Chapter 5
Incentivizing Relationship Investment for Mega Project Management

Liuying Zhu

Abstract Principal-agent theory (PAT) considers that relational risks for contracting parties are significant and may lead to opportunistic behavior. As mega projects often have high asset specificity and facing great uncertainty, the demand for cooperation between different participants is particularly prominent. Effective moves to enhance interorganizational relationships and alleviate the related bottlenecks are therefore encouraged. Construction incentivization is thus advocated because of its flexibility and high acceptability. This study examines the stimulating effect of construction incentivization on interorganizational relationships for mega projects. A PLS-SEM analysis of 142 projects shows that the interorganizational relationship acts as a mediator between construction incentivization and project performance. Furthermore, developers and contractors have different perceptive views on construction incentivization. It is therefore suggested that construction incentivization should go beyond conventional uses and embrace relationship investment as a goal. Furthermore, there is no substitute for negotiated agreement on incentivization arrangements if mutually aligned interests are pursued.

Keywords Incentivization · Interorganizational relationship · Social exchange theory

1 Introduction

Zeiss (2007) summarized five major challenges facing the construction industry: (1) global climate change; (2) aging infrastructure; (3) shrinking workforce; (4) declining productivity and (5) islands of information. The ability to adapt to the dynamic environment is therefore vitally needed to overcome challenges and to innovate (Flyvberg, 2017; Cheung and Chan, 2014). Comparatively, mega projects have

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S. O. Cheung and L. Zhu (eds.), *Construction Incentivization*, Digital Innovations in Architecture, Engineering and Construction,
https://doi.org/10.1007/978-3-031-28959-0_5

high asset specificity and require multiparty participation. Relational risks in buyer–seller relationships are recognized by agency theory, which are aggravated by the complexity and uncertainty of mega projects (Bryde et al., 2019). A noncooperative attitude is an important factor hindering project performance (PP hereafter). Moreover, the construction project team would dissolve upon completion of the project. Therefore, long-term benefits are seldom considered by team members (Suprapto et al., 2016). Opportunistic behavior occurs during the construction stage, which is not conducive to collaboration and promotes disputes (Zhang et al., 2020a, 2020b). Effective moves to enhance interorganizational relationships (IORs hereafter) and alleviate the related bottlenecks are therefore advocated.

What vehicle can be deployed to develop IORs? Williamson (1979) pointed out that contract incompleteness is unavoidable in complex, long-term transactions. Therefore, convergent contractual governance is inadequate (Nguyen & Garvin, 2019). The potential use of construction incentivization (CI hereafter) to address risks identified ex post has been suggested in Chapter 1. In fact, the flexibility and high acceptability of CI make it important and adequate to address project challenges (Meng, 2015). Furthermore, the case study of the Hong Kong-Zhuhai-Macao Bridge Project found that CI can serve the function of IOR maintenance by enhancing information exchange (Zhu et al., 2020). An integrated incentive system was also found to help the developer obtain additional project updates and enhance interorganizational communication. Jelodar et al. (2016) further added that incentives are instrumental in enhancing the quality of project teamwork, as evidenced by team members' commitment and collaboration. Investigating the use of CI on IORs is a valuable organizational study. Accordingly, this chapter reports a study that systematically examines the use of CI in mega projects to develop IORs for project performance improvement. The findings of this study suggest that the innovative planning of CI should embrace developing IORs, as put forward by the relevant theories. This study has the following research objectives:

(1) Identify IORs in mega projects;
(2) Analyze the functions of construction incentivization in mega project management; and
(3) Provide practical recommendations for construction incentivization planning.

2 Interorganizational Relationships in Construction Projects

Interorganizational relationships are the foundation of enduring bonding among organizations (Oliver, 1990). Recent literature focuses mainly on aligning mutual interests among project participants (Cropper et al., 2008; Manata et al., 2021). The value of collaboration and cooperation has gradually received attention.

2.1 The Developer-Contractor Interorganizational Relationship

The developer-contractor tensed relationship is commonly observed in construction projects. Based on principal-agent theory (Eisenhardt, 1989), the principal refers to the developer when the agent is the contractor. Cooperation and coordination are usually assumed among project participants. Based on principal-agent theory, different commercial organizations' behavior is driven by their self-interest. In addition, there are distinct aspects of this relationship because of the nature of construction projects. Compared with other projects, the particularity of a construction project is as follows:

(1) Construction project teams are often identified as **temporary organizations** (Cropper et al., 2008). Different from the buyer–seller relationship, construction projects exist for a limited period for prespecified goals. Project participants are commonly unfamiliar and self-interested. Opportunistic behavior may happen during the project.
(2) Mega projects often have **high asset specificity**. Asset specificity refers to durable investments undertaken for transactions. Should the original transaction be prematurely terminated, the opportunity cost incurred for investments is much lower in best alternative uses or by alternative users (Williamson, 1985). If the mega project is not finished, project stage results are irreversible and difficult to utilize. In that case, great loss may result if contract determination happens, especially in the middle or later stage of the project. Transaction cost economics (Williamson, 1979) therefore argues that the specific assets invested in a partnership increase the hazards of opportunism. Relational exchange theory suggests that asset specificity may also enhance trust among contracting partners and lead to more cooperative behavior and higher project performance (Lui et al., 2009). However, in either case, asset specificity affects both the status change and power use of both parties.

2.2 Key Dimensions of the Interorganizational Relationships in Construction

The interorganizational relationship captures the construction project team quality and the dynamic exchange between parties (Song et al., 2020). Zhu and Cheung (2022) identified six dimensions of interorganizational relationships, of which interdependency (Cropper et al., 2008; Fu et al., 2015; Cheung et al., 2018), trust (Cheung et al., 2014), reciprocity (Oliver, 1990) and relationship continuity are considered in this study (Güth et al., 2000; Macneil, 1974).

(1) Interdependency: The three subdimensions of interdependence are uncertainty, asset specificity, and frequency (Williamson, 1985). A 'lock-in' situation occurs when asset-specific investments are made by contractual parties (Williamson,

1979). Interdependence between developers and contractors is also realized when parties perceive that high termination costs are associated with ending the relationship (Sarkar et al., 1998). For construction projects, asset-specific investment substantially increases once projects reach milestones. Project participants thus rely heavily on each other, and the termination of construction contacts or a change in partners may cause significant losses (Guo et al., 2021). Relational exchange theory highlights that interdependency is the pillar of interorganizational cooperation (Kumaraswamy & Anvuur, 2008). After investigating 142 construction projects, Cheung et al. (2018) found that cooperative behavior would be created for contractual parties with high interdependency.

