# Chapter 2
# Competition Intensity: An Institutional Perspective on Sustainable Construction

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**Abstract** Sustainable construction has been gaining much academic attention in recent years. Achieving sustainability through market operation presents an institutional perspective on sustainable construction, and it has been gradually accepted as a key component of sustainable construction. While increasing attention has been paid to the subject of sustainable construction, the nexus between the intensity of competition, a useful proxy for reflecting market operation, and the sustainability performance of construction industry, has not been explored explicitly. Using the method of case study, this study addresses a novel notion of sustainable construction from the perspective of institution. A number of empirical cases were collected from China's construction industry to demonstrate the impacts of business competition on the sustainability of construction project. The research findings indicate those aspects that construction business competition can determine the potential of sustainable construction. It is implied that industrial policies and measures be formulated to oversee the operation of construction market to ascertain sustainable construction.

**Keywords** Industrial sustainability • Key performance indicators • Chinese construction industry • Competitive tendering

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## 2.1 Introduction

Construction refers to a process or mechanism of delivering human settlements and creating infrastructure that supports socio-economic development [1]. A mainstream of thoughts in the area of construction management and economics claims that construction sector is a key driver of sustainable development. Nevertheless, this industry can also generate serious negative effects on environment and society such as air pollution, natural resources depletion, and construction materials waste. The significance of construction sector to sustainability under the heading of "sustainable construction" has thus drawn much academic attention. As a result of long evolution, the term "sustainable construction" has developed from response to the limited resources, to advanced construction technologies and to current soft issues [2].

A key soft issue of sustainable construction is institutional arrangement [3]. Researchers have called for relying on market powers to attain sustainability by virtue of innovating production technology methods (e.g., low carbon techniques) and improving market efficiency in product/service exchange. Stigson [4] opined that achieving sustainability through the market is an important business agenda. Majdalani et al. [5] found that market participants including contractors, architects/engineers and owners/developers play important role in sustainable development. The World Business Council of Sustainable Development released a report of "Sustainability through the Market" in 2001 [6]. The thrust of this report is the driver of an open, transparent market to achieve industrial sustainability. The rationale behind this strand of view is that sustainable construction means producing and managing a healthy built environment should base on an orderly operating construction market.

Although previous studies have called for relying on market powers to attain sustainability, few efforts have been put to investigate the links between business competition and sustainable construction. Therefore, the reason why business competition can determine sustainable construction has not been offered explicitly. The objective of this study is therefore to identify the relationship of market competition and the sustainability performance of the construction industry. Research questions considered from the research objective are whether competition intensity is a key to the sustainable construction, and what industrial policies and measures can be adopted to oversee the operation of construction market to ascertain sustainable construction.

## 2.2 Literature Review

### *2.2.1 Sustainable Construction*

The term "sustainable construction" has kept ongoing evolution in the past decades. In the first international conference on sustainable construction in 1994, Professor

Charles, from the University of Florida, probably for the first time gave a definition to sustainable construction. In his view, sustainable construction refers to effective measures of resources utilization to create a healthy built environment based on the principles of ecology. Similarly, Sage (1998) used the concept of sustainable construction to describe the basic objectives of sustainable development throughout the construction process. Chong et al. (2009) argued that sustainable construction is committed to strengthening the sustainability of building design, construction, production and operation through the adoption of appropriate technology and knowledge. Chen [7] pointed out that sustainable construction is to handle the relationships between the present and the future, between human and nature, and between the economic development and environmental protection. Meanwhile, Chen [7] placed the sustainable construction on project lifecycle, and pointed out that all project construction stakeholders can be the main bodies of sustainable construction. Furthermore, the study by Ren et al. [8] revealed that sustainable construction is to strengthen the control of construction activities, maximize resource conservation through the process of construction, protect the environment and reduce pollution, providing people with the health, comfortable and efficient space for use.

### *2.2.2 Construction Competition*

Construction markets are price competitive with markups that vary with the construction cycle [9]. Construction business competition mainly refers to project work bidding activities [10]. In practice, the clients organize a price competition between contractors to construct a building and the contractor who submits the most competitive price wins the right to construct the building. What contractors initially need is to design a competitive tendering price to ascertain that they can outperform their competitors. In accordance with the elementary market law, if considerable suppliers compete for serving a small number of demanders, the price of the service will drop, and vice versa. Competition is an effective way to lower construction cost, encourage innovation, and safeguard the interests of clients [11].

