1. Introduction

Project success has been recognized as the ultimate objective for all stakeholders and has been attracting the attention from individuals and stakeholders in the field of project management (Mir and Pinnington 2014). Extant studies have examined multi-dimension nature of project success (Jiang, Lu, and Le 2016; Wu, et al. 2017b), the influence factors for project success (Banihashemi et al. 2017; Osei-Kyeyi and Chan 2015; Li, Ning, and Chen 2018; Zou et al. 2014), and how to promote project success (Khlaifat et al. 2019; Saunders, Gale, and Sherry 2015). In particular, in the issue of how to promote project success, scholars have witnessed four paradigm shifts, including technical paradigm (e.g., Ali 2020; Jin and Zhang 2011), organizational paradigm (e.g., Turner and Keegan 2001; Ananywlu 2013), contractual paradigm (e.g., Wu et al. 2017b; Hurk and Verhoest 2014) and relational paradigm (e.g., Ke et al. 2015; Benitezavila et al. 2018). The remarkable feature of the shift is that researches gradually go deep into the institution aspect (i.e., contractual and relational paradigm) from the management aspect (i.e., technical and organizational paradigm), and both contractual and relational governance have become important topics in the current researches of project success. In a word, much attention has been paid to promote project success from the relational paradigm in recent years. At this point, trust and asymmetric dependence related to owner–contractor relationships in construction projects, were regarded as the critical factors for project success by some researchers (Jiang, Lu, and Le 2016; Lu et al. 2016; Brinkhoff, Özer, and Sargut 2015).

However, it has been pointed out that the current researches in promoting project success from relational paradigm resulted in less attention to project management practices (Alias et al. 2014), especially in the process-related factors during projects implementation.
(Adenfelt 2010; Bhuiyan, Gerwin, and Thomson 2004). According to the previous researches, improving in construction processes through communication and coordination between owners and contractors can indirectly promote project success (Kivrak et al. 2008; Adenfelt 2010). So, it is imperative to consider the impact of process-related factors on project success in the researches from relational paradigm. Indeed, there is no comprehensive study that explores the joint impact of relationship-related factors and process-related factors on project success. Thus, examining the impact of relationship-related factors (e.g., asymmetric dependence and trust) and process-related factors (e.g., communication and coordination) on project success, and investigating the relationship between relationship-related and process-related factors in one study are needed for both academics and practitioners in the field of project management.

Although information and knowledge related to the implementation of projects will be shared and exchanged among the participants in most construction projects (Cheung, Yiu, and Lam 2013), they differ in various configurations of decision rights (Brinkhoff, Özer, and Sargut 2015). However, extant researches on project success did not differentiate the effect of the various decision rights (i.e., configurations of project control rights). So, the present study makes an exploratory effort on investigating how relationship-related factors and process-related factors influencing project success under alternative configurations of project control rights. For this purpose, we classified the configuration of project control rights into two categories from the perspective of owners: the strong and the weak. The strong mainly consists of projects adopting the delivery methods of DBB and DB, and the weak includes PPP projects and the projects adopting the delivery method of EPC. The theoretical foundation and standard of classification adopted are dilated in the section of model development and hypotheses.

The Stimulus-Organism-Response (S-O-R) paradigm, which was firstly put forward by Mehrabian and Russell (1974), connects stimulus, organism and response through a given relationship. In this paradigm, some environmental stimuli can provoke organisms’ reactions in cognition and emotion (Kim, Lee, and Jung 2020), which can then cause correlative behavioral responses (Donovan and Rositer 1982). Mollen and Wilson (2010), Lin et al. (2019) and Kamboj et al. (2018) had applied this paradigm in the research fields of website experience, tourism management and information management. Unfortunately, few researches have adopted this paradigm to the research field of construction project management. Consequently, the present study aims to fill in this research gap. Based on this paradigm, this paper considers that the asymmetric dependence (stimulus) in owner–contractor relationships influences owners’ trust level on contractors (organisms), which sequentially influences communication and coordination (responses) during implementation of projects. What’s more, by linking the S-O-R paradigm with project success, we proposed several multiple serial mediation models to examine the relationships of asymmetric dependence, trust, communication, coordination, and project success (Figure 1). Few researches have examined the multiple serial mediating relationships of these variables in the context of construction project. Consequently, multiple serial mediation may help us to see how relationship-related factors and project success are linked and what the fundamental mediators are in the chain. All hypothetical relations were verified using data obtained from the owner companies in Jiangsu, Zhejiang, Hubei, Guangdong, Sichuan and Shandong provinces of China. The data collected from the electronic questionnaire were tested through a two-step approach using Smart-PLS 3.0 software and PROCESS.

The rest of the present research is organized as follows. The next section reviews the theoretical background related to this study. Then, the following section establishes the research model and proposes several hypotheses. Section 4 introduces the research method of a questionnaire survey. Section 5 shows the results, while Section 6 gives the discussion. This study

![Figure 1](image_url)

**Figure 1.** Research model. AD = Asymmetric Dependence; TR = Trust; CO = Communication; CN = Coordination; PS = Project Success.
is ended up with Section 7, consisting of result summary, limitations and recommendations.

2. Theoretical background

Over the past three decades, both the theoretical and the practical personnel in the field of project management have been committed to the pursuit of project success (Lu et al. 2016). To ensure project success, from the technical paradigm, scholars considered that project failure was due to the failure in minimizing the uncertainty and risks of projects (Kendrick 2015; Saunders, Gale, and Sherry 2015). Thus, advanced project management methods and tools had been continuously applied to project management practice, such as Delphi method (Ayhan and Tokdemir 2018), artificial neural networks (Leśniak and Juszczyszyn 2018), Monte Carlo methods (Ouyang and Chen 2019) and fuzzy synthetic evaluation (Ameyaw and Chan 2015). In addition, emerging engineering materials (e.g., the phase change materials) have been used in most common engineering applications such as thermal energy storage and thermal comfort in modern buildings for the purpose of cost saving and eliminating the air pollution (Laraib Tariq et al. 2020). Similarly, nanofluids (Ahmadlouydarab, Ebadolahzadeh, and Ali 2020; Ahmadi et al. 2020) and air cooling technique (Murugan et al. 2020) have been also proposed and adopted to improve the performance of buildings. Notwithstanding, an increasing number of projects in the construction industry have failed and the construction industry needs to struggle to achieve project success (Khalilat et al. 2019). Consequently, it is imperative to discuss project success from other paradigms and perspectives (e.g., from the relational paradigm).