(2) Reciprocity: Reciprocity in construction projects occurs when project participants provide necessary assistance to each other, resulting in a win–win situation. It is one of the bases upon which interorganizational relationships develop (Oliver, 1990). Human altruistic instinct acts as a powerful force to drive people to cooperate rather than confront each other (Fehr & Fischbacher, 2003). Creating a cooperative working environment is also an essential adversarial strategy (Bower et al., 2002). Reciprocity contributes to project collaboration and coordination among project participants (Wang et al., 2019) and is the basis of trust building (Swärd, 2016). A positive relational attitude of reciprocity among team members is beneficial for project efficiency (Suprapto et al., 2016).

(3) Trust: Trust is the foundation of social order (Cheung et al., 2014) and the compensation for contractual control (Zhang et al., 2018). It takes time to develop and maintain mutual trust and major unresolved conflict can destroy trust in a relationship (Ceric, 2016). Mistrust is a potential factor that aggravates speculation and hostility. The evaluation of trust is always a key element of IORs. Cheung et al. (2011) identified three major types of trust in construction contracting: (1) system-based trust; (2) cognition-based trust; and (3) affect-based trust. System-based trust is trust in the performance of systemized open communication. Such arrangements can build trust through strengthened communication among contracting parties. Cognition-based trust develops from confidence in objective knowledge that demonstrates the trustworthiness of the contracting parties. The exchange of such knowledge can be attained through interaction or observation. Affect-based trust develops on a more sentimental platform and involves emotional bonds that connect individuals who value personal attachment.

(4) Relationship Continuity: Relationship stability and continuity are important for IOR long-term development. It has two dimensions: (1) for a specific construction project, the parties involved must be able to fulfill their obligations to ensure the stability of the relationship for a significant period, and (2) both parties must intend to maintain their cooperative relationship over the long term (Bock et al., 2005). This dimension shows that project participants are changing their focus from short-term gain and loss to long-term benefits. In this context, they are also willing to sacrifice short-term interests to obtain more long-term win–win and benefit opportunities. On the other hand, the stability of

their cross-organizational relationship improves. Examples include developing partnerships and creating long-term strategic cooperation opportunities.

3 Relationship Investment from Construction Incentivization

It is proposed that CI can be used to develop IORs to enhance PP. This section first discusses the constructs of CI and PP and then formulates the hypothesized relationships.

3.1 Identification of Construction Incentivization

CI refers to the collective terms of incentive schemes applied in construction projects. The main purpose of incentivization is to motivate project participants and obtain more value than expected (Meng & Gallagher, 2012a, 2012b). CI can be classified based on objective objectives such as cost, schedule, quality, and safety incentive schemes. Based on the nature of the rewards, it can also be divided into financial and nonfinancial incentive schemes (Saka et al., 2021). The underlying needs of the developer and the motivations of the contractor are pivotal and central to CI. To exemplify the four CI design parameters introduced in Chapter One, Zhu and Cheung (2021a) identified that effective CI has the following features: (i) goal commitment (Locke et al., 1988); (ii) expectation alignment (Wigfield & Eccles, 2002); iii) information exchangeability (Bryde et al., 2019; Laffont & Tirole, 1988); iv) risk efficiency (Boukendour & Hughes, 2014); and v) relationship investment (Adams, 1963).

(1) Goal Commitment: The mutual commitment of additional project goals is commonly manifested in CI. It reflects the performer's willingness to cooperate regardless of the difficulty, originality, or credibility of the assigning party (Zhu & Cheung, 2018). For construction projects, CI targets should be agreed upon by contracting parties (Rowlinson, 2012). Extra effort directed toward CI targets for working together should also be clarified (Rose & Manley, 2011). The incentives and rewards are related to the achievable project targets (Locke and Latham, 1990), and extra effort is necessary to fulfill these goals when difficulties arise.
(2) Expectation Alignment: The alignment of goals and expectations is essential in CI planning. Abu-Hijleh and Ibbs (1989) noted that CI targets should be attractive, affordable, and achievable to contractors. For example, financial incentives take effect by compensating the additional effort that a higher return may require. Bridging a project vision can also be a subjective benefit. Bandura's (1982) self-efficacy theory explains that the confidence between two parties underpins the desire for project success. Moreover, the expectation level also influences contracting behavior and the performance of contract commitments

(Blomquist et al., 2016). An appropriate and similar level of confidence should be developed for contractual parties through CI to enhance cooperation and manifest commitment (Das and Teng, 1998).

(3) Information Exchangeability: Information exchangeability holds that an additional information sharing system should be established for CI implementation. For schedule incentives, additional milestones are often set, and rewards are offered. The project procedure is thus more exposed for the developer and helps reduce information asymmetry to solve the agent problem (Schieg, 2008). For mega projects, integrated information sharing systems are established together with performance assessment systems to confer rewards or otherwise (Zhu et al., 2020). Based on the outcome, transaction uncertainty could be reduced. Screening refers to the means for the developer to collect project information for specific tasks (Cropper et al., 2008). As specific tasks are mentioned and additional information sharing platforms are often incorporated, settings relating to communication enrich information exchange, which in turn facilitates project progress and quality control (Hetemi et al., 2020).

(4) Risk Efficiency: Imbalanced risk allocation is a root cause of construction disputes (Zhu and Cheung, 2020). Risk reallocation is a key ammunition of CI (Chapman & Ward, 2008). Risk efficiency refers to the balanced risk toward project efficiency (Zhang et al., 2016) and aligns the risk preferences of stakeholders (Zou & Zhang, 2009). Risk reallocation therefore aims to reduce excessive risk premiums and minimize future construction disputes. Moreover, a fair and efficient risk sharing formula would incentivize contractors by removing suspicion and fostering trust (Boukendour & Hughes, 2014). Innovation is also encouraged when project risks are better allocated and more freedom is allowed (Zou & Zhang, 2009).

(5) Relationship Investment: Relationship investment refers to the motivational and relational move from a power-advantaged party to the invited reciprocation of support and trust. The contracting relationship is promoted to pursue mutual project benefits (Cook & Emerson, 1978). Status recognition is used to offer better recognition of the weaker party and enhance the other party's project engagement (Adams, 1965). Strategic alliances and partnering are also considered incentives for collaboration (Richmond-Coggan, 2001). They both aim to encourage contractors to focus on long-term returns. Their status changes from performance unit to strategic partner, which also improves their trust and participation.

