Case Study

Understanding Collusive Practices
in Chinese Construction Projects

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Abstract: Collusion is of critical concern to the construction sector as it undermines free competition in the construction market. Given that previous research on collusive practices concentrates mainly on the bidding phase, this study extended the research focus to the entire construction period and aimed to investigate specific collusive practices in Chinese construction projects. A total of 22 specific collusive practices in Chinese construction projects were first identified based on a comprehensive literature review and a Delphi survey with 15 industry experts. Then, a questionnaire survey was conducted to prioritize the identified collusive practices in terms of their probability and severity. The survey results indicate that the primary collusive practices in Chinese construction projects are misrepresentation of qualification certificates, loose site supervision, misusing prequalification requirements, fake tendering, approval of the unnecessary change orders, collective collusive tendering by helping one another, the nomination of a particular supplier, issuing certified works falsely, and inflating tender price. The findings of the study not only provide a clearer picture of collusive practices in construction projects in China but also provide a better understanding of collusive practices in other emerging economies. **DOI: 10.1061/(ASCE)EI.1943-5541.0000314.** © *2016 American Society of Civil Engineers.*

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Introduction

Collusion is a set of behaviors where competitors coordinate their market behavior surreptitiously, which is contrary to the principles of free competition (Chotibhongs and Arditi 2012a, b; Zarkada-Fraser 2000). Collusion is also insidious and harmful to the management of construction projects because it may decrease the number of bidders and increase contract prices, thus resulting in a poor project outcome (Oladinrin and Ho 2014; Zarkada-Fraser and Skitmore 2000). Moreover, collusion has brought an unflattering image to the construction sector and degraded the public trust regarding the sector (Zarkada-Fraser 2000).

Identifying collusive practices is critical because it is an initial but fundamental step of collusion research, which would benefit the establishment of anticollusion measures. Several researchers have scrutinized collusive practices in the construction sectors of diverse countries, such as Australia (Ray et al. 1999; Vee and Skitmore 2003; Zarkada-Fraser and Skitmore 2000), India (Tabish and Jha 2011), the Netherlands (Dorée 2004; Priemus 2004), Nigeria (Alutu 2007; Alutu and Udhawuve 2009), South Africa (Bowen et al. 2007a, b, 2012), and Zambia (Sichombo et al. 2009). However, very little attention has been paid to the construction sector of China, which contributes significantly to the global construction market.

Since the establishment of the socialist market economy in 1992, China has been continuously improving its construction sector by reforming administrative systems, reorganizing industry structure, and promoting free competition (Mayo and Liu 1995). However, collusion is a stubborn problem concerning the Chinese construction sector (Le and Shan 2013; Zou 2006). According to the National Bureau of Corruption Prevention of China (2011), the number of commercial bribery cases in the construction sector between 2007 and 2009 was 13,006, accounting for nearly 44% of all business bribery cases (29,600) occurring in that period. It has been widely accepted that a collusive agreement is a fundamental element in any commercial bribery case in China (Le et al. 2014). This could be attributed to the following facts. First, the key players of the Chinese construction market are the major state-owned construction companies (National Bureau of Statistics 2014), which are more likely to involve collusion practices due to the principal-agent problem (Le and Shan 2013). Second, current Chinese construction laws merely target collusive practices in the bidding stage, ignoring those prevailing in other construction stages (Lam and Chen 2004). Given these unique features, there is an urgent need to investigate collusive practices in Chinese construction projects.

The current literature investigating collusive practices has mainly concentrated on the project bidding phase (Ballesteros-Pérez et al. 2013; Lo et al. 1999; Ray et al. 1999; Sohail and Cavill 2008; Vee and Skitmore 2003; Zarkada-Fraser and Skitmore 2000). However, collusive practices can also occur in other project phases, such as the conception phase and implementation phase (Bowen et al. 2007a, b). Therefore, this study attempts to broaden the

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research boundary by identifying and evaluating specific collusive practices throughout the entire construction period.

Literature Review

To identify collusive practices in construction projects, a systematic literature search was conducted to spot the collusion-related papers published in peer-reviewed construction engineering and management (CEM) journals in the past two decades (1995–2014). This plan followed the structured search method, advocated by Hu et al. (2015) and Yi and Chan (2014), which consists of the following two steps:

Step 1, 10 peer-reviewed CEM journals, comprising the *Journal of Construction Engineering and Management*; *Construction Management and Economics*; *Journal of Management in Engineering*; *International Journal of Project Management*; *Project Management Journal*; *Building and Environment*; *Automation in Construction*; *Building Research and Information*; *Engineering, Construction and Architectural Management*; and *Journal of Professional Issues in Engineering Education and Practice*, were first selected as target journals. Considering that collusive practice is a type of unethical corrupt behavior (Le et al. 2014), a combined code of "Collusion OR Collusive OR Ethics OR Ethical OR Corruption" was searched in the Title/Abstract/Keyword field in the database of these 10 target journals between 1995 and 2014.