2.1. Relationship-related factors

From the relational paradigm, when owners and contractors establish flexible and solidarize relationships with each other, transactions will be satisfactory (Lu et al. 2015). Moreover, scholars in the field of relational governance regard mutual trust among organizations as the core elements and important means of relational governance (Ke et al. 2015; Tsarenko and Simpson 2017; Dong, Ma, and Zhou 2017). Furthermore, researchers have found that trust is a key element in establishing and maintaining good relationships between owners and contractors (Iyiola and Rjoub 2020), especially when facing unfamiliar partners and high cultural differences (Tsarenko and Simpson 2017). On the contrary, the adversarial and confrontational owner–contractor relationships can inhibit project success and make it harder to accomplish project goals (Jelodar, Yiu, and Wilkinson 2015; Iyiola and Rjoub 2020). That’s to say, maintaining trust relationships can promote the goals of partners (Ke et al. 2015). So, trust is the first relationship-related factor needed to be examined in this study. Similarly, asymmetric dependence is another one. General speaking, asymmetric dependence makes transaction costs increased and lowers trust level between partners (Scheer, Miao, and Palmatier 2015; Brinkhoff, Özer, and Sargut 2015; Caniels et al. 2017). A few researches have explored the effect of asymmetric dependence on cross-organizational relationships in some research fields (see, Lee, Mun, and Park 2015; Brinkhoff, Özer, and Sargut 2015). Specially, it has been pointed out that the asymmetric relationship between buyers and their matched suppliers affects perceived opportunism and firm performance (Villena and Craighead 2017). Unfortunately, few researches have tested the relationship between asymmetric dependence and project success in the research field of construction project management. So, this paper intends to make contributions through evaluating the influences of asymmetric dependence on trust and project success.

2.2. Process-related factors

Some scholars argued that process-related factors concerning to project implementation were critical constituent in making projects success (Alaloul, Liew, and Zawawi 2016; Adenfelt 2010). This is because when project partners neglect the control to process-related factors, wasting in time and cost occurs despite of the advanced project management methods and tools. So, process-related factors that lead to project success will be discussed in the present research. The first one is communication. Scholars found that project success was always closely related to a good communication mechanism between project partners (Wu et al. 2017a; Forcada et al. 2017). Specially, it was shared as a belief by all practitioners that an effective owner–contractor relationship should be based on honest communication (Suprapto et al. 2015). In addition, coordination is another process-related factor needed to be investigated in this study. Coordination was regarded as one of the critical factors contributing to project success in many previous researches (e.g., Lindhard and Larsen 2016; Yamin and Sim 2016). However, there is a lack of empirical investigation on the relationship between coordination and project success. Also, researchers have pointed out that it is imperative to conduct empirical researches to ascertain the relationship between coordination and projects success as well (Chang and Shen 2009; Alaloul et al. 2020). Although several researches responded to this call (see, Alaloul et al. 2020; Shrestha 2018), few researches have discussed this issue in an owner-contractor context. Therefore, investigating the role of process-related factors (communication and
coordinating) in promoting project success has become an urgently need to be addressed in specific contexts such as owner-contractor relationships.

3. Model development and hypotheses

3.1. The S-O-R paradigm

The S-O-R paradigm was adopted as the theoretical framework to establish a research model used in the present research. In more specific terms, the S-O-R paradigm consists of these elements: stimulus, organism and response. The stimulus refers to the environmental aspect which can arouse individuals (Eroglu, Machleit, and Davis 2001). In this study, asymmetric dependence is usually regarded as one type of relationship characteristic among project participants. So, it can be seen as one kind of environmental aspect (stimulus) that arouses the individuals. The organism is another element referring to the individual’s reaction in cognition and emotion. In this study, we regard owners’ trust on contractors as an organism which will be influenced by the stimulus (asymmetric dependence). The last element is response, referring to the outcome after owners trusting contractors, in the form of owners’ interactive behaviors (communication and coordination) with contractors. In a word, the present study considers asymmetric dependence between owners and contractors be the stimulus. On this background, we investigate the relationships of asymmetric dependence (stimulus), owners’ intrinsic state of trust (organism), communication and coordination behaviors (response) in owner-contractor relationships in construction projects.

3.2. Stimulus: asymmetric dependence

According to Lawler and Bacharach (1987), asymmetric dependence is the divergence between firm A’s dependence on firm B and the latter’s dependence on the former. From the perspective of the resource dependence theory (RDT), enterprises have the attribute of depending on external resources to maintain their own survival and development (Pfeffer and Salancik 1978). In construction projects, the owner depends on the contractor to finalize construction projects, while the latter depends on the former to provide incomes (Jiang, Lu, and Le 2016). In general, it was believed that high level of asymmetric dependence resulted in poor project performances. For example, Villena and Craighead (2017) had pointed out that the asymmetric relationship would likely serve as a catalyst for uncertainty within the exchange. In this kind of relationship, a disproportionate level of vulnerability whereby the larger company may use its bargaining power in the exchange to gain control over its smaller partner might be created. Specially, if it is not a priority to keep the relationship going, the dominant partner may derive the greatest benefit from the current relationship by fair means or foul (Brito and Miguel 2017). In construction projects, with high asymmetric dependence and divergent interests between owners and contractors, both partners will work hard to find loopholes in contracts and profit from them (Lu et al. 2016). Furthermore, asymmetric dependence can reduce mutual trust between project partners, and thus cause the problem of distrust between partners and the short-term interest-seeking behavior. Therefore, delays in progress and overruns in costs will eventually occur (Lu et al. 2016). So, the first hypothesis can be stated as follows:

Hypothesis 1. Asymmetric dependence between project partners has a negative influence on project success.

3.3. Organism: trust

According to the transaction cost theory (TCT), a trust relationship between transaction parties can greatly decrease transaction costs through increasing the flexibility in dealing with uncertain events, reducing conflict during the construction process, and lowering the waste in time and energy (Yang, Ho, and Chang 2012). Empirical researches showed that partners’ trust led to improved perceived credibility of their counterparts and reduced relational (e.g., opportunistic behavior) and emotional risk (e.g., Yuen et al. 2018). That is to say, trust makes interactions between transaction partners more efficient (Brinkhoff, Özer, and Sargut 2015). In construction projects, trust is especially significant for project success for the reason that trust can save time and cost during implementation phase by substituting unnecessary control mechanisms. In addition, empirical researches have confirmed that trust is critical to ensure project success. For example, Jiang, Zhao, and Zuo (2017) explored the relationship between owner-contractor trust and project success by using the data collected from owners, and found that trust positively influenced project success. A distrust relationship, on the contrary, may result in negative effects for construction projects and even lead to complete project failure (Jiang, Lu, and Le 2016). Therefore, we believe trust plays a positive role in project success, as stated in the following hypothesis:

Hypothesis 2. Trust between project partners has a positive effect on project success.

