THE EFFECTIVENESS OF EVOLUTIONARY GOVERNANCE IN MEGA CONSTRUCTION PROJECTS: A MODERATED MEDIATION MODEL OF RELATIONAL CONTRACT AND TRANSACTION COST

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Abstract. Mega construction project governance is an evolutionary process characterized by high transaction costs and complex interrelationships. Based on transaction cost theory, relational contract theory and evolutionary governance theory, this study explored the impact of evolutionary project governance on mega construction project performance by collectively considering the mediating effect of transaction costs and the moderating effect of a relational contract. Partial least squares structural equation modeling was used to test the hypotheses based on data collected from 176 respondents. The results show that evolutionary project governance would be more effective in increasing project performance and reducing transaction costs in the context of a relational contract. Reducing transaction costs is an effective way to improve project performance, and it is an important mediation variable between evolutionary project governance and project performance in the context of a relational contract. The results enrich the theory on mega construction project governance and reduce the imbalance between theory and practice in previous studies.

Keywords: mega construction project, evolutionary governance, transaction cost, relational contract.

Introduction

A mega construction project (MCP) is a dynamic system comprising a large number of stakeholders, including individuals and organizations, and interdependencies among these stakeholders (Jaafari, 2001). A project organization is an inter-firm organization composed of many sub-organizations from different firms (Sha, 2016a). Compared with ordinary projects, MCPs are more complex and uncertain in terms of their tasks and the relationships between organizations (Xue, Yuan, & Shi, 2016). Determining how to effectively govern all parties at the project level is critical for high project performance. MCPs are plagued by many underperformance problems, such as cost overruns, delays and unqualified construction quality (Flyvbjerg, Bruzelius, & Rothengatter, 2003; Sirisomboonsuk, Gu, Cao, & Burns, 2018). Studies have provided many explanations for the MCP underperformance problems, and these explanations can be divided into three distinct categories (Sanderson, 2012). The first considers that performance problems are caused by stakeholders' opportunism (Chang, 2013; Di Maddaloni & Davis, 2018; Xue et al., 2016). The second holds that the main reasons for

performance problems are inappropriate and incomplete governance mechanisms (Ahola & Davies, 2012; Loch, Demeyer, & Pich, 2006; Lu, Guo, Qian, He, & Xu, 2015; Manley & Chen, 2017). The last argues that performance problems are inevitable because of bounded rationality, multiple cultures, complexity and uncertainty (Cao & Lumineau, 2015; Kennedy, 2015; Marrewijk & Smits, 2016). Li, Lu, Ma, and Kwak (2018) state that the majority of these studies ignore the highly dynamic environment of MCPs. Static governance frameworks cannot adapt to the changing environment and be applied to solve practical problems effectively. Many researchers have realized the importance of dynamic and evolutionary governance, and different views have been proposed. Efficient and dynamic management controls are crucial measures of a successful project (Wit, 1988). The participant organizations of a collaborative project improve their governance by developing a contract system and changing the leadership structure continuously (Hartmann, Davies, & Frederiksen, 2010; Love, Ackermann, Teo, & Morrison, 2015).

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In this study, the transaction cost is set as a mediator for two reasons. First, MCPs can be considered transactions between participant organizations (Shenhar & Holzmann, 2017). Typical factors that cause transaction costs, such as opportunism, uncertainty and complexity, are similar to inherent characteristics of MCPs. Complexity and uncertainty can cause high-frequency opportunistic behavior and irrational decisions; these are the main reasons for transaction costs (Williamson, 1975). To reduce uncertainty and gain increased flexibility, the construction industry is naturally ruled by market governance (Winch, 1989); a higher transaction cost leads to inefficiency in the market allocation of resources (Williamson, 1975). Taking transaction costs as a mediator may help solve the governance issues and difficulties faced by MCPs. Second, project performance is often directly affected by transaction costs. The control of transaction costs is a bridge linking governance mechanisms and the achievement of project objectives. Ali, Zhu, and Hussain (2018) suggested that opportunism is one of the main causes of transaction cost escalation, and restrictions on opportunistic behavior can improve construction project performance. In MCPs, when parties perform a transaction, they often change their relationships with the evolution of the competitive environment. Understanding how to reduce transaction costs by choosing a scientific governance structure is important to MCP success (Shenhar & Holzmann, 2017).

Compared to a classic contract, a relational contract has been widely accepted as a more efficient and practical project governance tool, especially given the high complexity of MCPs. More importantly, one governance mechanism may present various effects under different contract contexts or interrelationship strengths. Xue et al. (2016) hold that the effect of partnership governance in MCPs is different under scenarios with high/low degrees of guanxi. Compared with formal contracts, relational behavior can contribute to better relationship quality and higher MCP performance (Zheng, Lu, Le, Li, & Fang, 2018). Trust, mutual interests and common goals are considered key factors of a relational contract for construction projects (D. W. Chan, A. P. Chan, & Yeung, 2009; Hartmann & Bresnen, 2011). Various forms of relational contracts have been used to solve the project governance problems in recent years; these include public-private partnerships, integrated project delivery (Rahman & Kumaraswamy, 2012), project/strategic partnering, project/strategic alliances (Sha, 2016b) and joint venture participation (Xue et al., 2016). In this context, it is difficult to ignore the existence of relational contracts in MCPs. The moderating role of relational contracts in the evolutionary governance of MCPs is an unexplored topic that worth studying.

However, existing studies remain limited in two aspects. First, although some studies have proposed that dynamic and evolutionary methods should be applied to a project governance process, the majority of related studies remains fragmented and lacks a mature theory system. In this study, evolutionary governance framework is used to measure dynamic changes in MCP governance. Second,

few studies have explored the effectiveness of evolutionary governance in MCPs by collectively considering transaction costs and relational contracts, which leads to an imbalance between MCP theory and practice. To fill these gaps, this paper analyzes the effectiveness of the evolutionary governance mechanism in MCPs at the project level and answers the following main questions:

1) Can evolutionary governance reduce transaction costs significantly and further promote MCP performance?
2) Can transaction costs mediate the effect of evolutionary governance on MCP performance?
3) Can the relationships among evolutionary governance, transaction costs and MCP performance be significantly moderated by a relational contract?

This paper is structured as follows. First, studies related to the theoretical foundation are summarized and reviewed. Then, nine hypotheses are proposed, and the conceptual model is established for empirical testing. Next, the analytical results of the structural model are presented. Finally, the findings of this paper are discussed, and its conclusions and limitations are provided.

1. Theoretical foundation

Before discussing the questions to be answered in this study, we first clarify the underlying theoretical foundations: transaction cost theory (TCT), relational contract theory (RCT) and evolutionary governance theory (EGT). TCT and RCT are important components of new institutional economics and have been widely used in the research on MCP governance. EGT integrates fragmented studies of dynamic and evolutionary governance and provides a systematic and comprehensive research framework.