The competitive bidding process for awarding construction contracts is close to pure competition [12]. Among various bidding procedures for project contracting, construction competition serves to determine quality project undertaker. Nevertheless, tougher competition has become a key feature of the construction market [9]. The stiffer competition has driven the bid price down and makes it harder for contractors to undertake a profitable business, shaking the possibility of clients in receiving value for money through tendering process [13, 14]. Currently, the construction market is blamed for its cut-throat competition, posing challenges onto sustainability of the construction industry.

### 2.2.3 The Role of Construction Competition in Sustainable Construction

Competitive tendering in construction has been demonstrated effective in determining the contractors most suitable for the given projects [15, 16]. Construction firms specialize in particular activities, according to location, the size of projects and the type of work undertaken [14], and they are preferred to build organizational competitiveness through general construction work or to become experts in one or two technical specialties [17]. These illustrate that the market furnished enterprises with a platform to pursue their own long-term sustainable development and improve their comprehensive capacities by bidding competition, which is undoubtedly beneficial to the sustainable development of the industry. Therefore, a well-developed construction market facilitates the fulfillment of construction industry to sustainable socio-economic development.

Nevertheless, competitive tendering in the construction industry forces construction companies to only focus on lowering costs, and divert their attention away from the environment and society [18]. Therefore, fierce competitions have caused all sorts of problems frequently throughout the life cycle of the project, affecting the sustainable performance of the project. Lowest price can often lead to the happening of claims, delay of project schedule, and decrease in project quality and project cost [12]. The study by Liu and Hu (2007) discloses that bribery, wastes of construction resources, and human resources are attributed to the unhealthy project competition.

## 2.3 Research Methods

In order to elaborate the relationships between the market competition and sustainable construction more clearly, we have conducted progressive analysis. Firstly, an extensive literature review is conducted to address the terms of construction business competition and sustainable construction. Then case study is to identify that the market operation can influence the sustainability performance of the industry. Finally, content analysis is adopted to explain further and comprehensively the relationship construction competition and sustainability in construction.

### 2.3.1 Cases

The impact of competition intensity on sustainability performance of construction industry is considered by using 25 projects collected from China's construction sector. These projects are published officially in main newspapers in China concerning the competition status and the current status of project construction.

The 25 projects, respectively with the unsustainable performances, are made up of 15 projects reported on the newspaper, five projects reviewed by experts, three projects investigated by the governmental work reports, and two projects with social commentary. Details of projects collected are described in Table 2.1.

## 2.4 Findings and Discussions

### *2.4.1 Impact of Market Competition on Sustainable Construction*

Judging from the above cases and the tables, it comes to conclusions that due to the designated constructors in the bidding market without competition or the collusion bidding, bid rigging and illegal subcontracting with fierce competition in the market, there are 14 aspects of resulting unsustainable performance in total, including project quality, fatal accidents, safety, the environment, the investment cost, project payment arrears, staff training, technology, social effects, social equity, market order, administrative intervention, corruption and economic losses. In other words, sustainable performance in construction at least manifest the 14 respects above and the 14 aspects have already covered the triple bottom line (economy, society and environment) of sustainable construction, indicating the cases are more comprehensive in this research.

### *2.4.2 Principal Indicators of Competition-Based Sustainable Construction*

According to the Table 2.2, these unsustainable performances in turn mainly concentrate on, social effects, market order, the investment costs, safety and quality etc. The first five aspects attributable to social dimension demonstrate that the social sustainability within the triple bottom line (TBL) of sustainable construction is more severe than the other two of economy and environment. Just as Vanclay [19] highlighted that social indicators are unlike economic and environmental indicators, which are easy to be identified, selected and measured. The undefined socio-related factors, their subjectivity, as well as the different views and priorities of stakeholders make it difficult to identify what improvements are required [20, 21].

