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INVESTIGATING THE IMPACT OF GOVERNMENTAL GOVERNANCE ON MEGAPROJECT PERFORMANCE: EVIDENCE FROM CHINA

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Abstract. Governmental governance is an emerging concept in the area of governance and is critical to the success of megaprojects. The aims of this study are to investigate the impact of governmental governance on megaproject performance and to identify the most critical component of governmental governance. To achieve these goals, a conceptual framework of governmental governance and a comprehensive framework of megaproject performance were established first, followed by proposing a research hypothesis that governmental governance could contribute to megaproject performance. To test the hypothesis, data collected by a questionnaire administered to 239 professionals were analyzed using partial least squares structural equation modelling. Results showed that governmental governance could contribute to megaproject performance significantly. It also reported that "public monitoring and scrutiny" was the most critical latent variable of governmental governance on megaproject performance, followed by "systemic risk management," "regulatory oversight," "construction of clean government," "strategic planning," and "institutional design." This study has contributed to the body of knowledge of governmental governance by investigating its impact on megaproject performance. The findings from this study are useful to the industry as well, because they can enhance practitioners' understanding of governmental governance, which could help them improve their management of megaprojects eventually.

Keywords: megaprojects, governmental governance, project governance, performance, structural equation modelling, China.

JEL Classification: G38, H19, L74.

Introduction

Over the past decades megaprojects have been increasingly built worldwide because they are crucial to economic growth and social prosperity (Hu et al., 2016; Söderlund et al., 2017).

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Despite the prosperity of megaprojects, it is a truism that megaprojects are confronted with various problems such as extreme technical and social complexity, poor delivery, poor performance of construction safety, and severe impact on society, human conditions, and environment (Callegari et al., 2018; Flyvbjerg, 2011). To address these problems, project governance, an approach that is beyond management and dealing with complexity, has been widely used in managing megaprojects, trying to ensure the success of megaprojects (Müller & Lecoeuvre, 2014; Pitsis et al., 2014; van Marrewijk & Smits, 2016).

Project governance refers to a management mechanism that defines objectives for some project, devises the relevant means to achieve those objectives, and presents how project performance is monitored (Müller & Lecoeuvre, 2014). Good project governance can balance the control and trust between project stakeholders (Zwikael & Smyrk, 2015), enable an effective management process (ul Musawir et al., 2017), thereby improving project performance (OECD, 2017; Too & Weaver, 2014; Joslin & Müller, 2016). When it comes to the realm of megaprojects, project governance is usually extended to the institutional level and macro environment (Morris & Geraldi, 2011), and refers mainly to the oversight of government in leading and managing megaprojects (Gil & Lundrigan, 2012). Considering the special role that government has played in managing megaprojects, Zhai et al. (2017) proposed the concept of governmental governance, which is a particular type of management framework that is developed for megaprojects, where government plays a vital role and the top-down management methods featured in administrative power are widely adopted to ensure project success. Furthermore, Ma et al. (2017) developed a megaproject governance framework from the view of "business–government–society", in which government relates the hierarchical governance. Brunet and Aubry (2016) and Cardenas et al. (2017) also examined the concept of governmental governance. They pointed out that the primary goal of implementing governmental governance is to achieve the legitimacy, accountability, efficiency, and resilience of megaprojects.

Recently, governmental governance has been increasingly adopted in managing megaprojects worldwide. For examples, the United States Department of Energy has adopted an alliance network combining government and the public to manage megaprojects in the field of energy (Peterman et al., 2014). Norwegian government established a government-featured hierarchical control regime to manage megaprojects, in which the governance flows from top government agencies down to the project level (Klakegg et al., 2008). In The United Kingdom, government plays a major role in supervising megaprojects. For instance, the Office of Government Commerce will establish guidelines for megaproject implementation; the Major Project Authority needs to report the construction status annually; and the National Audit Office is responsible for reviewing the report (Klakegg et al., 2016). Despite the increasing adoption of governmental governance, few studies have been done to examine the interrelationships between governmental governance and megaproject performance. As a result, this study aims to fill in the knowledge gap by conducting an empirical research to examine the possible interrelationships between governmental governance and megaproject performance.

The research efforts of this study were conducted under the context of China. In China, most megaprojects are led by an organization named *headquarter*, which is created by the government to coordinate the overall project progress and delivery (Li et al., 2019; Zhai

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et al., 2017). Over the past two decades, private capital has quickly flowed into the megaproject sector of China. However, Chinese governments, including the Central and Local levels, still play a primary role in managing megaprojects of the country. For instance, the Central government is responsible for initiating megaprojects, guiding, and coordinating the implementation of megaprojects at a high level, while the Local government is in charge of the megaproject construction (Chi et al., 2011; Lin et al., 2015). Additionally, the Local government will also help on some pre-construction matters such as acquisition of lands and relocation of the people who are affected by the megaproject construction (Dickson et al., 2016; Haveman et al., 2017). Thus, it can be observed that governmental governance has a widespread adoption in China, making China a good and suitable context to conduct the research. Similar to western countries, governmental involvement in megaprojects has been criticized for offering insufficient support (Bennon et al., 2017), making the megaproject more susceptible to corruption (Locatelli et al., 2017), even reduces the chance of success (Sallinen et al., 2011). However, it has not been able to rule out the possibility that in Chinese cases governmental governance might favorably influence the performance of projects (Ren, 2017; Wang, 2014; Zhu et al., 2018).

To achieve the goal of the research, this paper conducted a comprehensive literature review first. Then, using the information gathered from literature review, this paper established a theoretical framework of governmental governance and a framework of megaproject performance, respectively. After that, a hypothesis that governmental governance can contribute to the performance of megaprojects was suggested. Lastly, the hypothesis was tested using the approach of partial least squares structural equation modelling.

Although there has been considerable research on megaproject governance, for example the adoption of relational governance in the management of megaprojects (Chi et al., 2011), culture-based governance in megaprojects (van Marrewijk & Smits, 2016), evolutionary organizational governance in megaprojects (Lu et al., 2015), megaproject societal governance (Ma et al., 2017), evolutionary governance in a changing environment and its impact (Li et al., 2018, 2019), few of them looked into governmental governance, let alone the investigation of the interrelationships between governmental governance and megaproject performance. Thus, this study should make contribution to the field of governance research. Besides, as this study presented the experiences learned from the real megaprojects, it should prove to be valuable to industry practitioners, because they can enhance their understandings of governmental governance and thereby improve their management and implementations of megaprojects.

1. Conceptual framework

1.1. Governmental governance in megaproject

Although the notion of governmental governance is relatively new to megaproject management, it has been widely recognized by considerable studies that government is a powerful stakeholder of megaprojects and has played a critical role in managing such type of projects (Sallinen et al., 2011). For instance, Shiferaw et al. (2012) introduced a project governance framework that was established by the Ethiopian government, and they claimed that the

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active intervention by government is one of the top three most important components of the framework. Sallinen et al. (2013) achieved a similar conclusion that government was the most important stakeholders of megaprojects in the nuclear industry. Gil and Lundrigan (2012) and Aubry et al. (2014) found that appointing a top governance committee with most of the committee members from government is helpful to the successful implementation of megaprojects. Peterman et al. (2014) conducted a series of case studies and found that governments was the best party to coordinate the complicated relationships of the different stakeholders of megaprojects. Grubbauer and Čamprag (2018) further explained the power of coordination runs not only between different levels of government, but also between public and private stakeholders, based on governmental regulation. Li et al. (2019) elaborated a megaproject governance model in a transportation hub project and found higher hierarchical governance led to better project performance. Despite the positive governmental influence on megaprojects, some argue that active governmental involvement may limit project success (Sallinen et al., 2011). Together these studies provide insights into the importance of government in megaprojects.