1.1. Transaction cost theory

TCT holds that asset specificity, uncertainty and frequency are the three features of transactions, and transaction costs are caused by six sub-factors: bounded rationality, opportunism, uncertainty and complexity, specific investment, information asymmetry and atmosphere (Williamson, 1979). Opportunism is inevitable in many transactions and is defined as "the incomplete or distorted disclosure of information, especially with calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse" (Williamson, 1985). In MCP, opportunism behavior can be restrained effectively by proper governance mechanisms (Xue et al., 2016). Bounded rationality and asset specificity can make participants in a transaction collect the composite quasi-rent (Alchian & Woodward, 1988). In MCPs, composite quasi-rent can be considered the investment in specialized assets to support the construction of the MCPs, it may lead to additional transaction costs. It is widely acknowledged that high complexity and uncertainty are the main characteristics of MCPs; it has been confirmed that uncertainty and complexity positively correlate with transaction costs in project governance (Chen,

Zhang, & Xie, 2014; Choi & Krause, 2006). The first participants in a transaction generally possess more information than those that come later, and they tend to make extra profits due to information asymmetry. The additional profits caused by information asymmetry are considered a part of the transaction cost. Situations in which parties to the transaction do not trust each other and are in opposing positions may substantially increase unnecessary transaction difficulties and costs (Williamson, 1975). Li, Arditi, and Wang (2013) proposed that the predictability of owners' and contractors' behavior, project management efficiency and uncertainty in the transaction environment are the main factors that influence transaction costs in construction projects. Examining the critical risk factors that cause ex-post transaction costs in construction projects, Ali et al. (2018) find that technical risk and environmental risk can both increase ex-post transaction costs, and these risks can be effectively reduced by limiting claims and strengthening monitoring.

1.2. Relational contract theory

As a branch of incomplete contract theory, RCT maintains that a relational contract only determines the basic goals and principles rather than specifying all the terms of the transaction; the interpersonal relationships of the past, present and future play a key role in the long-term transaction (Macneil, 1978). There are many studies of relational contracts in the field of construction project governance. The measuring constructs of relational contracting, such as flexibility, reliance and expectations, and contractual solidarity, were developed to better research the effects of a relational contract on integration and project performance (Harper, Molenaar, & Cannon, 2016). The specific relational contracting practices can improve project performance significantly (Ling, Ke, Kumaraswamy, & Wang, 2014) and help the stakeholders of construction projects establish trust, promote cooperation and communication, share resources and resolve conflicts (Lahdenperä, 2012). Trust is the basis of a relational contract (Chan et al., 2009); however, Doloi (2009) proposed that the effect of trust is limited and does nothing for project success. Excessive trust and overly minimal trust are both harmful (Jeffries & Reed, 2000), the relational contract has been questioned. In fact, a relational contract is not weak in enforcement arrangements; the value of a future relationship (Baker, Gibbons, & Murphy, 2002), relational norms (Macneil, 1978) and reputation (Gil, 2009) are the guarantees for relational contract performance. These "soft rules" may be greater than a classic contract in a specific context. In summary, a relational contract is a type of contract that can be understood from two aspects. One is "relational", emphasizing flexible factors such as trust, coordination, renegotiation, realignment and restoration. The other is "contract", illustrating that a relational contract continues to have the power of punishment.

1.3. Evolutionary governance theory

How to address the challenges of change has become one of the most important issues for project governance theory. In addition, a few researchers have presented the dynamic interplay between formal and informal institutions (Greif, 2006; North, 2005). EGT is important and necessary because governance mechanisms are easily affected by dynamic internal and external environments (Van Assche, Beunen, & Duineveld, 2013). EGT was described as "a novel perspective on the way societies, markets and governance evolve, it integrates concepts and insights from various theoretical sources into a new coherent framework" (Beunen, Van Assche, & Duineveld, 2015). According to the EGT model proposed by Van Assche et al. (2013), EGT consists of three components. The first is configurations of actors, institutions and power/knowledge; these elements are co-evolutionary and interactive. The second is dependencies and path creation, which include path dependence, interdependence, and goal dependence. The third is governance paths, objects and subjects, which refer to governance mechanisms, techniques, and social identities of actors as defined in the governance, respectively. In the field of project governance, Li et al. (2018) applied the EGT model to mega event projects from the evolution of governance paths and techniques, interdependence, goals and governance configurations. Based on EGT, the existing research results and the characteristics of an MCP, we establish the conceptual framework of evolutionary project governance (EPG) in this study. The framework consists of three parts: (1) evolution of governance configurations (EGC), (2) evolution of interdependence and goals (EIG) and (3) evolution of a governance path (EGP). EGC refers to dynamic adjustments of governance mechanisms involving actors, institutions and power/knowledge. A project is a dynamic and evolutionary system that requires specific governance mechanisms. The governance mechanisms encompass the management of parties' relationships and should be adjusted to the changing environment (Ahola, Ruuska, Artto, & Kujala, 2014). Static governance mechanisms cannot address ever-changing risks and opportunities, especially in the context of MCPs, and it is important for project organizations to capture dynamic environments and develop an evolutionary governance mechanism to obtain competitive advantages (Choi, Cho, Han, Kwak, & Chih, 2018). As an important part of EPG, EIG mainly concerns changes in parties' interrelationships and project objectives. In construction projects, the relationships between parties change with the degree of trust and reciprocity (Wang, Li, & Fang, 2018). The evolution of interdependence between institutions or groups may lead to changes in their own goals and common goals (Van Assche, Beunen, Jacobs, & Teampau, 2011). A lack of evolutionary interdependencies and goals can easily lead to risk of project failure. Therefore, it is crucial for parties of MCPs to constantly revise the interdependence and project goals in order to achieve project success. EGP refers

to the implications of prior governance experiences for current projects. Many project managers copy their own success experiences or imitate others' successful practices in their current projects (Li et al., 2018). This method can protect current projects from previous errors, but differences between projects always lead to inefficiency in the governance path and results in new problems. Therefore, while retaining experience that can be applied to current projects, the governance path should also be changed to adapt to the new challenges of a project.

2. Hypotheses

2.1. The relationship between EGC and transaction costs

The configurations of actors, institutions, and power/knowledge are the main components of EGC. The cooperation and confrontation among parties regarding their different ideas, plans and cognitive frames will improve, weaken or eliminate the role of an actor. Redefining actors will lead to institutional changes and transformations of power/knowledge, which may have an impact on transaction costs and performance (Van Assche et al., 2013; Weber, 2014).

The configurations of actors and institutions are related to formal and informal configurations (Van Assche et al., 2013). Actors play different roles and use different governance approaches in formal and informal systems; contractual and relational governance represent the formal and informal governance approaches, respectively (Cao & Lumineau, 2015; Lu, Luo, Wang, Le, & Shi, 2015; Poppo & Zenger, 2002). Many researchers argue that contracts lack flexibility in a changing environment (Carson, Madhok, & Wu, 2006; Das & Teng, 1998); however, the change elements are considered important measure indexes for an efficient contract and can provide flexible solutions or guidelines for stakeholders when they encounter unanticipated contingencies, which reduce the ex-post transaction cost and improve project performance (Lu et al., 2015). In contrast to contractual governance, relational governance provides a complete evolutionary idea for all parties, which depend on a soft and adjustable method to resolve conflicts in the governance process (Claro, Hagelaar, & Omta, 2003). As a flexible and dynamic method, relational governance can effectively reduce the transaction cost (Y. Liu, Luo, & T. Liu, 2009) and enhance MCP performance (Xue et al., 2016). From the perspective of power/knowledge configuration, one's expertise and knowledge can be found, built or changed when he or she accepts a type of actor/institution configuration (Van Assche et al., 2013); knowledge evolution is accompanied by knowledge sharing in general. The relationship between knowledge sharing and transaction costs has been proven to be negative (Ke & Wei, 2007). In addition, project performance can be improved by knowledge sharing behavior (Liu, Keller, & Shih, 2011). The configurations of actors, institutions, power and knowledge are co-evolved (Van Assche et al., 2013). Accordingly, the effects of power evolution

on transaction costs and project performance are generally considered positive. Based on this fact, we can infer that an evolutionary power structure can reduce transaction costs in the governance process.