**Table 2.1** Cases of project competition

| A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|
| Projects | A1-1 | Sichua Yongding bridge reservoir bidding | 2009 | Sichuan | Legal Daily | OT | CEM |
| | A1-2 | Jingzhou road brush black engineering bidding | 2008 | Hubei | Xinhua Net | OT | Low bid |
| | A1-3 | Xiamen 8 school project Bid-rigging | 2004 | Fujian | Legal Daily | OT | Low bid |
| | A1-4 | Hangzhou metro line 1 Xianghu satiation project | 2008 | Zhejiang | Sohu Net | OT | Low bid |
| | A1-5 | Yantai dangerous building of East bus station | 2009 | Shandong | (09/11) Focus Interview | OT | – |
| | A1-6 | Zhejiang province First case of construction engineering collusion | 2002 | Zhejiang | Xinhua Net | OT | – |
| | A1-7 | Ryan mega collusion case | 2007 | Zhejiang | Wenzhou Net | OT | – |
| | A1-9 | The first case of The Municipal Engineering collusion | 2005 | Zhejiang | Xinlang Net | OT | Low bid |
| | A1-10 | Dalian metro collapse accident | 2010 | Liaoning | Xinlang Net | – | – |
| | A1-11 | 300 million government projects and social welfare project corruption | 2005 | Jiangsu | Beijing Bidding Information platform | OT | – |
| | A1-14 | Shanghai “6.27” Lotus Riverside accident | 2010 | Shanghai | People’s Daily Online | – | Low bid |
| | A1-15 | Theater stage mechanical engineering bidding in a city of Sunan | 2010 | Jiangsu | Jiangsu Legal News | OT | – |
| | A1-18 | Office building project of Wenzhou branch of The bank of China | 2003 | Zhejiang | People’s Daily Online | – | Low bid |
| | A1-22 | Kunming new airport the supporting bridge approach collapse accident | 2010 | Yunnan | Xinhua News Agency | – | – |
| | A1-24 | Hunan Zhuzhou viaduct collapse accident | 2009 | Hunan | CCTV | – | – |
| Expert review | A1-8 | Pingxiang 200 million yuan collusion bidding | 2010 | Jiangxi | National Business Daily | – | – |
| | A1-12 | Low cost engineering bidding lead to engineering accident ratio greatly increased | 2010 | – | Members of the Chinese National Trade Promotion | – | Low bid |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | A1-13 | Zhu Shuying lawyer answers reporters on construction project bidding below the cost price | 2010 | – | Construction Times | – | Low bid |
| | A1-17 | Project bidding rate to 95 %, the frequency of accidents still worrying | 2009 | – | China Association of Bidding | – | – |
| | A1-23 | XX building is market hot in 2009 and experts analyze cutting corners is root cause | 2010 | – | Legal Evening News | – | – |
| The Government work report | A1-19 | Tracking audit results of Beijing-Shanghai high-speed railway construction project in 2010 | 2011 | China | The Chinese Government Network | – | – |
| | A1-20 | Tracking audit results of the Second West–East Gas Pipeline Project's eastern section in 2010 | 2011 | China | The Chinese Government Network | – | – |
| | A1-21 | No. 2 of 2007 (20): 34 high-grade highway project construction management and investment benefits audit results | 2007 | China | China's Audit Office | – | – |
| Social commentary | A1-16 | Low price bidding compress the duration, "3 without" enterprises to enter; Construction lack regulation and who did disturb the desulfurization market? | 2007 | – | China Environment News | – | Low bid |
| | A1-25 | Xinjiang Dushanzi serious safety accidents of crude oil storage tank under construction | 2006 | Xinjiang | China Chemical Industry News | – | – |

Abbreviations: *A* classification, *B* number, *C* case, *D* time, *E* province, *F* source of information, *G* tender, *H* scoring method, *OT* open tender, *CEM* comprehensive evaluation method