Partidário and Coutinho (2011) pointed out that the government's strategic planning is the key decision factor in front-end phase of airport projects. Locatelli et al. (2015) investigated 12 large power plants and highlighted that megaprojects must fit in the long-term plan of the government. Similarly, Papke-Shields and Boyer-Wright (2017) claimed that a feasible strategic plan made by governments would be helpful to the implementation of megaprojects, especially to the handling of the unanticipated difficulties in megaprojects. OECD (2017) also highlighted the importance of government's planning in conducting megaprojects and emphasized that establishing a standard plan procedure and having a clear budget al.ocation are extremely important.

Regulatory oversight of megaprojects has been widely discussed by prior studies. Stoney and Krawchenko (2012) pointed out that adequate supervision for megaprojects by government is crucial. A. Toivonen and P. U. Toivonen (2014) examined the potent governance mechanisms in controlling and monitoring megaprojects. Also, a multi-level regulatory system in regard to the multi-level nature of megaprojects benefits the successful project delivery (Biesenthal & Wilden, 2014; Hu et al. 2018).

Ng et al. (2012) pointed out that public participation should be allowed by the government throughout the whole project lifecycle, which has been usually ignored yet (Xie et al., 2017). To improve the transparency in managing megaprojects, World Bank (2016)suggested that the government should release important information of megaprojects opportunely and regularly, such as taking the media as a governance mechanism (Bednar, 2012), and establishing agency to audit and assess performance of megaprojects (Klakegg et al., 2016).

As noted in previous studies, lacking mature legislative systems could lead to corruption in megaprojects (Locatelli et al., 2017; Shan et al. 2015a, 2015b). Ming Shan et al. (2015a) suggested that the government should build rules and regulations to improve process transparency to proactively prevent corruption practices both in government officials and construction enterprises. The OECD Integrity Framework for Public Investment (OECD, 2016) proposed a set of measures seeking to safeguard integrity of megaprojects. Locatelli et al. (2017) used Italian high-speed railways to explain the corruption project context and pro-

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vided strategies such as establishing transparent benefit tracking record. Zhang et al. (2017) reported that stricter regulations and relationship between governmental officials and stakeholders should be given priority.

To increase megaprojects' capacity in adapting to disruptive events, OECD (2017) recommended several solutions, including establishing a governmental organization particularly responsible for emergency management, developing a comprehensive plan for risk management, and referring to the past experiences. Similarly, Vahanvati and Mulligan (2017) also suggested that establishing a particular governmental organization responsible for emergency management is a necessity to managing megaproject. The researchers also highlighted that the primary missions of the organization are to establish and prioritize the various actions that will be used to deal with emergency issues.

Based on the literature review presented above, it can be found that government has made considerable efforts in managing megaprojects. These efforts can be categorized into six aspects, including strategic planning (SP), institutional design (ID), regulatory oversight (RO), public monitoring and scrutiny (PMS), construction of clean government (CCG), and systemic risk management (SRM). Thus, a framework of governmental governance was created in this study. Constructs and the relevant observed variables of the framework are shown in Table 1.

Table 1. Proposed framework of governmental governance

Latent variables	Code	Observed variables	Sources
Strategic Planning (SP)	SP11	Presence of a feasible strategic plan	(OECD, 2017; Papke-Shields & Boyer-Wright, 2017; Brookes and Locatelli, 2015)
	SP12	Budget al.ocation to projects in plan	(OECD, 2017; Peterman et al., 2014)
	SP13	Dedicated procedure for governing the project	(OECD, 2017; Zhang et al., 2017)
	SP14	Formal top governance committees or platforms to make decision	(OECD, 2017; Aubry et al., 2014; Bennon et al., 2017)
Institutional Design (ID)	ID21	A clear set of documents of responsibilities for all levels of government involved	(OECD, 2017; Peterman et al., 2014)
	ID22	Formal set of criteria to determine how to deliver the project	(Lundrigan et al., 2015; OECD, 2017)
	ID23	Formal co-ordination mechanisms (such as meetings) are frequently used and produce clear outputs/outcomes	(Zwikael & Smyrk, 2015; OECD, 2017)
	ID24	Informal co-ordination mechanisms (such as private communications) are frequently used between government and stakeholders	(Zwikael & Smyrk, 2015; Chi et al., 2011; A. Toivonen & P. U. Toivonen, 2014)
	ID25	Incentives for high-performance co-ordination from higher levels of government	(OECD, 2017)

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End of Table 1

Latent variables	Code	Observed variables	Sources
Regulatory \Oversight (RO)	RO31	Powerful regulatory mechanism for the project	(Stoney & Krawchenko, 2012; OECD, 2017)
	RO32	Multi-level regulatory systems for the project	(Biesenthal & Wilden, 2014; OECD, 2017)
	RO33	Independent regulatory authority for the project	(OECD, 2017; Loch et al., 2017)
	RO34	Regulatory authority governs the project within legal authority	(Stoney and Krawchenko, 2012; OECD, 2017)
	RO35	Confidence of stakeholders enhanced by the regulatory mechanisms	(OECD, 2017)
Public Monitoring and Scrutiny (PMS)	PMS41	Transparent plans for the project	(Ng et al., 2012; OECD, 2017)
	PMS42	The public can question and give advice in the planning phase	(Liu et al., 2016; Shi et al., 2015; Ma et al., 2017; Xie et al., 2017)
	PMS43	The public can participate in the project in the construction phase	(Ng et al., 2012; Zhao, 2010; Xie et al., 2017)
	PMS44	Disclosure of data in an open format on a dedicated website	(OECD, 2017; Zhang et al., 2017; Bednar, 2012)
	PMS45	Dedicated procedure for balancing the interests between public and private parties	(OECD, 2017)
	PMS46	Presence of a sound audit system	(OECD, 2017; Papke-Shields & Boyer-Wright, 2017)
	PMS47	Disclosure of audit results	(OECD, 2017; Mok et al., 2017)
Construction of clean government (CCG)	CCG51	Conflict of interest policies for government officials	(OECD, 2017)
	CCG52	Internal system to monitor and identify irregularities	(Locatelli et al., 2017; OECD, 2017)
	CCG53	Measures in place to identify the integrity of all participants	(OECD, 2017; Chi et al., 2011)
	CCG54	Mechanisms to report illegal behaviors related to megaprojects	(OECD, 2017; Bednar, 2012)
Systemic risk management (SRM)	SRM61	Ability to determine the disaster prioritization	(Vahanvati & Mulligan, 2017)
	SRM62	The presence of government agencies answerable for post-disaster reconstruction	(OECD, 2017)
	SRM63	The presence of a disaster risk assessment plan	(OECD, 2017)
	SRM64	The presence of emergency rescue system	(Vahanvati & Mulligan, 2017)
	SRM65	Mechanisms in place to learn from past events	(Söderlund et al., 2017)

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1.2. Megaproject performance

It is important and necessary to assess the performance of megaprojects, because project performance assessment is a good strategy to check whether the established objectives of the project are successfully achieved or not (Gil & Lundrigan, 2012). Recently, an increasing number of studies have started looking into some particular performance of megaprojects. For instance, Flyvbjerg et al. (2003) pointed out the poor performance of megaprojects in terms of economy, environment and public support. Toor and Ogunlana (2010) extend the traditional iron triangle (cost, schedule and quality) to a three-layer performance measurement criteria for megaprojects, including safety, efficiency, effectiveness, satisfaction, and reduced conflicts. Hu et al. (2016) proposed a framework to value the program organization performance of Chinese megaprojects. The proposed framework consists of four types of performance which are cost performance, functionality and quality performance, time performance, and occupational health and safety performance. Xie et al. (2017) assessed the public participation performance of public construction projects. Shenhar and Holzmann (2017) gauged the success of megaprojects using a framework that has dimensions: efficiency, customer, business/financial, and society. Besides traditional objectives, social and environmental concerns in megaprojects have recently received more attention (Ma et al., 2017; Lin et al., 2018). To achieve sustainability, relevant stakeholders including governments are required to take economic, legal, ethical and political responsibilities (Lin et al., 2017; Ghosh et al., 2014). Whether megaprojects objectives are in line with the governmental goals is crucial component of project strategic management, having consequences in various policy arenas (e.g., environmental and social stability maintenance), as well as adapting the project to its complex circumstance (OECD, 2017; Shenhar & Holzmann, 2017).

