Is risk assessment matter in infrastructure projects on soft soils?

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Abstract. Infrastructure projects are not merely complicated but they require high investment costs and a considerable amount of resources and stakeholders are necessary to assure their performance. Infrastructure projects especially transportation projects like highway, bridge, etc. cover a significantly large area and involve a lot of different stakeholders as such they are high in risks and uncertainties compared to other types of projects. The large covered area has led to construction on different types of soils including soft soils. This will complicate the construction process. The results of the literature review showed that existing knowledge on risk assessment of infrastructure on soft soils is not merely insufficient. Some researchers have highlighted the importance of risk assessment in construction projects on soft soils. Hence, the aim of this research was to explore the perception of industry personnel about the significance of risk assessment in infrastructure projects. A questionnaire survey was designed and distributed to consultants and contractors in Malaysia. Data were analyzed based on the descriptive method. Results showed that industry people perceived that the level of risks and uncertainties of infrastructure projects on soft soils is higher than other types of soil. As such, the impact of infrastructure projects on soft soils on project cost performance will be more significant than other types of soil. Hence, construction industry professionals perceived that risk management is critical in mitigating risks especially in infrastructure projects on soft soils.

1. Introduction

The construction of mega infrastructure projects, namely East Coast Rail Link (ECRL), Mass Rapid Transit 2 (MRT2) and Light Rapid Transit 3 (LRT3) has shed light on the importance of risk management in infrastructure projects. In the Malaysian Budget 2020, the Malaysian government will continue providing support to the primary infrastructure to improve the competitiveness of the country [1]. Examples of infrastructure projects include development of Chuping Valley Industrial area, Kuantan port-related projects, construction of centralized sewerage treatment plant in Johor, development of infrastructure in Samalaju Industrial Park, upgrading FELDA roads and basic infrastructure, development of tourism-related infrastructure, development of basic infrastructure to increase the connectivity between urban and rural areas especially in Sabah and Sarawak and so on [1].

The large covered area has led to construction on different types of soils and these include soft soils. Soft soils such as peat soil and organic soil are problematic [2]. The low bearing capacity of soft soils tends to increase risks and uncertainties during the design and construction stages. According to the Project Management Body of Knowledge (PMBOK) guide 5th edition, “project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives such
as scope, schedule, cost, and quality”[3, 310]. It increases the challenge of assuring project performance and success. In Malaysia, peat covers over 25,000 square km and about 69% is located at Sarawak [4]. Because of the significant coverage of soft soils, those major infrastructure development projects are on soft soils [5]. In addition, each infrastructure project has its own unique risks and uncertainties.

In view of this, decision making plays a critical role in assuring the performance of infrastructure projects. Risk management is one of the ways to improve the performance of infrastructure projects on soft soils. Academic researchers have highlighted the importance of risk management process in managing and monitoring risks and uncertainties in infrastructure projects. Risk assessment is one of the processes in risk management involves the estimation of probability and severity of each identified risk on project objectives. Also, recent literature has shown that existing knowledge on risk assessment of infrastructure projects especially on soft soils is not sufficient [6, 7].

Although academic researchers have addressed the importance of risk management in infrastructure projects, the perspective from industry professionals about the importance of risk management is still in doubt. As such, the aim of this research was to explore the perception of industry personnel about the significance of risk assessment in infrastructure projects.

2. Literature Review
Risk management in infrastructure projects is gaining momentum in academia. Considerable past studies have focused on the risk assessment aspect. Risk assessment in infrastructure projects has been studied in different types of infrastructure projects, different geographical locations and different project stages. For example, Zhi [8] focused on general infrastructure, Ghosh and Jintanapakanont [9] assessed risks of underground mass rapid-transit in Thailand, Zayed et al. [10] conducted study on risk assessment in a highway project, Wong et al. [11] studied the cross-sea route project in China and Johnsen and Veen focused on communication infrastructure in railway, just to name few. From the perspective of the academic researchers, risk assessment is critical in mitigating, monitoring and controlling risks in infrastructure projects. But what do industry professionals say about this? According to Low et al. [6], risk assessment in infrastructure projects based on soil types (e.g. soft soils) is not getting much attention among academic researchers, especially in the management context. Does risk assessment a matter in infrastructure projects on soft soils among industry practitioners?

3. Research Methodology
To explore the significance of risk assessment in infrastructure projects on soft soils, four fundamental aspects were focused on this study. The first aspect was about risk level, the second aspect was about the uncertainties level, the third aspect was about cost performance and the final aspect was concerned with the application of risk management. A questionnaire was designed and distributed to the contractors and consultants in Malaysia after getting the ethics approval from the human research ethics committee. To assure validity and reliability of the study, industry professional with at least 10 years of working experience in infrastructure projects on soft soils was targeted in this study. To speed up the data collection process, random and convenience sampling methods were used in this study. The descriptive analysis method (e.g. percentage, mean) was used to analyze the data.

4. Results and discussions
One-hundred eighty questionnaires have been sent out by post, email and hand-delivered, 72 questionnaires have been received. However, a total of 62 valid responses were used in this study. This made a response rate of 34%. About 34% of them are at the seniority level and 66% are at the management level. About 35% of them have more than 20 years and above working experience in the construction industry. Table 1 indicates the results of the data collected from the 62 respondents. It was found that the statement, “Risk management is critical in mitigating risks and important in infrastructures projects soft soils” has the highest mean value, 4.10. This followed by the statement, “Infrastructure projects on soft soils will contribute significant impact on project’s cost performance
than infrastructures project on other types of soils” with the mean value of 4.06. The third highest mean value’s statement was “The uncertainties level in infrastructure projects on soft soils is higher than infrastructure projects on other types of soils” with a mean value of 3.98. The fourth highest mean value was “The risks level in infrastructure projects on soft soils is higher than infrastructure projects on other types of soils” with the mean value of 3.94. In general, most respondents supported that the risks and uncertainties levels in infrastructure projects on soft soils are higher than other types of soil. As such, they perceived that it will contribute a significant impact on project cost performance. Cost performance is always an element that concerned by all the project team members. This is also the reason for this study taking this aspect into consideration. Hence, they perceived that risk management is critical in mitigating risks and it is important in infrastructure projects on soft soils.

![Table 1. Mean values of four different aspects (adapted from [12]).](image)

| Four aspects                                                                 | Percentage (%) | Mean  |
|------------------------------------------------------------------------------|----------------|-------|
| • The risks level in infrastructure projects on soft soils is higher than     |                |       |
|     infrastructure projects on other types of soils.                         | 0.0            | 8.1   |
| • The uncertainties level in infrastructure projects on soft soils is        |                |       |
|     higher than infrastructure projects on other types of soils.             | 0.0            | 3.2   |
| • Infrastructure projects on soft soils will contribute significant impact    | 1.6            | 4.8   |
|     on project’s cost performance than infrastructures project on other types |                | 9.7   |
|     of soils.                                                                 |                | 53.2  |
| • Risk management is critical in mitigating risks and important in           | 3.2            | 1.6   |
|     infrastructures projects on soft soils.                                  |                | 11.3  |

5. Conclusions
In view of the high risks and uncertainties of infrastructure projects on soft soils compared to other types of soils from the perspective of industry professionals. It can be concluded that risk management process such as risk assessment plays a vital role in assuring the performance or even success of infrastructure projects on soft soils. Results of the study also indicated that the research value of future studies focusing on this area. As such, future studies can focus on proposing a risk management methodology for infrastructure projects on soft soils or assess and compare risks of different soil types based on a longitudinal approach.

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