



Assessing risk management capability of contractors in subway projects in mainland China

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Abstract

Contractor's risk management capability (RMC) reflects the sophistication of contractor's understanding of risk portfolio and how to manage those risks. This paper aims to develop a RMC assessment model for subway project contractors and to assess the current overall RMC of subway project contractors in mainland China. To achieve the objectives, a questionnaire survey was conducted and data were collected from 58 respondents. The empirical research findings showed that the overall RMC of subway project contractors can be regarded as between "low" and "medium". In addition, currently in subway projects' area, contractor's risk analysis capability is relatively more mature than other capabilities. However, contractors' risk management attitude is relatively less mature than other capabilities. Assessing the current RMC of subway project contractors can be used to identify the priority or weakest areas needed for improvement.

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1. Introduction

Subways are constructed in major cities across mainland China to overcome the transportation problems in the urbanization process. Up to July 2007, statistical data provided by China's Ministry of Construction showed that 10 cities had constructed subway or light rail transit systems and had been successful in their operation. Moreover, urban rail transit construction programs in Beijing, Shanghai, Tianjin, Chongqing, Guangzhou, Shenzhen, Nanjing, Hangzhou, Wuhan, Chengdu, Harbin, Changchun, Shenyang, Xi'an, Suzhou and Changsha have been approved by the China State Council. By 2020, the total length of urban rail transit lines in the above cities is estimated to be about 2500 km (NDRC, 2007).

Urban rail transit can be divided into subway, light rail transit, tramway, suburban railway and so on according to

traffic scope and vehicle type. The International Tunnelling Association (ITA, 2004) defined subway as an urban rail transit traffic system whose gross rail load on axle is relatively heavier and whose conveying capacity in a single direction is more than 30,000 persons per hour. Generally underground parts take about 70% of subway construction while the ground and elevated parts take about 30%. In China, most urban railway transit systems are subways (Xue et al., 2001). Thus, subway projects are the ones we focus on here.

At any stage of a life cycle, a project is plagued with various risks due to the complex and dynamic nature (Zhao et al., 2010). According to the Project Management Institute (PMI, 2008), project risk is an uncertain event that, if it occurs, impacts at least one project objective (e.g. quality, cost, and time) and risk management (RM) is fundamental to accomplish project objectives, and it is not only trying to keep away bad results but also acting as a guide to maximize positive results (Ghosh and Jintanapanont, 2004; Monetti et al., 2006).

Subway projects are very risky due to the complex and unpredictable underground conditions, and if these risks are

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not identified, assessed and responded to properly, may cause problems in design, construction and operation (Zhu et al., 2008). Thus it is very important to conduct RM in subway projects and implementing RM in subway projects may bring a number of benefits (Nakano et al., 2007).

Risks are usually undertaken by all project participants, and the contractors that deal with construction work are more likely to confront risk accidents which may have a negative impact on all other project objectives such as cost overruns, delays, poor quality, loss of productivity and loss of morale (El-Sayegh, 2008). Thus, RM should be also emphasized and implemented by contractors to assure the achievement of project objectives.

Risk management capability (RMC) reflects the sophistication of an organization's understanding of its risk portfolio and how to manage those risks (Zou et al., 2010). Contractors with diverse RMC can reduce risk in different levels (Hopkins and Nightingale, 2006). Besides, assessing the current RMC of construction organizations can be used to identify the priority or weakest areas needed for improvement and actions can be taken to increase the performance (Hopkinson, 2011).

More specifically, the objectives of this paper are: (1) to identify appropriate indices to assess the RMC of subway project contractors; (2) to develop appropriate weightings for each index; (3) to develop a RMC assessment model for subway project contractors and (4) to assess the current overall RMC of subway project contractors in mainland China. Thus, the findings of this study provide practitioners with a clear understanding of the status quo of their RMC. It also forms a solid base for industrial practitioners to measure, evaluate and improve the current performance of their RMC. Besides, as few studies have focused on RMC in subway project contractors, this study contributes to the body of knowledge relating to the RMC of subway project contractors.

Following the introduction to this study, the second section provides the background information relating to the RM in mainland China, RMC and RMC assessment. In the third section, RMC indices are identified. Then research methodologies are presented in the fourth section. Then, using factor analysis, mean scoring ranking technique, and fuzzy synthetic evaluation as quantitative tools for data analysis, a RMC assessment model for subway project contractors is developed and the current overall RMC of subway project contractors in mainland China is assessed, and the results are discussed in the fifth section. Finally, the sixth section draws conclusions of this study and recommends further research.

2. Background

2.1. Risk management in subway projects in mainland China

In mainland China, research on RM in subway projects began with how to relieve the impact of risks by means of insurance (Chen, 2004). Research was extended to risk assessment in terms of market, resource, financing and engineering (Chen, 2004). Later, the development of RM for subway projects in mainland China followed the way experienced by other countries. Risks were focused on cost, geological uncertainty, pit excavation,

shield tunneling and safety (Zou et al., 2010). After analyzing recent accidents in mainland China, people's competency and safety behavior were found to be big issues which in many cases contributed to the accidents (Zou et al., 2010). In summary, current RM in subway projects in mainland China mainly focuses on geological, technical and safety risk identification and assessment, while little effort has been committed to research on assessing RMC.

2.2. Risk management capability

Wang et al. (2004) indicated that RM is a formal and orderly process of systematically identifying, analyzing and responding to risks throughout the lifecycle of a project to obtain the optimum degree of risk elimination, mitigation and/or control. According to PMI (2004), to be successful, the organization should be committed to addressing the management of risk proactively and consistently throughout the project, in addition, establishing the maturity level of RMC in an organization is very important especially for construction organizations due to the high risk nature of their business.

Akkirajul et al. (2010) argued that enterprise RMC means the process, data, tools and the culture in the organization that enables one to manage risks. And it is necessary for organizations to have a clear view on their current approach to risk in order to define goals, specify processes, and manage progress in raising their RMC (Risk Management Research and Development Program Collaboration, 2002). The mature RMC can contribute to minimizing costs and improving profitability (Anagnostopoulos et al., 2005).

As Loosemore et al. (2006) indicated, many organizations operate at different levels of maturity for different types of risks. For example, an organization's RM culture may be as low as level 1 but achieved level 3 in RM processes. This means that while organizations may have developed sophisticated RM systems, they have not fully imbedded it within its organizational behavior and practices. Furthermore, Hopkinson (2011) indicated that assessing RMC can help identify the strengths and weaknesses of the organization and can also identify areas needing improvement. In short, assessing the current RMC of subway project contractors can be used to identify the priority or weakest areas needed for improvement and actions can be taken to increase the performance.

2.3. Risk management capability assessment

Specific to RMC assessment, several researches have been conducted by researchers and organizations such as Ren and Yeo (2004), HVR Consulting (2006), Risk and Insurance Management Inc. (RIMI) (2006), Loosemore et al. (2006), Zou et al. (2010), Risk Management Research Development Program Collaboration (RMRDPC) (2002), and International Association for Contract and Commercial Management (IACCM) (2003), all of whom have successfully developed RM maturity models. Some developments of maturity models originated from a generic risk maturity model proposed by Hillson, 1997.

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