　　H1a: EGC can effectively reduce transaction costs.
　　H2a: EGC has a positive effect on MCP performance.

2.2. The relationship between EIG and transaction costs

Interdependence is regarded as a restriction in choice that originates in relationship networks of actors, institutions and social contexts (Van Assche et al., 2013). Interdependence emphasizes the importance of interrelationships between different stakeholders such as individuals, groups, institutions and functional systems (Li et al., 2018). Changing relationships between stakeholders can improve MCP performance and reduce transaction costs (Mok, Shen, & Yang, 2015). In project governance, interrelationships among stakeholders are evolutionary, and growing trust can significantly promote project performance (Arranz & Arroyabe, 2012). With the improvement of cooperation, the relationship quality is gradually enhanced (Zheng, Roehrich, & Lewis, 2008); the transaction costs are lower when stakeholders are able to fully understand and respect each other's respective rights and liabilities (Liu et al., 2009). Relational behavior, such as the dynamics of long-term relational exchange partnerships and long-term cooperation, may result in lower transaction costs and higher performance (Hill, 1990; Yilmaz, Sezen, & Ozdemir, 2005). In contrast to typical, normal-sized projects, MCPs' goals are always diverse, dynamically evolving and even mutually contradictory, such as incompatibility of schedule and cost and inconsistencies between long-term plans and short-term goals (Li et al., 2018). The relationships between parties are reflected by common interests and goals; dynamic goals result in changes in institutions' and actors' positions (Beunen, Van Assche, & Duineveld, 2016). Adjusting stakeholders' relationships and goals based on the evolution of project contexts could reduce the impact of transaction uncertainty. According to TCT, a decrease in uncertainty could lead to a reduction in transaction costs (Williamson, 1979). Thus, we hypothesized the following:

　　H1b: EIG can effectively reduce transaction costs.
　　H2b: EIG has a positive effect on MCP performance.

2.3. The relationship between EGP and transaction costs

Due to the complexity of MCPs, there continues to be no mature governance path (Li et al., 2018). Although the governance experience of similar projects could provide a guide for managers, the governance path must be adaptable to environmental change, and indiscriminate imitation leads to an increase in transaction costs. The information cost of construction projects can be reduced by changing the vertical governance structure (Sha, 2011). Diverse and dynamic governance paths can effectively improve

project performance (Watabaji, 2014). To better respond to fast-changing markets, a dynamic project risk governance path was used to decrease the uncertainty of projects (Fink, 2016); low uncertainty leads to a decrease in transaction costs (Williamson, 1979) and enhances MCP performance (Sanderson, 2012). Based on prior governance experiences, project managers should change the governance path when confronting different events (Watabaji, 2014). To better solve this problem, Noorderhaven (1995) established the dynamic hybrid governance model; it maintains that shifts from one form of governance to another according to different situations could reduce transaction costs. These research findings show that evolving governance paths are more efficient than static governance mechanisms. Thus, we hypothesized the following:

H1c: EGP can effectively reduce transaction costs.

H2c: EGP has a positive effect on MCP performance.

2.4. The effect of transaction costs on project performance

Low transaction costs support high performance (Dyer & Chu, 2003). Opportunism, uncertainty and asset specificity are not only the main reasons for transaction costs (Williamson, 1985) but also the features of MCPs (Hu, Chan, Le, & Jin, 2013). Many studies have confirmed that these factors can lead to low performance in MCPs (Ahola & Davies, 2012; Di Maddaloni & Davis, 2018; Kennedy, 2015). Opportunism is regarded as an obstacle to enhancing performance; it causes high transaction costs and damages project performance (Sanderson, 2012). Stakeholders generally want to obtain the maximum benefit, which is the main cause of transaction costs (Williamson, 1979), and a low level of opportunism is conducive to improving performance (Jap & Anderson, 2003). Uncertainty and complexity can lead to many performance problems (Sanderson, 2012); uncertainty makes stakeholders lack mutual trust and increases the communication cost, which can lead to high transaction costs (Wang, Yeung, & Zhang, 2011). To improve project performance, construc-

tion firms minimize asset specificity to reduce transaction costs (Winch, 1989). Thus, we hypothesized the following:

H3: Transaction costs have a positive effect on MCP performance.

H4: Transaction costs mediate the effects of EGC, EIG and EGP on MCP performance.

2.5. The moderating role of the relational contract

Due to the high complexity of MCPs, the flexibility of contracts positively correlates with the cooperation quality between parties (Ning & Ling, 2015). Consequently, the relational context is important for the implementation of evolutionary governance. In the construction industry, project partnering, project alliances and integrated project delivery are defined as three types of relational project delivery arrangements (Lahdenperä, 2012). The main characteristics, such as an atmosphere of actively avoiding controversy, risk pooling, benefit sharing and joint and several liability (Lahdenperä, 2012), can better promote dynamic and evolutionary governance. A relational contract can better adapt to the evolution of policy and rules that disrupt the balance between the established institutional environment and the governance mechanism (Tennant & Fernie, 2012). To reduce transaction costs, Williamson (1985) emphasizes using private ordering rather than court ordering to resolve ex-post conflicts. This characteristic is closely related to a relational contract. In the project governance process, relational contracts can reduce the transaction cost and improve performance via dynamic and evolutionary governance (Carson et al., 2006). Accordingly, a relational contract is not a list of rights and obligations but a beginning point of renegotiation when the environment changes (Kimel, 2007). Thus, we hypothesized the following:

H5: The effect of evolution governance is strengthened when MCPs adopt a relational contract.

The research model is shown in Figure 1, where c_1, c_2, c_3, c_4, c_5, c_6 and c_7 represent path coefficients.