**Table 2.2** Effects of competition intensity on sustainability

| | | | Unsustainable performance | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | B | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W |
| Projects | A1-1 | CB | – | – | – | – | √ | – | | – | √ | – | √ | – | √ | √ |
| | A1-2 | CB | – | – | – | – | √ | – | | – | √ | – | √ | √ | √ | √ |
| | A1-3 | BR | – | – | – | – | – | – | | – | √ | – | √ | – | – | – |
| | A1-4 | BR | √ | √ | √ | √ | √ | – | √ | √ | √ | – | √ | – | – | – |
| | A1-5 | CB | √ | – | √ | – | √ | – | | – | √ | – | √ | √ | √ | – |
| | A1-6 | CB | – | – | – | – | | – | | – | √ | √ | √ | √ | √ | – |
| | A1-7 | BR | – | – | – | – | √ | – | | – | √ | √ | √ | – | – | √ |
| | A1-9 | CB | √ | – | – | – | √ | – | | – | √ | √ | √ | – | – | – |
| | A1-10 | – | √ | – | √ | – | √ | √ | √ | – | √ | – | – | – | – | √ |
| | A1-11 | CB | – | – | – | – | – | – | | – | √ | √ | √ | – | √ | √ |
| | A1-14 | IS | √ | √ | √ | – | – | – | | – | √ | – | √ | – | – | – |
| | A1-15 | – | – | – | √ | – | √ | – | | – | √ | √ | √ | – | – | – |
| | A1-18 | CB | √ | – | √ | √ | √ | – | | – | √ | √ | √ | √ | √ | √ |
| | A1-22 | IS | √ | √ | √ | √ | √ | – | √ | √ | √ | – | – | – | – | √ |
| | A1-24 | BR | √ | √ | √ | √ | √ | – | – | √ | √ | √ | √ | √ | – | √ |
| Expert comments | A1-8 | CB | – | – | – | – | √ | – | – | – | √ | √ | √ | √ | √ | – |
| | A1-12 | – | – | √ | √ | – | √ | – | – | – | √ | – | √ | – | – | – |
| | A1-13 | – | √ | √ | √ | √ | √ | – | – | – | √ | – | √ | – | √ | – |
| | A1-17 | – | √ | √ | √ | √ | √ | – | – | – | √ | – | √ | – | √ | √ |
| | A1-23 | – | √ | √ | √ | √ | √ | – | – | √ | – | – | – | – | – | – |
| The Government work report | A1-19 | DC | √ | √ | √ | √ | √ | – | √ | √ | √ | √ | √ | √ | √ | √ |
| | A1-20 | DC | √ | – | √ | √ | √ | – | – | – | √ | √ | √ | √ | √ | √ |
| | A1-21 | – | √ | √ | √ | √ | √ | – | – | √ | √ | √ | √ | √ | √ | √ |
| Social commentary | A1-16 | – | √ | – | √ | √ | – | – | – | – | √ | – | √ | – | – | – |
| | A1-25 | – | √ | √ | √ | √ | √ | – | √ | √ | √ | √ | √ | – | – | √ |
| In total | – | – | 16 | 11 | 17 | 12 | 20 | 1 | 5 | 6 | 24 | 12 | 22 | 9 | 12 | 13 |

Abbreviations: *A* classification, *B* number, *I* competition type, *J* quality, *K* fatal accident, *L* safety, *M* environment, *N* investment cost, *O* project payment arrears, *P* staff training, *Q* technology, *R* social effects, *S* social equity, *T* market order, *U* administrative intervention, *V* corruption, *W* economic losses, *CB* collusion bidding, *CR* bid rigging, *IS* Illegal subcontracting, *DC* designated contractors

### *2.4.3 Competition – Based Policies for Sustainable Construction*

In order to pursue the sustainable development of the construction industry, it is not to be ignored that some industrial policies and measures be supposed to formulated to oversee the operation of construction market to ascertain sustainable construction. For example, some countries, such as UK and Australia have codes on good tendering practice, which includes identifying that number of competing contractors in any competition should not exceed six. Likewise, our governments also need in the position of construction market to promote the sustainable development of the construction industry.

## 2.5 Conclusions

By virtue of the impact of the construction market competition intensity, each project's sustainable performance varies and all of these projects' performance adds up to the sustainable performance of the entire construction industry. As the cases above demonstrate, when there is no competitive in construction market, the resources of the construction industry doesn't achieve optimal allocation, which doesn't reflect the concept of sustainable construction; when stiff competition in the market, the development of sustainable construction will be hindered due to illegal means of market competition; thereby it can be indicated that there is a moderate competition status which can determine sustainable construction performance. In other words, there exists a certain relationship between the competitive intensity of the market and the sustainable construction industry. When the market reaches the state of moderate competition, sustainable construction can be in healthy and orderly development. But whether the relationship between competition intensity and sustainable performance in construction can be determined by the function equations will be our research to go further.

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