Additionally, considerable studies have assessed the performance of generic construction projects. Some of these studies are widely recognized and have been highly cited. For example, Ling et al. (2009) considered project performance measurements as cost, schedule, quality, owner satisfaction, profitability and public satisfaction. In Eriksson and Westerberg (2011)'s study, project performance was evaluated by cost, time, quality, environmental impact, work environment, and innovation. Hanna et al. (2014) provided a mathematical formulation to assess the performance of construction projects on the basis of customer satisfaction, schedule, cost, profit, and communication. Similarly, Chen and Manley (2014) adopted a comprehensive framework consisting of eight dimensions to measure the performance of construction projects. The eight dimensions include cost efficiency, time efficiency, quality, collaboration, innovation, safety, environmental and community impact. Joslin and Müller (2016) showed that project success correlated with project governance significantly. Similar conclusions can be found in Ul Haq et al. (2018) and Ghosh et al. (2014).

In light of the existing literature, this study proposed a comprehensive framework that can assess the performance of megaprojects, which is comprised of three latent variables: primary goals of project (PGP), stakeholder satisfaction (SS) and sustainability of project (SoP). PGP measures the achievement of the major goals of a project, such as the schedule,

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budget, quality, health and safety, and functionality. SS measures the satisfactions of various stakeholders of megaprojects, including the government, the public, as well as the major contracting parties like contractors, consultancies, and suppliers. SoP measures the sustainability of project in terms of environmental sustainability and social sustainability. Details of the three latent variables and the relevant observed variables are shown in Table 2.

Table 2. Proposed framework of megaproject performance

Latent variables	Code	Observed variables	Sources
Primary goals of the project (PGP)	PGP1	Completed within schedule	(Flyvbjerg et al., 2003; Toor & Ogunlana, 2010)
	PGP2	Completed within budget	(Flyvbjerg et al., 2003; Toor & Ogunlana, 2010)
	PGP3	Completed with high quality	(Flyvbjerg et al., 2003; Toor & Ogunlana, 2010)
	PGP4	Meeting the health and safety requirements	(Xie et al., 2017; Hu et al., 2016)
	PGP5	Meeting the functional requirements	(Shenhar & Holzmann, 2017)
Stakeholder satisfaction (SS)	SS1	Governments are satisfied with the project	(Flyvbjerg, 2014; Crawford & Helm, 2009)
	SS2	The public are satisfied with the project	(Xie et al., 2017; Hanna et al., 2014; Di Maddaloni & Davis, 2017)
	SS3	The stakeholders (e.g., contractors) are satisfied with the project	(Toor & Ogunlana, 2010; Pinto et al., 2009; Hanna et al., 2014)
Sustainability of project (SoP)	SoP1	Environment-friendly (e.g., the project prevents or mitigates the negative environmental impact on local community)	(Chen & Manley, 2014; Xie et al., 2017)
	SoP2	Durability (e.g., the project will not be eliminated too soon)	(Toor & Ogunlana, 2010)
	SoP3	Social harmony and stability	(Xie et al., 2017; Shenhar & Holzmann, 2017)

1.3. Hypothesis development

In order to check the possible impact of governmental governance imposed on megaproject performance, a hypothesized structural equation model was established, as shown in Figure 1. The development of the model adopted the approach recommended by (Wetzels et al., 2009), which makes measurement and hierarchical models as interpretable as possible. The model consists of nine measurement models and one structural model. Governmental governance in the hypothesis model is considered as six-dimensional and second-order variable composed of strategic planning, institutional design, regulatory oversight, public monitoring and scrutiny, construction of clean government, and systemic risk management. Megaproject performance is deemed as a three-dimensional and second-order variable composed primary goals of project, stakeholder satisfaction and sustainability of project. Based on previous stud-

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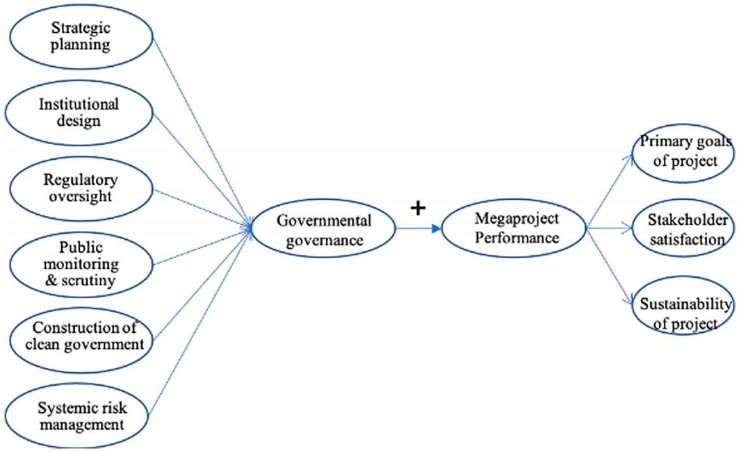

Figure 1. The hypothesized structural equation model of governmental governance and megaproject performance

ies mentioned above, the structural model measures the relationships between governmental governance and megaproject performance, hypothesizing that governmental governance can help improve the performance of megaprojects. The impacts of governmental governance imposed on megaproject performance can be revealed by testing the hypothesized model.

2. Research methods and data presentation

Various research methods, such as structured interview, questionnaire, and post-survey interviews, were adopted in this study. By using multiple methods, consistent relationships among variables can be detected, which brings greater confidence in tests of the hypotheses(Abowitz & Toole, 2010). It was expected that multi-dimensional results could triangulate and enhance the study's validity and reliability.

In the research of construction management, structured interviews with experienced industry experts are widely used to define the central themes of some specific research subject (Hwang et al., 2018b; Shan et al., 2017; Zhao & Singhaputtangkul, 2016). Thus, this study used structured interview as instrument to verify the theoretical framework of governmental governance and megaproject performance that were established from literature review. Because the framework is based on international research, before adopting them to develop the questionnaire, all variables should be verified through interviews. Interviews were conducted between May and July 2017 with 35 experts who are mainly from industry and academy. The interviewees were identified from the network of the research institution that the authors affiliate. Additionally, to maintain a sound understanding of the research study, only experts who hold senior positions within their organizations were invited. The profile of the interviewees is presented in Table 3 and the diversity of the backgrounds among the experts was expected to increase the quality and reliability of the results of the interviews.

