0.212	0.074
Organizational-related Factors (IV2)					
Leadership-related factor	0.072	0.222**	−0.150	−0.099	−0.027
Organizational culture-related factor	0.287**	0.366**	0.280**	0.122	0.045
Innovation-related factor	−0.152	−0.040	−0.111	−0.146	0.311**
Learning organization-related factor	0.451**	0.042	0.246**	0.428**	0.149
Control Variable (Size of the Organization)	0.253**	0.151	0.135	−0.103	−0.133
R^2 Value (%age of variance in the dependent variable explained by the independent variables)	0.513	0.291	0.361	0.371	0.269
F Value (indicates significance of overall model fit)	5.513	2.146	2.949	3.081	1.922
P Value (indicates significance of overall model fit)	0.000**	0.015**	0.003**	0.002**	0.049**

** Coefficients significant at 0.05 level of significance, n = 82.

guides the behavior of the entire organization (Yazici, 2009). The positive relationship of culture with project success has been highlighted by prior research (Belassi et al., 2007; Vaidyanathan, 2016; Yazici, 2009), and the positive relationship is established strongly in this research. The technological changes in the civil, building and infrastructure sector are fast and rampant, and it is essential for the construction firms to have a culture that encourages learning and adapting. Researchers have pointed out that the ability of an organization to learn and adapt to the changes is influenced by the culture that exists in the organization (Cooke-Davies, 2002; Love et al., 2004; Tennant & Fernie, 2013) and therefore, it is expected that these factors are positively related.

Marine Sector

According to the Ministry of Transport, Malaysia has 47 active marine ports of which 9 are major ports handling the bulk of the trade. These 47 ports require expansion, upgrading, and maintenance regularly to meet the economic growth of the country. The volume of goods handled by Malaysia's main ports for the year 2016 recorded a 10-year compound annual growth rate (CAGR) of 5–6% (The Edge Financial Daily, 2017). The significant relationships of project-related and organizational-related factors on dimensions of project performance for marine sector are discussed in detail in the following paragraphs.

Among the project-related factors, contractor-related factor has negative relationships with time and safety performances, consultant-related factor has positive relationships with time, safety, quality, and financial performances and material-related factor has a positive relationship with safety performance. The contractors are an integral part of construction industry. Many researchers have shown that the performance of contractors has a direct relationship with the performance of projects (e.g., Marzouk & El-Rasas, 2014; Sambasivan & Soon, 2007). Our findings indicate that drop in performance of contractors due to poor planning, poor site management, poor construction methods, and inadequate experience can cause the projects to be delayed (time performance) and can severely compromise the safety performance of the projects. According to Gudmestad (2013), marine construction is very challenging due to diverse climatic and ocean conditions under which the contractors and workers have to operate. Therefore, the contractors have to be extremely skilled to operate under these conditions without any untoward safety incidents.

The positive relationship with consultant-related factor indicates that the increased roles of consultants such as contractor management, preparation and approval of drawings, control of quality assurance, and getting approvals of tests and inspections assist in improving the performance of projects in terms of time, safety, quality, and financial indicators. According to Nikumbh and Pimplikar (2014), at every stage of the construction project cycle (conception to closure), being proactive and having the ability to provide effective and timely solutions to various challenges faced in the projects are crucial and consultants offer these services. Sarda and Dewalkar (2016) have argued that consultants play a crucial role in meeting the performance requirements of

Exhibit 8. Regression Analysis – Multidiscipline Construction Sector's Project Performance with Control Variable

