

# Identifying the critical risks in underground rail international construction joint ventures: Case study of Singapore

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## Abstract

Since the 1980s, Singapore has experienced the widespread use of international construction joint ventures (ICJVs), which are associated with a variety of risks. This study aims to assess the risks associated with the underground rail ICJVs in Singapore. To achieve this objective, a comprehensive literature review was carried out and a questionnaire survey was conducted with 33 contractors. The survey results reported “disagreement on some conditions in contract” as the most critical risk. Although the risk criticalities of some risks significantly differed according to multiple company characteristics, there was strong agreement on the risk rankings. With the help of this study, ICJV partners can identify the most critical risks and thus develop mitigation measures. Also, the findings from this study provide a comprehensive picture of risks for the companies that intend to participate in ICJVs in Singapore.

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## 1. Introduction

Joint ventures (JVs) can be recognized as temporary agreements or arrangements which enable two or more parties to jointly carry out projects (Chow, 1985; Dalle and Potts, 1999). Due to the growing scale and complexity of construction projects, organizations have begun to set up construction JVs to utilize the resources of partners as a solution to bid for projects that are out of the capacity of a single contractor. The responsibilities and rights of individual parties, risk allocation, distribution of profits, as well as dispute resolutions should be clearly specified in a JV agreement (Gale and Luo, 2004).

In most cases, the construction of large-scale projects requires high-level civil engineering technologies and a large amount of capital, which is also the case for the Mass Rapid Transit (MRT) system in Singapore (Shimizu, 2008). The Singapore MRT construction commenced in the 1980s and is still in progress.

Besides the current five operating lines, another three fully underground lines will be under construction till 2020. In the context of Singapore, underground works are very risky due to the complex and unpredictable ground conditions, which results in the difficulty in ground settlement control (Nakano et al., 2007). Thus, the impact of settlement on built structures and ground settlement control have been seen as pressing issues in Singapore underground rail construction (Osborne et al., 2008). In addition to the risks inherent in construction activities, ICJVs are also risky due to the complexity of management and operation issues (Goh and Kwok, 2000). Furthermore, ICJVs are also plagued with external risks that fall outside the control of companies (Frame, 2003; Li et al., 1999; Low et al., 2009). As a result, stringent risk management is necessary and crucial to the participants of ICJVs in Singapore underground rail projects.

Risk management in ICJVs has attracted great attention from the academia (e.g. Dalle and Potts, 1999; Favié et al., 2009; Kwok et al., 2000; Li and Tiong, 1999). However, few studies have identified the critical risks in underground rail ICJVs. As underground rail construction will last till 2020 and contractors

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may form ICJVs to bid for these projects, it is meaningful for practitioners to understand the risks in these ICJVs. Proposing a risk criticality (*RC*) index and using the data from a questionnaire survey, this study assesses the risks in underground rail ICJVs in Singapore. More specifically, the objectives of this study are: (1) to identify the most critical risks associated with performing underground rail ICJVs in Singapore; and (2) to examine the differences in *RC* values and ranks of risks according to contractor characteristics. Thus, by ranking the risks based on their overall *RC* values, this study identifies the most critical risks. Also, with the help of statistical analysis methods, this study also examines the differences in *RC* values and ranks of risks according to contractor characteristics, and discusses the implications of these differences.

It is worth reiterating that underground rail ICJVs are confronted with risks not only from the works but also from the ICJVs themselves. The recognition of critical risks is necessary and important for the contractors that are either participating or about to participate in ICJVs, regardless their company nationalities. Using the findings from this study, contractors can be clear about the risks that are critical for them according to their characteristics.