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Table 3. Interviewee profile

Profile	Category	Number	%
Institution	Government	5	14.29
	Client	12	34.29
	Academic	2	5.71
	Consultant	7	20.00
	Designer	3	8.57
	Contractor	6	17.14
Position	Division chief	5	14.29
	Project manager	9	25.71
	Deputy director	2	5.71
	Senior engineer	7	20.00
	Department manager	12	34.29
Years of experience in megaprojects	Less than 5 years	1	2.86
	5–10	14	40.00
	11–20	15	42.86
	21–30	3	8.57
	More than 30 years	2	5.71
The types of the megaprojects conducted	Transportation	13	37.14
	Energy	3	8.57
	Water conservancy project	8	22.86
	Unban infrastructure	11	31.43
Working place	North-eastern China	3	8.57
	Eastern China	15	42.86
	Central China	4	11.43
	Western China	13	37.14

Table 4. Profile of questionnaire respondents

Description	Number	Percentage
Year of experience in megaprojects		
1–5 years	53	22.20%
6–10 years	98	41.00%
11–20 years	65	27.20%
21–30 years	23	9.60%
Institutions		
Government	7	2.90%
Client	83	34.70%
Designer	20	8.40%
Contractor	58	24.30%

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End of Table 4

Description	Number	Percentage
Consultant	63	26.40%
Research Institution	8	3.30%
Positions		
Top managerial level (e.g., director, general manager)	46	19.20%
Middle managerial level (e.g., project manager)	115	48.10%
Professional (e.g., engineer, quantity surveyor)	78	32.60%

Questionnaire has been long established in construction engineering and management research to present detailed analysis of the views of professionals on some particular topic in construction engineering and management research (Chen et al., 2019; Hwang et al., 2018a). Thus, this study adopted questionnaire to gather the perceptions of the professionals regarding the observed variables in the frameworks of governmental governance and megaproject performance. Based on the results obtained from the structured interviews, a questionnaire was formulated, in which the respondents were asked to indicate their endorsement on the observed variables of governmental governance and megaproject performance. The population of the survey targets governmental officials, clients, contractors, consultants, and academics who have experiences in conducting megaprojects in China. Following the recommendation of Shan et al. (2017), the questionnaire used a nonprobability sampling approach which is expert sampling. Under such sampling approach, some qualified experts are selected and then invited to fill in the questionnaire. This is because there are too many officials, professionals, and academics qualified for the questionnaire and it would be extremely difficult to survey them all. Specifically, 1000 experts from 1000 megaprojects in ten major cities of China, namely Beijing, Shanghai, Chongqing, Guangzhou, Shenzhen, Chengdu, Xi'an, Nanjing, Zhengzhou, and Changchun were contacted for data collection (100 projects for each city). The contacts of these experts were obtained from the Megaproject Offices of these cities, with the help of the networks of the research team's institution. Electronic copies of the questionnaire were sent to experts via emails and 297 replies were returned. After a careful visual examination, 58 replies were excluded due to low level of completeness. Lastly, 239 valid replies were obtained. The profile of the respondents and the information of the projects those respondents have conducted are presented in Tables 4 and 5, respectively. From Table 4 we can see that two-thirds of the respondents are holding management positions in their organizations and nearly 40 percent of them have over ten years of experiences in working on megaprojects. This implies that the respondent panel is familiar with the governance topic and also experienced enough for the questionnaire.

Partial least squares-structural equation modeling (PLS-SEM) was used to test the hypothesized structural equation model, using the data collected by the questionnaire. This approach was adopted due to the following advantages: (1) being able to address complex problems with a relatively small sample size, and (2) having no particular requirement for data distribution (Shan et al., 2017; Zhao et al., 2018). Following the recommendation of Hair et al. (2011), three indicators were used to check the test results of measurement models, which

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Table 5. Profile of megaprojects participated by questionnaire respondents

Description	Number	Percentage
Project type		
Transportation	67	28.0%
Energy	18	7.5%
Water safety	37	15.5%
Urban infrastructure	112	46.9%
Ocean engineering	5	2.1%
Project Cost		
Less than CNY 1 billion (approx. USD 0.15 billion)	42	17.6%
CNY 1–2 billion (approx. USD 0.15–0.3 billion)	82	34.3%
CNY 2–3 billion (approx. USD 0.3–0.45 billion)	61	25.5%
CNY 3–4 billion (approx. USD 0.45–0.6 billion)	21	8.8%
Over CNY 4 billion (approx. USD 0.6 billion)	33	13.8%
Project location		
Northeastern China	7	2.9%
Eastern China	142	59.4%
Central China	42	17.6%
Western China	48	20.1%

are composite reliability, loadings of observed variables, and average variance extracted; and critical t-value was used to check the test result of structural model (Hair et al., 2011). The test results of PLS-SEM will reveal whether the hypothesis of this research study is supported and which latent variable is more critical to megaproject performance.

The final stage of the study comprised post-survey interviews with five experts who worked in the same megaproject. Among those interviewees, two were from a developer whereas the other three were from government agency, consultancy, and main contractor, respectively. Results obtained from the questionnaire were presented to the experts to test the validity. Furthermore, the five experts were asked to provide in-depth explanations for the results wherever necessary. Each interview lasted from thirty minutes to one hour. The outputs of the post-survey interviews can triangulate the findings revealed by structural equation modelling analysis, making the findings of this study more convincing.

3. Results and discussions

3.1. Results of structured interviews

During the interviews, interviewees were requested to assess the applicability of the observed variables identified by the literature review, using a five-point Likert rating scale (i.e., 1 = very inapplicable, 2 = inapplicable, 3 = neutral, 4 = applicable, 5 = highly applicable). Furthermore, interviewees were encouraged to supplement new variables based on their practical experiences. To identify the valid observed variables of governmental governance

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and megaproject performance, mean scores of all observed variables were calculated and then applied to a cut off criterion of 3.0, following the recommendation of Hwang et al. (2018b). According to the results shown in Table 6, ID25 "incentives for high-performance co-ordination from higher levels of government" was removed as it received a mean of 2.943. Additionally, two new observed variables, namely "proper solutions for resettlement" and "labour emulation", were added by the interviewee panel to measure governmental governance, under the latent variables of "strategic planning" and "construction of clean government", respectively. Resettlement is involuntary to most of the residents affected by megaprojects (Jackson & Sleigh, 2000), and civil disorder might occur if the resettlement is poorly planned and managed (Shi et al. 2015). Labour emulation is designed by the construction authorities of China to develop friendly competition between organizations working on a same project, aiming to encourage the less advanced units to catch up with the more advanced one (Tung, 1981), and ultimately ensuring the whole success of the entire project. After the new observed variables were added, all the interviewees were contacted again to evaluate the supplement. While a minority of the interviewees mentioned that those two observed variables were not important, the majority agreed that they should be included into the observed variables assessing governmental governance. Table 6 presents all the observed variables of governmental governance and megaproject performance.