Step 2, in order to gather more collusion-related papers, a new search was carried out using two popular search engines, namely Web of Science and Scopus. The combined code of "Collusion OR Collusive OR Ethics OR Ethical OR Corruption AND Construction" was searched in the Title/Abstract/Keyword field of Scopus, and in the Topic field of Web of Science, respectively, within the period from 1995 to 2014.

Subsequently, a visual examination was further conducted on the initial papers to verify their relevance to the topic of this study. Only those examining collusive practices were retained. Finally, a total of 20 papers remained via this systematic search process. Table 1 lists the 20 identified papers, as well as their countries of origin.

The existing literature reveals that particular efforts have been made to investigate collusive practices in construction projects.

For instance, Ray et al. (1999), Priemus (2004), and Ballesteros-Pérez et al. (2013) regarded collusion as one of the major ethical issues in tendering because it enables unethical tenderers to reap an illicit profit. Zarkada-Fraser and Skitmore (2000) conducted a survey in the Australian construction industry and identified three collusive practices committed by tenderers, i.e., submission of cover prices, withdrawal from the bidding process, and inflation of tenders by a prearranged amount. Vee and Skitmore (2003) investigated the collusive practices between clients and their preferred tenderers, including clients divulging more tender information to preferred tenderers and withholding vital information from the other tenderers, bias in tendering evaluations to favor major contractors, and clients preselecting the consultant then calling tenders to fulfill organizational or statutory requirements.

Bowen et al. (2007a) conducted a survey in the South African construction industry and found various forms of collusive tendering, including leaking of the tender price in return for payment, cover pricing, bid cutting, hidden fees and commissions, and compensation of tendering costs to unsuccessful tenderers. Sohail and Cavill (2008) revealed a typical collusive practice where project requirements may be overstated or tailored to fit the preferred tenderer. Tabish and Jha (2011) investigated collusive practices involved in the Indian public procurement, such as adequate and full publicity not given to tender, prequalification not done as per notified criteria, and evaluation of tenders not done correctly as per the announced rules. Alutu (2007) and Alutu and Udhawuve (2009) scrutinized collusive practices in the Nigerian construction industry and found that the chief executive may award a contract to his/her preferred company illegally without a necessary procedure of tendering, that the use of incomplete and/or low-quality materials by contractors are ignored by the supervising team due to a collusive agreement between the two parties, and that completion certificates are sometimes issued illegally to the contractor to enable collection of payments, even when jobs are incomplete or sometimes abandoned. Sichombo et al. (2009) also obtained similar findings in their research on collusive practices in the Zambian construction industry.

Collusive practices in Taiwan and mainland China have also been investigated. For instance, Lo et al. (1999) found that in Taipei mass rapid transit projects, clients might set extremely high

Table 1. Collusive Practice Papers Identified from Literature Review

Number	References	Construction period involved	Country/region
1	Lo et al. (1999)	Bidding and tendering	Taiwan
2	Ray et al. (1999)	Bidding and tendering	Australia
3	Zarkada-Fraser and Skitmore (2000)	Bidding and tendering	Australia
4	Vee and Skitmore (2003)	Bidding and tendering	Australia
5	Dorée (2004)	Bidding and tendering	Netherlands
6	Priemus (2004)	Bidding and tendering	Netherlands
7	Zou (2006)	Bidding and tendering, construction	China
8	Alutu (2007)	Bidding and tendering	Nigeria
9	Bowen et al. (2007a)	Design, bidding, and tendering, construction	South Africa
10	Bowen et al. (2007b)	Design, bidding, and tendering, construction	South Africa
11	Sohail and Cavill (2008)	Planning, design, bidding, and tendering, construction	Not indicated
12	Alutu and Udhawuve (2009)	Bidding and tendering	Nigeria
13	Hartley (2009)	Bidding and tendering	Australia
14	de Jong et al. (2009)	Bidding and tendering	Not indicated
15	Sichombo et al. (2009)	Bidding and tendering	Zambia
16	Wang et al. (2009)	Construction	China
17	Ameh and Odusami (2010)	Bidding and tendering	Nigeria
18	Tabish and Jha (2011)	Conception, bidding, and tendering, construction	India
19	Bowen et al. (2012)	Bidding and tendering	South Africa
20	Ballesteros-Pérez et al. (2013)	Bidding and tendering	Spain

prequalification requirements to restrain competition, and certain contractors may use the name of qualified contractors to bid and operate projects. Zou (2006) reported some collusive practices of contractors in his study of anticorruption strategies in the Chinese construction sector. Wang et al. (2009) stated that, in Chinese construction projects, supervising engineers might collude with contractors or clients by concealing their illegal activities from government authorities.

This brief review indicates that, although efforts have been made to investigate collusive practices in construction projects, research on this topic in China remains limited. Meanwhile, the existing studies of collusive practices focus on the project bidding phase, ignoring the project conception and implementation phases. Thus, this study attempts to fill this knowledge gap by conducting a systematic investigation of collusive practices in Chinese construction projects.