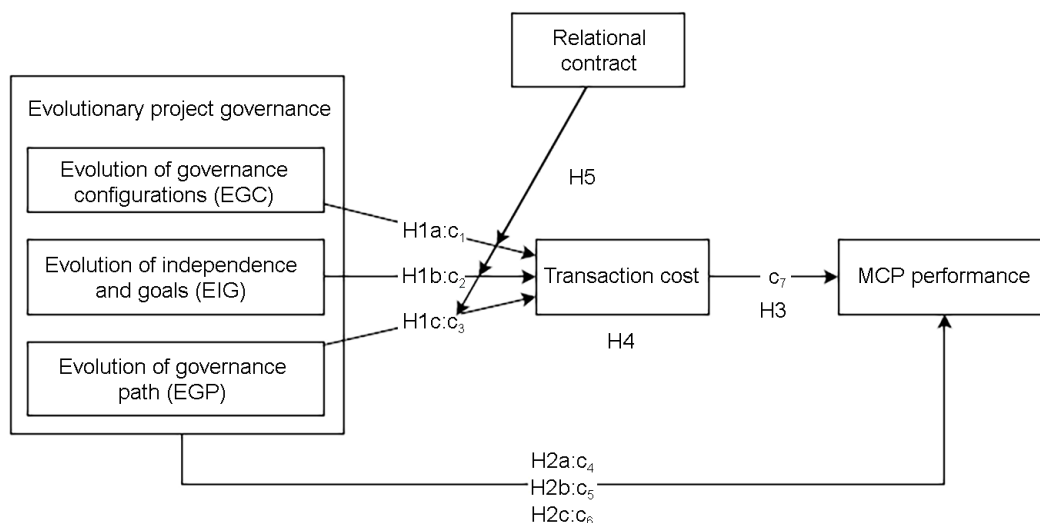Figure 1. Research model and hypotheses

3. Methodology

3.1. Sample and data collection

According to the definition of MCPs proposed by Flyvb-jerg et al. (2003), the project cost threshold of USD 1 billion is accepted as the standard for MCPs. Based on this standard, we selected 86 MCPs in Shandong province, China, including state-owned MCPs and large real estate development projects. To better explore the effect of EPG at the project level, we chose to collect data from project managers of main organizations participating in MCPs. A total of 400 project managers from owners, construction firms, supervision firms and engineering consulting firms for these MCPs were invited to answer our questionnaire by email or through an interview. MCPs that adopted public-private partnerships, project/strategic partnering, project/strategic alliances, integrated project delivery or joint venture participation were grouped into the relational contract group; otherwise, they were grouped into the non-relational contract group. After the questionnaires were distributed, 182 responses were returned, for a response rate of 45.5%. After responses with more than 15% of the information missing were removed, 176 valid responses remained. The data collection process occurred between September 2017 and February 2018. The respondents were classified based on three factors: the degree of experience, the organization and the investment scale, as shown in Table 1. Of the 176 respondents, 18.8% had been working in MCPs for 3–5 years, 29.6% for 6–10 years, 26.1% for 11–15 years, 19.9% for 16–20 years, and 5.7% for more than 20 years. With regard to the firm's role, 40.9% of the respondents represented owners, 30.1% construction firms, 14.8% supervision firms, and 14.2% consulting firms. In terms of the type of contract, 40.9% were relational contracts, and 59.1% were non-relational contracts.

3.2. Method

In this study, partial least squares structural equation modeling (PLS-SEM) is applied to analyze the data. PLS-SEM and covariance-based structural equation modeling (CB-SEM) are two different forms of structural equation modeling. Compared with CB-SEM, PLS-SEM is more suitable for this study because it has two advantages. First, PLS-SEM can be implemented with a small sample size (ten times the largest number of structural paths directed at a particular latent construct in the structural model) (Hair, Ringle, & Sarstedt, 2011). At least thirty samples are needed for this study, whereas CB-SEM requires more than 200 samples (Henseler, Ringle, & Sinkovics, 2009); that is, PLS-SEM has stronger analytical power when confronting a limited sample size. Second, PLS-SEM is better with respect to models that remain at an exploratory stage or whose theoretical basis requires further development (Hair et al., 2011). Therefore, PLS-SEM is a better choice for this study because "EGT is an unfinished project with great potential" (Van Assche et al., 2013). Few people have applied EGT in research on MCP governance, and our structure model is not yet well established in previous research. These are important reasons supporting the application of PLS-SEM for further data analysis.

3.3. Measures

The questionnaire for this study was developed based on items in the previous literature on project governance, transaction costs, project performance and relational contracts. A seven-point scale ranging from one (completely disagree) to seven (fully agree) was used to measure the attitudes of respondents. Before the questionnaire was distributed, six experts with over ten years of experience in project management were invited to modify the scale items that were unclear or incorrectly expressed. To differentiate the two groups, the type of contract needed to be identified first; that is, respondents needed to answer whether their MCPs adopted a relational contract as the cooperation mode. All items are shown in Table 2.

Four items (GC1-GC4) (Ning & Ling, 2015; Xue et al., 2016) were used to measure the EGC from the configurations of actors, institutions and knowledge. Four items (IG1-IG4) (Ning & Ling, 2015; Suprapto, Bakker, & Mooi, 2015) were used to examine EIG to capture the changes in interrelationships and goal setting. Three items (GP1-GP3) (Goo, Kishore, Rao, & Nam, 2009; Xue et al., 2016) were used to assess the EGP; their objective was to test the flexibility of the governance mechanism in an MCP's organization. The transaction cost was measured by four items (TC1-TC4) (Shervani, Frazier, & Challagalla, 2007; Xue et al., 2016), which surveyed the transaction cost from three main aspects: internal and external uncertainty, opportunism and asset specificity. MCP performance was measured by three items (MP1-MP3) (Pinto, Slevin, & English, 2009) that explore important factors such as the budget, schedule and quality.

4. Data analysis and results

4.1. Measurement model

The reliabilities of EGC, EIG, EGP, transaction costs and MCP performance were estimated based on internal consistency reliability (Cronbach's alpha) and composite

Table 1. Respondent classification

	Type	Number	Percentage
Experience	3–5 years	33	18.8%
	6–10 years	52	29.6%
	11–15 years	46	26.1%
	16–20 years	35	19.9%
	More than 20 years	10	5.7%
Organization	Owners	72	40.9%
	Construction firms	53	30.1%
	Supervision firms	26	14.8%
	Consulting firms	25	14.2%
Type of contract	Relational contract	72	40.9%
	Non-relational contract	104	59.1%

Table 2. Measures of constructs

Constructs	Items
Relational contract	Do your projects adopt public-private partnership, project/strategic partnering, forming a project/strategic alliance, integrated project delivery, participating in a joint venture or other typical relational contracts?
EGC	GC1 Actors are willing to adapt to the MCPs' needs.
	GC2 The institution has specified major principles or guidelines for handling unanticipated contingencies as they arise.
	GC3 Exchange of knowledge and information among the parties occurs frequently.
	GC4 The parties were willing to change configurations to devise solutions if unexpected situations arise.
EIG	IG1 We have regular team building and alignment meetings.
	IG2 We will perform dynamic goal setting and alignment with project goals.
	IG3 The parties are expected to be able to make adjustments in their ongoing relationship to cope with changing circumstances.
	IG4 Both organizations communicated directly with each other.
EGP	GP1 We have many alternative governance mechanisms for responding to various contingencies that are likely to arise.
	GP2 The governance path changes as the MCP environment changes.
	GP3 The governance path can adapt to the parties' specific needs.
Transaction cost	TC1 Our partner breaches formal or informal agreements to his/her benefit.
	TC2 It is easy to gauge market competition and policy.
	TC3 It is easy to assess how well each MCP participant is doing.
	TC4 We have high human asset specificity, physical asset specificity and devoted assets specificity.
MCP performance	MP1 This project was completed within the budget.
	MP2 This project was completed on schedule.
	MP3 The construction and deliverables quality are in accordance with the standard.

reliability (CR). Cronbach's alpha and CR values are considered adequate when they are greater than 0.7. As shown in Table 3, the analytical result shows that all Cronbach's alpha values and CR values are greater than 0.7, implying a high level of internal consistency and composite reliability. Here, validity consists of convergent validity and discriminant validity. Convergent validity was assessed by average variance extracted (AVE), and an AVE value is considered adequate when it is greater than 0.5. As shown in Table 3, AVE values meet all requirements. According to the criterion of discriminant validity (Fornell & Larcker, 1981), the square roots of AVE of each construct should

Table 3. Measurement reliability and convergent validity assessment

Constructs		Non-relational contract	relational contract
EGC	Cronbach's alpha	0.815	0.853
	CR	0.763	0.884
	AVE	0.732	0.766
EIG	Cronbach's alpha	0.821	0.874
	CR	0.796	0.928
	AVE	0.688	0.734
EGP	Cronbach's alpha	0.838	0.823
	CR	0.835	0.937
	AVE	0.727	0.673
Transaction cost	Cronbach's alpha	0.791	0.834
	CR	0.852	0.889
	AVE	0.654	0.737
MCP performance	Cronbach's alpha	0.818	0.814
	CR	0.826	0.866
	AVE	0.694	0.784

Table 4. AVE values and correlations of the constructs

	1	2	3	4	5
1 EGC	0.856/0.875				
2 EIG	0.453/0.498	0.829/0.857			
3 EGP	0.468/0.527	0.542/0.571	0.853/0.820		
4 Transaction cost	−0.656/−0.668	−0.445/−0.534	−0.513/−0.582	0.809/0.858	
5 MCP performance	0.634/0.682	0.511/0.613	0.624/0.673	−0.521/−0.576	0.833/0.885

Note: Non-relational context/ relational context

be greater than its correlation with any other constructs. As shown in Table 4, the values meet all requirements for discriminant validity, confirming that it exists.