Table 6. Observed variables of governmental governance and megaproject performance

Latent variables	Code	Observed variables	Mean
Strategic Planning (SP)	SP11	Presence of a feasible strategic plan	3.857
	SP12	Budget al.ocation to projects in plan	4.114
	SP13	Dedicated procedure for governing the project	3.829
	SP14	Formal top governance committees or platforms to make decision	4.000
	SP15[a]	Proper solutions for resettlement in the front-end phase	4.029
Institutional Design (ID)	ID21	A clear set of documents of responsibilities for all levels of government involved	3.886
	ID22	Formal set of criteria to determine how to deliver the project	3.971
	ID23	Formal co-ordination mechanisms (such as meetings) are frequently used and produce clear outputs/outcomes	4.057
	ID24	Informal co-ordination mechanisms (such as private communications) are frequently used between government and stakeholders	3.686
	ID25[b]	Incentives for high-performance co-ordination from higher levels of government	2.943
Regulatory Oversight (RO)	RO31	Powerful regulatory mechanism for the project	3.857
	RO32	Multi-level regulatory systems for the project	3.971
	RO33	Independent regulatory authority for the project	3.686
	RO34	Regulatory authority governs the project within legal authority	3.571
	RO35	Confidence of stakeholders enhanced by the regulatory mechanisms	3.457

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End of Table 6

Latent variables	Code	Observed variables	Mean
Public Monitoring and Scrutiny (PMS)	PMS41	Transparent plans for the project	3.486
	PMS42	The public can question and give advice in the planning phase	3.286
	PMS43	The public can participate in the project in the construction phase	3.200
	PMS44	Disclosure of data in an open format on a dedicated website	3.657
	PMS45	Dedicated procedure for balancing the interests between public and private parties	3.514
	PMS46	Presence of a sound audit system	4.029
	PMS47	Disclosure of audit results	3.343
Construction of clean government (CCG)	CCG51	Conflict of interest policies for government officials	3.457
	CCG52	Internal system to monitor and identify irregularities	3.771
	CCG53	Measures in place to identify the integrity of all participants	3.829
	CCG54	Mechanisms to report illegal behaviors related to megaprojects	3.657
	CCG55[a]	labor emulations	4.029
Systemic risk management (SRM)	SRM61	Ability to determine the disaster prioritization	3.943
	SRM62	The presence of government agencies answerable for post-disaster reconstruction	4.057
	SRM63	The presence of a disaster risk assessment plan	3.714
	SRM64	The presence of emergency rescue system	4.086
	SRM65	Mechanisms in place to learn from past events	3.600
Primary goals of the project (PGP)	PGP1	Completed within schedule	4.200
	PGP2	Completed within budget	3.971
	PGP3	Completed with high quality	4.143
	PGP4	Meeting the health and safety requirements	3.971
	PGP5	Meeting the functional requirements	3.829
Stakeholder satisfaction (SS)	SS1	Governments are satisfied with the project	3.800
	SS2	The public are satisfied with the project	4.000
	SS3	The stakeholders (e.g., contractors) are satisfied with the project	3.714
Sustainability of project (SoP)	SoP1	Environment-friendly (e.g., the project prevents or mitigates the negative environmental impact on local community)	4.057
	SoP2	Durability (e.g., the project will not be eliminated too soon)	3.857
	SoP3	Social harmony and stability	3.971

Note: [a]SP15 and CCG55 were added by the interviewees; [b]ID25 was excluded with means loadings lower than 3.0.

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3.2. Test results of the hypothesized structural equation model

3.2.1. Evaluation of measurement models

Data was inserted into Smart PLS 2.0M3 to test the hypothesized model. The evaluation results of the measurement models are presented in Tables 7–9. It can be seen from Table 7 that the loadings of all observed variables are higher than 0.6, suggesting a satisfactory level of indicator reliability; all composite reliability values are larger than 0.70, suggesting the acceptable internal reliability of observed variables with their corresponding latent variables; and the values of average variance extracted are greater than 0.5, showing a satisfactory level of convergent validity for all the latent variables (Hair et al., 2011; Le et al., 2014; Liu et al., 2017; Zhao & Singhaputtangkul, 2016).

Table 8 shows that square root of each latent variable's average variance extracted is greater than its highest correlation with any other latent variable. Table 9 indicates that each observed variable's outer loading on the associated latent variable is greater than all of its cross loadings. These results suggest that the latent variables in the hypothesized model have a high discriminant validity (Hair et al., 2011).

Table 7. Measurement model evaluation

Latent variables	Code	Loading	t-value	AVE	CR
SP	SP11	0.864	50.364	0.688	0.917
	SP12	0.838	32.508		
	SP13	0.857	40.134		
	SP14	0.814	27.826		
	SP15	0.772	18.972		
ID	ID21	0.854	52.568	0.599	0.855
	ID22	0.778	18.126		
	ID23	0.831	33.044		
	ID24	0.611	8.726		
RO	RO31	0.870	33.151	0.748	0.937
	RO32	0.865	31.291		
	RO33	0.857	25.523		
	RO34	0.867	47.936		
	RO35	0.865	44.963		
PMS	PMS41	0.784	28.024	0.597	0.912
	PMS42	0.724	38.625		
	PMS43	0.761	24.505		
	PMS44	0.773	23.361		
	PMS45	0.767	24.547		
	PMS46	0.754	26.222		
	PMS47	0.741	22.623		

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End of Table 7

Latent variables	Code	Loading	t-value	AVE	CR
CCG	CCG51	0.780	20.182	0.647	0.901
	CCG52	0.827	26.886		
	CCG53	0.852	35.07		
	CCG54	0.849	41.61		
	CCG55	0.704	19.243		
SRM	SRM61	0.884	57.224	0.786	0.948
	SRM62	0.909	66.775		
	SRM63	0.883	60.581		
	SRM64	0.889	47.768		
	SRM65	0.857	41.96		
PGP	PGP1	0.747	17.564	0.684	0.915
	PGP2	0.796	28.864		
	PGP3	0.887	54.552		
	PGP4	0.857	32.525		
	PGP5	0.840	38.109		
SS	SS1	0.784	22.601	0.771	0.91
	SS2	0.904	105.003		
	SS3	0.910	78.422		
SoP	SoP1	0.818	29.517	0.703	0.876
	SoP2	0.813	28.436		
	SoP3	0.883	47.571		

Table 8. Correlation matrix and square root of average variance extracted of latent variables

	SP	ID	RO	PMS	CCG	SRM	PGP	SS	SoP
SP	0.830								
ID	0.814	0.774							
RO	0.780	0.769	0.865						
PMS	0.700	0.724	0.765	0.773					
CCG	0.654	0.713	0.725	0.766	0.804				
SRM	0.579	0.644	0.686	0.664	0.765	0.887			
PGP	0.552	0.587	0.539	0.627	0.639	0.647	0.827		
SS	0.456	0.504	0.461	0.601	0.619	0.593	0.769	0.878	
SoP	0.445	0.518	0.479	0.560	0.598	0.571	0.736	0.747	0.838

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Table 9. Cross loadings for observed variables under different latent variables