Research Methods

A combination of qualitative and quantitative research methods was employed to address the research question in this study. First, an initial list of collusive practices in construction projects was identified from a comprehensive literature review. Second, the initial collusive practices were refined by a two-round Delphi survey. Third, based on the consolidated framework, an empirical questionnaire survey was administered to gauge these refined collusive practices in terms of probability and severity. The sequential use of qualitative and quantitative research methods is expected to yield stronger and more reliable findings (Hon et al. 2013).

Delphi Survey

Based on a comprehensive literature review, an initial list of 22 collusive practices was established (Table 2). To refine this initial list under the context of China, a two-round Delphi survey was conducted.

The Delphi method is a structured communication and consensus-building approach conducted among a group of experts on a complex problem, which has been widely adopted in CEM research (e.g., Ameyaw et al. 2016; Hallowell and Gambatese 2009; Xia and Chan 2012a, b). The success of a Delphi survey depends primarily on the careful selection of panel members (Chan et al. 2001; Xia et al. 2009). Therefore, the following criteria were employed to identify eligible participants for this Delphi survey: (1) at least 10 years of experience in the Chinese construction

Table 2. Collusive Practices Identified from Literature Review

Number	Collusive practice	Definition
CP1	Misusing prequalification requirements	A client abuses prequalification requirements by setting up the tailored prequalification requirements to fit its preferred tenderer
CP2	Leaking vital information by the client	A client leaks important information (e.g., pricing by other tenderers) to its preferred tenderer
CP3	Inflating tender price	A client hints tenderers to inflate tender price in return for kickbacks
CP4	Fake tendering	A client preselects a contractor/consultant/supplier and then calls tenderers to fulfill organizational or statutory requirements
CP5	Intervening in tender evaluation	The chief executive in a client organization intervenes in tender evaluation and helps his/her preferred tenderer win the contract
CP6	Splitting a large project illegally	To evade the due tender procedure, a client breaks a large project which should be awarded by tendering into several small projects and grants them directly to his/her preferred tenderer
CP7	Lack of publicity	A client gives insufficient or inadequate advertising of tender
CP8	Insufficient tender time	A client sets an excessively short tender time for the potential tenderers
CP9	Absence of tender	The chief executive in a client organization approves and awards a contract to his/her preferred tenderer directly but illegally without a necessary tender procedure
CP10	Bias in tender evaluation	A tenderer bribes the member(s) of tender evaluation panel to seek for the illegal competitive advantages in tender evaluation
CP11	Misrepresentation of qualification certificates	A qualified contractor facilitates an unqualified contractor to participate in tendering by providing its qualification certificate illegally
CP12	Collective collusive tendering by helping one another	Collusive tenderers assist one of them in winning the contract according to an agreement that they help each other win the contract in turns
CP13	Helping the preestablished tenderer by giving up the contract	A collusive agreement is reached that the tenderer providing the most competitive price helps the preestablished tenderer win the contract by giving up the contract
CP14	Leaking vital information by the bidding consultant	A bidding consultant leaks important tendering information to the particular tenderer who has paid a bribe
CP15	Loose site supervision	The irregularities conducted by a contractor in project construction are ignored by the site supervising team because of the collusive pact between the two parties
CP16	Issuing the certified works falsely	A quantity surveyor incorrectly issues the certified work to obtain extra money from the contractor
CP17	Seeking for unnecessary change orders	To get additional profits from construction changes, a contractor bribes the designer and asks for the unnecessary design change orders
CP18	Approval of the unnecessary change orders	A contractor bribes the client staff for his/her active support of the unnecessary change orders
CP19	The nomination of a particular supplier	A supplier bribes the client staff to get it nominated as a supplier of the project and recommended to the contractor
CP20	The manipulated design for a particular supplier	Based on a collusive pact between the designer and the supplier, project design is manipulated to benefit the latter
CP21	The usage of unqualified materials	The unqualified construction materials are provided and used favorably according to the collusive agreement between the supplier and the contractor
CP22	Inflating material price	The prices of the materials supplied are inflated due to the collusive agreement between the supplier and the client

Table 3. Profile of the Delphi Panel

Expert	Employer	Position	Years of experience	Value of largest project managed/consulted
A	Client	Project manager	19	US$ 167 million
B	Client	Deputy manager	16	US$ 308 million
C	Client	Director	15	US$ 231 million
D	Contractor	Deputy manager	17	US$ 363 million
E	Contractor	Project manager	25	US$ 122 million
F	Contractor	Project manager	20	US$ 85 million
G	Consultant	Deputy manager	16	US$ 35 million
H	Consultant	Deputy manager	18	US$ 20 million
I	Consultant	General manager	16	US$ 55 million
J	Designer	Director	25	US$ 197 million
K	Designer	Project manager	20	US$ 73 million
L	Supplier	General manager	15	US$ 122 million
M	Supplier	General manager	17	US$ 167 million
N	Academia	Professor	20	US$ 363 million
O	Academia	Professor	17	US$ 231 million