According to RDT, the dominant partner can weaken or overcome resource vulnerability in their business environment, comprising the possibility of resorting to opportunistic behaviors (Crosno and Dahlstrom 2008; Villena and Craighead 2017), which usually reduces mutual trust between project partners. An often
accepted assumption in the literature is that depend-ence on a dominant party has negative consequences for the dependent party (Caniels et al. 2017), which can significantly affect the built and development of trust between partners. In addition, asymmetric dependence usually leads to more conflict between transaction parties (Scheer, Miao, and Palmatier 2015), lower commit-ment (Caniels et al. 2017) and less motivation to cooperate (Griffith et al. 2017). And all of these results can then result in higher transaction costs and agency costs, both of which are harmful for the trust in transac-tion relationships. Thus, asymmetric dependence nega-tively affects the mutual trust between project partners (Scheer, Miao, and Palmatier 2015; Caniels et al. 2017), as stated in the hypothesis below:

Hypothesis 3. Asymmetric dependence has a negative effect on trust between project partners.

3.4. Response: communication and coordination

Successful implementation of construction projects demands the thoughts of potential process-related fac-tors which influence project performance (Lindhard and Larsen 2016). As is often pointed out, optimizing in the construction processes can indirectly result in better project performance and eventually promote project success (Kivrik et al. 2008; Lindhard and Larsen 2016). On the contrary, the difficulties in coordination and communication between project partners have been highlighted as important factors hampering project suc-cess (Adenfelt 2010; Hsu et al. 2012). In addition, based on a case study of an oil and gas industrial project in the construction phase, the result showed that both communication and coordination were critical factors for project success (Bubshait, Siddiqui, and Al-Buali 2015).

So, we regard communication and coordination as the two process-related factors discussed in this study.

Communication is the first process-related factor to be discussed. According to Anderson and Narus (1990), communication was the formal and informal spreading in a timely and appropriate way between communicators. As mentioned before, scholars regarded communication as an important predictor for project success (i.e., Wu et al. 2017a; Forcada et al. 2017; Lindhard and Larsen 2016; Kozhakhmetova et al. 2019). What’s more, Pinto, Slevin, and English (2009) had pointed out that meaningful communication between project partners was extremely important to project success, especially when construction projects were characterized by high level of uncertainty. Therefore, the fourth hypothesis can be stated as follows:

Hypothesis 4. Communication between project partners has a positive effect on project success.

Coordination, the second process-related factor in the model, is the specific activities related to the manage-ment of resources with organized manners so that efficient construction and orderly operation in con-struction projects can be come true (Hossain 2009). Coordination is an important challenge for project partners, because lots of work in construction projects is cross-organizational and requires the joint efforts of different participants to realize the given objectives (Bubshait, Siddiqui, and Al-Buali 2015). At present, a significant number of projects are pretty complex in the design of electrical and mechanical installations. So, effective coordination between project partners is required (Alaloul, Liew, and Zawawi 2016). Furthermore, based on a survey identifying the factors influencing project performance in Indian, Iyer and Jha (2005) pointed out that coordination among project participants was the most important element effecting projects’ costs (one of the key indicators of project success). In a word, coordination between project partners affects project performance and eventually influences project success (Yamin and Sim 2016; Hossain 2009; Alaloul, Liew, and Zawawi 2016). So, we expect coordination to play a significant role:

Hypothesis 5. Coordination between project partners has a positive effect on project success.

3.5. Mediation effects

3.5.1. Simple mediations

Though project success usually bases on the foundation of trust between project partners, trust does not necessarily lead to project success. As Schoorman et al. (2007) had already pointed out, trust only provided confidence guarantee of not being cheated for project partners, but there must be some mediating mechanisms for its impact on project success. Thus, we assume that in construction projects, the influence of trust on project success is indirectly realized via mediating variables.

The first one is communication. Generally speaking, trust contributes to communication (Dalmolen and Sikkel 2015; Cheung, Yiu, and Lam 2013; Coovert, Miller, and Bennett 2017) owing to trust’s role in restraining opportunistic behaviors. On the contrary, failures in controlling schedule, cost and quality will occur when owners and contractors cooperate in tense relationships (Wu, Zhao, and Zuo 2017; Halac 2014). For this reason, trust was often regarded as a critical prerequisite for effective communication between project partners. Furthermore, it was reported that trust among members of project teams affected communication and then impacted project performance (Wu et al. 2017a). Similarly, Cheung, Yiu, and Lam (2013) found that trust influenced project performance via its effect on communication.
The second one is coordination. As a relationship mechanism, trust can promote cooperation and coordination in exchange relationships (Li 2005). From the perspective of relational governance, relational contracts and formal contracts function as complements (Poppo and Zenger 2002). As is known to all, trust is an important element of relational contracts, while coordination mechanism of transaction partners can be stipulated in contracts. That’s to say, a satisfactory transaction requires the good combination of trust and coordination. Furthermore, scholars concentrating on the performance implications of inter-organizational trust held that trust between organizations reduced transaction costs and facilitated coordination (Hatak and Roessl 2011), which was beneficial to project success (Lindhard and Larsen 2016; Yamin and Sim 2016). In a word, trust makes a contribution to project success through facilitating coordination between project partners. Therefore, we expect communication and coordination to play mediating roles:

Hypothesis 6a. Communication mediates the effect of trust on project success.

Hypothesis 6b. Coordination mediates the effect of trust on project success.

In addition, we discussed the mediating mechanisms of asymmetric dependence and project success. In general, symmetric dependence has a positive effect on coordination in a dyadic relationship (Payan 2006), while a high level of asymmetric dependence could lead to less relationship continuity and less cooperative behaviors (Griffith et al. 2017). And this is harmful for project success. Furthermore, it was recognized that when asymmetric dependence was high in a trading relationship, communication among partners would be restricted and the unidirectional and formal communication was more common (Brinkhoff, Özer, and Sargut 2015). What’s more, empirical studies focusing on inter-organizational relationships (e.g., buyer–supplier relationships) had found the mediation effect of communication on the relationship of asymmetric dependence and project success (Brinkhoff, Özer, and Sargut 2015). Therefore, we expect coordination and communication to play mediating roles in the relationship between asymmetric dependence and project success, as stated in the below:

Hypothesis 7a. Communication mediates the effect of asymmetric dependence on project success.

Hypothesis 7b. Coordination mediates the effect of asymmetric dependence on project success.