3.2 Project Performance

Project performance (PP hereafter) represents the project outcomes. Multiple dimensions are therefore used due to the many facets of project results (Ahmadi Digehsara et al., 2018). Eisenhardt (1988) argued that performance measured by target outcomes is appropriate for highly programmable tasks only. Moreover, mega projects are often highly complex with low task programmability. Behavior-based criteria are thus necessary to provide a full spectrum of performance. In addition, innovation is also encouraged and cannot be evaluated by programmable tasks (Zhang et al., 2020a, 2020b). The evaluation of project performance thus includes (i) project outcomes in terms of cost, schedule, quality, and safety (Yu et al., 2005); (ii) behavioral outcomes such as joint problem solving and communication (Eisenhardt, 1989; Zhang et al., 2020a, 2020b); and (iii) innovation (technical and managerial) (Dulaimi et al., 2003).

3.3 The Relationships Among CI, IOR and PP

(1) Effective CI enhances PP improvement

Based on principal-agent theory, the use of CI helps reduce project uncertainty and make more transparent decisions (Zhu & Cheung, 2021b). For example, developers set the incentive of the benefit-sharing ratio to encourage cost savings. For this purpose, an open-book approach is adopted, along with enhanced project information sharing. Observability is therefore increased. Work segregation can also reduce the indeterminacy of other parties (Hosseinian, 2016). Likewise, schedule incentives are set with specific milestones (Wang et al., 2018). Information asymmetry between principal and agent can be reduced by enhancing task measurability (Holmstrom, 1979). In addition, more balanced risks can encourage contracting parties to adopt innovative ideas (Bower et al., 2002).

(2) IOR mediates the relationship between CI and PP

Apart from the effectiveness of CI based on principal-agent theory, relevant studies point to the multifunction of CI instead of using it solely as financial bait. Rose and Manley (2011) found the importance of providing incentives when cooperation is solicited. IORs thus can be incentivized (Oliver, 1990; Cropper et al., 2008; Kwawu & Laryea, 2014). Incentivization can kickstart IOR development. The different aspects of CI, such as goal commitment, risk allocation and relationship investment, have been found to be essential motivational factors for developing trust (Gunduz & Abdi, 2020). Reallocation of risk perceptions is also beneficial to reinforce trust at the organizational level based on rational pursuit (Yao et al., 2019). With improved IOR, mutual trust can be enhanced with the effect of suppressing opportunistic behavior (Ceric, 2016), raising operational efficiency (Liu et al., 2017) and minimizing construction disputes (Zhu & Cheung, 2020). Enhanced IOR is also instrumental for PP improvement. Collaboration and cooperation are promoted in construction projects, as they are conducive to improving project efficiency (Gunduz & Abdi, 2020). The enhanced relationship reduces the risk premium caused by mistrust during the project procedure and minimizes transaction costs (Kumaraswamy & Anvuur, 2008).

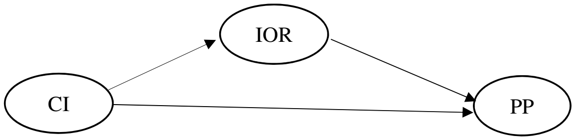

Fig. 1 The conceptual relationships among CI, IOR and PP

Based on the literature, the relationships of these three factors are like the mediation effect. Figure 1 presents the conceptual relationships of CI, IOR and PP. IOR acts as a mediator between CI and PP:

4 Empirical Study

An online questionnaire was designed to verify the conceptual framework. Construction professionals from the Hong Kong Institute of Architects (HKIA), the Hong Kong Institute of Surveyors (HKIS), the Hong Kong Institute of Construction Managers (HKICM), listed real estate companies and contracting companies located in Hong Kong were invited to participate. The questionnaire focuses on personal particulars (Part 1), the participating project details of CI (Part 2), and the three constructs (Part 3–5). A 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) was used to capture the respondents' viewpoints. To obtain valid data, responses with unreasonable filling times were excluded.

The data were analyzed with confirmatory factor analysis (Hair et al., 2010). Partial least squares-structural equation modeling (PLS-SEM hereafter) was applied considering the sample size and the distribution of data (Hair et al., 2014; Henseler et al., 2009). Smart PLS 3 was used to estimate the measurement models and the mediating effect of the key constructs. A hierarchical component model (HCM) is applied for the measurement model of CI, IOR and PP. The mediating effect of IOR was tested based on PLS-SEM. A multigroup analysis (MGA hereafter) was applied. A heterogeneity test was also conducted to check group differences in project roles (the developer/contractor) and the contractual role of CI (CI initiator/recipient).

Over 450 questionnaires were distributed online, and 142 valid responses were obtained. For Part 1, Table 1 presents the personal particulars of these professionals. The table shows that the ratio of management staff and professional staff in this investigation is 1:2. Work experience was basically evenly distributed among these four groups.

Part B investigates the project details incorporating CI. The contractual and organizational roles were investigated. Table 2 presents the cross-check relationship between the organizational role and contractual role of CI:

Most CI was planned and implemented by developers, and contractors were the primary recipients. Among the 73 developer respondents, only 5 have project experience as recipients of CI. To summarize, 79% (68 responses) of the CI projects

Table 1 Personal particulars (Part A)

No	Description	Number	%
1.1	Your position		
1	Management staff	48	34
2	Professional staff	94	66
	Sum	142	100
1.2	Working experience		
1	<5 years	33	23
2	5–10 years	36	25
3	11–20 years	40	28
4	>20 years	33	23
	Sum	142	100

Table 2 The relationship between the organizational role and the contractual role in CI

		The contractual role of CI		Total
		Initiator	Recipient	
Project role	Developer	68	5	73
		93%	7%	100%
	Contractor	18	51	69
		26%	74%	100%
Total		86	56	142
		59%	41%	100.%

investigated were initiated by the developer, and only 21% (18 responses) were initiated by the contractor.

Table 3 presents the details of the projects investigated.

There is a generally even distribution of the project nature, and half of the projects are private projects. Twenty-eight percent of the projects are government projects,

Table 3 Project details

1	Project nature	Num	%
1.1	Residential	50	35
1.2	Commercial	27	19
1.3	Civil/Infrastructure	35	25
1.4	Composite	30	21
2	Project type		
2.1	Government project	40	28
2.2	Institutional project	21	15
2.3	Private project	81	57

and 15% are institutional projects. To obtain a detailed view of the distribution by project nature, a cross check was performed based on these two questions.