Table 4. Results of the Two-Round Delphi Survey

	First round		Second round	
Code	Mean	Asymptotic significance of KWT	Mean	Asymptotic significance of KWT
CP1	3.94	0.435	3.96	0.467
CP2	3.73	0.546	3.70	0.613
CP3	3.44	0.428	3.38	0.586
CP4	3.33	0.740	3.28	0.703
CP5	3.28	0.671	3.21	0.609
CP6	3.15	0.273	3.11	0.348
CP7[a]	2.78	0.543	2.76	0.505
CP8[a]	2.25	0.431	2.20	0.487
CP9	3.54	0.434	3.51	0.429
CP10	3.18	0.435	3.14	0.438
CP11	3.89	0.578	3.90	0.613
CP12	3.68	0.286	3.64	0.292
CP13	3.16	0.532	3.11	0.574
CP14	3.80	0.531	3.82	0.589
CP15	3.92	0.336	3.93	0.388
CP16	3.63	0.333	3.56	0.443
CP17	3.50	0.581	3.44	0.550
CP18	3.69	0.504	3.62	0.539
CP19	3.32	0.356	3.29	0.345
CP20	3.43	0.443	3.41	0.450
CP21	3.57	0.436	3.60	0.467
CP22	3.74	0.517	3.75	0.523

Note: KWT = Kruskal-Wallis test.
[a]The collusive practice is deleted due to an evaluation below 3.0 points.

sector and (2) possessing management experience related to bidding and tendering. In particular, the latter criterion was highlighted, considering that the majority of identified collusive practices are related to bidding and tendering affairs in construction projects.

A total of 15 experts (as shown in Table 3) meeting the selection criteria were identified and invited to participate in this Delphi survey. The target experts were from one research institution at Tongji University (i.e., Research Institute of Complex Engineering and Management, Tongji University), and five industry institutions (i.e., Jinan Hi-Tech Holding Group, China Construction Eighth Engineering Division Company, Shanghai Construction Consultants Association, Shanghai Xian Dai Architectural Design (Group) Co., Ltd., and Baosteel Group Corporation), which have close collaboration relationships with Tongji University. All the experts hold senior positions in their organizations and have sufficient work experience, especially a sound knowledge of collusive practices in Chinese construction projects. Additionally, their diversified employer backgrounds (i.e., clients, contractors, consultants, designers, suppliers, and academics) help increase the heterogeneity of the Delphi panel and thus improve the survey validity.

In the first-round Delphi survey, the experts were requested to assess the occurrence probability of each initial collusive practice, using a five-point rating scale (i.e., 1 = very few, 2 = few, 3 = medium, 4 = common, and 5 = very common). Additionally, based on their experience, they were encouraged to list any new collusive practices that were not included in the Delphi survey. The mean score of each collusive practice was calculated and then fed back to the Delphi panel. In the second-round survey, participants were asked to reassess their evaluations in the light of the findings obtained in the previous round. A threshold of 3 points was established as a cut-off criterion, as recommended by Jamieson (2004). To verify if significant differences exist among the experts of different backgrounds, a Kruskal-Wallis test was conducted as recommended by Hon et al. (2012) and Ameyaw et al. (2016).
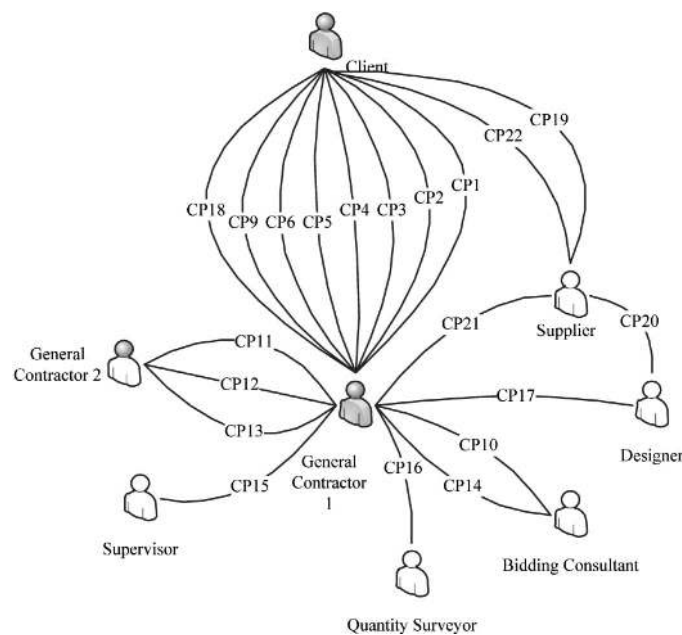
According to the feedback from the first-round survey, no additional collusive practices were added by the Delphi panel. Table 4 shows the results of the two-round Delphi survey. The Kruskal-Wallis test result shows that the asymptotic significance value of each collusive practice is greater than 0.05, indicating no significant difference among the experts of different employer backgrounds (Ameyaw et al. 2016; Hon et al. 2012). The mean scores of lack of publicity (CP7) and insufficient tender time (CP8) were below the threshold of 3 points and thus were deleted from the list of

Fig. 1. Collusion network in construction projects

collusive practices, revealing that the Delphi panel believed the current publicity and tender time of most tenders in China are adequate. This may be due to the fact that the authority in the Chinese construction sector has issued mandatory regulations on the level of publicity and time for tendering (National People's Congress of People's Republic of China 1999) and the majority of industrial practitioners follow these regulations in practice. Fig. 1 depicts a network of the 20 identified collusive practices, in which each link

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represents one specific collusive practice occurring between the two relevant project stakeholders. The figure reveals that 10 collusive practices occur between the client and other contracting parties and another nine collusive practices occur between the contractor and other contracting parties. Thus, 19 out of 20 collusive practices refer to the client and contractor. These findings indicate that the client and contractor are the two primary contracting parties responsible for the collusion in construction projects.