As stated previously, in the relationship characterized by high asymmetric dependence, the dominant partner can weaken or overcome resource vulnerability in its business environment, comprising the possibility of resorting to opportunistic behaviors (Crosno and Dahstrom 2008; Villena and Craighead 2017). And this usually reduces the level of trust among partners (Brinkhoff, Özer, and Sargut 2015). Correspondingly, a high level of control measures might be exploit to ensure project success (Jiang, Zhao, and Zuo 2017), which may damage the relationship and flexibility of the partners. So, project success becomes more complicated under this circumstances. Furthermore, Brinkhoff, Özer, and Sargut (2015) had hypothesized and empirically examined the mediation effect of trust on the relationship of asymmetric dependence and project success based on inter-organizational supply chain projects. Even though an insignificant result was obtained, it is still a meaning question deserved to be further discussed. Thus, the corresponding hypothesis is stated in the below:

Hypothesis 8. Trust mediates the effect of asymmetric dependence on project success.

3.5.2. Multiple serial mediations

In addition, based on the mixed data collected from industries of consumer goods, automotive, and construction etc., Brinkhoff, Özer, and Sargut (2015) empirically examined supply chain project success and found that the negative influence of asymmetric dependence on project success was achieved via a multiple serial path: asymmetric dependence→trust→employee commitment→project success, in which employee commitment was also a process-related factor in their study. Similarly, we expect trust and process-related factors (communication and coordination) to play mediation roles in the multiple serial mediations to ensure project success in the present research:

Hypothesis 9a. Trust and communication mediate the effect of asymmetric dependence on project success.

Hypothesis 9b. Trust and coordination mediate the effect of asymmetric dependence on project success.

3.6. The moderation effect of the configuration of project control rights

Previous research pointed out that the enterprise control right was the exclusive right to dominate business operations and decisions (Loss and Seligman 2001). According to incomplete contract theory (ICT), a firm owning assets possesses two types of control rights over assets, namely specific control right and residual control right (Grossman and Hart 1986). In this study, we hold the idea that the project control right which is akin to the notion of the enterprise control right, is an exclusive set of dominant powers for all participants to allocate resources (natural resources, economic
resources, human resources, etc.) to ensure project success. From the perspective of transaction cost economics (TCE), the incentive intensity is unavoidably compromised by internal organizational structure (Williamson and Oliver 2002), in which the configuration of project control rights is a crucial element. In general, the configuration of project control rights can affect owners’ and contractors’ rights scope in project management. For instance, when owners completely (or partly) delegate project control rights to contractors and retain none (or only a few) project control rights, contractors will be encouraged to implement projects more energetically. That’s to say, the relationship among relationship-related factors, process-related factors and project success may vary depending on diverse configurations of project control rights. Therefore, to assess the moderation effects of the configuration of project control rights, owners’ control rights over projects were divided into two types of the strong and the weak, and this kind of division was based on two principles as follows. First, do owners retain the right to sign relevant contracts with stakeholders? Second, do owners still participate in project management activities? Specifically, when owners retain the right to sign relevant contracts with stakeholders, or to a large extent, owners involve in project management activities personally, then owners possess the strong project control rights; while when owners completely (or partly) delegate the right to sign relevant contracts with stakeholders to contractors, or owners rarely participate in project management activities by themselves, owners possess the weak project control rights.

Based on these criteria, we divided the configuration of project control rights into two categories from the perspective of owners: the strong and the weak, in which the strong mainly consisted of projects adopting the delivery methods of DBB and DB, while the weak included PPP projects and projects adopting the delivery method of EPC. According to a survey based on Chinese construction market, the most common delivery methods were DBB, DB, EPC and their derivative models (Chen et al. 2011). More recently, a survey based on 113 Chinese samples of construction projects pointed out that the total amount of DBB, DB and EPC projects accounted for 89.38% of all the projects (Liu et al. 2016). Thus, the strong and the weak in this study can cover the most projects models implemented in China. Therefore, the next hypothesis can be stated as follows:

Hypothesis 10. The configuration of project control rights moderates the relationship among relationship-related factors, process-related factors and project success.

4. Research method
4.1. Questionnaire design
We adopted the method of questionnaire survey to collect data for the present research. This study adopted measurement items all from published sources. Additionally, 15 professionals were asked to give their optimization suggestions on the initial questionnaire to make the questionnaire reasonable and effective. Then the modified and improved questionnaire basing on the professionals’ feedback was regarded as the formal questionnaire, whose items are shown in the Appendix. Each measurement criterion adopted a 5-point Likert scale.

4.2. Sampling and procedure
The owner is the overall integrator and organizer of the construction project. In particular, in the event of a dispute the owner has the authority to exclude anybody from working on the project at any stage (Besley and Ghatak 2001). Furthermore, it had been pointed out that owners’ relational capabilities were extremely important to project performance and project success on complex projects (Caldwell and Howard 2010). So this study chose the owner companies, who had participated in construction projects, as the potential respondents. This survey was limited to Jiangsu, Zhejiang, Hubei, Guangdong, Sichuan and Shandong provinces. These six provinces can be considered representative in the Chinese construction industry because they completed 48.6% of the country’s total output value of construction in 2018 (National Bureau of Statistics of China 2019).

The form of electronic questionnaire was adopted in this study. First of all, e-mail and chatting software—WeChat were applied to send 400 questionnaires to respondents and then recover them. Specially, we contacted with the respondents who were responsible for the survey of their companies once a week for the purpose of improving recovery rate. Additionally, to facilitate the subsequent examination—the moderation effect of the configuration of project control rights, we asked respondents to fill in the blanks reserved for the name, investment amount and location of the selected projects in the questionnaires. By doing this, we’d like to ensure the uniqueness of the collected projects. For this purpose, when two or more respondents chose one same project, we only kept one with high-quality answers. As for the others, we paid a return visit to them by telephone or e-mail, asking if they could provide another project which they had participated in to replace the previous. In this way, we finally collected a total of 173 valid projects within seven months and ensured the one-to-one consistent relationship between the respondents and the projects.
4.3. Common method bias

The data collected from single respondents were self-reported. So, it is imperative to prevent the issue of common method bias (CMB). For this reason, two methods were applied, namely ex-ante control and ex-post control. As for ex-ante control, we gave the respondents a brief explanation attached to the questionnaires that this survey was merely for scientific research and your answer would be anonymous and kept in secret. Moreover, different data sources were used to avoid the occurrence of homologous bias. With regard to ex-post control, Harman’s single-factor test and confirmatory factor analysis were conducted. First of all, the present research adopted exploratory factor analysis to extract common factors from all items (KMO = 0.896; Bartlett spherical test is significant at the level of 0.001). By this way, we got five factors, which was in line with the questionnaire structure. In addition, the variance accounted for by the first factor before rotation was less than 40%. Finally, the confirmatory factor analysis was utilized to load all the items on a common factor. The results indicated that the model’s fit index was worse than that of the initial model. So, CMB was not a concern in this research.

