THE MODERATING EFFECT OF PROJECT RISK RESPONSE-RELATED MEASURES ON THE RELATIONSHIP BETWEEN PROJECT-RELATED DELAY FACTORS AND CONSTRUCTION PROJECT PERFORMANCE

Priyadatchini Karunakaran\(^1\), Abdul Halid Abdullah\(^2\), Sasitharan Nagapan\(^3\), Murali Sambasivan\(^4\), Gopal Sekar\(^5\)

\(^1\)PhD Scholar, Fac. Civil and Environmental Engineering, Universiti Tun Hussein Onn Malaysia, Malaysia, \(^2\)Assistant Professor, Fac. Civil and Environmental Engineering, Universiti Tun Hussein Onn Malaysia, Malaysia, \(^3\)Senior Lecturer, Fac. Civil and Environmental Engineering, Universiti Tun Hussein Onn Malaysia, Malaysia, \(^4\)Professor at Taylor's Lakeside College, Subang Jaya, Selangor, Malaysia, \(^5\)Corporate QA/QC, Muhibbah Engineering (M) Bhd, Malaysia.

Email: \(^1\)hf160070@siswa.uthm.edu.my, \(^2\)halid@uthm.edu.my, \(^3\)sasi@uthm.edu.my, \(^4\)sambasivan@hotmail.com, \(^5\)sekar@muhibbah.com.my

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Abstract

Purpose of the study: This conceptual paper is based on a review of delay issues, risk response management and project performance in the Malaysian construction industry. The study also involved the evaluation of latent relationships among project-related delay factors, project risk response-related measures and project performance in terms of time and cost.

Methodology: Literature in light of recent studies was reviewed and a thematic review approach was also conducted. The themes summarized delay issues, risk response measures, and project performance. Subsequently, the synthesized literature review aided the development of the conceptual framework for the delay mitigation model.

Main Findings: The authors presented a model where project-related delay factors have a negative effect on project performance, project risk response-related measures have a positive effect on project performance and project risk response-related measures positively moderate the relationship between project-related delay factors and project performance.

Applications of this study: This study will enable the construction practitioners to understand better ways to mitigate delay issues in the construction industry.

Novelty/Originality of this study: This work offers a conceptual perspective on the enhancement of project performance in terms of cost and time by addressing the issues of project delay factors managed using project risk response-related measures.

Keywords: Construction, Delay, Malaysia, Project Performance, Risk Response Management.

INTRODUCTION

Project management is the lifeline of project success. Construction projects are usually facilitated by the application of project management tools such as project planning & controlling for the effective accomplishment of construction projects in terms of quality, time and cost (Sekar et al., 2018). However, studies revealed that construction project overrun in terms of time and cost manner are still deeply rooted in the global construction industry (e.g., Assaf & Al-Hejji (2006) (Saudi Arabia); Sambasivan & Soon (2007), Zailani et al. (2016), Sekar et al. (2018) (Malaysia); Ajanleko (1987), Aibinu & Jagboro (2002) (Nigeria); Aibinu (2009) (Singapore)) arising from unmanaged or unmitigated risks during the project life-cycle (Jung & Han, 2017). Sekar et al. (2018) indicating construction project risk factors are more or less associated with 29.5% variance in time performance and 25.9% variance in cost performance. This consensus with the findings by Assaf & Al-Hejji (2006). In 1994, Latham strictly emphasized that identifiable risks should be tackled in inappropriate ways (i.e. managed, reduced, shared, transferred or accepted) but it should not be ignored at any point (Latham, 1994). Hence, this reveals the need to address delay factors that are associated with the project’s time and cost risks, for instance, it to be moderated and managed well with proper project risk response management.

To expand the discussion on what attributes are necessary for risk responsive development, as well as to identify which attributes could enhance the relationship between delay risk factors and project time-cost performance, this study would be evaluating two major underpinning theories that are relevant to project performance in the construction industry. These namely (i) transaction cost economics (TCE) theory, and (ii) project risk management theory. The TCE theory deals with causes of delay, whereas the project risk management theory deals with the systematic procedure of mitigating the delay causes. By combining both the TCE and project risk management theories, the project management theory can be strengthened to enhance the project performance for the construction industry. A clear overview of project-related delay factors and project risk response development is discussed in the following sections. Then, a model is proposed illustrating the hypothesis developed for this study. Finally, a broad discussion together with suggestions for future research and practical implications are highlighted.
DELAY FACTORS