Questionnaire Survey

Research on collusive practices was carried out predominantly with the help of a questionnaire survey (Bowen et al. 2007a, b; Le and Shan 2012; Vee and Skitmore 2003) because a questionnaire is an effective and widely used instrument to gauge people's perceptions on collusion, a topic that is sensitive and difficult to get objective data (Kenny 2009; Shan et al. 2015). Hence, based on the framework consolidated from the two-round Delphi survey, a questionnaire survey was administered to evaluate the refined collusive practices in Chinese construction projects, in terms of probability and severity.

Given that the Chinese construction sector is a large and complex sector with about 29,212,000 employees across the country (National Bureau of Statistics of China 2015), it is extremely difficult to conduct probability sampling in the questionnaire survey. Therefore, this study employed purposive sampling, a common type of nonprobability sampling approach that can also help obtain a representative sample (Liu et al. 2016; Trochim 2006; Zhao et al. 2015). To maximize the number of potential survey respondents, some government agencies, research institutions, and enterprises were contacted. In the end, a total of 12 institutions agreed to participate in the questionnaire survey. These institutions are (1) China State Construction International Holdings Ltd.; (2) China Construction Eighth Engineering Division Company; (3) Shanghai Construction Consultants Association; (4) Shanghai Xian Dai Architectural Design (Group) Co., Ltd.; (5) China Construction Design International; (6) Research Institute of Complex Engineering & Management, Tongji University; (7) Zhengzhou Municipal Construction Commission; (8) Shanghai Pudong New Area Highway Administration; (9) Shanghai Lujiazui Finance and Trade Zone Development Company Ltd.; (10) Zhengzhou Metro Group Co., Ltd.; (11) Jinan Hi-Tech Holding Group; and (12) Baosteel Group Corporation. These institutions cover a diverse stakeholder background in the Chinese construction sector, including clients,

contractors, consultants, designers, suppliers, and academics. In addition, all these institutions are active players in their fields, suggesting that they could represent the Chinese construction sector to a certain extent. In addition, the employees of these supporting institutions are believed to possess real and profound understanding of Chinese construction sector and thus are qualified respondents for the questionnaire survey.

A web-based anonymous questionnaire was developed and distributed to potential respondents from the 12 supporting institutions. Respondents were requested to evaluate the probability and severity of each collusive practice using a five-point rating scale (i.e., 1 represents the least probability and severity, and 5 represents the highest likelihood and severity). Such a measurement approach is recommended by Shen et al. (2001), Molenaar (2005), Zou and Zhang (2009), and Ke et al. (2011) in their risk evaluation studies, which are similar to the assessment of collusive practices in this study.

Results

A total of 108 responses were collected from the questionnaire survey. After a careful visual examination, 11 were found to be inappropriately filled out and were thus excluded. Therefore, 97 total valid responses were used for the further data analysis. Table 5 shows the profile of the respondents. The respondents were from diversified employers (i.e., government, client, contractor, consultant, designer, and academia). More than 70% of them had at least 6 years of practical experience in this sector. More than 80% of them were holding middle or senior managerial positions in their organizations. Such a panel of respondents is believed to be able to provide reliable evaluations on the collusive practices.

As the probability and severity of each collusive practice were evaluated simultaneously, the following formula [Eq. (1)] was developed as suggested by Ke et al. (2011) and Hwang et al. (2015a), to calculate the significance index of each collusive practice provided by each respondent

$$CP_{ni} = \sqrt{CP_{npi} \times CP_{nsi}} \qquad (1)$$

where CP_{ni} = significance index of the ith collusive practice provided by the nth respondent; CP_{npi} = probability assessment of the ith collusive practice by the nth respondent; and CP_{nsi} = severity assessment of the ith collusive practice by the nth respondent.

Table 5. Profile of Respondents

Personal attribute	Category	Number of respondents	Percentage	Cumulative percentage
Employer	Client	19	20	29
	Contractor	25	26	55
	Consultant	18	19	74
	Designer	15	15	89
	Supplier	11	11	100
	Academia	9	9	9
Position	Top managerial level (e.g., president, general manager, chief director, professor)	22	23	23
	Middle managerial level (e.g., project manager, department director, associate professor)	48	49	72
	Professional (e.g., engineer, technician, quantity surveyor)	27	28	100
Years of experience	>20	19	20	20
	11–20	28	29	49
	6–10	37	38	87
	<5	13	13	100