4.2. Structural model

The R^2 is the coefficient of determination, and it is used to assess the central criterion of a structural model. In a group of non-relational contracts, R^2 values of transaction costs and MCP performance are 41.8% and 45.3%, respectively. In the relational contract group, the R^2 values of transaction costs and MCP performance are 39.8% and 43.2%, respectively. These R^2 values demonstrate the predictive validity of the model.

We execute the PLS algorithm with 300 iterations to obtain path coefficients and perform bootstrapping analysis with 5000 subsamples to test the significance of the path coefficients. In the context of a non-relational contract, as shown in Figure 2, EGC has a significant effect on transaction costs ($c_1 = -0.257$, $T = 2.268$) but no significant effect on MCP performance ($c_4 = 0.132$, $T = 1.285$); thus, hypothesis H1a is supported and hypothesis H2a is not supported. EIG has no significant effect on transaction costs ($c_2 = -0.153$, $T = 1.318$) or MCP performance ($c_5 = 0.113$, $T = 1.739$); therefore, hypotheses H1b and H2b are not supported. EGP can significantly decrease transaction costs ($c_3 = -0.274$, $T = 2.231$) and improve MCP performance ($c_6 = 0.245$, $T = 2.863$); therefore, hypotheses H1c and H2c are supported. The relationship between transaction costs and MCP performance is significantly negative ($c_7 = -0.373$, $T = 4.146$), which illustrates that a higher transaction cost can lead to lower MCP performance, hypothesis H3 is supported.

In the context of a relational contract, as shown in Figure 2, EGC has a significant effect on transaction costs ($c_1 = -0.356$, $T = 3.823$) and MCP performance ($c_4 = 0.284$, $T = 2.842$); thus, hypotheses H1a and H2a are supported. The effects of EIG on transaction costs and MCP performance are significant ($c_2 = -0.237$, $T = 2.196$; $c_5 = 0.347$, $T = 4.479$); therefore, hypotheses H1b and H2b are supported. EGP can continue to significantly decrease transaction costs ($c_3 = -0.358$, $T = 3.942$) and increase MCP performance ($c_6 = 0.397$, $T = 4.128$); thus, hypotheses H1c and H2c are supported. The relationship between transaction costs and MCP performance is significantly negative ($c_7 = -0.368$, $T = 5.372$), which illustrates that transaction costs can significantly restrict MCP performance, hypothesis H3 is supported.

We also study the indirect effects of EGC, EIG and EGP on project performance through transaction costs, that is, the mediating effect of transaction costs. In this study, bootstrapping is used to estimate the indirect effects. A total of 5000 subsamples at the 0.95 significance level were calculated. When MCPs are in the context of a non-relational contract, the bias-corrected confidence intervals of EGC, EIG and EGP range from 0.002 to 0.157, −0.009 to 0.162 and 0.003 to 0.198, respectively. The bias-corrected confidence interval of EIG includes zero, which illustrates that the transaction cost has no mediating effect between EIG and MCP performance. The bias-corrected confidence intervals of EGC and EGP do not include zero. This result indicates that the transaction cost is a mediator between EGC, EGP and MCP performance; thus, hypothesis H4 is partially supported. When MCPs are in the context of a relational contract, the bias-corrected confidence intervals for EGC, EIG and EGP are from 0.003 to 0.162,
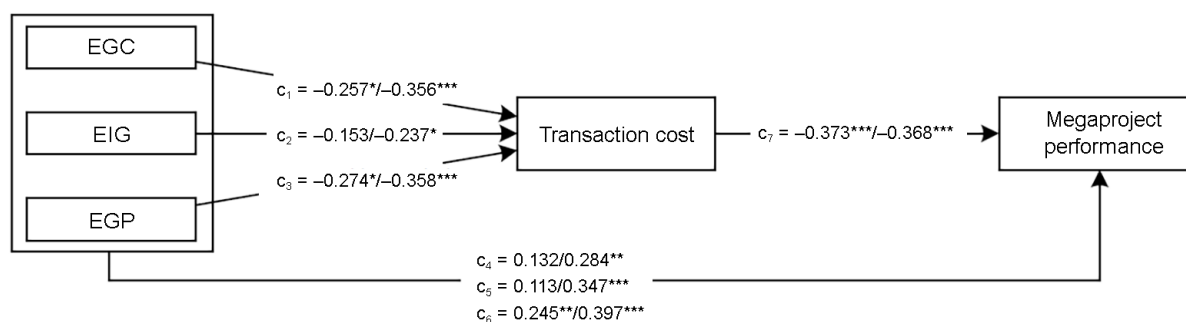

Figure 2. Results of structural equation modeling

Table 5. Multi-group comparison test results

Path	EGC→TC	EIG→TC	EGP→TC	EGC→MP	EIG→MP	EGP→MP	TC→MP
$P_{Henseler}$	0.006**	0.013*	0.027*	0.002**	0.007**	0.022*	0.375

Note: *** p < 0.001, ** p < 0.01, * p < 0.05; TC = Transaction cost, MP = MCP performance.

0.001 to 0.187 and 0.004 to 0.159, respectively. No bias-corrected bootstrapping confidence interval includes zero. Thus, the transaction cost has a mediating effect between EGC, EIG, EGP and MCP performance; hence, hypothesis H4 is supported.

To test the significance of the moderating role of a relational contract, in SmartPLS 3.0, we applied multi-group analysis (MGA) (Henseler et al., 2009) to make all comparisons between bootstrap coefficients derived from two separate groups: relational contracts and non-relational contracts. $P_{Henseler}$ reflects the significance of the difference between the two groups. The results are shown in Table 5. All comparisons of path coefficients, except the transaction cost, to the MCP performance are significant, which illustrates that the differences of EPG to the transaction cost and MCP performance between the two groups are significant; therefore, hypothesis H5 is supported. The difference in transaction costs to MCP performance between the two groups is not significant, which illustrates that relational contract has no impact on this path.

5. Discussion

Based on TCT, RCT and EGT, we established a novel research framework of EPG. This study provides a deeper understanding of the relationship between EPG, transaction costs and MCP performance and enhances the ability of MCP managers to resolve conflicts with a relational contract.

5.1. The effects of EGC, EIG and EPG

Within the context of a non-relational contract, the evolutionary configurations of actors, institutions and power/knowledge can reduce the transaction cost; however, it cannot improve MCP performance. Due to the high complexity of the arrangement of personnel, institutions and knowledge flows in MCPs, the type and number of project team members can often change as the project progresses (PM Institute, 2008); the accumulation of knowledge as the project progresses and proper personnel adjustments can reduce transaction costs. These results agree with the views of Li et al. (2018). Changing parties' interdependences and goals to adapt to environmental changes cannot provide a lower transaction cost or higher MCP performance. The main reason may be that a hierarchical relationship and goals defined by formal contracts are rigid and do not provide sufficient space for evolutionary governance. Consequently, it is difficult to achieve a low transaction cost and high performance through the dynamic adjustment of interdependences and goals when there is no stable relational foundation (Poppo & Zenger,

2002). It is confirmed that evolutionary governance paths can reduce the transaction cost and enhance MCP performance significantly, which is consistent with the findings of Watabaji (2014).