The transaction cost economics (TCE) theory offers a remarkable recognition dealing with the project management processes (Coase, 1937). Since construction projects are the product of numerous complicated activities, multiple cost transactions can occur at various stages of a project’s life cycle. Any rise in transaction costs along the project’s life cycle without proper mitigation management would lead to cost overruns. Sambasivan et al. (2017) revealed the delay influencing factors in construction project activities holding the main role as transaction partners when dealing with time and cost overrun. Therefore, a collective of studies on delay issues has been collected and summarized in Table 1 to understand its causes and effects.

| Source/Place of study | Causal factors | Effect factors | Techniques/tools used |
|-----------------------|----------------|----------------|-----------------------|
| Assaf & Al-Hejji (2006) Saudi Arabia | Owner, contractor, client, design, labor, consultant, material, external, project and equipment | Time and cost overruns | Descriptive statistics and rank correlation |
| Sambasivan & Soon (2007) Malaysia | Client, contractor, consultant, material, labor/equipment, contract, contractual relationships, and external | Time overrun, cost overrun, dispute, arbitration, litigation, and abandonment | Descriptive statistics and rank correlation |
| Enshassi et al. (2009) Denmark | Project-related, responsibilities, consultants’ responsibilities, owners’ responsibilities, professional management, design and documentation, materials, execution, labour and equipment, contractual relationship, government relations, and external factors | contractors’ and external factors | Descriptive statistics, Spearman correlation and rank correlation |
| Zailani et al. (2016) Malaysia | Coordination, resources, and environmental | Project performance | SEM - PLS |
| Sambasivan et al. (2017) Tanzania | Client, contractor, consultant, material, labor/equipment, contract, contractual relationships, and external | Cost overrun, dispute, arbitration, litigation, and abandonment | Descriptive statistics and SEM – Lisrel 9.1 |
| Sekar et al. (2018) Malaysia | Project-related factors: Client, contractor, consultant, material, labor/equipment, contract management, external, and project management tools/techniques Organizational-related factors: Leadership, organizational, innovation, and learning | Time, cost, safety, quality, and financial performance | Descriptive statistics and regression |

There seems to be a general agreement on the delay causes and effects among all studies tabulated in Table 1. The processes of project management are seen to be highly influenced by the requirement, extent, and planning of work to be executed, proper selection of tools and techniques, adequate allocation of resources, proper utilization of monitoring system and also the extent of changes incur from the initial plan. Moreover, external or environmental factors also influence the performance of a project and making it difficult for the construction managers to complete their project on time and within the stipulated cost. Basically, Sambasivan et al. (2017) revealed that the causes of delay are actually the outcomes of uncertainties (i.e. poor governance structure, weather, acts of nature, improper tool or techniques selection for time and cost estimation), bounded rationality (i.e. limitation of knowledge when making decisions), and opportunistic behaviour (i.e. firm maximizing own interest). Uncertainties, bounded rationality, and opportunistic behaviour are the attributes of TCE and they were first remarked by Williamson (1975). A high level of bounded rationality and opportunistic behaviors would produce a higher level of uncertainty. Arain&Pheng (2013) grouped these risks as either controllable or uncontrollable delay factors. Controllable delay factors defined as the risks that could be actually prevented or mitigated from being impactful on project performance, whilst uncontrollable delay factors deal with uncertainties, where the risks are said beyond the control of project managers. Unfortunately, most studies found these unmanaged risks causing severe impact on time and cost performance as shown in Table 1. So, it is no big surprise.
when most of these studies in Table 1 propose on managing these delay risks with effective project risk response management to enhance the project performance in the construction industry.

PROJECT RISK RESPONSE MANAGEMENT

Every construction projects have unique sizes, nature and complexity, and hence, there are high possibilities of encountering multiple risks and uncertainties during the project construction time period (Hwang et al., 2017). The main reason why most practitioners are facing unsuccessful project accomplishment within budgeted time and cost is due to the ignorance of the contract parties to mitigate the identified risks (Prasad et al., 2019). In compliance with this study, the project risk management theory would be utilized. In a systematic project risk management approach, there are four main steps to be followed, namely, risk identification, risk analysis, risk evaluation and finally, risk response (Wang et al., 2004). The final stage of project risk response management holds an important role of decision making in construction industry (Hwang et al., 2017). The risk response management and construction project success is heavily dependent on the best knowledge and practices by the peer construction practitioners (Hwang et al., 2017; Yap et al., 2018). The development of project risk response measures would require a process of continuous learning, adapting to change, managing risk and evaluating progress (Yap et al., 2018).