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Table 6. Rankings of Collusive Practices

| | | | | Respondents of different stakeholder | | | | | | | | | | |
| | Significance index | | | Client (CL) | | Contractor (CT) | | Designer (DE) | | Consultant (CS) | | Supplier (SU) | | Academia (AC) | |
Code	Score	Rank	Normalization[a]	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
CP11	4.03	1	1	4.25	2	3.86	4	3.87	6	4.06	1	3.96	1	4.19	1
CP15	3.97	2	0.89	4.23	3	3.82	5	3.94	4	3.83	9	3.93	2	4.08	4
CP1	3.94	3	0.83	3.45	12	4.25	1	4.11	1	3.92	4	3.94	3	3.96	10
CP4	3.93	4	0.81	3.32	18	4.13	2	4.03	2	4.01	2	3.95	2	4.15	2
CP18	3.91	5	0.78	3.95	6	3.72	11	3.94	4	3.87	7	3.89	5	4.09	3
CP12	3.90	6	0.76	4.35	1	3.54	15	3.98	3	3.78	13	3.67	12	4.08	4
CP19	3.88	7	0.72	3.74	9	4.08	3	3.85	8	3.96	3	3.65	13	3.98	9
CP16	3.84	8	0.65	4.08	4	3.61	14	3.86	7	3.65	17	3.85	6	3.99	8
CP3	3.77	9	0.52	3.34	17	3.73	10	3.85	8	3.83	9	3.85	6	4.03	7
CP20	3.75	10	0.48	3.82	8	3.75	9	3.54	17	3.92	4	3.52	18	3.93	14
CP17	3.74	11	0.46	3.87	7	3.43	20	3.51	18	3.82	11	3.85	6	3.96	10
CP21	3.74	12	0.46	4.06	5	3.52	17	3.82	10	3.85	8	3.23	20	3.95	13
CP22	3.72	13	0.43	3.43	14	3.79	6	3.79	11	3.91	6	3.37	19	4.05	6
CP5	3.71	14	0.41	3.45	12	3.78	7	3.69	13	3.73	14	3.78	9	3.85	15
CP6	3.71	15	0.41	3.24	19	3.77	5	3.71	12	3.82	11	3.78	9	3.96	10
CP10	3.67	16	0.33	3.70	10	3.47	18	3.66	14	3.69	15	3.72	11	3.79	18
CP9	3.63	17	0.26	3.37	15	3.69	12	3.64	15	3.67	16	3.61	14	3.82	17
CP2	3.59	18	0.19	3.23	20	3.66	13	3.63	16	3.61	19	3.58	15	3.84	16
CP13	3.54	19	0.09	3.36	16	3.45	19	3.50	19	3.65	17	3.54	16	3.72	19
CP14	3.49	20	0	3.65	11	3.53	16	3.32	20	3.27	20	3.53	17	3.66	20

[a]Normalized value = (average actual value − average minimum value)/(average maximum value − average minimum value).

Table 6 shows the evaluation results of the refined framework of collusive practices

After the significance indices of all collusive practices were calculated, statistical tests were conducted with the aid of Statistical Package for the Social Sciences (SPSS) 17.0 (George 2011). To test its reliability, the common tool Cronbach's alpha was adopted (Deng et al. 2014). In this study, the Cronbach's alpha was 0.935, higher than the threshold of 0.7. Therefore, the evaluations provided by the respondents can be considered as reliable.

To test whether each collusive practice has a significant impact on a Chinese construction project, the one-sample t-test was conducted as suggested by Hwang et al. (2015b) and Zhao et al. (2013b, c). The hypothesized value of 3.00 and the significance level of 0.05 were adopted here. As shown in Table 7, the p-values of all the collusive practices were less than 0.05, suggesting that all the collusive practices have a significant impact on Chinese construction projects.

To test if significant differences exist among respondents with different employer backgrounds, an independent sample t-test was conducted, as suggested by Zhao et al. (2013a), Ning and Ling (2013), and Hwang et al. (2014b). A confidence level of 95% was adopted in this study. The test results in Table 7 show that significance values of all collusive practices are greater than 0.05, indicating no significant differences among the respondents of different employer backgrounds.

Discussions of the Primary Collusive Practices

To identify the primary collusive practices in construction projects, normalization was engaged for the questionnaire survey results, as instructed by Xu et al. (2010). Table 6 shows the normalization results. A cut-off threshold of 0.5 was adopted according to Xu et al. (2010). Correspondingly, the top nine collusive practices were selected as the primary collusive practices and discussed in detail in the following.

Misrepresentation of qualification certificates was ranked first with an evaluation of 4.03 points by the respondents. This collusive practice refers to the misuse of technical qualification certificates by the tenderers. In the Chinese construction sector, a corresponding qualification certificate is a mandatory precondition for a tenderer to participate in tendering. Nevertheless, in some cases, companies having qualified certificates may reach collusive pacts with unqualified companies and let its certificates out to the latter (Tai and Qiu 2011). Hence, by using the rented certificates, the unqualified companies can participate in tendering and have an opportunity to bid for projects that they are incapable of implementing, which would bring numerous risks to the projects.