Table 4 shows the data for Parts 3–5 of the survey.

The descriptive data for Parts 3–5 are shown in Table 4. For the setting of CI (Part 3), the average scores of most responses are above 4 (neutral), and most of them are higher than 5 (slightly agree). This result shows that these key features are reflected during the project procedure. The highest mean score was obtained for Q3.4 (The expected performance was considered achievable for project participants) (5.80) and Q3.1 (Incentive plans applied common goals set by the contracting parties) (5.76). The standard deviations of these two items are 0.84 and 0.83, respectively. The lowest mean score is Q3.9 (The project participants' unobserved behavior was monitored under CI) (4.84), showing that the CI function of information exposure is comparatively less effective.

The mean scores for most questions regarding IOR are all above 5 (slightly agree). This result shows that a satisfying level of IOR is maintained under CI. The lowest score is Q4.3 (Misunderstandings were avoided through open communication) (4.30). The respondents agreed that IORs were sufficiently maintained in these two areas. Responses with the highest mean scores are related to trust building.

The mean scores of the questions in Part 5 section (Project Performance) are all above 5. Comparatively, all the behavior outcomes have the most satisfying responses, i.e., above 5. For the hard outcome, Q5.7 (This project achieved a satisfactory level of project quality) has the highest mean score. Comparatively, CI created less innovative value for the overall project.

A collinearity test is conducted to identify and eliminate redundant or conflicting variables (Hair et al., 2010). As collinearity impacts the accuracy of the PLS-SEM analysis, redundant or conflicting indicators should be removed based on Pearson's correlation test (Hair et al., 2014). Based on the test result, Cronbach's alpha (α) is also calculated to check internal consistency. A threshold of 0.6 has been proposed (Davcik, 2014).

PLS-SEM Analysis

To evaluate internal consistency and convergent validity, composite reliability tests and average variance extracted (AVE) tests are suggested for PLS-SEM analysis (Davcik, 2014; Hair et al., 2014). An AVE value higher than 0.4 is adequate when the composite reliability level is higher than 0.6 (Fornell & Laecker, 1981). Table 5 shows the composite reliability and AVE of the constructs in this study.

Based on the acceptance of the indices, Fig. 2 shows the PLS-SEM analysis results. Generally, all the coefficients are significant at the 5% level:

Figure 2 presents the analysis results of the empirical study. For each factor, the following is found. (1) For CI, risk efficiency contributes the most (0.870), while information exchangeability contributes the least (0.791) at the 5% significance level. (2) For IOR, trust has the highest contributing value of 0.969, and interdependency has the lowest. 3) For PP, behavior outcome contributes the most (0.939), while innovation contributes the least (0.692).

Table 4 Descriptive statistics for Parts 3–5 of the survey

No	Description		Mean	Std	Cronbach's alpha (α)
Part 3	CI				9.911
Q3.1	Goal Commitment (Locke et al., 1988)	The incentive plan includes common goals agreed upon by the contracting parties	5.76	0.83	0.800
Q3.2		Notable efforts were directed to achieve common goals	5.72	0.86	
Q3.3		Extra efforts were used to accomplish common goals when difficulties arose	5.70	0.89	
Q3.4	Expectation Alignment (Willison,1975; Aiken & Hage, 1987; Vroom, 1964)	The expected performance was achievable for project participants	5.80	0.84	0.730
Q3.5		A reasonable financial bonus was set to for the expected performance	5.46	1.19	
Q3.6		The performance exceeding expectation led to a certain level of rewards	5.20	1.34	
Q3.7	Information Exchangeability (Schieg, 2008)	Project information was easier to access than expected under CI	5.01	1.08	0.612
Q3.8		Project information was exchanged smoothly under CI during the whole project	5.40	0.93	
Q3.9		The project participants' unobserved behavior was monitored under CI	4.84	1.11	

(continued)

Table 4 (continued)

No	Description		Mean	Std	Cronbach's alpha (α)
Q3.10	Risk Efficiency (Zou & Zhang, 2009; Zou et al., 2007)	The tender documents revealed a risk allocation pattern that was more balanced than market norms	5.00	1.21	0.761
Q3.11		The CI enabled a risk allocation pattern more equitable than the pattern displaced in the tender documents	5.03	1.17	
Q3.12		Sufficient resources were provided to promote innovation	5.04	1.18	
Q3.13		Sufficient resources were provided to prevent project failure	5.32	1.07	
Q3.14	Relationship Investment (Cook & Emerson, 1978; Oliver, 1990)	The spirit of partnership was promoted to pursue mutual project benefits	5.57	1.16	0.790
Q3.15		Provisions are included in the construction incentivization to compensate work due to unforeseen events	5.26	1.21	
Q3.16		Compensation for Item Q3.15 was based on the principle of ensuring a win–win situation	5.57	1.04	
Q3.17		The CI focused more on long-term returns instead of short-term gain	5.25	1.05	
Part 4	IOR				0.909
Q4.1	Interdependency (Cheung et al., 2018)	Lost transaction costs were unrecoverable when switching to another counterpart	5.13	1.08	0.679
Q4.2		Lost time was unrecoverable when switching to another counterpart	5.12	1.18	

(continued)

Table 4 (continued)

No	Description		Mean	Std	Cronbach's alpha (α)
Q4.3		Lost project information and data were unrecoverable when switching to another counterpart	4.30	1.15	
Q4.4	Reciprocity (Suprapto et al., 2015)	Shared norms developed between the two senior management teams	4.96	1.00	0.762
Q4.5		Project participants sensed being treated fairly when dedicating efforts to the attainment of common goals	5.05	1.20	
Q4.6		A culture free of blame was established between the two contracting parties	4.48	1.25	
Q4.7	Trust (Cheung et al., 2011b)	A good management system was established to reinforce goal achievement such as continual improvement, profit generation and business expansion	5.27	0.95	0.901
Q4.8		Misunderstandings were avoided through open communication	5.63	0.95	
Q4.9		Information included in the contract document was explained to the affected parties	5.35	1.01	
Q3.10		Project participants engaged in positive interactions to obtain more information from the other party	5.55	0.86	
Q3.11		Each party had confidence in working with the other because it considered the other party honest	5.64	0.75	

(continued)

Table 4 (continued)