In a risk response management, there are five major ways of managing risks, firstly, prevention and reduction (higher orders), then followed by sharing, transferring and acceptance (lower orders) (Latham, 1994). In risk management, project managers prioritize the higher order risk managing ways instead of the lower ones because they are more effective in reducing the frequency of transaction costs. The risk prevention involves ways of avoiding any possible risk occurrence throughout the project life cycle, whilst the risk reduction aims to minimize the effects of delays on project performance. On the other hand, the risk sharing deals on distributing the percentage of cost risks among contract parties, the risk transfer deals with distributing all the cost risks to one or two concerned parties and finally, the risk acceptance deals with the accepting all the uncertainties risk. It is recommended to investigate the project risk response-related measures and project performance quantitatively as there is an argument that risk response measures or strategies have positive effect in enhancing project performance (Ropponen & Lyytinen, 1997; McGrew & Bilotta, 2000; Abdul-Rahman et al., 2006; Chai et al., 2015; Zailani et al., 2016; Yap et al., 2018). To date, there are only two studies that have attempted investigating the relationship between project risk response measures and project performance empirically, meanwhile another two studies focused on implying project risk mitigation strategies/tactics as a means of avoiding or reducing the delay effects as summarized in Table 2. Due to limited quantitative studies in past literature, there is a requirement to further explore and investigate the effectiveness of project risk response measures or strategies on project performance in terms of time and cost.

Table 2: Past empirical studies on delay risk mitigation

| Source/Place of study | Risk measures/strategies | Effect factors | Techniques/tools used |
|-----------------------|-------------------------|----------------|----------------------|
| Aibinu (2009)         | As a means of strategy: Preventive, predictive, corrective, organizational-related measures | Delays and disruptions | SEM - PLS |
| Chai et al. (2015)    | Malaysia                | Preventive, predictive, corrective, organizational-related measures | Delays | SEM - AMOS |
| Zailani et al. (2016) | Malaysia                | As a means of strategy: Project visibility, project flexibility and supplier development | Delays | SEM - PLS |
| Yap et al. (2018)     | Malaysia                | Preventive-related measures: Effective communication tools, effective communication influences, critical learning situations, essential reusable project experiences | Project time-cost performance | SEM - PLS |

RESEARCH METHODOLOGY

For developing a conceptual framework, themes, issues and gaps have been identified in the construction management field as suggested by Miles & Huberman (1984). By setting the scope and limitations of the study, the information for the strategy and direction to mitigate the delay issues about the Malaysian construction industry can be synthesized by recent and current literature. The initial stage of the conceptual framework only involves the relationship between project-related delay factors and project performance. The framework is then expanded by including project risk response-related measures as the moderator to moderate the relationship between delay issues and project performance. The developed framework is re-verified to ensure it matches the objective of this study.

MODEL CONCEPTUALIZATION

The proposed framework for this study is shown in Figure 1. The framework consists of three major constructs which include project-related delay factors as independent variable, project risk response-related measures as moderator variable, and project time-cost performance as dependent variable. This proposed model attempts to evaluate the
relationships of project-related delay factors on project time-cost performance with project risk response-related measures as the moderators. Project-related delay factors comprise of coordination-related, resource-related and environment-related factors, which were adopted from Zailani et al. (2016). Meanwhile, project risk response-related measures are preventive-related, predictive-related, corrective-related, and organizational-related in nature, which were adopted from Chai et al. (2015). On the other hand, project performance-related factors are based on their effects on the time and cost variation incurred at project completion stage, which were adopted from Sekar et al. (2018).

![Figure 1: Research framework](image)

**Project-Related Delay Factors and Project Performance**

Studies across the globe have attained a saturation point in investigating the impact of project-related delay factors on project performance that is associated with time and cost performance (Yap et al., 2018). The delay issues in the global construction industry remained an omnipresent problem due to the rise in the transaction cost (Sambasivan et al., 2017). Zailani et al. (2016) formed a central focus on project-related delay factors by identifying coordination-, resources-, and environmental-related factors as the major causes of delay since they can reflect in terms of functionality, controllability, and intra- and inter-organizational. The coordination-related factors deal with the client-, contractor-, consultant-, and contract management style towards mutual objectives (Malone & Crowston, 1994, Sambasivan & Soon, 2007), meanwhile the resources-related factors can be defined as a process of managing four major inputs, namely, labours, materials, equipment and financing for project accomplishment (Nagaraju et al., 2012). Environmental-related factors refer to unpredictable factors that could have an impact on the processes of business activities (Sambasivan & Soon, 2007; Majid et al., 2019). The coordination- and resources-related factors are set within the controllability of an organization, unlike the environmental-related factors which are labeled as uncontrollable factors.