	Dependent Variable				
Independent Variable	Time	Cost	Quality	Safety	Financial
Project-related factors (IV1)					
Client-related factor	0.057	−0.127	−0.095	0.318**	−0.219
Contractor-related factor	−0.365**	−0.120	−0.188	−0.355**	−0.034
Consultant-related factor	0.036	−0.148	0.013	0.170	−0.164
Material-related factor	−0.026	0.004	−0.152	−0.080	0.058
Labor and equipment-related factor	0.080	0.319	0.159	0.162	0.220
Contract-related factor	0.295	−0.130	0.337	−0.090	0.248
External-related factor	−0.078	0.009	−0.210	−0.188	−0.062
Project management tools/techniques-related factor	0.229	0.366**	0.193	0.195	0.019
Organizational-related factors (IV2)					
Leadership-related factor	−0.127	0.282**	−0.092	0.105	−0.036
Organizational culture-related factor	0.216	0.125	0.197	0.246	0.207
Innovation-related factor	−0.011	0.228	0.217	−0.010	0.017
Learning organization-related factor	0.245**	0.193	0.238**	0.096	0.359**
Control Variable (Size of the Organization)	−0.019	0.014	−0.267**	−0.247**	0.063
R^2 Value (%age of variance in the dependent variable explained by the independent variables)	0.345	0.391	0.329	0.388	0.340
F Value (indicates significance of overall model fit)	2.714	3.303	2.530	3.267	2.653
P Value (indicates significance of overall model fit)	0.005**	0.001**	0.012**	0.001**	0.006**

** Significant at 0.05 level of significance, $n = 8$

construction projects. Therefore, selection of consultants with the appropriate skills (technology, quality, safety, and project management) is vital to the successful completion of projects.

The positive relationship with material-related factor indicates that availability of quality materials at the right time in right quantity can help improve the safety performance of the project. The literature is replete with studies that explicate the importance of materials for ensuring safety in the construction industry. According to Isnin, Ahmad, and Yahya (2012), toxic, defective and contaminated materials can directly affect the safety of the workers and therefore, the marine construction project. The materials (such as steel and concrete) are subjected to harsh environment in the marine sector, which results in corrosion and cracks (Husain, Al-Bahar, Abdul Salam, & Al-Shamali, 2004), and these can have severe safety implications. Therefore, the relationship between the safety and quality of materials is very strong in the marine sector. The site managers must ensure that the quality of the construction materials is not compromised to reduce the costs.

Among the organizational-related factors, leadership has a positive relationship with quality performance, organizational culture has a positive relationship with safety performance, innovation has a negative relationship with quality performance, and learning organization has positive relationships with quality and financial performances. The positive effect of leadership on project (quality) performance has been addressed by researchers. For example, Jha and Iyer (2006) have studied the quality performance of the projects in India and have shown leadership to be an important factor, Ananatatmula (2010) has clearly argued the impact of leadership on improving the project performance, and Larsson, Eriksson, Olofsson, and Simonsson (2015) have explicitly shown that project performance (in terms of cost, time, and quality) is affected by leadership.

Lack of sensitivity among different project participants to cultural differences can lead to adversarial relationships between the stakeholders, which in turn can lead to negative performance in terms of cost, time, safety, and quality (Phua & Rowlinson, 2003). A strong organizational culture is claimed to be an effective way to respond to the environment, thus achieving a superior performance. Considering the hyper-turbulent environment and fragmented nature of the construction industry in general and marine construction industry, in particular, understanding and managing organizational culture is of particular importance in enhancing organizational performance (Ankrah & Langford, 2005). According to Molenaar, Park, and Washington (2009), there is a strong relationship between corporate culture and safety performance. In fact, they argued that safety culture is an integral part of the organizational culture. Nguyen and Watanabe (2017) have shown a strong relationship between organizational culture and project performance of construction firms based on a study in Vietnam.

In the marine sector, innovation has a negative regression coefficient with quality performance (shown in Exhibit 6). Based on the meanings of low and high scores, a low score indicates that the construction firm favors innovation. Therefore, it can be concluded that if a marine construction firm favors innovation, then the quality performance improves.