Loose site supervision ranked second among all collusive practices. In the Chinese construction sector, a site supervisor oversees the execution of a construction project on behalf of the client (Rojas 2013). Thus, many contractors can bribe site supervisors in order to reap a higher profit. Meanwhile, the income of site supervisors in the Chinese construction sector is low compared with other project professionals such as contractors, consultants, designers, and suppliers (Lin and Chen 2004). Therefore, unsurprisingly, some site supervisors may fail in maintaining their integrity standard and collude with contractors.

Misusing prequalification requirements ranked third with an evaluation of 3.94 points. As an important and necessary tool for contractor selection, prequalification has been widely adopted in Chinese construction projects (Russell and Skibniewski 1988; Xia and Ye 2005), but it can also be utilized illegally by the conspirators. For instance, current Chinese tendering regulations allow a client to shortlist potential tenderers via prequalification if there are numerous potential tenderers. Therefore, some clients misuse this privilege by setting specific requirements to exclude qualified tenderers and only allow its favored tenderers to participate in tendering (Xia and Ye 2005), which runs counter to the rule of free competition. Table 5 shows that respondents from the contractor and designer subgroups both gave a top ranking in this collusive practice.

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Table 7. Statistical Test Results of Collected Data

							Significance									
Code	CL-CT	CL-DE	CL-CS	CL-SU	CL-AC	CT-DE	CT-CS	CT-SU	CT-AC	DE-CS	DE-SU	DE-AC	CS-SU	CS-AC	SU-AC	*p*-value
CP1	0.539	0.499	0.896	0.660	0.899	0.875	0.101	0.348	0.162	0.060	0.284	0.108	0.666	0.595	0.525	0.000[a]
CP2	0.583	0.355	0.589	0.647	0.771	0.363	0.671	0.692	0.129	0.138	0.255	0.119	0.910	0.121	0.228	0.000[a]
CP3	0.148	0.060	0.078	0.098	0.196	0.122	0.780	0.316	0.573	0.344	0.904	0.081	0.122	0.602	0.179	0.000[a]
CP4	0.299	0.285	0.567	0.385	0.598	0.702	0.064	0.303	0.082	0.072	0.367	0.085	0.632	0.659	0.354	0.000[a]
CP5	0.359	0.272	0.218	0.290	0.192	0.768	0.555	0.439	0.986	0.680	0.215	0.809	0.144	0.536	0.449	0.000[a]
CP6	0.121	0.074	0.103	0.091	0.100	0.724	0.405	0.408	0.572	0.156	0.192	0.690	0.808	0.179	0.208	0.000[a]
CP9	0.109	0.145	0.101	0.136	0.060	0.654	0.377	0.874	0.224	0.639	0.847	0.385	0.522	0.532	0.186	0.000[a]
CP10	0.059	0.064	0.061	0.079	0.143	0.192	0.644	0.341	0.773	0.464	0.986	0.223	0.623	0.563	0.349	0.000[a]
CP11	0.665	0.165	0.267	0.060	0.383	0.202	0.056	0.126	0.175	0.124	0.474	0.214	0.141	0.884	0.085	0.000[a]
CP12	0.623	0.467	0.521	0.482	0.672	0.357	0.642	0.507	0.749	0.647	0.965	0.323	0.769	0.489	0.389	0.000[a]
CP13	0.502	0.408	0.720	0.561	0.640	0.645	0.378	0.892	0.499	0.153	0.628	0.292	0.574	0.953	0.636	0.000[a]
CP14	0.080	0.262	0.092	0.231	0.244	0.859	0.873	0.674	0.852	0.754	0.638	0.779	0.760	0.942	0.871	0.000[a]
CP15	0.080	0.055	0.244	0.061	0.131	0.140	0.233	0.269	0.372	0.373	0.621	0.406	0.877	0.880	0.782	0.000[a]
CP16	0.968	0.933	0.771	0.743	0.713	0.898	0.441	0.422	0.556	0.351	0.365	0.639	0.789	0.223	0.275	0.000[a]
CP17	0.100	0.055	0.144	0.089	0.156	0.498	0.213	0.780	0.363	0.129	0.845	0.111	0.178	0.945	0.284	0.000[a]
CP18	0.178	0.213	0.297	0.346	0.254	0.748	0.785	0.872	0.507	0.555	0.707	0.400	0.962	0.716	0.724	0.000[a]
CP19	0.704	0.473	0.773	0.465	0.845	0.294	0.833	0.573	0.282	0.201	0.797	0.071	0.463	0.361	0.149	0.000[a]
CP20	0.754	0.699	0.804	0.718	0.703	0.904	0.736	0.716	0.799	0.604	0.729	0.839	0.515	0.569	0.915	0.000[a]
CP21	0.570	0.390	0.565	0.516	0.654	0.414	0.551	0.585	0.832	0.125	0.986	0.393	0.263	0.803	0.546	0.000[a]
CP22	0.548	0.320	0.229	0.323	0.089	0.108	0.245	0.129	0.139	0.483	0.780	0.643	0.377	0.181	0.902	0.000[a]

[a]The collusive practice exists significantly, and has a significant impact on, Chinese construction projects at the significance level of 0.05.