Studies found a significant relationship exists between project-related factors and construction project performance in terms of time and cost (Sambasivan & Soon, 2007; Zailani et al., 2016; Sambasivan et al., 2017; Sekar et al., 2018). Even though some causes and effects are unique to certain countries, some significant comparable factors were seen. For instances, Belassi & Tukel (1999), Zailani et al. (2016), and Sekar et al. (2018) empirically proved that the environmental-related factors take the lead among all other delay factors in construction projects. Meanwhile, a number of researchers have reported material-related factors to be the one critically impacting cost performance (Frimpong et al., 2003; Enhanssi et al., 2009; Memon et al., 2012; Sambasivan et al., 2017). Studies by Sekar et al. (2018) reported the major sources of the delays in the Malaysian construction projects are due to the multiple-parties involvement, complexity of expectation and loose management style. In some other investigation, Aibinu & Jagboro (2002) revealed client-related factors as the most significant delay factors in Nigeria. In Malaysia, Alagbari et al. (2007) found financial issues and coordination issues as major delay problems in construction projects. Based on prior findings of past literature and relevant discussion presented here prompt to propose the following hypothesis:
H1: Project-related delay factors significantly having a negative effect on the project time-cost performance.

**Project Risk Response-Related Measures and Project Performance**

Managing risk is a vital management process in every construction project (Yap et al., 2018). Most of the studies (Abdul-Rahman et al., 2006; Sambasivan & Soon, 2007; Doli, 2013; Olawale et al., 2015) have suggested a list of possible practices that could effective in project success delivery. Preliminary work on project risk response-related measures was undertaken by Olawale & Sun (2010). It is a qualitative study that covers four major measures, namely, preventive-, predictive-, corrective-, and organizational-related measures with a total of 90 measures developed to inhibit the time and cost factors. What is more, the risk response management literature body grew with several notable qualitative research works such as Mbachu (2011), Roslan et al. (2015), Asiedu et al. (2017), Prasad et al. (2019) and Hwang et al. (2017). The present study primarily focuses on project risk response-related measures observed by Chai et al. (2015), who used an insufficient sample size to generalize their findings with the real delay issues scenario in the Malaysian construction industry. The study extracted 17 mitigation measures into four major risk response measures (preventive-, predictive-, corrective- and organizational-related measures) by conducting a principal component analysis. Their empirical study indicated seven of their preventive measures are far more effective in enhancing the project time performance in the Malaysian construction industry. Based on Chai’s findings, in 2018, Yap et al. observed out of these seven significant preventive measures, two of them hold an important mitigation role in enhancing project time-cost performance (Yap et al., 2018). On account of investigating the effectiveness of these risk response measures, the study explored the latent relationship among project communication management, project learning and project time-cost performance in the Malaysian construction industry. The results suggested both preventive-related measures have a positive impact on project time-cost performance. The limitation of this study is that the findings only focused on two preventive-related measures and project time-cost performance. Looking into the gap, so far, too little attention has been paid to investigate the relationship of four major groupings of project risk response-related measures on project time-cost performance. Hence, based on prior findings of past literature and relevant discussion presented here prompt to propose the following hypothesis:

H2: Project risk response-related measures significantly having a positive effect on the project's time-cost performance.

**The Role of Project Risk Response-Related Measures as Moderators**

Utilizing project risk response-related measure could enable to have additional insights as a contingent factor. Limited evidence proved that with the role of project risk response-related measures as moderator, the cost and time performance can be more controlled or vice versa. Up to date, only one study investigated the moderating effect of project risk responses. Zailani et al. (2016) studied the role of risk mitigation strategies in terms of project visibility, project flexibility and supplier development as moderators on resources, coordination and environmental and project performance in the Malaysian construction industry. The findings revealed that only project visibility and project flexibility risk strategies were significantly related to mitigating the effect of resources and coordination issues to enhance project performance. No moderating variance was found between all three mitigation strategies and environmental issues. Consequently, the need for more quantitative research study to be conducted is apparent such as developing models to create project risk response-related measures as aforementioned. Hence, based on the arguments presented, the third proposed hypothesis can be concluded as follow:

H3: Project risk response-related measures significantly having a positive moderating effect on the relationship of project-related delay factors and project time-cost performance.