Marine construction offers numerous challenges, which provide great opportunities for innovation (Gerwick, 2007). According to Brockmann, Brezinski, and Erbe (2016), the construction industry, in spite of criticisms for not innovating enough, has showcased many innovative projects. Those authors argued, "The construction industry with its bewildering diversity of products and services provides results on a continuum from repetition to innovation" (p. 1). The authors contend that innovation is an integral part of marine construction sector, and the innovative strategies adopted by the firms in terms of materials and technology have a telling impact on the quality of construction.

Love et al. (2004) have shown that a relationship exists between quality and learning organization. According to Fong and Yip (2006), the capacity of the construction firms to learn and adapt is critical for success. They did a study on construction firms in Hong Kong and concluded that organizational learning did not exist in those construction firms, and more often than not, mistakes were repeated in other projects. Zhai, Liu, and Fellows (2014), based on their study in China, have argued that learning organization is an important competitive advantage for construction firms and urged firms to develop systems and practices that can assist firms in learning. The project managers in the marine construction must ensure that the experiences, issues, and challenges faced during the lifecycle of a project must be captured, and eventually this knowledge must be utilized to successfully execute and complete the existing and future projects.

O&G Sector

O&G sector contributes to 20–30% of Malaysian GDP (https://www.export.gov/article?id=Malaysia-Oil-and-Gas-Equipment). According to the Performance Management and Delivery Unit of Malaysia (PEMANDU) and the central bank of Malaysia, the O&G sector is a major contributor to the Malaysian economy. The significant relationships of project-related and organizational-related factors on dimensions of project performance for O&G sector are discussed in the following paragraphs.

Among the project-related factors, contractor-related factor has a negative relationship with financial performance. Our finding indicates that a drop in performance of contractors due to poor planning, poor site management, poor construction methods, and inadequate experience can have significant relationships with the financial performance of the O&G projects. Thuyet, Ogunlana, and Dey (2007) have argued the role of contractors in affecting the performance of contractors by analyzing the O&G construction projects in Vietnam. Fallahnejad (2013) has analyzed the factors causing delays and poor performance in O&G projects in Iran and has identified contractors to be one of the reasons for poor performance. Therefore, O&G construction firms must appoint the contractors with the right skills.

Among the organizational-related factors, leadership has a positive relationship with cost performance, organizational culture has positive relationships with time, cost and quality performances, innovation has a positive relationship with financial performance, and learning organization has positive relationships with time, quality, and safety performances. Many researchers have highlighted the significance of leadership in construction industries (Ananatatmula, 2010; Jha & Iyer, 2006; Larsson et al., 2015; Nolan & Anderson, 2015). According to Nolan and Anderson (2015), the role of leadership is critical in improving the operational excellence of O&G industry, and this improvement eventually leads to enhanced cost performance. It is vital that O&G construction projects are executed by the project managers with strong leadership skills.

The relationships between organizational culture and the performances of construction firms have been studied by many researchers (Ankrah & Langford, 2005; Molenaar et al., 2009; Nguyen & Watanabe, 2017; Phua & Rowlinson, 2003). According to Kashwani and Nielsen (2017), organizational culture affects employee safety behavior in O&G construction, and this contributes to faulty implementation, which can have significant relationships with time, cost, quality, and safety performances. Therefore, it is imperative that the employees in the O&G construction firms understand and are trained in the cultures in which they operate.

In the O&G sector, innovation has a positive relationship with financial performance. Based on the meanings of low and high scores, a high score indicates that the O&G construction firms in Malaysia do not favor innovation. This result is not surprising given the Malaysian context. According to Wang (2017), the decline of O&G prices and the weakening of Malaysian currency have had a negative impact on the Malaysia economy and severely affected the O&G construction firms, which are now exercising caution with respect to RandD expenditures (vital to innovation) as these might have a significant impact on the financial performance of the firms. Our interviews with the managers of O&G construction firms have revealed that they are 'going slow' on expenditures related to innovation.