	SP	ID	RO	PMS	CCG	SRM	PGP	SS	SoP
SP11	**0.864**	0.701	0.667	0.655	0.594	0.537	0.544	0.454	0.471
SP12	**0.838**	0.661	0.645	0.558	0.530	0.449	0.429	0.342	0.326
SP13	**0.857**	0.697	0.658	0.583	0.574	0.525	0.470	0.404	0.357
SP14	**0.814**	0.647	0.631	0.520	0.515	0.451	0.386	0.305	0.293
SP15	**0.772**	0.670	0.634	0.581	0.491	0.430	0.451	0.377	0.388
ID21	0.746	**0.854**	0.709	0.672	0.638	0.560	0.550	0.467	0.482
ID22	0.697	**0.778**	0.590	0.559	0.489	0.423	0.403	0.330	0.306
ID23	0.642	**0.831**	0.678	0.570	0.633	0.588	0.514	0.434	0.464
ID24	0.386	**0.611**	0.461	0.411	0.419	0.400	0.312	0.308	0.330
RO31	0.678	0.734	**0.870**	0.634	0.619	0.576	0.473	0.346	0.420
RO32	0.609	0.690	**0.865**	0.620	0.575	0.531	0.462	0.372	0.435
RO33	0.681	0.627	**0.857**	0.622	0.576	0.546	0.396	0.326	0.343
RO34	0.685	0.666	**0.867**	0.679	0.679	0.647	0.450	0.464	0.406
RO35	0.713	0.728	**0.865**	0.743	0.675	0.654	0.539	0.475	0.462
PMS41	0.700	0.659	0.677	**0.784**	0.579	0.562	0.517	0.468	0.444
PMS42	0.543	0.580	0.650	**0.824**	0.607	0.603	0.487	0.451	0.424
PMS43	0.388	0.461	0.503	**0.761**	0.516	0.404	0.396	0.409	0.340
PMS44	0.515	0.544	0.556	**0.773**	0.583	0.496	0.495	0.475	0.438
PMS45	0.478	0.569	0.607	**0.767**	0.566	0.477	0.483	0.434	0.408
PMS46	0.648	0.604	0.615	**0.755**	0.643	0.503	0.529	0.504	0.540
PMS47	0.468	0.470	0.500	**0.741**	0.640	0.524	0.470	0.503	0.414
CCG51	0.482	0.552	0.560	0.668	**0.780**	0.506	0.467	0.419	0.442
CCG52	0.553	0.611	0.623	0.649	**0.827**	0.634	0.541	0.528	0.490
CCG53	0.503	0.575	0.616	0.650	**0.852**	0.646	0.528	0.572	0.511
CCG54	0.599	0.631	0.618	0.626	**0.849**	0.648	0.547	0.520	0.523
CG55	0.485	0.490	0.487	0.475	**0.704**	0.643	0.485	0.441	0.431
SRM61	0.492	0.542	0.574	0.598	0.712	**0.884**	0.591	0.528	0.521
SRM62	0.461	0.560	0.602	0.593	0.673	**0.909**	0.615	0.539	0.530
SRM63	0.557	0.603	0.648	0.595	0.659	**0.893**	0.589	0.540	0.565
SRM64	0.477	0.552	0.602	0.558	0.674	**0.889**	0.510	0.472	0.439
SRM65	0.575	0.595	0.613	0.600	0.673	**0.857**	0.559	0.546	0.472
PGP1	0.492	0.483	0.435	0.509	0.511	0.524	**0.747**	0.620	0.457
PGP2	0.410	0.416	0.404	0.510	0.508	0.451	**0.796**	0.600	0.577
PGP3	0.456	0.472	0.436	0.495	0.552	0.570	**0.887**	0.651	0.680
PGP4	0.496	0.572	0.507	0.549	0.570	0.589	**0.857**	0.616	0.653
PGP5	0.434	0.483	0.447	0.536	0.501	0.536	**0.840**	0.690	0.656
SS1	0.331	0.375	0.336	0.435	0.413	0.383	0.547	**0.784**	0.466
SS2	0.459	0.512	0.473	0.608	0.629	0.606	0.728	**0.934**	0.709
SS3	0.401	0.432	0.398	0.526	0.568	0.549	0.731	**0.910**	0.758
SoP1	0.414	0.470	0.452	0.482	0.526	0.567	0.661	0.642	**0.818**
SoP2	0.306	0.362	0.362	0.421	0.425	0.392	0.552	0.611	**0.813**
SoP3	0.393	0.464	0.388	0.502	0.546	0.470	0.634	0.625	**0.883**

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3.2.2. Evaluation of structural model

Table 10 shows the results of the path coefficients and the corresponding t-values of the structural model. It can be seen from Table 10 that the t-values of all the paths are greater than 2.58. This indicates that all these paths are statistically significant at the level of 0.01 (Hair et al., 2011). Particularly, the path coefficient between "governmental governance" and "megaproject performance" is significant (t-value = 15.946, $p < 0.01$) and has a high path coefficient of 0.708. This proves that the hypothesis of this study, namely "governmental governance" can help improve the performance of megaprojects, is supported. The results obtained from the PLS-SEM analysis are shown in Figure 2.

Table 10. Evaluation of structural model

Paths	Path coefficient	T-value	CR
SP –> GG	0.176	21.281	0.970
ID –> GG	0.130	23.067	
RO –> GG	0.200	25.075	
PMS –> GG	0.236	26.159	
CCG –> GG	0.185	22.685	
SRM –> GG	0.215	21.237	
MP –> PGP	0.942	106.755	0.942
MP –> SS	0.907	69.655	
MP –> SoP	0.883	56.766	

3.3. Critical components of governmental governance: from the view of megaproject performance

Based on the results of path coefficient of different latent variables of governmental governance, "public monitoring and scrutiny" was found to be the most critical component of governmental governance in sense of improving megaproject performance, followed by "systemic risk management", "regulatory oversight", "construction of clean government", "strategic planning" and "institutional design".

"Public monitoring and scrutiny" (PMS) was found to be the most critical component of governmental governance with a path coefficient of 0.236. In the past few years, public participation has been increasingly employed in the megaproject sector of China. Various approaches that can help increase public participation, such as consultative meetings, public hearings, surveys and workshops, have been widely adopted (Ng et al. 2012; Xie et al. 2017). Moreover, some evaluation systems of public participation widely used in democratic contexts also confirmed the improvement of public participation in China. For example, Arnstein (1969) proposed an eight-level scale that can be used to assess levels of citizen participation. According to Arnstein's scale, the degree of participation climbs up from nonparticipation to citizen power. The sixth level "partnership", at which power is "redistributed through negotiation between citizens and powerholders", fits for the majority of public participation in the megaproject sector of China. This is a favorable score and is mainly because many megaprojects in the transportation sector of China have adopted the approach of Public-Private Partnership which is a typical type of "partnership" (Xie et al. 2017; Zhang et al., 2018).

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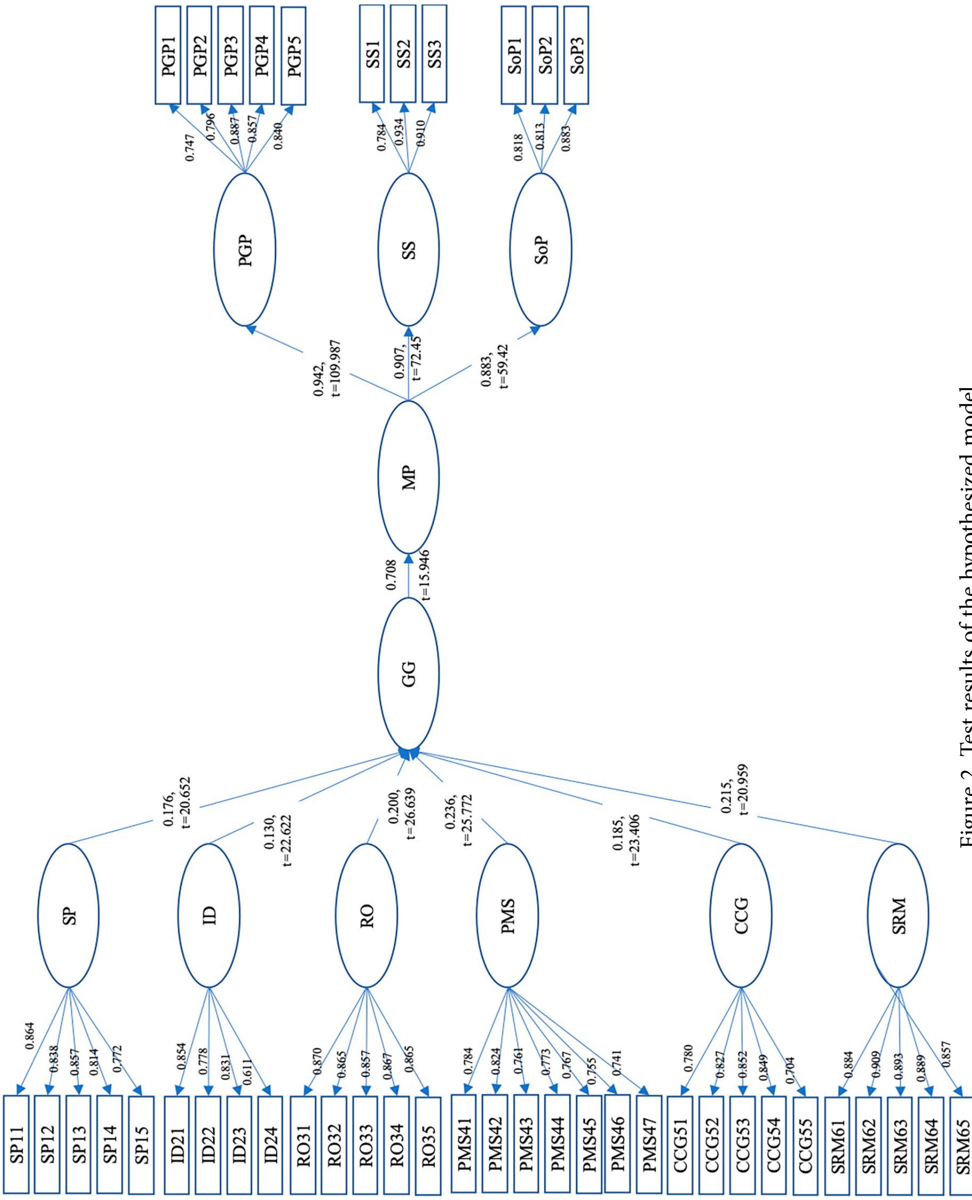