No	Description		Mean	Std	Cronbach's alpha (α)
Q3.12		Both parties understood each other's needs and feelings at work	5.20	0.98	
Q3.13		Considerate behavior enhanced the working capacity of the counterpart	5.26	0.99	
Q3.14		A strong interorganizational relationship developed between the two parties	5.40	0.98	
Q3.15	Relationship Continuity (Bock et al., 2005)	Both parties perceived the working environment as collaborative	5.51	0.96	0.814
Q3.16		Both parties perceived future working opportunities to be likely	5.44	0.98	
Q3.17		Both parties were willing to accept short-term dislocation by considering that it would balance out over the long run	5.32	0.96	
Part 5	PP				0.897
Q5.1	Behavior outcome (Eisenhardt, 1988)	The contractor's behavior could be systematically evaluated during the whole project	5.24	1.07	0.858
Q5.2		Programmable tasks were completed at each stage of the project	5.09	1.14	
Q5.3		Unexpected situations and difficulties were handled effectively by the contracting parties	5.09	1.10	
Q5.4		The contracting parties cooperated with each other to maximize common interests, not just their own interests	5.07	1.24	

(continued)

Table 4 (continued)

No	Description		Mean	Std	Cronbach's alpha (α)
Q5.5		The contracting parties seek cooperation and value cocreation in the future	5.15	1.14	
Q5.6	Hard Outcome (Yu et al., 2005)	The project cost fell within overall budget limits	5.10	1.36	0.891
Q5.7		This project achieved a satisfactory level of project quality	5.41	1.10	
Q5.8		This project was completed on time	4.49	1.65	
Q5.9		The volume of disputes was controlled to a reasonable range	5.25	1.09	
Q5.10		The number of disputes was controlled to a reasonable range	5.20	1.14	
Q5.11	Innovation (Dulaimi et al., 2003)	Innovations were generated by the developer through the project	4.53	1.47	0.796
Q5.12		Innovations were generated by the contractor through the project	4.63	1.50	
Q5.13		Improvements in project performance (e.g., cost savings, shortened construction periods and quality improvements) surpassed expectations	4.76	1.42	
Valid N		142			

Table 5 Composite reliability and average variance extracted (AVE)

	Composite reliability	Average variance extracted (AVE)
CI	0.93	0.43
Goal commitment	0.88	0.71
Expectation alignment	0.79	0.57
Risk efficiency	0.85	0.59
Information exchangeability	0.85	0.66
Relationship investment	0.87	0.62
IOR	0.94	0.51
Interdependency	0.88	0.90
Reciprocity	0.76	0.68
Trust	0.91	0.60
Relationship continuity	0.82	0.73
PP	0.92	0.48
Hard outcome	0.89	0.62
Behavior outcome	0.90	0.64
Innovation	0.88	0.71

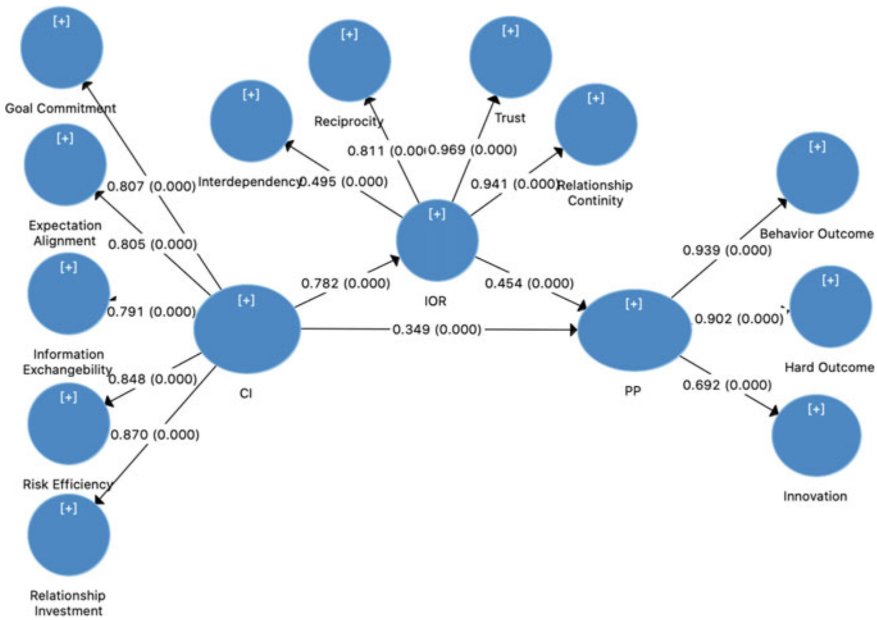

Fig. 2 PLS-SEM analysis result of the framework

Table 6 R^2 value

Factor	R^2	Adjusted R^2
CI	–	–
Goal commitment	0.667	0.664
Expectation alignment	0.650	0.648
Information exchangeability	0.617	0.614
Relationship investment	0.754	0.753
Risk efficiency	0.722	0.720
IOR	0.613	0.610
Interdependency	0.246	0.241
Reciprocity	0.656	0.653
Relationship continuity	0.822	0.821
Trust	0.951	0.951
PP	0.574	0.568
Behavior outcome	0.878	0.877
Hard outcome	0.818	0.817
Innovation	0.477	0.474

The relationships of CI, IOR and PP are also analyzed and validated. Partial mediation means that there is not only a significant relationship between the mediator and the dependent variable but also a direct relationship (e.g., CI and PP). Statistically, the result shows that IOR acts as a partial mediator between CI and PP. The positive relationship between CI and PP is validated, and the coefficient is 0.349. The indirect effect of CI on PP is 0.355 (0.782*0.454 = 0.355), accounting for approximately 50% of the total effect.

SmartPLS3 presents the model fit indices. The R^2 value is the most used measure to evaluate a model's predictive accuracy (Hair et al., 2014). Table 6 shows the R^2 value of the conceptual framework. As R^2 and adjusted R^2 values greater than 0.10 are acceptable (Falk & Miller, 1992),the accuracy of the framework is validated.

Table 7 shows the effect size f^2 and Stone-Geisser's Q^2 values.

In PLS-SEM analysis, the effective size f^2 was examined to evaluate the R^2 values of all endogenous constructs (Hair et al., 2014). For the measurement model, the most effective size f^2 in Table 7 is higher than 0.35, showing that they have large effects (Cohen, 1988). Interdependency has a moderate effect, as the value is higher than 0.15 (Cohen, 1988). The blindfolding procedure is also conducted to assess the Q^2 value. The smaller the difference between the predicted and original values is, the greater the Q^2 value is (Ringle et al., 2018). Table 7 shows that all the Q^2 values are higher than 0.02, which is acceptable, and those higher than 0.35 are considered to have a high effect.

