



# The impact of technical standards on international project performance: Chinese contractors' experience

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## Abstract

In international construction, Chinese contractors encounter an ongoing challenge to achieve expected project cost and time performances. This is often attributed to the use of various foreign standards, which are substantially different from Chinese standards. There are limited studies that investigate the reasons why the difference in standards are creating this challenge. This study explores the reason for the difficulties by using a mixed method research with survey data collected from construction companies involving 170 experienced managers who were involved in 115 international projects. It also involved interviews with an additional 76 managers. The findings confirm that Chinese contractors perceived significant difficulties implementing international projects due to the lack of knowledge of the foreign standards. It is concluded that an enhanced understanding of foreign standards, particularly in Middle Eastern countries, will improve cost and time performances in international projects. Strategies of active learning, inter-organizational cooperation and adjustment of talent training mode are suggested for the international contractors to cope with the issue of standards implementation.

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## 1. Introduction

### 1.1. Overview

Over the last decade, global contractors have greatly increased their involvement and contracting revenue (i.e. from \$189.4 billion in 2005 to \$521.5 billion in 2014) in international construction markets (Reina and Tulacz, 2015). Chinese contractors therein are playing an increasingly important role and accounted for 17.2% of the international market revenue in

2014, acquiring a greater share than any other country's international contractors (Reina and Tulacz, 2015). According to National Bureau of Statistics of China (2016), Chinese contractors achieved \$210 billion overseas contract value in 2015, with an average annual growth rate of 12.3% in the last decade. They have worldwide business across Asia (44.8%), Africa (35.6%), Latin America (10.6%), Europe (5.7%), North America (1.8%) and Oceanic and Pacific Islands (1.4%) according to their reported 2015 turnover (National Bureau of Statistics of China, 2016).

Unlike domestic projects, international projects generally involve participants with different backgrounds and are delivered in relatively unfamiliar locations (Javernick-Will and Scott, 2010). International contractors have to deal with challenges of institutional differences with regards to different regulative, normative and cultural-cognitive institutions in host countries compared with those in domestic markets (Javernick-Will and Scott, 2010; Orr and Scott, 2008). These differences generally

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cause additional transaction costs and misunderstandings between project participants, which may further lead to time delay and cost overrun (Mahalingam and Levitt, 2007). Many studies have investigated the issue of institutional differences in international project delivery. For example, Chua et al. (2003) identified five risk factors, i.e. business environment discontinuity, regulation obstacles, contractual issues, differences in standards and cultural differences, that can lead to cost overrun in the East Asian construction industry. Han et al. (2007) emphasized the importance of considering market differences and collecting information of host countries from the bidding stage to achieve good profit in international construction projects. Targeting legal differences, Ling and Low (2007) specifically investigated the legal risks that foreign firms encounter in China. Low and Shi (2001) identified cultural differences between Singapore and China associated with the impact of cross-cultural differences on Singaporean construction firms' project effectiveness in China.

As for Chinese international contractors, institutional differences remain a challenge, particularly differences in technical standards (Lu et al., 2009). In different regions or countries, the technical standards, e.g., design and construction standards, can vary significantly (Lee et al., 2016; Kwon and Kareem, 2013). Although scholars have noticed the issue of difference in standards in international project delivery (Javernick-Will and Scott, 2010; Lu et al., 2009; Chua et al., 2003), there is a lack of solid and specific investigation about international contractors' perceptions of standards difference. It is unclear whether the standards difference can affect the overall project performance of international contractors. Based on an empirical survey from Chinese contractors, this study aims to explore the difficulty level of standards implementation perceived by the contractors and the effect of use of standards on overall project performance. Project performances by using Chinese and foreign standards were analyzed by adopting a comparative test. Project performances by using foreign standards were further compared between different regions and different industry sectors. Current views are considered in the following literature review. This is followed in the paper by the research questions and hypotheses, research methodology and results.

## 1.2. Literature review

Technical standards, establishing the engineering and technical requirements for processes, procedures and methods, are important parts of knowledge about local institutions that contractors should be familiar with in international business (Yates and Anifotis, 1997; Javernick-Will and Scott, 2010). Technical standards from different regions can be substantially different, as the development of technical standards is mostly promoted in a specific country or based on a regional perspective and corresponds to local environmental, technical, legal, cultural and beneficial features (Lane, 1997; Yates and Anifotis, 1997; Geels, 2004; Blayse and Manley, 2004). For example, Lee et al. (2016) pointed out that the US standards about wind loads for the design of pipe-rack structures respectively display about 15% and 25% smaller than the Korean and Euro standards. As with Chinese

contractors going globally, more and more Chinese experts and scholars have noticed the difference between Chinese standards and foreign standards, including design standards, construction standards, standards for building materials and components and standards for mechanical and electrical equipment (Gu et al., 2014; Qu, 2013; Tao, 2016; Yan, 2012; Xue, 2006). Table 1 details some examples of the more commonly required technical standards in the construction industry.

Chinese standards were established based on former Soviet Union construction system and can be rather different with the other widely used standards in the world, e.g., American standards, British standards and French standards (Lu et al., 2009). The establishment of Chinese standards system was dominated by government with the characteristics of a planned economy. For example, each sector (e.g., houses, roads, railway, hydraulic engineering, etc.) of the civil engineering industry in China has their own standards for concrete structure design and construction. In contrast, the widely used foreign standards systems such as American and European standards are developed and promoted mainly by industrial force with the principle of voluntariness. This helps western standards such as European concrete standards and American Concrete Institute standards as they consider a wide range of applications and show stronger versatility (Yan, 2012). The requirements of procedures, methods and value of specific parameters between Chinese standards and foreign standards can also be significantly different. For example, American and Chinese standards for design of hydraulic concrete structures (see examples in Table 1) are different in partial coefficients for structural design, design load combinations, minimum requirements of concrete strength, and minimum ratio of reinforcement. The road design standards from America and China (see examples in Table 1) are different in road classification, design vehicle dimensions, consideration of human factor, consideration of traffic volumes and traffic characteristics and sight distances. American concrete testing uses cylindrical or beam specimens, while Chinese concrete testing uses cubic or cuboid specimens. American and Chinese standards for concrete construction (see examples in Table 1) are also different in preparation for concrete placement, batching methods, transportation limits, compaction, curing and protection of works. Chinese and foreign standards for materials and equipment (see examples in Table 1), which are related to purchasing activities in international projects, can also be different in the likes of: product classification, quality requirements and testing methods.

The impact of technical standards on companies' international business can be complex. Mangelsdorf (2011) found that pure Chinese standards have negative influences while Chinese international standards have positive influences on European exports. This finding indicates that the effect of standards on international trade is related to the uniformity of domestic and foreign standards. The difference in technical standards can play a role of technical barriers for firms' international business. Chen et al. (2006) also found that technical standards in developed countries reduce companies' export in developing countries. The difference in standards can raise the cost of companies' export activities and reduce the likelihood of exporters' market entry (Chen et al., 2006). However, Marett

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