Figure 2. Test results of the hypothesized model

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As for the specific variables under PMS, public participation in the front-end phase (PMS42) had the highest factor loading (0.824) on PMS. Experience from developed countries is that the public should be involved in projects as early as possible (Flyvbjerg et al., 2003). The absence of public in front-end phase may be more challenging to megaprojects as obstructing construction process may cause social disorder and conflict (Liu et al., 2016; Shi et al., 2015), thus increasing the chance of project failure (Li et al., 2016; Ng et al., 2012). "Transparent plans for the project" (PMS41) had the second highest factor loading (0.784), and the disclosure of data in an open format on a dedicated website (PMS44) received the third highest loading (0.773). That is largely on account of the need for transparency across government's operations to enable the public to hold government bodies to account. Flyvbjerg et al. (2003) proposes that transparency is the main instruments of enforcing accountability in megaproject, which means the public shoulde get access to governmental information about megaprojects. The requirement of transparency is also based on the fact that megaprojects may affect human lives and livelihoods, and the public deserve being informed early, even to be pro-actively involved in the decision-making process.

"Systemic risk management" (SRM) is the second most critical component of governmental governance with a path coefficient of 0.215. Megaprojects might pose various challenges to the local community and government (Aarseth et al., 2017), and systemic risk management is strongly needed for addressing those challenges. The highest loading is the presence of designed authorities (SRM62), followed by presence of a disaster risk assessment plan (SRM63). The results match those observed in earlier studies (Bozza et al., 2017; Vahanvati & Mulligan, 2017). Setting strategic and tactical goals of sustainability is one of the main strategies advocated by the government agency (Aarseth et al., 2017). Lower factor loadings are "presence of emergency rescue system" (0.889) and "ability to determine the disaster prioritization" (0.884), which represent projects' response and their capability to deal more successfully with occurrence of risk, accident or disaster (Bozza et al., 2017). Although learning mechanism got the lowest factor loading (0.857), it is essential for improving response speed as emergency arise.

"Regulatory oversight" (RO) is the third most critical component of governmental governance with a path coefficient of 0.200. Under this latent variable, powerful regulatory mechanism (RO31) and legitimate regulatory authority (RO34) received the highest factor loadings (0.870 and 0.867). The government must retain regulatory oversight as an essential function, looking for approaches to improve quality of megaprojects and establish clear regulatory policy objectives. Oversight mechanism would be much more effective if governments adopt powerful and legitimate mechanism (Stoney & Krawchenko, 2012). There are local authorities with regulatory powers and legal departments of legislative branches in charge of producing regulations and supervising implementation of megaprojects in China. For instance, in Shanghai, an authority named "megaproject office" is established within Shanghai Housing and Urban-Rural Development Management Committee, aiming at putting efforts to enhance regulatory policy on local megaprojects. Furthermore, there are "megaproject offices" in every district under municipal government's jurisdiction. Those authorities constitute a multi-level regulatory system (RO32), which is in the model, received the third highest rank as well as enhanced stakeholder confidence (RO35). The former reflects multi-level

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governance trends in megaprojects (Biesenthal & Wilden, 2014), and the latter leads to the goal of oversight. The multi-layered governance mechanism can improve budgets' allocation while controlling the contingency drawdown (Flyvbjerg et al., 2016).

"Construction of clean government" (CCG) received a path coefficient of 0.185 and was the fourth most critical component of governmental governance. Opportunities for corruption, which is an international issue in both developing and developed countries (Besfamille, 2004), should be mitigated at each stage of the development of megaprojects. The highest factor loading (0.852) on this latent variable is measures to control the integrity of firms (CCG53). This accords with earlier observations in the interview with one expert, "there must be a pre-inspection system to inspect their previous projects. For example, if the on-site personnel were not as same as they proposed in bidding, we have reasons to believe that they may do so in our project. Hence, the company should be excluded." The result is also in line with those of previous studies showing measurement and causes of corruption in China's construction projects (Shan et al., 2015b; Zhang et al., 2017). After CCG53, mechanisms to report wrongdoings (CCG54) and system of internal controls (CCG52) received the second and third factor loadings (0.849 and 0.827) on CCG. Lacking report mechanism or internal control both lead to be flawed regulation system, which causes corruption in public sectors (Le et al., 2014). CCG53 could be viewed as an external control process when compared to CCG52. As core actors, government officials are the target of companies who want to participate in megaprojects. Additionally, labour emulation, as part of the CPC Party conduct, has been adopted in Chinese construction projects over the years. Multi-level labour emulations are provided during the megaproject development, such as nation-level demonstration labour emulation areas in Three Gorges Project, Shanghai 2010 EXPO, and Hong Kong-Zhuhai-Macao Bridge, as well as some local emulations in major projects.

"Strategic planning" (SP) was the fifth most critical component of governmental governance, with a path coefficient of 0.176. Although the economic transition in China has generated more opportunities in construction industry, uncertainty is even higher because the political institutions continue to be authoritarian. Therefore, whether the government has a strategic plan in the front-end phase is a basic premise of megaprojects (OECD 2017). Under this latent variable, the presence of a feasible strategic plan (SP11) and a dedicated procedure for governing the project (SP13) received the highest factor loadings (0.864 and 0.857). The government is supposed to allocate a budget to megaprojects within the limits of fiscal planning, decide how to deliver a project, and establish a process for generating a megaproject (Peterman et al., 2014). Otherwise, weak planning might hamper the operation and implementation of projects (Shrestha et al., 2017). Besides, proper solutions for relocation (SP15) had the lowest factor loading (0.772) on the SP. On the one hand, this result may be related to the contradiction between rapid economic growth and backwardness of relocation compensation provisions. Relocation arrangement and expropriation compensation may easily cause conflicts (Shi et al., 2015). The government must guarantee reasonable compensation for relocation, to maintain social stability and maximize residents' benefit (Liu et al., 2016). On the other hand, parts of the sample projects did not involve resettlement issues and the respondents gave 1 point, which resulted the low factor loading.