**DISCUSSION AND CONCLUSION**

Those project managers in the construction industry who seek to improve their decision making have a plethora of approaches to consider such as risk prevention and reduction (higher orders), then followed by sharing, transferring and acceptance (lower orders). However, to provide a foundation for further empirical research, risk prevention and reduction are consolidated as the project risk response-related measures and its relationships with project-related delay factors and project time-cost performance were proposed to be investigated. Even though the other risk response strategies could be included in the framework, to remain parsimonious, risk prevention and reduction are the only attributes focused. The decision taken for this study was prompted by the early assumptions that risk response measures are important to reduce the delay effects by enhancing the project time-cost performance. This study discloses with a discussion of future research, including potential challenges, and practitioner implications.

**Future Research**

From the discussion presented earlier, the following research questions (RQs) are proposed:

Delay in construction industry projects caused by the coordination, resources and environment-related factors and have adverse effects on the project performance in terms of time and cost. The first research question proposed by this very study is as follow:
RQ1: Which are the project-related delay factors (coordination, resources and environmental factors) that significantly impact project time-cost performance of Malaysian construction companies?

The risk response measures or strategies are sometimes utilized or ignored. Previous studies suggest these measures could have a positive effect on construction project time and cost performance. It is worthwhile to explore and discuss the effect of these risk response measures on the construction project performance in future research. So, the second proposed question is as follow:

RQ2: Which are the project risk response-related measures (preventive, predictive, corrective and organization measures) that significantly impact project time-cost performance of Malaysian construction companies?

The risk response measures could likely have some insightful contribution as moderator for the relationship between the construction project delay factors and project performance in terms of time and cost. Hence, the third proposed research question is as follow:

RQ3: Which are the project risk response-related measures that significantly moderate the relationship between project-related delay factors and project time-cost performance of Malaysian construction companies?

This study argues these relationships are required to be investigated as it is a much more important and practical attribute in this model. The interactions among project-related delay factors, project risk response-related measures and project time-cost performance merit worthwhile findings avenue to further the knowledge about management of delays issues. Nonetheless, the implementation of the proposed model needs careful attention, as the measurement of the proposed model constructs needs multi-source data to address the delays issues and its impact on the construction project time and cost performance. This study proposes investigating the delay issues that arise due to coordination-, resources- and environmental-related factors (Zailani et al., 2016; Asnawi et al., 2019). On the other hand, for assessing the project risk response-related measures, this study proposes preventive-, predictive-, corrective- and organizational-related measures (Chai et al., 2015) as the basic metrics. Finally, for measuring project performance measures, the time and cost dimensions from Sekar et al. (2018) are proposed. There may also be a role of project and organizational size differences that could impact the relationship of the proposed model. For instance, Sekar et al. (2018) found practitioners from different levels of organizations have a different level of impact on the findings. Hence, this reminds future research should be considering the size of the project and organizational (in terms of the number of employees) as the control variable.

Practical Contribution

The research question put forward here is important for construction industry professionals. As the construction industry projects run into a delay that subsequently leads to an increase in the project time and cost. It helps the construction project managers to evaluate the delay factors and appropriate contingency plans can be drafted to tackle the delay factors. Furthermore, if the project risk response-related measures and construction project time and cost performance found to be associated, construction managers can design the risk response measures to manage the construction project in terms of time and cost. Moreover, if the project risk response-related measures found to act as moderators among the relationship between the project delay factors and construction project performance’s time and cost, construction management staff can develop appropriate responsive measures to deals with the delay factors and its effects on the construction project performance in terms of time and cost. As efficient and effective responsive measures are vital to the organizations, the research proposed here will guide practitioners in making decisions related to the contingency plan. In conclusion, the hypotheses presented here merit empirical research.

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CO-AUTHOR CONTRIBUTIONS

Priyadatchini Karunakaran is a Ph.D. student from Universiti Tun Hussein Onn Malaysia, Johor. She is currently surveying the mediating effect of mitigation measures on project delay. She is the main writer of this study which conceptually provides a framework on the moderating effect of mitigation measures for project delays.

Abd Halid B Abdullah and Sasitharan Nagapan are both professors and senior lecturer, respectively from Universiti Tun Hussein Onn Malaysia, Johor. They are the academic supervisors of Priyadatchini. Both having vast knowledge in construction management and provided content support especially in research methodology for this study. They also aided to improve the content grammatically.
Murali Sambasivan is a professor from Taylor’s Lakeside College, Selangor. He has vast knowledge in operations management, management science, supply chain management as well as applications of OR. He contributed many ideas and advice to improve the framework.

Gopal Sekar has both technical and research knowledge in the construction management field. He works with Muhibbah Engineering (M) Sdn Bhd, Selangor, and as well as a part-time lecturer in Universiti Teknologi Petronas, Perak. He also contributed many ideas and advice to improve the framework.

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