The positive relationships of learning organization with performances of construction firms have been established (Fong & Yip, 2006; Love et al., 2004; Zhai et al., 2014). According to Ross (1996), the key attributes of learning organization are leadership, accountability, shared vision, and culture of learning. Ross has suggested that the learning organization embeds quantum improvement capability in O&G firms. According to Prokesch (1997), based on his interview with the CEO of British Petroleum, "learning is at the heart of company's ability to adapt to a rapidly changing environment" (p. 1). According to Avnet (2015), organizational culture and learning play a very important role in enhancing the safety performance of O&G construction firms. These firms in Malaysia are going through turbulent times due to several challenges (Wang, 2017). Therefore, the construction firms must learn to adapt to this change to improve their performance in terms of cost, time, and safety.

Multidiscipline Sector

Due to the competitiveness of the Malaysian construction industry and government policies on promoting foreign construction companies to bid for competitive mega-projects in Malaysia, the local construction firms have been forced to learn and enter into multidiscipline project construction such as civil, building, infrastructure, marine, O&G, property development, and engineering consultancy. The entry into multidiscipline operations have helped firms to manage their operations without serious losses if one of the construction sectors is not doing well due to various issues associated with that particular sector. The significant relationships of project-related and organizational-related factors on dimensions of project performance for the multidiscipline sector are discussed in the following paragraphs.

Among the project-related factors, the client-related factor has a significant positive relationship with safety performance, the contractor-related factor has significant negative relationships with both time and safety performances, and the use of project management tools and techniques has a significant positive relationship on cost performance. The positive relationship of client-related factor with safety performance is intriguing. This relationship suggests that factors such as client interference, lack of financing and delay in payments, slow decision-making, unrealistic project duration and imposed condition can improve the safety performance. According to Ogunlana, Santosa, and Minato (2003), client interference increases in high-rise building projects in Jakarta (Indonesia) when there is reduced communication among clients, contractors, and consultants. According to Idaro (2010), in the construction industry in Nigeria, the clients interfere in the selection of contractors to ensure that the quality and safety of the projects are not compromised. According to Jatarona, Yusof, Ismail, and Saar (2016), the Malaysian Government (public sector) remains the largest client in the construction industry. Therefore, it is not surprising that interference, delay in payments, delay in decision-making, and imposed conditions take place to ensure that safety performance of public projects is not compromised.

In general, the role of contractors in the construction industry is critical, and many researchers have highlighted this fact (Gudmestad, 2013; Marzouk & El-Rasas, 2014; Sambasivan & Soon, 2007). According to our findings, contractor performance due to better planning, better site management, good construction methods, and adequate experience can have significant relationships with the time and safety performances of multidiscipline projects. Sambasivan and Soon (2007) have shown that the poor performance of contractors has a direct relationship with time performance. According to Gudmestad (2013), the poor performance of contractors in construction firms can lead to a decline in safety performance. Therefore, it is essential that contractors with adequate skills be appointed by the construction firms.

Our findings indicate that usage of appropriate project tools and techniques can help improve the cost performance of projects. White and Fortune (2002) have argued that reduced usage of project management tools/techniques leads to poor project performance of construction companies. According to Murphy and Ledwith (2007), proper usage of project management tools/techniques is imperative for project success. They claim that these tools and techniques help the project managers to plan, design, and manage their projects better, resulting in reduced delays and therefore, better performance in terms of time and cost.

Among the organizational-related factors, leadership has a positive relationship with cost performance and learning organization has positive relationships with time, quality, and financial performances. The role of leadership in construction firms has been highlighted by many researchers (Ananatatmula, 2010; Jha & Iyer, 2006; Larsson et al., 2015; Nolan & Anderson, 2015). Critical to improving the operational excellence of construction firms, this improvement eventually leads to enhanced cost performance (Nolan & Anderson, 2015) and indicates the importance that construction projects are executed by project managers with strong leadership skills.

Many researchers have argued a strong link between the learning organization and the performances of construction firms (Fong & Yip, 2006; Love et al., 2004; Zhai et al., 2014). Zhai et al. (2014) found that the ability of construction firms to learn provides a competitive advantage and improves project performance. The project managers have to ensure that the experiences, issues, and challenges faced by different projects are captured and eventually utilized successfully to help the firms improve their time, quality and financial performances.