4.4. Data analysis

The model in this paper was tested adopting a Partial Least Squares (PLS) approach by means of Smart-PLS 3.0 software. In recent years, more and more management researchers have utilized PLS approach since it has many advantages comparing with co-variance based methods (e.g., Lin et al. 2019). For instance, in PLS analysis, neither large samples nor the normally distributed data are required (Hair et al. 2017). In a word, PLS has a higher statistical power (Hair et al. 2019). What’s more, constructs can be measured with a single item in PLS, whereas in covariance-based approaches, four or more questions per construct is needed (Bontis, Booker, and Serenko 2007). In this study, the construct of asymmetric dependence only included one item. So, PLS is suited for the present research. The research model was tested via a two-step process. Firstly, we estimated the measurement model to identify constructs’ reliability and validity. Then, we tested the structural model to identify the significance and the strength of the relationships between variables in the model.

5. Results

5.1. Descriptive analysis

Characteristics of respondents and projects are presented in Table 1.

5.2. Assessment of the measurement model

The constructs’ reliability and validity are presented in Table 2. As shown in Table 2, all constructs’ factor loadings are statistically significant and exceed 0.70 threshold level (Hair, Ringle, and Sarstedt 2011). In addition, the AVE value of each construct exceeds 0.50 threshold level, indicating that all constructs’ convergent validities are adequate and satisfactory (Hair, Ringle, and Sarstedt 2011). Besides, all constructs’ composite reliability and Cronbach’s alpha values exceed 0.70 threshold level, establishing internal consistency.

The constructs’ discriminant validity were evaluated with three approaches as follows:

First, cross-loadings of measurement items were adopted. As shown in Table 3, each item’s loading on its own construct (the bold values) exceeds the cross-loadings on the other constructs.

Second, we conducted the analysis with Fornell-Larcker criterion. As shown in Table 4, square roots of all constructs’ AVEs (the diagonal elements) exceed the correlation between the constructs, demonstrating adequate and appropriate discriminant validity (Fornell and Larcker 1981).

Finally, the HTMT approach proposed by Henseler, Ringle, and Sarstedt (2015) was adopted. Results in

Table 1. Characteristics of respondents and projects.

| Characteristic of respondents | Frequency | Characteristic of projects | Frequency |
|-------------------------------|-----------|-----------------------------|-----------|
| Education                     | 43(24.9%) | Total investments (RMB)     | 74(42.8%) |
| Master degree or above        | 115(66.8%)| >500 million                | 66(38.2%) |
| Bachelor degree               | 15(8.7%)  | 100–500 million             | 6(3.8%)   |
| College degree                | 0         | 50–100 million              | 19(11.0%) |
| Others                        | 0         | < 50 million                | 14(8.1%)  |
| Work experience (years)       | 82(47.4%) | Project type                | 51(29.5%) |
| >10                           | 23(13.3%) | Office and residential construction | 51(29.5%) |
| 6–10                          | 17(9.8%)  | Industrial construction     | 43(24.9%) |
| 3–5                           | 19(10.8%) | Public construction         | 21(12.1%) |
| <3                            | 51(29.5%) | Infrastructural construction| 36(20.8%) |
| Job position                  | 55(31.8%) | Commercial construction     | 54(31.2%) |
| Manager at the headquarters   | 55(31.8%) | Others                      | 8(4.6%)   |
| Project manager               | 55(31.8%) | The configuration of project control rights | 74(42.8%) |
| GMTP                          | 28(16.2%) | The strong (DBB and DB projects) | 74(42.8%) |
| Others                        | 8(4.6%)   | The weak (EPC and PPP projects) | 99(57.2%) |

GMTP = General management/technical personnel.
Table 2. Reliability and validity analysis.

| Variable (TR) | Items | LOA  | CR   | α   | AVE  | Variable (CO) | Items | LOA  | CR   | α   | AVE  |
|----------------|------|------|------|-----|------|---------------|------|------|------|-----|------|
| TR1            | 0.833| 0.872| 0.861| 0.579|      | CO1           | 0.728|      |      |      |      |
| TR2            | 0.837|      |      |      |      | CO2           | 0.782|      |      |      |      |
| TR3            | 0.710|      |      |      |      | CO3           | 0.723|      |      |      |      |
| TR4            | 0.701|      |      |      |      | CO4           | 0.703|      |      |      |      |
| TR5            | 0.754|      |      |      |      | CO5           | 0.701|      |      |      |      |
| Project Success| PS1  | 0.776| 0.913| 0.892| 0.569| Coordination (CN) | CN1 | 0.708|      |      | 0.846|
| (PS)           | PS2  | 0.756|      |      |      | CN2           | 0.785|      |      |      | 0.840|
|                | PS3  | 0.742|      |      |      | CN3           | 0.743|      |      |      | 0.555|
|                | PS4  | 0.795|      |      |      | CN4           | 0.785|      |      |      |      |
|                | PS5  | 0.753|      |      |      | CN5           | 0.732|      |      |      |      |
|                | PS6  | 0.739|      |      |      | CN6           | 0.712|      |      |      |      |
|                | PS7  | 0.730|      |      |      | CN7           | 0.699|      |      |      |      |
|                | PS8  | 0.762|      |      |      | CN8           | 0.592|      |      |      |      |

LOA = factor loading; α = Cronbach’s α. All items are specified in the Appendix. Asymmetric dependence was measured as the absolute difference between the value of AD1 and AD2.

Table 3. Cross-loadings for measurement items.

| Asymmetric dependence | Communication | Coordination | Project success | Trust |
|-----------------------|---------------|--------------|----------------|-------|
| AD                    | 1.000         | 0.193        | 0.194          | 0.292 |
| CN1                   | 0.016         | 0.410        | 0.708          | 0.446 |
| CN2                   | 0.195         | 0.559        | 0.785          | 0.495 |
| CN3                   | -0.228        | 0.431        | 0.743          | 0.421 |
| CN4                   | -0.169        | 0.452        | 0.785          | 0.511 |
| CN5                   | -0.149        | 0.511        | 0.732          | 0.407 |
| CN6                   | -0.122        | 0.496        | 0.712          | 0.375 |
| CO1                   | -0.110        | 0.484        | 0.728          | 0.428 |
| CO2                   | -0.190        | 0.782        | 0.488          | 0.435 |
| CO3                   | -0.132        | 0.723        | 0.443          | 0.428 |
| CO4                   | -0.146        | 0.703        | 0.403          | 0.426 |
| CO5                   | -0.118        | 0.701        | 0.495          | 0.406 |
| PS1                   | -0.185        | 0.470        | 0.451          | 0.762 |
| PS2                   | -0.218        | 0.496        | 0.496          | 0.776 |
| PS3                   | -0.229        | 0.322        | 0.443          | 0.736 |
| PS4                   | -0.196        | 0.452        | 0.433          | 0.742 |
| PS5                   | -0.321        | 0.493        | 0.397          | 0.795 |
| PS6                   | -0.157        | 0.462        | 0.579          | 0.753 |
| PS7                   | -0.191        | 0.368        | 0.370          | 0.739 |
| TR1                   | -0.357        | 0.337        | 0.461          | 0.730 |
| TR2                   | -0.480        | 0.326        | 0.396          | 0.505 |
| TR3                   | -0.364        | 0.361        | 0.347          | 0.425 |
| TR4                   | -0.157        | 0.252        | 0.277          | 0.408 |
| TR5                   | -0.242        | 0.394        | 0.364          | 0.462 |