Within the context of a relational contract, the evolutionary configuration of actors, institutions and knowledge can significantly reduce the transaction cost and improve MCP performance. The adjustment of configurations may be more acceptable for all parties under a flexible environment with a high degree of trust and coordination that a relational contract provides; this not only will achieve cost savings from changing the bureaucratic organization built by classic contracts but also may reduce the information cost between parties and enhance project performance (Sha, 2011). Changing parties' interdependences and goals to adapt to environmental changes can lead to lower transaction costs and higher MCP performance. With the support of a relational contract, stakeholders have more common interests (Sha, 2016b). Dynamic interrelationships can make both parties communicate directly with each other (Xue et al., 2016), and all parties are more willing to make adjustments to their goals to adapt to changing circumstances. Evolutionary governance paths are also effective for reducing the transaction cost and enhancing MCP performance in the context of a relational contract. This result shows that regardless of the type of contract adopted by MCPs, EGP can be effective.

5.2. The effects of relational contracts and transaction costs

By exploring the changes in the relationships among EPG, transaction costs and MCP performance, we find that under the moderation of a relational contract, the effect of EGC on transaction costs and MCP performance is larger. The effect of EIG on transaction costs and MCP performance changes to significant from insignificant. The effects of EGP on transaction costs and MCP performance are significantly increased. The transaction cost plays a negative role in the improvement of MCP performance, regardless of whether there is a non-relational or relational contract. This result illustrates that the negative relationship between the two cannot be changed by a relational contract. However, the mediating effects of transaction costs are different between the two types of contracts. In the context of a non-relational contract, the mediating effects of transaction costs exist only between EGC, EGP and MCP performance. In the context of a relational contract, the mediating role of transaction costs is effective for EGC, EIG and EGP. The findings indicate that a relational contract can improve the effects of EPG and transaction costs in the evolutionary governance of MCPs.

Conclusions

Prior research in the field of construction project governance has paid limited attention to the evolutionary governance of MCPs, especially under the collective consideration of transaction costs and relational contracts. This study filled this gap by examining the effects of evolutionary project governance on MCP performance, and studying the mediating role of transaction costs and the moderating role of relational contracts. It makes several contributions to the literature.

First, this study contributes to the body of knowledge on MCP governance by enhancing the understanding of how EPG affects MCP performance. Compared with a non-relational contract, EPG is more effective in a situation in which it is moderated by a relational contract. This finding indicates that a more effective implementation of EPG needs the support of a relational contract. In contrast to previous studies that focus on the effects of evolutionary governance (Li et al., 2018) or dynamic capabilities (Choi et al., 2018) without considering the moderating role of contract type, this study paid attention to various effects of EPG under different contract type backgrounds. By decomposing contracts into relational contracts and non-relational contracts and considering their effects on EPG, we reveal changes in EPG effects caused by the differences between contract types. MCP organizations need to weight the effectiveness of the EPG against the inefficiencies it provides in different contract contexts.

Second, we find that reducing transaction costs is an effective way to improve MCP performance regardless of the contract type (i.e., non-relational or relational). The transaction cost plays a mediating role between EGC, EIG, EGP and MCP performance in the context of a relational contract. However, in the context of a non-relational contract, the mediating role of the transaction cost between EIG and MCP performance is non-existent. MCP organizations need to attach importance to the change in transaction cost impacts and learn to choose appropriate perspectives to reduce the transaction cost in the evolutionary governance process. In particular, the evolution of interdependencies between different parties and project goals should be conducted in a relational-contract project because relational contracts provide a flexible way for all parties to communicate with, cooperate with and understand each other. As one of the few studies applying the transaction cost literature to the context of evolutionary governance in MCPs, this research initially empirically confirms the mediating role of transaction costs in the relationships between the dimensions of EPG and MCP performance. This leads to a deeper understanding of MCP parties' inherent willingness to reduce transaction costs by borrowing TCT and EGT. Through the explanation of transaction costs in MCPs, we know that MCPs create long-term dynamic relationships between all parties at the project level rather than simple transactions between individuals.

Although this study is helpful to MCP governance in both theory and practice, it is subject to certain limita-

tions. First, this study did not distinguish the types of relational contracts; different types of relational contracts may have different impacts on transaction costs and MCP performance. This point needs to be studied in the future. Second, although the framework of EGT has been established, it remains in a development stage. Certain hypotheses may lack sufficient literature support. As the research on MCP governance develops, we believe that the results will be accepted by additional researchers.

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References

Ahola, T., & Davies, A. (2012). Insights for the governance of large projects: Analysis of organization theory and project management: Administering uncertainty in Norwegian offshore oil by Stinchcombe and Heimer. *International Journal of Managing Projects in Business*, *5*(4), 661-679. https://doi.org/10.1108/17538371211268979

Ahola, T., Ruuska, I., Artto, K., & Kujala, J. (2014). What is project governance and what are its origins?. *International Journal of Project Management*, *32*(8), 1321-1332. https://doi.org/10.1016/j.ijproman.2013.09.005

Alchian, A. A., & Woodward, S. (1988). Review: The firm is dead; long live the firm a review of Oliver E. Williamson's The economic institutions of capitalism. *Journal of Economic Literature*, *26*(1), 65-79.

Ali, Z., Zhu, F., & Hussain, S. (2018). Risk assessment of ex-post transaction cost in construction projects using structural equation modeling. *Sustainability*, *10*(11), 4017. https://doi.org/10.3390/su10114017

Arranz, N., & Arroyabe, J. C. F. D. (2012). Effect of formal contracts, relational norms and trust on performance of joint research and development projects. *British Journal of Management*, *23*(4), 575-588. https://doi.org/10.1111/j.1467-8551.2011.00791.x

Baker, G., Gibbons, R., & Murphy, K. J. (2002). Relational contracts and the theory of the firm. *Quarterly Journal of Economics*, *117*(1), 39-84. https://doi.org/10.2139/ssrn.2211

Beunen, R., Van Assche, K. V., & Duineveld, M. (2015). *Evolutionary governance theory: theory and applications*. London: Springer International Publishing.

Beunen, R., Van Assche, K., & Duineveld, M. (2016). *Evolutionary governance theory*. London: Springer.