Group differences were also tested by heterogeneity tests to highlight further implications. Views of the developer and contractor, CI initiator and CI recipient were analyzed. Tables 8 and 9 show the group differences.

Table 7 Effect size f^2 and Q^2 values

	Effect size f^2	Q^2 (=1-SSE/SSO)
CI	–	–
Goal commitment	2.001	0.470
Expectation alignment	1.858	0.413
Information exchangeability	1.611	0.338
Risk efficiency	2.593	0.410
Relationship investment	3.073	0.436
IOR	–	0.301
Interdependency	0.327	0.204
Trust	19.572	0.561
Relationship continuity	4.613	0.586
Reciprocity	1.903	0.430
PP	–	0.267
Behavior outcome	7.217	0.550
Hard outcome	4.508	0.489
Innovation	0.914	0.321

Table 8 Group differences between developers and contractors

Description	Path coefficients-diff (developer–contractor)	New p value (developer–contractor)
CI -> Information exchangeability	−0.179	0.035
CI -> Risk efficiency	0.012	0.012
CI -> IOR	0.169	0.003

Table 9 Group differences between CI initiators and recipients

Description	Path coefficients-diff (initiator–recipient)	New p value (initiator–recipient)
CI -> Information Exchangeability	−0.179	0.007
CI -> Expectation Alignment	−0.141	0.003

Table 8 shows that contractors tend to hold a view that CI has a greater effect on information exchange but a slightly lower effect on risk efficiency. Additionally, a stronger connection between CI and IOR is found from the developer's view. Table 9 shows the differences between the CI initiator and the recipient. Similarly, the significance of the difference is also reflected in the contributing value of information exchangeability. Moreover, CI recipients recognize the value more of aligning the expectation of two parties.

5 Discussion and Recommendations

The PLS-SEM analysis empirically validates the hypothesis with 142 responses. Bootstrapping with 5000 samples is adopted, and all the coefficients are significant at the 5% level. It is found that IORs and CI are instrumental for behavior-based project performance improvement. The overall contractual framework also implies that IORs play a mediating role between CI and PP. The results also validate this finding.

The results also show that singular financial rewards are beneficial for project performance enhancement; moreover, relationship investment also improves behavior-based project performance. The focus should be incentivizing relationship investment to engender mutual trust and cooperation. For the heterogeneity test, group differences were detected. Differences were found between developer and contractor. Information exchangeability tends to have a lower contributing value toward CI for developers. As most CI initiators are developers, this difference is also reflected between the CI initiator and recipient. Additionally, the investigation shows that most CI projects are introduced unilaterally. Developers have greater interest in building IORs through CI, which has a less positive effect on recipients in nurturing trust and developing relationship continuity.

Based on both theoretical development and empirical study, recommendations for management are as follows:

(1) *CI should be treated as a stimulator of IOR development.*

Conventional studies of CI have focused mainly on the use of CI to compensate for the extra effort it may cost to improve performance. This study further found that to improve PP, CI should act as a stimulator of IOR development. Different from the traditional concept, relationship investment is found to be the most significant contributor to CI planning, which is less relevant to monetary rewards. Apart from financial incentives, status recognition (partnership) and long-term working opportunities are the sweetener for the contractor to cooperate and maximize project value. Moreover, IOR is the partial mediator between CI and PP. The CI-IOR-PP relationship takes half (0.782*0.454 = 0355) of the total effect (0.355 + 0.349 = 0.704), representing the key position of IOR in the relationship between CI and PP. For CI design, in the design of incentive mechanisms, the proportion of terms for maintaining IOR deserves project managers' attention.

(2) *Bilateral decisions should be the basis of CI planning*

Another major finding is the differential viewpoints of CI between developer and contractor. The major differences concern the recognition of CI. Developers (most are CI initiators) usually have higher expectations regarding information exchangeability and risk efficiency. However, as the agent, the attitude of the CI recipient is more directly linked to its effect on PP. Bilateral discussion is thus encouraged for the implementation of CI. Negotiating the allocation of risk and expected return promotes the success of CI.

6 Summary of Chapter

Mega projects are classic examples of transactions with high asset specificity and multiparty participation. Relational risks in the buyer–seller relationship is recognized by agency theory. The complexity and uncertainty surrounding mega projects necessitate the use of relationship investment to lubricate the potential working bottlenecks. The flexibility and high acceptability of CI make it a perfect tool to meet project challenges. It is advocated that CI can play a pivotal role in delivering PP through IOR building. This study examines the stimulating effect of CI on IOR development in mega projects. Based on a literature review, the key contributors of IORs are identified as interdependency, trust, reciprocity, and relationship continuity. Goal commitment, risk efficiency, relationship investment, information exchangeability and expectation alignment are essential elements of successful CI. After subjecting 142 project data to PLS-SEM analysis, the IOR was found to be a partial mediator between CI and PP. Accordingly, it is recommended that (1) CI should be treated as a stimulator of IOR development and (2) bilateral decisions should be the basis of CI planning.

Acknowledgements The empirical work of this chapter has been reported in a paper entitled "Incentivizing Relationship Investment for Project Performance Improvement" of Project Management Journal.

References

Adams, J. S. (1963). Toward an understanding of inequity. *Journal of Abnormal and Social Psychology, 67*(5), 422–436. https://doi.org/10.1093/past/96.1.22

Ahmadi Digehsara, A., Rezazadeh, H., & Soleimani, M. (2018). Performance evaluation of project management system based on combination of EFQM and QFD. *Journal of Project Management*, 171–182. https://doi.org/10.5267/j.jpm.2018.4.003

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*(2), 122–147.

Blomquist, T., Farashah, A. D., & Thomas, J. (2016). Project management self-efficacy as a predictor of project performance: Constructing and validating a domain-specific scale. *International Journal of Project Management, 34*(8), 1417–1432. https://doi.org/10.1016/j.ijproman.2016.07.010

Bock, A. G., Zmud, R., Kim, Y., & Lee, J. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly, 29*(1), 87–111.