Table 4. Correlation matrix and HTMT ratios (the values in the parentheses).

| Items               | AD    | CO    | CN    | PS    | TR    |
|---------------------|-------|-------|-------|-------|-------|
| Asymmetric dependence (AD) | 1.000 |       |       |       |       |
| Communication (CD)    | -0.193(0.218) | 0.725 |       |       |       |
| Coordination (CN)     | -0.194(0.215) | 0.639(0.792) | 0.745 |       |       |
| Project success (PS)  | -0.292(0.310) | 0.580(0.700) | 0.592(0.684) | 0.754 |       |
| Trust (TR)            | -0.434(0.467) | 0.441(0.550) | 0.491(0.582) | 0.592(0.694) | 0.761 |

Table 4 indicate that none of the HTMT ratios exceed 0.90 threshold level (Henseler, Ringle, and Sarstedt 2015). The HTMTreference criterion which is evaluated by complete bootstrapping, demonstrates that the uppers of 97.5% confidence bounds are all less than 1. As a result, discriminant validity problems is not a concern in the present research.

5.3. Assessment of the structural model

Several criteria were applied to evaluate the structural model. The standardized root-mean-square residual (SRMR) which was recommended as the approximate criterion of model fit proposed by Henseler, Ringle, and Sarstedt (2015), is the first one. According to the instruction of Smart-PLS, a SRMR value less than 0.10 represents a good fit. The SRMR value of the structural model is 0.070, indicating an appropriate model fit. In addition, the Chi-Square of the model is 594.890. Moreover, all R² values which was proposed by Falk and Miller (1992) exceed the 0.10 threshold level (trust: 0.188; communication: 0.195; coordination: 0.242; project success: 0.518). Besides, all the values of Stone-Geisser’s Q² exceed 0 (trust: 0.104; communication:
0.097; coordination: 0.122; project success: 0.285), suggesting the satisfactory predictive relevance of the research model (Hair et al. 2017).

The path coefficients of the relationships proposed in the model are presented in Table 5. As proposed in H2, trust has a positively and significantly effect on project success (β = 0.327, p < 0.001). Similarly, as proposed in H3, asymmetric dependence has a significant negative effect on trust (β = −0.434, p < 0.001). As hypothesized in H4 and H5, both communication and coordination are positively associated with project success, providing supports for H4 and H5 (β = 0.267, p < 0.01; β = 0.258, p < 0.01). However, asymmetric dependence is found to have no significant impact on project success, demonstrating that H1 is not supported.

5.4. Assessment of the mediation effects

First, we tested the simple mediations. The results presented in Table 6 signify that trust has an indirect effect on project success through communication (coefficient = 0.122, 95% CI [0.047, 0.216]) and coordination (coefficient = 0.128, 95% CI [0.048, 0.227]). The total indirect effect of trust on project success via communication and coordination adds up to 0.250 with a bootstrap 95% CI [0.151, 0.362]. Because none of these CIs contains the value of 0, the mediation effects are statistically significant. So, we can say that trust promotes project success by strengthening communication and coordination, which provides supports for H6a and H6b. Similarly, H8 is supported. However, communication and coordination are found to have no significant influences on the relationship between asymmetric dependence and project success, indicating that H7a and H7b are not supported.

Second, we tested the multiple serial mediations. The result shows that asymmetric dependence is negatively associated with trust, and then trust is positively associated with communication, which then relates to project success (coefficient = −0.034, 95% CI [−0.069, −0.010]) (H9a). Likewise, asymmetric dependence is negatively associated with trust, and then trust is positively associated with coordination, which then relates to project success (coefficient = −0.037, 95% CI [−0.068, −0.128]) (H9b). The total indirect effect of asymmetric dependence on project success via all the mediation variables adds up to −0.168 with a bootstrap 95% CI [−0.253, −0.077]. Because none of these CIs contains the value of 0, the mediation effects are statistically significant, which indicates that both multiple serial mediations (H9a and H9b) are supported.

5.5. Assessment of the moderation effects

The present research tested the moderation effects of the configuration of project control rights by means of multi-group permutation tests (Henseler, Ringle and Sinkovics 2009) akin to Lee and Hallak (2017). First, the whole sample appeared as two subsamples (the strong and the weak). Second, Smart-PLS 3.0 software was utilized to estimate path coefficients for both subsamples. The third step was to analyze the differences between the two groups using the permutation tests. As shown in Table 7, despite of a few slight differences in respect of the estimates in significant paths between the two groups, the multi-group permutation tests (the differential of p values in Table 7) demonstrate no significant differences between the strong and the weak on any paths. This suggests that the configuration of project control rights does not play a moderating role on the relationships among the relationship-related factors, process-related factors and project success (Hair et al. 2017). Therefore, H10 is not supported.

| Table 5. Estimates for the research model. |
|---------------------------------------------|
| Hypothesis | β   | T value | P value | Support | Hypothesis | β   | T value | P value | Support |
| H1: AD→PS | −0.048 | 0.901 | 0.368 | No | H4: CO→PS | 0.267 | 3.253 | 0.001 | Yes |
| H2: TR→PS | 0.327 | 3.869 | 0.000 | Yes | H5: CN→PS | 0.258 | 3.290 | 0.001 | Yes |
| H3: AD→TR | −0.434 | 5.589 | 0.000 | Yes | |

β = Path coefficient.