Cao, Z., & Lumineau, F. (2015). Revisiting the interplay between contractual and relational governance: A qualitative and meta-analytic investigation. *Journal of Operations Management*, *33*, 15-42. https://doi.org/10.1016/j.jom.2014.09.009

Carson, S. J., Madhok, A., & Wu, T. (2006). Uncertainty, opportunism, and governance: The effects of volatility and ambiguity on formal and relational contracting. *Academy of Management Journal*, *49*(5), 1058-1077. https://doi.org/10.2139/ssrn.611208

Chan, D. W., Chan, A. P., & Yeung, J. F. (2009). *Relational contracting for construction excellence*. UK: Routledge. https://doi.org/10.4324/9780203926727

Chang, C.-Y. (2013). Understanding the hold-up problem in the management of megaprojects: The case of the Channel Tunnel Rail Link project. *International Journal of Project Management*, *31*(4), 628-637. https://doi.org/10.1016/j.ijproman.2012.10.012

Chen, G., Zhang, G., & Xie, Y. M. 2014. Impact of transaction attributes on transaction costs in project alliances: Disaggregated analysis. *Journal of Management in Engineering*, *31*(4), 1-10. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000259

Choi, S., Cho, I., Han, S. H., Kwak, Y. H., & Chih, Y. Y. (2018). Dynamic capabilities of project-based organization in global operations. *Journal of Management in Engineering*, *34*(5), 04018027. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000621

Choi, T. Y., & Krause, D. R. (2006). The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation. *Journal of Operations Management*, *24*(5), 637-652. https://doi.org/10.1016/j.jom.2005.07.002

Claro, D. P., Hagelaar, G., & Omta, O. (2003). The determinants of relational governance and performance: How to manage business relationships?. *Industrial Marketing Management*, *32*(8), 703-716. https://doi.org/10.1016/j.indmarman.2003.06.010

Das, T. K., & Teng, B. S. (1998). Between trust and control: Developing confidence in partner cooperation in alliances. *Academy of Management Review*, *23*(3), 491-512. https://doi.org/10.5465/amr.1998.926623

Di Maddaloni, F., & Davis, K. (2018). Project manager's perception of the local communities' stakeholder in megaprojects. An empirical investigation in the UK. *International Journal of Project Management*, *36*(3), 542-565. https://doi.org/10.1016/j.ijproman.2017.11.003

Doloi, H. (2009). Relational partnerships: the importance of communication, trust and confidence and joint risk management in achieving project success. *Construction Management & Economics*, *27*(11), 1099-1109. https://doi.org/10.1080/01446190903286564

Dyer, J. H., & Chu, W. (2003). The role of trustworthiness in reducing transaction costs and improving performance: Empirical evidence from the United States, Japan, and Korea. *Organization Science*, *14*(1), 57-68. https://doi.org/10.1287/orsc.14.1.57.12806

Fink, D. (2016). *Project risk governance: Managing uncertainty and creating organisational value*.UK: Routledge. https://doi.org/10.4324/9781315602486

Flyvbjerg, B., Bruzelius, N., & Rothengatter, W. (2003). *Megaprojects and risk: An anatomy of ambition*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781107050891

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 39-50. https://doi.org/10.2307/3151312

Gil, N. (2009). Developing cooperative project client-supplier relationships: How much to expect from relational contracts?. *California Management Review*, *51*(2), 144-169. https://doi.org/10.2307/41166484

Goo, J., Kishore, R., Rao, H. R., & Nam, K. (2009). The role of service level agreements in relational management of information technology outsourcing: an empirical study. *MIS Quarterly*, *33*(1), 119-145. https://doi.org/10.2307/20650281

Greif, A. (2006). *Institutions and the path to the modern economy: Lessons from medieval trade*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511791307

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory & Practice*, *19*(2), 139-152. https://doi.org/10.2753/MTP1069-6679190202

Harper, C. M., Molenaar, K. R., & Cannon, J. P. (2016). Measuring constructs of relational contracting in construction projects: The owner's perspective. *Journal of Construction Engineering & Management*, *142*(10), 04016053. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001169

Hartmann, A., & Bresnen, M. (2011). The emergence of partnering in construction practice: an activity theory perspective. *Engineering Project Organization Journal*, *1*(1), 41-52. https://doi.org/10.1080/21573727.2010.549609

Hartmann, A., Davies, A., & Frederiksen, L. (2010). Learning to deliver service-enhanced public infrastructure: balancing contractual and relational capabilities. *Construction Management & Economics*, *28*(11), 1165-1175. https://doi.org/10.1080/01446193.2010.521942

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. *Social Science Electronic Publishing*, *20*(4), 277-319. https://doi.org/10.1108/S1474-7979(2009)0000020014

Hill, C. W. (1990). Cooperation, opportunism, and the invisible hand: Implications for transaction cost theory. *Academy of Management Review*, *15*(3), 500-513. https://doi.org/10.5465/amr.1990.4309111

Hu, Y., Chan, A. P. C., Le, Y., & Jin, R. Z. (2013). From construction megaproject management to complex project management: Bibliographic analysis. *Journal of Management in Engineering*, *31*(4), 04014052. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000254

Jaafari, A. (2001). Management of risks, uncertainties and opportunities on projects: time for a fundamental shift. *International Journal of Project Management*, *19*(2), 89-101. https://doi.org/10.1016/S0263-7863(99)00047-2

Jap, S. D., & Anderson, E. (2003). Safeguarding interorganizational performance and continuity under ex post opportunism. *Management Science*, *49*(12), 1684-1701. https://doi.org/10.1287/mnsc.49.12.1684.25112

Jeffries, F. L., & Reed, R. (2000). Trust and adaptation in relational contracting. *Academy of Management Review*, *25*(4), 873-882. https://doi.org /10.5465/amr.2000.3707747

Ke, W., & Wei, K. K. (2007). Factors affecting trading partners' knowledge sharing: Using the lens of transaction cost economics and socio-political theories. *Electronic Commerce Research & Applications*, *6*(3), 297-308. https://doi.org/10.1016/j.elerap.2006.06.006

Kennedy, L. (2015). The politics and changing paradigm of megaproject development in metropolitan cities. *Habitat International*, *45*, 163-168. https://doi.org/10.1016/j.habitatint.2014.07.001

Kimel, D. (2007). The choice of paradigm for theory of contract: Reflections on the relational model. *Oxford Journal of Legal Studies*, *27*(2), 233-255. https://doi.org/10.1093/ojls/gqm003

Lahdenperä, P. (2012). Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery. *Construction Management & Economics*, *30*(1), 57-79. https://doi.org/10.1080/01446193.2011.648947

Li, H., Arditi, D., & Wang, Z. (2013). Factors that affect transaction costs in construction projects. *Journal of Construction Engineering and Management*, *139*(1), 60-68. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000573

Li, Y., Lu, Y., Ma, L., & Kwak, Y. H. (2018). Evolutionary governance for Mega-Event Projects (MEPs): A case study of the World Expo 2010 in China. *Project Management Journal*, *49*(1), 57-78. https://doi.org/10.1177/875697281804900105

Ling, F. Y. Y., Ke, Y., Kumaraswamy, M. M., & Wang, S. Q. (2014). Key relational contracting practices affecting performance of public construction projects in China. *Journal of Construction Engineering & Management*, *140*(1), 156-165. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000781

Liu, Y., Luo, Y., & Liu, T. (2009). Governing buyer-supplier relationships through transactional and relational mechanisms: Evidence from China. *Journal of Operations Management*, *27*(4), 294-309. https://doi.org/10.1016/j.jom.2008.09.004

Liu, Y., Keller, R. T., & Shih, H. A. (2011). The impact of team-member exchange, differentiation, team commitment, and knowledge sharing on R&D project team performance. *R&D Management*, *41*(3), 274-287. https://doi.org/10.1111/j.1467-9310.2011.00636.x

Loch, C. H., Demeyer, A., & Pich, M. T. (2006). *Managing the unknown: A new approach to managing high uncertainty and risk in projects*. New Jersey: Wiley & Sons, Inc. https://doi.org/10.1002/9780470172377

Love, P. E. D., Ackermann, F., Teo, P., & Morrison, J. (2015). From individual to collective learning: A conceptual framework for enacting rework prevention. *Journal of Construction Engineering & Management*, *141*(11), 05015009. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001013

Lu, P., Guo, S., Qian, L., He, P., & Xu, X. (2015). The effectiveness of contractual and relational governances in construction projects in China. *International Journal of Project Management*, *33*(1), 212-222. https://doi.org/10.1016/j.ijproman.2014.03.004

Lu, Y., Luo, L., Wang, H., Le, Y., & Shi, Q. (2015). Measurement model of project complexity for large-scale projects from task and organization perspective. *International Journal of Project Management*, *33*(3), 610-622. https://doi.org/10.1016/j.ijproman.2014.12.005

Macneil, I. R. (1978). Contracts: Adjustment of long-term economic relations under classical, neoclassical and relational contract law. *Northwestern University Law Review*, *72*(6), 854-905.