## 2. Background

### 2.1. ICJVs in Singapore

The Singapore construction industry was based on the British model where traditional procurement predominated (Ofori, 1993). In 1984, the Construction Industry Development Board (CIDB) was founded to overlook the development of the construction industry in Singapore (Ofori and Lean, 2001). Sridharan (1995) indicated that only a minority of the registered construction firms were eligible to bid for projects worth over S\$50 million, which forced the government to seek aid from foreign companies to achieve their economic objectives. Thus, in Singapore, the Preferential Margin Scheme (PMS) was introduced to encourage the collaboration between foreign and local contractors. Under the PMS, ICJVs in which local firms had a significant share of the ownership were offered tendering preferences on major public projects (Ofori, 1993). Also, ICJVs were perceived as a suitable vehicle that meets the competing interests of the national development and that prevents foreign investors from dominating the economy (Somarajah, 1992). On one hand, the PMS helped improve the construction and management skills and reputation of local contractors, thereby facilitating their growth and development. On the other hand, forming ICJVs provided foreign contractors with opportunities to expand to the Singapore construction market and helped them gain access to regional knowledge and customs concurrently. This may indicate continuous benefits for foreign contractors and reduce potential risks in an unfamiliar market (Norwood and Mansfield, 1999; Zhang and Zou, 2007). Although the PMS was later scrapped, the formation of ICJVs to bid for construction projects still continued in Singapore.

In Singapore, ICJVs were set up mainly to bid for MRT projects (Sridharan, 1995). Most of these ICJVs were dissolved

after project completion, while some sustained their operations (Ofori and Chan, 2000). Through case studies on ICJVs in Singapore MRT projects, Sridharan (1995) found that the performance of most European–Singapore JVs was unsatisfactory, while Japanese–Singapore JVs achieved satisfactory performance. Sridharan (1995) also pointed out that a detailed JV agreement cannot guarantee a conflict-free partnership. Although the Europeans preferred detailed contracts, more conflicts occurred due to their ambiguity over each partner's role, lack of understanding of objectives, and lack of commitment to partners. In contrast, Japanese firms used brief documents and depended on mutual trust and verbal communications to resolve disagreement, which enhanced the environment for making mutual decisions. Thus, Sridharan (1995) concluded that conflicts worsened performance while cooperation and mutual trust improved performance of ICJVs in Singapore.

### 2.2. Risk management in ICJVs

Because of historical and geographical issues, China, Singapore and other Southeast Asia countries share more or less similar economic, environmental, and cultural backgrounds, which may lead to similar risks in the ICJV practices (Zhang and Zou, 2007). Thus, the literature relating to the risk management in ICJVs in China and Southeast Asia countries is reviewed in this section.

Li et al. (1999) identified 25 risks in ICJVs in East Asia and classified them into external, internal and project-specific risks, and found that the most critical risks exist in the financial status, government policies, economic conditions, and project relationship. Li and Tiong (1999) proposed a risk management model for ICJVs incorporating effective risk mitigating measures, which were categorized into partner selection, agreement, employment, control, subcontracting, engineering contract, good relationship, and renegotiation. In addition, Shen et al. (2001) identified the critical risks for the Sino-foreign construction JVs in Mainland China and proposed three practical risk management strategies to deal with them: cooperation with government offices, proper risk allocation in contract, and technical risk control.

Using a questionnaire survey, Kwok et al. (2000) found that the most important risks factors for ICJVs in Singapore were disagreement in accounting profit and loss, potential financial distress of partners, a partner's lack of management competence and resourcefulness, over-interference by parent companies of either parties, and disagreement on allocation of works. Through interviews with nine senior executives from ICJVs in Hong Kong, Walker and Johannes (2003) found that problems may occur when one ICJV partner did not understand the political and historical pressures influencing their partners.

Moreover, Gale and Luo (2004) found that foreign firms in Sino-foreign JVs cared more about cultural compatibility than their Chinese counterparts. A possible reason was that experienced foreign managers realized that doing business in China is different from that in their own countries while Chinese managers recognized this factor as less important because of their position as the host country. In addition, Swierczek (1994) found that most conflicts within ICJVs resulted from the culture differences in Southeast Asia and that the collaborative approach could be

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