Implications for Engineering Managers

The implications for engineering managers in the civil, building and infrastructure construction sector are: (1) use appropriate project management tools and techniques, (2) devise a risk management system to mitigate the effects of external factors, (3) help employees understand and be guided by the organizational culture, and (4) provide the environment and technologies such as an effective knowledge management system to encourage the organization (employees) to learn and apply new knowledge in the management of future projects.

The implications for engineering managers in the marine construction sector are: (1) appoint contractors and consultants with appropriate skill sets, (2) ensure availability of quality material in right quantities and at right time, (3) appoint a project manager with strong leadership qualities, (4) train the project team to be sensitive to a diverse organizational culture (client, supplier, contractor, consultant and other stakeholders), (5) strengthen innovation through research and development and knowledge management, and (6) provide the infrastructure and training necessary to capture and utilize learning.

The implications for engineering managers in the O&G construction sector are: (1) ensure appointment of contractors with requisite skills, (2) appoint project managers with strong leadership qualities, (3) train the project team to be sensitive to a diverse organizational culture (client, supplier, contractor, consultant and other stakeholders), (4) drive innovation in spite of external challenges, and (5) provide the infrastructure and training necessary to capture and utilize learning.

The implications for engineering managers in the multidiscipline construction sector are: (1) clients must resort to minimum interference and ensure that decisions and payments are made on time, (2) appoint contractors with requisite skills, (3) use appropriate tools and techniques to plan, design, and manage projects, (4) appoint project managers with strong leadership skills, and (5) provide the infrastructure and training necessary to capture and utilize learning.

Conclusion and Limitations

This research has improved upon previous research from three perspectives: (1) by combining project-related and organizational-related factors in a single framework, (2) by analyzing the relationships of factors with five dimensions of project performance (cost, time, quality, safety, and financial), and (3) by analyzing the framework on different sectors of construction industry. An important finding is that the significance of the relationships of project-related and organizational-related factors with different dimensions of project performance are different for various sectors of the construction industry.

Some limitations of this research are: (1) the sample sizes are lower for marine sector because of small population of projects, (2) all the responses have been obtained from project managers/directors, and the results may differ if other stakeholders are considered, (3) the study is a cross-sectional study, and a longitudinal study could be done to provide better cause-effect relationships over time, and (4) the data was obtained from a single country and may not

be directly applicable to all projects globally. Future studies can build on the framework of this study by collecting data from multiple countries and from multiple levels of stakeholders.

Disclosure statement

No potential conflict of interest was reported by the authors.

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About the Authors

Gopal Sekar is currently employed as a Senior Quality Manager at Muhibbah Engineering (M) Bhd in Malaysia. He recently obtained his DBA from Universiti Utara Malaysia. He has more than 30 years of professional experience.

Kuperan Viswanathan is a Professor at Othman Yeop Abdullah Graduate School of Business, Universiti Utara Malaysia, Malaysia. He obtained his PhD in Natural Resource Economics from University of Rhode Island. He has more than 25 years of experience in resource economics, policy and development research, social science research capacity building, education and training. He was a member of the World Bank affiliated Centers for International Agricultural Research (CGIAR).

Murali Sambasivan is a Professor at Taylor's University Lakeside Campus, Malaysia. His areas of interest are Management Science, Operations and Supply Chain Management, Healthcare Management and Entrepreneurship. He has published in many international journals in various areas of management. Prof. Murali before becoming an academic worked in the industry for 10 years. He has a bachelors' and a masters' degree in Engineering from India and PhD in Management Science from University of Alabama.

Contact: Murali Sambasivan, Taylor's University Lakeside Campus, No 1, Jalan Taylor's, Subang Jaya, 47500 Selangor, Malaysia; sambasivan@hotmail.com