| Table 6. The analysis results the mediation models estimated using PROCESS. |
|---------------------------------------------|
| Model | IE  | S.E. | 95% CI  | DE  | S.E. | 95% CI  |
|       |     |     |         |     |     |         |
| H6a   | TR→CO→PS | 0.122 | 0.044 | 0.047 | 0.216 | 0.371 | 0.066 | 0.000 | 0.241 |
| H6b   | TR→CN→PS | 0.128 | 0.045 | 0.048 | 0.227 |
| H7a   | AD→CO→PS | 0.250 | 0.054 | 0.151 | 0.362 |
| H7b   | AD→CN→PS | 0.003 | 0.016 | −0.031 | 0.036 |
| H8    | AD→TR→PS | −0.098 | 0.030 | −0.158 | −0.428 |
| H9a   | AD→TR→CO→PS | −0.034 | 0.015 | −0.069 | −0.100 | −0.041 | 0.042 | −0.124 | 0.043 |
| H9b   | AD→TR→CN→PS | −0.037 | 0.015 | −0.068 | −0.128 |
| Total | −0.168 | 0.044 | −0.253 | −0.077 |

IE = Indirect Effect; DE = Direct Effect; S.E. = Standard Error; 95% CI = 95% Confidence Interval; BL = Boot Lower; BU = Boot Upper; Total = Total Indirect Effect.
6. Discussion

6.1. Major findings

6.1.1. Project success is influenced by the relationship-related factors

The test results of the research model provide supports to H2, demonstrating that trust significantly and positively affects project success, which is consistent with previous researches (e.g., Jiang, Lu, and Le 2016; Lu et al. 2016). Although the test of H1 shows asymmetric dependence has no significant influence on project success, we still find the direct effect of asymmetric dependence on trust (H3) and the indirect effect of asymmetric dependence on project success via the simple mediation model: asymmetric dependence → trust → project success (H8) and the multiple serial mediation models: asymmetric dependence → trust → communication → project success (H9a) and asymmetric dependence → trust → coordination → project success (H9b). Considering these results based on the test results on H1, H7a and H7b, all of which are not supported, the total negative effect of asymmetric dependence on project success is accomplished only via the three mediations, where trust and process-related factors (coordination and communication) are the mediating variables between asymmetric dependence and project success. So, project success is influenced by the relationship-related factors, namely trust and asymmetric dependence.

6.1.2. Project-related factors add another layer of complexity to project success

The tests of H4 and H5 examine the relationship between process-related factors—communication (H4)/coordination (H5) and project success. The results suggest that both communication and coordination between project partners are crucial elements needed to be carefully treated by all partners, which are consistent with previous researches (e.g., Adenfelt 2010; Hsu et al. 2012; Meng 2012; Pinto, Slevin, and English 2009; Alaloul, Liew, and Zawawi 2016; Hossain 2009). Besides, the tests of H6a and H6b examine the mediation effects of process-related factors (communication and coordination) on the relationship between trust and project success, and the results show that trust can promote project success by strengthening communication and coordination. Similarly, the test result of H8 shows that asymmetric dependence has an indirect effect on project success through trust. In addition, in the multiple serial mediations, we find that trust and communication (H9a)/coordination (H9b) sequentially mediate the relationship between asymmetric dependence and project success. Therefore, to achieve project success, both process-related factors, namely communication and coordination, should be considered.

6.1.3. The configuration of project control rights has no moderating effect in the model

The test result of H10 shows that the configuration of project control rights does not moderate the relationships among the relationship-related factors, process-related factors and project success, which is different from the hypothesis 10. The reason may be that China only has a small amount of social capital, which leads to a low level of social trust. According to Yang and Wang (2013), the overall trust score of Chinese society was 59.7 points, which was lower than the social trust warning line of 60 points and had entered the level of “distrust”. As a result, contracts of EPC and PPP projects in China show less trust and more rigidity at present, which is similar with the contracts of DBB and DB projects. In this case, owners still retain more project control rights instead of delegating them to contractors. For instance, a post-approval system for budget approval has been adopted to restrict contractors’ control rights over EPC projects. Eventually, no difference is found in the model.

6.2. Research implications

This paper contributes to the academia in four aspects. Foremost, this study moves us beyond the assumption of the direct relationship between trust and project success by testing the mediating effects of process-related factors—communication and coordination,
which are relevant to the project implementation process. For this purpose, we investigated the relationship between trust and project success in more detail in inter-organization relationship under the project context. In addition, we attached much importance to the relationship-related factor—asymmetric dependence, which was extremely important for partners in the early stage of projects. By doing this, we can see a more detail relationship not a direct relationship between trust and project success, which has been already challenged by researchers (e.g., Schoorman, Mayer, and Davis 2007).

Second, this research incorporates process-related factors into the research system of project success. The focus on process-related factors—communication and coordination which have not been examined in detail in the research system of project success, represents an important contribution to the literature. In the meanwhile, by incorporating the relationship-related and process-related factors affecting project success into the comprehensive analysis framework, this study enhances our understanding on the joint impact of relationship-related factors and process-related factors on project success for both academics and practitioners.

Third, this study examines the impact of configurations of project control rights on project success, which is a gap in previous researches in the field of construction project management. By examining the configuration of project control rights as a moderator, the present research explores the impact of relationship-related factors and process-related factors on project success under alternative configurations of projects control rights. Therefore, this study contributes to project success literature which has given scant attention to the configurations of project control rights.

Fourth, this paper is novel in adopting the S-O-R paradigm in construction project management field, which represents an innovation of research paradigm in this field. Additionally, by linking the S-O-R paradigm with project success, the present research exploratorily proposes multiple serial mediation models: asymmetric dependence → trust → communication → project success and asymmetric dependence → trust → coordination → project success, all of which constitute an attempt to dig one level deeper into current research. Thus, it helps us to see how asymmetric dependence, trust, communication, coordination and project success are linked and what the fundamental paths are in the chain.

6.3. Practical implications

This research also presents significant implications for practices. The first practical implication is that potential participants should ally with whom they share mutual trust. This implication is for project managers and is about the choices of companies’ potential partners. The positive influence of trust (see, H2, H6a and H6b) and the negative influence of asymmetric dependence (see, H8, H9a and H9b) on project success are statistically supported in the present research. So, to ensure project success, the first priority for project partners is that they should ally with ones they share mutual trust. For this purpose, it is important for owners to attach much importance to the prequalification work and choose the contractors with high trust. In addition, both owners and contractors should also establish relationships which unlikely have the feature of asymmetric dependence. There is an old Chinese saying that goes like this: big shops bully customers, while powerful customers bully shops. This mentions the fact that in Chinese trading culture, it is believed that a dominant trader can put pressure on the dependent trader to agree on its own conditions and intentions because of the poor negotiating ability of the dependent trader. Frankly speaking, a certain degree of asymmetric dependence is to be inevitable in the relationship of project partners. However, a relatively symmetric dependence could be come true through conducting capability analysis filtering out the potential partners who are possible to put the chooser in a disadvantaged position. For example, owners can evaluate contractors basing on contractors’ size, qualification, performance and reputation through the prequalification work. In a word, a detailed investigation on the issues of trust and asymmetric dependence of the potential relationships can give the choosers opportunities to decrease the risks impeding project success. Then project partners can then focus on the process-related factors to promote project success.