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"Institutional design" (ID) was the sixth most critical component of governmental governance, with the lowest path coefficient of 0.130. Since the governments have responsibilities in a broad array of areas, good institutional design is a precondition for governing megaproject just as previous studies indicating "a set of formal principle, structure and process is important in governing a project" (Mosavi, 2014). In the model, a clear set of documents of responsibilities (ID21) had the highest factor loading (0.854) on ID. This result is similar to that found in (Gunduz & Yahya, 2018) who report scope and work definition contributes in finishing the project successfully. After the responsibilities settle down, coordination across the different levels of governments are needed to boost governance outcome (OECD, 2017). Besides, coordination exists not only within the governments, but also between government, the public and stakeholders. Formal coordination mechanisms (ID23) received the second highest outer loading (0.831) on ID. This is consistent with those of other studies that show formal communications such as meetings to be of great importance in buffering conflicts (Bygballe et al., 2015). Also, informal governance approaches appear to be a positive compliment, which in turn increases performance. In some megaprojects, personal relationship between stakeholders and governmental staffs offers convenience in solving problems (Chi et al., 2011). In the test, determine how to deliver the project (ID22) received the third factor loading (0.778) on ID. Delivery modalities vary under governmental decisions in balancing the political, sectoral, economic, and strategic aspects (Flyvbjerg et al., 2003; OECD, 2017). the government keeps its regularity position (Bennon et al., 2017). Regulated privatization, state-owned enterprises, concessions or PPPs, or a combination of these (Flyvbjerg et al., 2003) may be involved by approaches for delivering and managing megaprojects.

4. Post-survey interviews

The post-survey interviews were carried out with five representatives who worked in an ongoing megaproject named West Bund Media Port (WBMP in short) conducted in Shanghai, China. WBMP is an important pilot program in the "megaproject list" in Xuhui District Government as well as in City Government. It starts from 2014 and is expected to complete in the end of 2018. The whole project was divided into 9 blocks and six developers were invited to construct the aboveground buildings. To better understand the governmental governance strategies in the construction procedures, five interviewees were provided with a presentation of the results from questionnaires and asked to comment on them. They all confirmed that the findings were reasonable and gave some explanations for the governmental governance practices in WBMP project to help gain an in-depth understanding of the findings.

According to the interviewees, the strategic planning of WBMP was confirmed in 2012 in line with the 12th Five-Year Plan of City Shanghai. Municipal Government set up a Development Management Committee as the authority to strengthen capacities of all the governmental agencies involved and facilitate all the stakeholders. To be in charge of developing West Bund area on behalf of local government, a solely state-owned enterprise – Shanghai West Bund Development Group (WB Group), was also founded. The construction process was not only aligned with existing laws and regulations, but also with dedicated procedure set by Management Committee. One important responsibility of the Management Commit-

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tee is holding thematic conferences when conflicts or problems emerge. Talking about this issue, interviewees from the consultant and contractor said: "in most cases, the Management Committee can solve our problems quickly and efficiently". Inside the Management Committee, a specialized oversight body was created to apply strict procedures for monitoring construction progress to ensure that WBMP project was built on time and within budget. Besides the Committee, Megaproject Office in Xuhui District performs an important steering and oversight role with regard to WBMP, even when it isn't involved in its delivery. And the multi-level labour emulations, held by Megaproject Office during the construction process, inspired contractors and improve the WBMP performance.

In addition to the governmental strategies mentioned above, the interviewees highlighted the importance of public monitoring on WBMP project. As a political symbol, WBMP projects has drawn attention from the public. In the front-end phase, resident representatives living around were invited to participate in the planning. During the construction phase, progress reports were prepared regularly and open to public. The role and impact of e-government strategy, through which the interaction between public and government was delivered, were brought up and emphasized by the interviewees. For instance, online platforms have offered new opportunities for public participation. Last year, a safety rumor about WBMP showed up on Weibo, the Chinese version of Twitter. WB Group detected it quickly, reported to Megaproject Office, established a joint team to investigate the issue, and publicized the investigation progress timely. Also, both citizens and business communities can report the illegal behaviors via government websites or mayor's mailbox. Since fiscal year 2014, Xuhui Audit Bureau have engaged to exercise its surveillance and audit powers and no irregularities have been reported. Besides, as the project moves on, an evolving document about risk assessment is periodically reviewed and updated, which supports WBMP's ability to adapt to the evolving environment.

In general, referring to the governmental governance strategies mentioned by the interviewees, it could be noted that they are mainly associated with the planning, cooperation between levels of governments, regulatory oversight, public supervision, anti-corruption approaches and risk management, which are generally in accord with the findings obtained from the questionnaire survey. Thus, findings have proven to be reliable.

Conclusions and policy recommendations

This study investigated the impacts of adopting governmental governance on megaprojects performance and identified the critical components of governmental governance that can help improve megaproject performance. A theoretical hypothesis between governmental governance and megaproject performance were proposed and then verified using the approach of partial least squares structural equation modelling. Data collected from 239 professionals in the megaproject sector of China were analyzed. Results reported that governmental governance can contribute to improving megaproject performance. It also revealed that "public monitoring and scrutiny" was the most critical latent variable of governmental governance on megaproject performance, followed by "systemic risk management", "regulatory oversight", "construction of clean government", "strategic planning", and "institutional design".

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It is the first research effort to develop a unique framework of governmental governance of megaproject. It highlights governance practices of government, identifies the most critical practices that governments should adopt to facilitate the provision of megaprojects, and reveals positive impacts of governmental governance on megaproject performance. This study extends the governance framework in megaprojects and thus contributes to the current body of knowledge. Additionally, it can enhance the practitioners' understandings of governmental governance and thereby benefitting the practice.

The findings of this study can offer policy recommendations for the design of governmental governance systems. According to PLS-SEM results, public monitoring and scrutiny had the highest path coefficient. Thus, government agencies should try to maximize public participant into their governance systems and institutionalize participation mechanisms and practices. For instance, the government should hold public hearings to obtain public comments on megaprojects, provide online platforms where the public can access megaproject information, and establish channels for the public to raise their concerns. Additionally, the findings recommended that the government should take actions to reduce corruption. Effective strategies include but are not limited to inviting private investment and increasing the transparency in the implementation of megaprojects.

Limitations and future research

Findings of this study are subject to some limitations needed to be considered in future research. First, this study collected opinion-based data from respondents and bias might occur due to the different backgrounds of the respondents. Second, the sample size of the questionnaire was relatively small to a study that adopted structural equation modelling approach. These results therefore need to be interpreted with caution. Third, the unique political and cultural context in China impedes the generalization of the findings to other countries and regions. It might be possible to extrapolate to a government-led context similar as China, but when it comes to others, contextual factors, such as the political system, tendering practices, and social factors, must be taken into consideration.

As for future research, it is necessary to develop an evaluation model to assess the maturity of adopting governmental governance in megaprojects. Additionally, further studies could also be conducted to compare the adoption of governmental governance between different countries, so that the body of knowledge of governmental governance could be further established. Lastly, an effectiveness comparison for adopting different governance mechanisms (e.g., governmental, contractual, and relational governance) could also be conducted to identify the most effective governance mechanism.

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Author contributions

Zhao ZHAI was responsible for data collection, data analysis, and manuscript draft. Ming SHAN conceived the study and was responsible for data analysis and data interpretation. Yun LE conceived the study.

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This study has no competing financial, professional, or personal interests from other parties.

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