Boukendour, S., & Hughes, W. (2014). Collaborative incentive contracts: Stimulating competitive behaviour without competition. *Construction Management and Economics, 32*(3), 279–289. https://doi.org/10.1080/01446193.2013.875215

Bower, D., Ashby, G., Gerald, K., & Smyk, W. (2002). Incentive mechanisms for project success. *Journal of Management in Engineering* [Preprint].

Bryde, D. J., Unterhitzenberger, C., & Joby, R. (2019). Resolving agency issues in client–contractor relationships to deliver project success. *Production Planning and Control, 30*(13), 1049–1063. https://doi.org/10.1080/09537287.2018.1557757

Ceric, A. (2016). Trust in Construction Projects. Devon, Taylor & Francis Group.

Chapman, C., & Ward, S. (2008). Developing and implementing a balanced incentive and risk sharing contract. *Construction Management and Economics, 26*(6), 659–669. https://doi.org/10.1080/01446190802014760

Cheung, S. O., Wong, W., Yiu, T., & Pang, H. (2011). Developing a trust inventory for construction contracting. *International Journal of Project Management, 29*(2), 184–196. https://doi.org/10.1016/j.ijproman.2010.02.007

Cheung, S. O., Wong, W., Yiu, T., & Pang, H. (2014). *Construction dispute research, construction dispute research*. Springer.https://doi.org/10.1007/978-3-319-04429-3

Cheung, S. O., Zhu, L., & Lee, K. W. (2018). Incentivization and interdependency in construction contracting. *Journal of Management in Engineering, 34*(3), 1–13. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000601

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences. Second Edi*. Lawrence Erlbaum associates.

Cook, K. S., & Emerson, R. M. (1978). Power, equity and commitment in exchange. *American Sociological Review, 43*(5), 721–739. https://doi.org/10.3102/0034654311405999

Cropper, S., Ebers, M., Huxham, C., & Ring, P. (2008). Introducing Inter-organizational relations. In *Oxford Handbooks Online Introducing*, 1–23. https://doi.org/10.1093/oxfordhb/9780199282944.003.0001

Das, T. K., & Teng, B.-S. (1998). Between trust and control: developing confidence in partner cooperation in alliances. *The Academy of Management Review, 23*(3), 491–512.

Davcik, N. S. (2014). The use and misuse of structural equation modeling in management research. *Journal of Advances in Management Research, 11*(1), 47–81. https://doi.org/10.1108/JAMR-07-2013-0043

Eisenhardt, K. M. (1988). Agency and institutional theory explanations: The case of retail sales compensation. *The Academy of Management Journal, 31*(3), 488–511.

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *The Academy of Management Review, 14*(1), 57–74.

Eisenhardt, K. M., & Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *The Academy of Management Review, 14*(1), 57–74.

Falk, R. F., & Miller, N. B. (1992). *A primer for soft modelling*. University of Akron Press.

Fehr, E., & Fischbacher, U. (2003). The nature of human altruism—Proximate and evolutionary origins. *Nature, 425*(October), 785–791.

Fornell, C., & Laecker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics.

Fu, Y., Chen, Y., Zhang, S., & Wang, W. (2015). Promoting cooperation in construction projects: An integrated approach of contractual incentive and trust. *Construction Management and Economics, 33*(8), 653–670. https://doi.org/10.1080/01446193.2015.1087646

Gunduz, M., & Abdi, E. A. (2020). Motivational factors and challenges of cooperative partnerships between contractors in the construction industry. *Journal of Management in Engineering, 36*(4), 1–10. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000773

Guo, W., Lu, W., Hao, L., & Gao, X. (2021). Interdependence and information exchange between conflicting parties: The role of interorganizational trust. *IEEE Transactions on Engineering Management* [Preprint]. https://doi.org/10.1109/TEM.2020.3047499

Güth, W., Königstein, M., Marchand, N., Nehring, K. (2000). Trust and reciprocity in the investment game with indirect reward.

Hair, J. F., Black, W., Babin, B., & Anderson, R. (2010). Multivariate Data Analysis. Seventh, Pearson Education. https://doi.org/10.1016/j.ijpharm.2011.02.019

Hair, F., Jr., J., et al. (2014). Partial least squares structural equation modeling (PLS-SEM). *European Business Review, 26*(2), 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. *Advances in International Marketing, 20*(May 2014), 277–319.https://doi.org/10.1108/S1474-7979(2009)0000020014

Hetemi, E., Gemünden, H. G., & Meré, J. O. (2020). Embeddedness and actors' BehavIOR in large-scale project life cycle: lessons learned from a high-speed rail project in Spain. *Journal of Management in Engineering, 36*(6), 05020014. https://doi.org/10.1061/(asce)me.1943-5479.0000849

Holmstrom, B. (1979). Moral hazard and observability. *The Bell Journal of Economics, 10*(1), 74. https://doi.org/10.2307/3003320

Hosseinian, S. M. (2016). An optimal time incentive/disincentive-based compensation in contracts with multiple agents. *Construction Economics and Building, 16*(4), 35–53.

Jelodar, M. B., Yiu, T. W., & Wilkinson, S. (2016). A conceptualisation of relationship quality in construction procurement. *International Journal of Project Management, 34*(6), 997–1011. https://doi.org/10.1016/j.ijproman.2016.03.005

Kumaraswamy, M. M., & Anvuur, A. M. (2008). Selecting sustainable teams for PPP projects. *Building and Environment, 43*(6), 999–1009. https://doi.org/10.1016/j.buildenv.2007.02.001

Kwawu, W., & Laryea, S. (2014). Incentive contracting in construction. In *Proceedings 29th annual association of researchers in construction management conference, ARCOM 2013*, pp. 729–738.

Laffont, J.-J., & Tirole, J. (1988). The dynamics of incentive contracts, *56*(5), 1153–1175.

Liu, J., et al. (2017). Evolutionary game of investors' opportunistic behaviour during the operational period in PPP projects. *Construction Management and Economics, 35*(3), 137–153. https://doi.org/10.1080/01446193.2016.1237033

Locke, E. A., Latham, G. P., & Erez, M. (1988). The determinants of goal commitment. *Academy of Management Review, 13*(1), 23–39. https://doi.org/10.5465/AMR.1988.4306771

Macneil, I. R. (1974). A Primer of contract planning.

Manata, B., et al. (2021). Documenting the interactive effects of project manager and team-level communication behavior in integrated project delivery teams. *Project Management Journal* [Preprint].

Meng, X., & Gallagher, B. (2012a). The impact of incentive mechanisms on project performance. *International Journal of Project Management, 30*, 352–362.