Fake tendering received the fourth ranking with an evaluation of 3.93 points. This is a typical collusive practice in the Chinese construction sector, committed by the client and its preferred tenderers (Le et al. 2012a; Wang and Qin 2011). In this collusive practice, a client usually preselects a contractor/consultant/supplier in advance based on its preference and then calls other tenderers to undertake the organizational or statutory tendering procedures. Obviously, such a collusive practice is difficult to be detected because all the tendering procedures have been followed rigorously based on the protocols.

Approval of the unnecessary change orders was ranked fifth in this survey with an evaluation of 3.91 points. Changes in construction projects arise due to the active or passive modification of the original scope, execution time, or project design, and its occurrence is inevitable due to the complexity, uncertainty, and uniqueness of each project (Hanna et al. 2002; Hwang et al. 2014a). Meanwhile, the change of orders is also a major source of cost overruns (Jiang et al. 2001). Therefore, to maximize their profit, though illegally, many contractors are inclined to propose as many unnecessary change orders as they can, and try to get these change orders approved even by bribing the client staffs. Undoubtedly, this typical collusive practice, which exists widely in the Chinese construction sector, leads the project to be run over budget (Le et al. 2012b; Zhou et al. 2007).

The collusive practice of collective collusive tendering by helping one another severely damages the competitive nature of tendering, and was ranked sixth in this survey with an evaluation of 3.90 points. Under the excessive competition pressure in the Chinese construction market, some contractors may enter into a collusive agreement where a designed winner is designated in turns and others should help the designed winner win the project (Wu et al. 2009). More specifically, the designed winner submits an artificially high tender price, whereas others submit even higher ones to help the designed winner win the project. Additionally, after the designed winner signs the contract, it may provide some compensation to the unsuccessful tenderers or employ the unsuccessful tenderers as subcontractors (Zhang and Zhao 2008; Zou 2007). A similar collusive practice has also been identified and discussed in the Australian and South African construction sectors (Bowen et al. 2007a, b; Vee and Skitmore 2003).

The nomination of a particular supplier was ranked seventh with an evaluation of 3.88 points. In the Chinese construction sector, the client usually has the privilege to nominate one supplier for material or equipment supply and recommends it to the general contractor. Hence, a supplier may bribe the client staff for such a collusive nomination. However, to compensate the cost for the bribery, the supplier may provide cheap and unqualified materials and equipment, which inevitably lead to potential quality hazards (He et al. 2009).

Issuing the certified works falsely was ranked eighth with an evaluation of 3.84 points. Considered as most susceptible to bribery (Ameh and Odusami 2010), quantity surveyors play a vital role in this collusive practice together with contractors. After reaching a collusive agreement, the quantity surveyor would issue completion certificates to the contractor even when jobs are incomplete or sometimes abandoned. Other specific cases of this collusive practice include overstating the quantities of various items of works, covering unexecuted items of work in the periodic evaluation, exaggerating the cost of design variation, and inflating prices of the works (Zou 2006).

Inflating the tender price received the ninth ranking with an assessment of 3.77 points. In doing this collusive practice, some staff members of the client usually imply its preferred tenderer to inflate the tender price first and then seek kickbacks in return after the contract is awarded. This collusive practice is more common in Chinese public projects (Le et al. 2012a). This can be explained by the principal-agent theory, in which the agent (i.e., the collusive staff of the client) has different ideas and purposes from the principal (i.e., the client), which may finally lead to a moral hazard that the agent reaps his/her private benefits at the cost of the principal (Turner and Müller 2003).

Conclusions

Based on the hybrid use of a systematic literature review, a two-round Delphi survey, and an empirical questionnaire survey, this

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study identified and ranked the collusive practices in Chinese construction projects. The survey results indicated that the primary collusive practices in current Chinese construction projects are misrepresentation of qualification certificates, loose site supervision, misusing prequalification requirements, fake tendering, approval of unnecessary change orders, collective collusive tendering by helping one another, the nomination of a particular supplier, and issuing certified works falsely.

Although this study has systematically identified and prioritized collusive practices in the Chinese construction projects, it suffered several limitations. First, prioritizing collusive practices may be subjective due to the use of opinion-based data, which may be limited to the individual experience of those experts involved. Second, the nonprobability sampling approach used in this study is less accurate and rigorous as compared with that of probability sampling (Trochim 2006). Third, due to the sensitive nature of the topic, this study only received a small number of responses in its questionnaire survey. Therefore, caution should be retained when the results are interpreted and generalized. Lastly, the findings of this study were interpreted in the Chinese context, which might vary from that of other countries.

In spite of these limitations, this study still has several useful implications, especially for those international contractors that are or will be involved in the Chinese construction sector. This study provides helpful insight about collusive practices in the country. Further research directions could be twofold. First, underlying factors resulting in the collusive practices should be investigated, which may reveal the rationality of collusion in construction. Second, corresponding anticollusion measures, as well as their effectiveness, should be examined, which may provide the industry with a full-scale understanding of collusion for its healthy development.

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