Manley, K., & Chen, L. (2017). Collaborative learning to improve the governance and performance of infrastructure projects in the construction sector. *Journal of Management in Engineering*, *33*(5), 04017030. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000545

Marrewijk, A. V., & Smits, K. (2016). Cultural practices of governance in the Panama Canal Expansion Megaproject. *International Journal of Project Management*, *34*(3), 533-544. https://doi.org/10.1016/j.ijproman.2015.07.004

Mok, K. Y., Shen, G. Q., & Yang, J. (2015). Stakeholder management studies in mega construction projects: A review and future directions. *International Journal of Project Management*, *33*(2), 446-457. https://doi.org/10.1016/j.ijproman.2014.08.007

Ning, Y., & Ling, F. Y. Y. (2015). The effects of project characteristics on adopting relational transaction strategies. *International Journal of Project Management*, *33*(5), 998-1007. https://doi.org/10.1016/j.ijproman.2014.12.006

Noorderhaven, N. G. (1995). Transaction, interaction, institutionalization: Toward a dynamic theory of hybrid governance. *Scandinavian Journal of Management*, *11*(1), 43-55. https://doi.org/10.1016/0956-5221(94)00025-D

North, D. C. (2005). *Understanding the process of economic change*. Princeton: Princeton University Press. https://doi.org/10.1515/9781400829484

Pinto, J. K., Slevin, D. P., & English, B. (2009). Trust in projects: An empirical assessment of owner/contractor relationships. *International Journal of Project Management*, *27*(6), 638-648. https://doi.org/10.1016/j.ijproman.2008.09.010

PM Institute. (2008). *Project human resource management*. New Jersey: John Wiley & Sons, Inc.

Poppo, L., & Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or complements?. *Strategic Management Journal*, *23*(8), 707-725. https://doi.org/10.1002/smj.249

Rahman, M. M., & Kumaraswamy, M. M. (2012). Multicountry perspectives of relational contracting and integrated project teams. *Journal of Construction Engineering & Management*, *138*(4), 469-480. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000463

Sanderson, J. (2012). Risk, uncertainty and governance in megaprojects: A critical discussion of alternative explanations. *International Journal of Project Management*, *30*(4), 432-443. https://doi.org/10.1016/j.ijproman.2011.11.002

Sha, K. (2011). Vertical governance of construction projects: an information cost perspective. *Construction Management & Economics*, *29*(11), 1137-1147. https://doi.org/10.1080/01446193.2011.637939

Sha, K. (2016a). Understanding construction project governance: An inter-organizational perspective. *International Journal of Architecture, Engineering and Construction*, *5*(2), 117-127. https://doi.org/10.7492/IJAEC.2016.012

Sha, K. (2016b). Relational contracting in China's building sector: Potentialities and challenges. *International Journal of Architecture, Engineering and Construction*, *5*(4), 207-216. https://doi.org/10.7492/IJAEC.2016.020

Shenhar, A., & Holzmann, V. (2017). The three secrets of megaproject success: Clear strategic vision, total alignment, and adapting to complexity. *Project Management Journal*, *48*(6), 29-46. https://doi.org/10.1177/875697281704800604

Shervani, T. A., Frazier, G., & Challagalla, G. (2007). The moderating influence of firm market power on the transaction cost economics model: An empirical test in a forward channel integration context. *Strategic Management Journal*, *28*(6), 635-652. https://doi.org/10.2139/ssrn.920080

Sirisomboonsuk, P., Gu, V. C., Cao, R. Q., & Burns, J. R. (2018). Relationships between project governance and information technology governance and their impact on project performance. *International Journal of Project Management*, *36*(2), 287-300. https://doi.org/10.1016/j.ijproman.2017.10.003

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

Tennant, S., & Fernie, S. (2012). The commercial currency of construction framework agreements. *Building Research & Information*, *40*(2), 209-220. https://doi.org/10.1080/09613218.2012.655072

Van Assche, K., Beunen, R., Jacobs, J., & Teampau, P. (2011). Crossing trails in the marshes: rigidity and flexibility in the

governance of the Danube Delta. *Journal of Environmental Planning & Management*, *54*(8), 997-1018. https://doi.org/10.1080/09640568.2010.547687

Van Assche, K., Beunen, R., & Duineveld, M. (2013). *Evolutionary governance theory: an introduction*. UK: Springer.

Wang, D. D., Li, K. L., & Fang, S. Z. (2018). Analyzing the factors influencing trust in a construction project: evidence from a Sino-German eco-park in China. *Journal of Civil Engineering and Management*, *24*(4), 331-343. https://doi.org/10.3846/jcem.2018.3069

Wang, L., Yeung, J. H. Y., & Zhang, M. (2011). The impact of trust and contract on innovation performance: The moderating role of environmental uncertainty. *International Journal of Production Economics*, *134*(1), 114-122. https://doi.org/10.1016/j.ijpe.2011.06.006

Watabaji, M. D. (2014). Contractual and relational governances: Are they complementary or substitutable in the context of value chains. *European Journal of Business & Management*, *6*(1), 17-24.

Weber, L. (2014). Transaction cost economics and the cognitive perspective: investigating the sources and governance of interpretive uncertainty. *Academy of Management Review*, *39*(3), 344-363. https://doi.org/10.5465/amr.2011.0463

Williamson, O. E. (1975). *Market hierarchies: Analysis and antitrust implication*. New York: Free Press.

Williamson, O. E. (1979). Transaction-cost economics: the governance of contractual relations. *The Journal of Law and Economics 22*(2), 233-261. https://doi.org/10.1086/466942

Williamson, O. E. (1985). *The economic institutions of capitalism*. New York: Free Press.

Winch, G. (1989). The construction firm and the construction project: a transaction cost approach. *Construction Management & Economics*, *7*(4), 331-345. https://doi.org/10.1080/01446198900000032

Wit, A. D. (1988). Measurement of project success. *International Journal of Project Management*, *6*(3), 164-170. https://doi.org/10.1016/0263-7863(88)90043-9

Xue, J., Yuan, H., & Shi, B. (2016). Impact of contextual variables on effectiveness of partnership governance mechanisms in megaprojects: Case of Guanxi. *Journal of Management in Engineering*, *33*(1), 04016034. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000476

Yilmaz, C., Sezen, B., & Ozdemir, O. (2005). Joint and interactive effects of trust and (inter) dependence on relational behaviors in long-term channel dyads. *Industrial Marketing Management*, *34*(3), 235-248. https://doi.org/10.1016/j.indmarman.2004.07.005

Zheng, J., Roehrich, J. K., & Lewis, M. A. (2008). The dynamics of contractual and relational governance: Evidence from long-term public–private procurement arrangements. *Journal of Purchasing & Supply Management*, *14*(1), 43-54. https://doi.org/10.1016/j.pursup.2008.01.004

Zheng, X., Lu, Y., Le, Y., Li, Y., & Fang, J. (2018). Formation of interorganizational relational behavior in megaprojects: Perspective of the extended theory of planned behavior. *Journal of Management in Engineering*, *34*(1), 04017052. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000560