Meng, X., & Gallagher, B. (2012b). The impact of incentive mechanisms on project performance. *International Journal of Project Management, 30*(3), 352–362. https://doi.org/10.1016/j.ijproman.2011.08.006

Nguyen, D. A., & Garvin, M. J. (2019). Life-cycle contract management strategies in US highway public-private partnerships: Public control or concessionaire empowerment? *Journal of Management in Engineering, 35*(4), 1–13. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000687

Oliver, C. (1990). Determinants of interorganizational relationships: integration and future directions published by: academy of management linked references are available on JSTOR for this article: Determinants of interorganizational relationships: Integration and future. *Academy of Management Review, 15*(2), 241–265.

Richmond-Coggan, D. (2001). Construction contract incentive schemes: Lessons from experience.

Ringle, C. M., et al. (2018). Partial least squares structural equation modeling in HRM research. *International Journal of Human Resource Management*, (January), 1–27. https://doi.org/10.1080/09585192.2017.1416655

Rose, T., & Manley, K. (2011). Motivation toward financial incentive goals on construction projects. *Journal of Business Research, 64*(7), 765–773. https://doi.org/10.1016/j.jbusres.2010.07.003

Rowlinson, M. (2012). A practical guide to the nec3 professional services contract. *Wiley*. https://doi.org/10.1002/9781118406373

Saka, N., Olanipekun, A. O., & Omotayo, T. (2021). Reward and compensation incentives for enhancing green building construction. Environmental and Sustainability Indicators. Elsevier B.V. https://doi.org/10.1016/j.indic.2021.100138

Schieg, M. (2008). Strategies for avoiding asymmetric information in construction project management. *Journal of Business Economics and Management, 9*(1), 47–51. https://doi.org/10.3846/1611-1699.2008.9.47-51

Song, M., et al. (2020). Testing structural and relational embeddedness in collaboration risk. *Rationality and Society, 32*(1), 67–92. https://doi.org/10.1177/1043463120902279

Suprapto, M., et al. (2016). How do contract types and incentives matter to project performance? *International Journal of Project Management, 34*(6), 1071–1087. https://doi.org/10.1016/j.ijproman.2015.08.003

Suprapto, M., Bakker, H. L. M., & Mooi, H. G. (2015). Relational factors in owner-contractor collaboration: The mediating role of teamworking. *International Journal of Project Management, 33*(6), 1347–1363. https://doi.org/10.1016/j.ijproman.2015.03.015

Swärd, A. (2016). Trust, reciprocity, and actions: The development of trust in temporary interorganizational relations. *Organization Studies, 37*(12), 1841–1860. https://doi.org/10.1177/0170840616655488

Vroom, V. H. (1964). *Work and motivation.* Wiley.

Wang, T. K., et al. (2018). Causes of delays in the construction phase of Chinese building projects. *Engineering, Construction and Architectural Management, 25*(11), 1534–1551. https://doi.org/10.1108/ECAM-10-2016-0227

Wigfield, A., & Eccles, J. S. (2002). Expectancy–value theory of achievement motivation. *Journal of Asynchronous Learning Network, 6*(1), 68–81. https://doi.org/10.1006/ceps.1999.1015

Williamson, O. E. (1979).Transaction-cost economics: The governance of contractual relations. *The Journal of Law and Economics, 22*(2).

Williamson, O. E. (1985). The Economic Institutions of Capitalism., China social sciences publishing house Chengcheng books ltd. https://doi.org/10.5465/AMR.1987.4308003

Yao, H., Chen, Y., Chen, Y., & Zhu, X. (2019). Mediating role of risk perception of trust and contract enforcement in the construction industry. *Journal of Construction Engineering and Management, 145*(2), 1–13. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001604

Yu, A. G., Flett, P. D., & Bowers, J. A. (2005). Developing a value-centred proposal for assessing project success. *International Journal of Project Management, 23*, 428–436. https://doi.org/10.1016/j.ijproman.2005.01.008

Zhang, L., Huang, S., Tian, C., & Guo, H. (2020a). How do relational contracting norms affect IPD teamwork effectiveness? A social capital perspective. *Project Management Journal, 51*(5), 538–555.

Zhang, M., Lettice, F., Chan, H., & Nguyen, H. (2018). Supplier integration and firm performance: The moderating effects of internal integration and trust. *Production Planning and Control, 29*(10), 802–813. https://doi.org/10.1080/09537287.2018.1474394

Zhang, R., Wang, Z., Tang, Y., & Zhang, Y. (2020b). Collaborative innovation for sustainable construction: The case of an industrial construction project network. *IEEE Access, 8*, 41403–41417. https://doi.org/10.1109/ACCESS.2020.2976563

Zhang, S., Zhang, S., Gao, Y., & Ding, X. (2016). Contractual governance: Effects of risk allocation on contractors' cooperative behavior in construction projects. *Journal of Construction Engineering and Management, 142*(6), 1–11. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001111

Zhu, L., Cheung, S., Gao, X., Li, Q., & Liu, G. (2020). Success DNA of a record-breaking megaproject. *Journal of Construction Engineering and Management, 146*(8), 05020009. https://doi.org/10.1061/(asce)co.1943-7862.0001878

Zhu, L., & Cheung, S. O. (2018). The implementation of incentive schemes in construction. In *11th International Cost Engineering Council (ICEC) world congress and the 22nd annual pacific association of quantity surveyors conference in 2018*, pp. 1–9.
Zhu, L., & Cheung, S. O. (2020). Power of incentivization in construction dispute avoidance. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 12*(2), 1–7. https://doi.org/10.1061/(ASCE)LA.1943-4170.0000368
Zhu, L., & Cheung, S. O. (2021a). Equity gap in construction contracting identification and ramifications. *Engineering, Construction and Architectural Management.* https://doi.org/10.1108/ECAM-09-2020-0725
Zhu, L., & Cheung, S. O. (2021b). Towards an equity-based analysis of construction incentivization. *Journal of Construction Engineering and Management* [In Press]
Zou, P. X. W., & Zhang, G. (2009). Managing risks in construction projects: Life cycle and stakeholder perspectives. *International Journal of Construction Management, 9*(1), 61–77. https://doi.org/10.1080/15623599.2009.10773122
Zou, P. X. W., Zhang, G., & Wang, J. (2007). Understanding the key risks in construction projects in China. *International Journal of Project Management, 25*(6), 601–614. https://doi.org/10.1016/j.ijproman.2007.03.001
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