Second, communication and coordination should be paid much attention from owners and contractors. This implication is also for project managers and is related to the process-related factors during projects implantation. In China’s construction industry especially in public ones, most contractors do not have the cooperation opportunity with owners exclusively and repeatedly for the reason of avoiding corruption. In fact, both partners are unfamiliar with each other in the early stage of projects implementation (Jiang, Lu, and Le 2016). In this case, it is meaningful to attach much importance to the two process-related factors—communication and coordination when one cannot match its counterpart with mutual trust and the same level of dependence. As the dominant partners have the ability to terminate the transaction in general, it is critical for the dependent partners to clearly communicate the value they add to the projects in an appropriate manner. Additionally, the present research confirms that coordination between project partners is an important predictor for project success. So, the designated individuals who are in charge of
coordination among organizations should be built to insure that the dominant partners also remain motivated throughout projects implantation. Third, strategies for strengthening the mutual trust between owners and contractors should be adopted. This implication is for construction industry authorities and is related to trust in EPC and PPP projects. Engineering construction all over the world is developing towards integration, modularization and informatization. To conform to the world trend and meet new challenges, the Chinese government has put forward the concept of “new infrastructure”, which refers to a new generation of information infrastructure and new urban infrastructure built with new construction modes and new technologies. In general, it has three new features, namely new investment fields (5G, artificial intelligence, industrial internet and Internet of Things), new construction modes (EPC and PPP modes) and new construction technologies (BIM, fabricated buildings and IPD). In the new construction modes, no matter EPC or PPP mode, contractors will gain much more project control rights, requiring mutual trust relationships between owners and contractors. However, as the present research confirmed, the configuration of project control rights doesn’t moderate the relationship among the relationship-related factors, process-related factors and project success, indicating that the high level of trust relationships between owners and contractors have not been established. Therefore, it is necessary to strengthen the mutual trust between owners and contractors in EPC projects, and the following three strategies are available: The first is to adopt an irrevocable system of favorable comments and unfavorable comments. With this system, when all EPC projects are tendering in the tangible market, synchronous virtual transactions on the Internet platform are added, so that buyers (owners) can give sellers (contractors) unfavorable comments. The second is to adopt the shortlist system. In such system, the government investment departments invite public bidding for procurement and then contractors bid to obtain shortlisted qualifications. The former’s evaluation score is used as the condition for the latter to be shortlisted next time. The more times the latter is shortlisted, the higher trust level will be. The third is to create EPC contract texts corresponding to different trust levels. The higher the trust level of owners to contractors, the greater trust terms can be injected into contracts.

7. Result summary and future research

7.1. Result summary

This paper investigates the roles of relationship-related factors and process-related factors in project success adopting the S-O-R paradigm. Overall, 9 out of 13 hypotheses in the present research are supported. The test results of the research model statistically support the following viewpoints: (1) project success is influenced by the relationship-related factors (trust and asymmetric dependence) of partners, (2) project-related factors (communication and coordination) add another layer of complexity to project success, and (3) the configuration of project control rights does not regulate.

7.2. Limitations and recommendations

In spite of the achievements of this study, there are still some limitations. First, the data used in the present research were only gathered from China. Therefore, the practical implications to other countries should be applied with cautious and proper adjustments. Additionally, the sample size used in the present research was rather small because of the required cost and time. Consequently, the results may have a limited representativeness and generalizability. Because the applicability of empirical findings may be limited when cultural differences exists in social issues (Lin et al. 2019), it is imperative to test the model with larger sample size from other countries.

In addition, Hill et al. (2009) had pointed out that partners’ experience of psychological contract violation played a significant mediating role in their perceptions related to trust. However, this study does not distinguish partners’ actions with the corresponding perceptions from their counterparts. Thus, future researches in project success which incorporate relationship-related factors and process-related factors can benefit from such models which explicitly distinguish partners’ actions with the corresponding perceptions from their counterparts. In other words, future researches in this research field can incorporate relational-related factors (e.g., trust) originating from one side and the corresponding psychological perceptions from their counterparts from a psychological perspective.

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### Appendix. Measurement scales (Strongly Disagree/Agree, 1–5 scale)

| Construct | Code | Items | Source |
|-----------|------|-------|--------|
| TR | TR1 | We are certain that other party have the ability to perform their tasks. | Lu et al. 2016 |
| TR | TR2 | We believe that the other party could meet the requirements of the project in technology and management. | |
| TR | TR3 | We believe the project engineers and other technical people are competent at what they are doing. | |
| TR | TR4 | We believe that the other party are able to fulfill contractual agreements. | |
| TR | TR5 | We believe that the other party can keep their word throughout the life of the project. | |
| AD | AD1 | Our project partner is dependent on us. | Brinkhoff, Özer, and Sargut 2015 |
| AD | AD2 | Our project partner is dependent on us. | Paulraj, Lado and Chen 2008 |
| CO | CO1 | We share sensitive information. | |
| CO | CO2 | Our project partner is provided with any information that might help them. | |
| CO | CO3 | Exchange of information takes place frequently, informally and/or in a timely manner. | |
| CO | CO4 | We keep each other informed about events or changes that may affect the other party. | |
| CO | CO5 | We have frequent face-to-face planning/communication. | |
| CN | CN1 | Our project team worked interactively with the other party on important aspects of the project. | Liberatore and Luo 2009 |
| CN | CN2 | Giving instructions or directions is an important way we coordinate with our project partner. | |
| CN | CN3 | There were established rules and procedures for coordination between the partner organizations. | |
| CN | CN4 | Team members were engaged in coordinating with our project partner. | |
| CN | CN5 | I worked interactively with my counterpart from the partner organization on important aspects of the project. | |
| PS | PS1 | Our project team worked interactively with the other party on important aspects of the project. | Wu et al. 2017a |
| PS | PS2 | The project deliverable meets the client’s objectives. | |
| PS | PS3 | The project has qualified acceptance and successful delivery. | |
| PS | PS4 | The project can solve most problems encountered during the project execution. | |
| PS | PS5 | The project process is satisfactory. | |
| PS | PS6 | This project creates positive impacts for end users. | |
| PS | PS7 | We are optimistic about the success of this project. | |
| PS | PS8 | We are likely to cooperate with the other party again in the future. | |
| PS | PS9 | The project satisfied the client’s special requirements. | |

AD = Asymmetric Dependence; TR = Trust; CO = Communication; CN = Coordination; PS = Project Success.