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Governing behavioral integration of top management team in megaprojects: A social capital perspective

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Abstract:

Behavioral integration (BI), or the extent to which top management team (TMT) members engage in collective interactions, is a critical element for achieving business success in corporate management that has rarely been examined in megaproject studies. The organizational complexities of megaprojects contribute to biases in TMT's behavior. This study presents a team-level analysis of the drivers of BI in megaprojects through the theoretical lens of social capital. Based on a survey conducted with 128 senior managers from 48 megaprojects, the results showed that (1) both the structural and cognitive dimensions of social capital have a significantly positive effect on BI, with the structural dimension being more influential; (2) the relational dimension of social capital showed a partial effect on BI; (3) affective commitment plays a mediating role that bridges social capital and the TMT's BI. These findings shed new light on cultivating interactions among TMT members in governing megaprojects.

*Keywords***:** Megaproject, Social capital, Behavioral integration, Top management team

1 Introduction

As temporary and complex endeavors (Wang et al., 2017), megaprojects are being increasingly adopted as preferred delivery models for goods and services across a wide range of fields, such as infrastructure, information technology, supply chains, and air and space exploration (Flyvbjerg, 2014). In the construction engineering domain, megaprojects usually refer to large-scale infrastructures commissioned by governments that significantly influence economic developments, social welfare, and environmental protection (Brookes and Locatelli, 2015; Locatelli et al., 2017; Wang et al., 2020a). Although megaprojects vary widely in terms of project types, they demonstrate several similarities. Unlike small- or medium-sized projects, the performance of megaprojects is usually lower than expected (Qiu et al., 2019). The megaproject is a complex system (Locatelli et al., 2020), and even skilled and dedicated managers find it hard to achieve effective performance through individual efforts (Bai et al., 2016). In megaprojects, governments typically set up special-purpose agencies or authorities for the project delivery (Hu et al., 2018; Sainati et al., 2017), otherwise known as project management entities, which acts as client/owner (Brookes et al., 2017). Senior managers in these client/owner organizations comprise the top management team (TMT) of the megaproject, such as the project alliance leadership team in the Sydney Olympic project (Pitsis et al., 2003), the board of Hong Kong-Zhuhai-Macao Bridge authority (Hu et al., 2018), and the top executive team in the 2012 London Olympic project (Lundrigan et al., 2015). Compared with lower management teams focusing on specific management issues, TMT is responsible for making strategic decisions and becomes a leading force in the megaproject delivery process (Wan et al., 2020; Yun et al., 2020).

Members of excellent TMTs are not independent individuals but collaborative entities (Carmeli et al., 2011). Compared to individual executives, the behavioral process of the TMT can better explain organizational effectiveness (Halevi and Carmeli, 2015). According to Pinto and Winch (2015), the management of projects needs to empirically capture important activities required to improve organizational effectiveness. Therefore, the transition from individual to group level is a developmental trend in leadership studies and reflects an urgent need for research on project governance. A megaproject

TMT involves a wide range of team members from multiple departments (Guo and Sheng, 2018). Such a team needs to integrate individual behaviors into group behaviors to attain performance benefits (Tiwana and Mclean, 2005). Behavioral integration (BI) is a collective process involving social interactions among team members (Mathieu et al., 2014). Thus, BI is embedded in the relational network to facilitate cooperation within the megaproject TMT. However, in light of the dynamic, temporary, and complex characteristics of megaprojects (Davies and Mackenzie, 2014), the BI of TMT faces huge challenges at the socio-relational level (Halevi et al., 2015; Wan et al., 2020).

In megaprojects, formal governance mechanisms play a pivotal role in integrating behaviors in TMTs (Too and Weaver, 2014). However, a TMT's temporary and unique nature, as well as the lack of organizational routines, challenge TMT members' relationship management, leading to difficulties in cooperation (Phelps and Reddy, 2009), institution rollback (Silva et al., 2018), and organizational decline (Carmeli and Schaubroeck, 2006). Pemsel and Müller (2012) indicated that faced with a team "*integration dilemma*," it is more necessary for organizations to rely on informal governance mechanisms. Compared to formal governance mechanisms, relationship governance is more closely related to the BI within a TMT (Rosenkranz et al., 2019). Therefore, effective informal governance contributes to stimulating BI among TMT members and is considered as the key to the success of megaprojects. Nevertheless, only a few studies have focused on the effectiveness of informal governance mechanisms on the TMT's BI in the context of megaprojects. According to Bartsch et al. (2013), the key elements of informal governance, such as social network, trust, and communication, are closely related to the social capital perspective. Thus, social capital provides a potentially useful perspective for exploring the relationship between informal governance and BI within the megaproject's TMT.

The social capital theory successfully explains a series of organizational behaviors, such as organizational citizenship behaviors (Ko et al., 2018) and safety behaviors (Wu et al., 2018). Remarkably, most of the literature is rooted in the context of permanent organizations (e.g., corporations). Only a few studies, such as Brookes et al. (2006), Di and Mascia (2012), and Bartsch et al. (2013), explored the social capital within the project setting. To date, the literature on the influence of social capital on TMT's behaviors in megaprojects is lacking. Megaprojects face huge organizational complexities where rules are

imperfect, and project organization elements interact with each other (Luo et al., 2017). The diversity of project objectives and the high dynamic nature of the delivery process exacerbate the contradictions and conflicts among TMT members (Zeng et al., 2017). While prior literature has devoted considerable attention to formal megaproject governance (Biesenthal et al., 2018; Brunet, 2019), only a limited number of studies have addressed how informal governance benefits organizational behaviors from the perspective of social capital (Di and Mascia, 2012). Social capital facilitates TMT members to internalize project tasks into individual goals, improve communication efficiency, cultivate an effective cooperation mechanism, and strengthen the collective action (Harashima et al., 2013), thereby stimulating BI's emergence.

Furthermore, most of the prior studies on the TMT's BI have followed direct input-output relationship paths (Carmeli et al., 2011; Camelo-Ordaz et al., 2014), ignoring the role of affective commitment. Affective commitment refers to the degree to which TMT members participate in organizational interactions, reflecting an individual's psychological state toward the team (Carmeli, 2005). Therefore, affective commitment is believed to influence the relationship between their social relations and team behaviors (Meyer et al., 2002). TMT members who are affectively committed are considered to be more efficient and less likely to withdraw (Meyer and Allen 1997), even if they are distracted by other work. The megaproject is a temporary endeavor, and TMT members are usually not familiar with each other, making it difficult to arouse teamwork enthusiasm (Le et al., 2020; Wan et al., 2020). Accordingly, the "part-time job" phenomenon among TMT members is common (Zhai et al., 2017). They have stronger autonomy, and thus their attitude toward the team may have a more profound effect on team behaviors. Therefore, to some extent, affective commitment is pivotal for BI.

Based on the reviewed literature, this study aims to answer the following research question:

To what extent does the social capital shape TMT members' affective commitment and ultimately affect the TMT's BI in megaprojects?

The rest of this paper is organized as follows. Section 2 describes the theoretical foundations and research hypotheses. Section 3 outlines the research method and analytical procedures. Section 4 presents the data analysis results. Section 5 discusses the research findings and their implications. In section 6, conclusions are drawn regarding key ideas.

2 Theoretical background and hypotheses derivation

2.1 BI in megaproject TMTs

Top management team (TMT) research has originated from the upper echelons theory (Hambrick, 1984), the emergence of which has encouraged the research on executives from the individual to the team level (Haleblian and Finkelstein, 1993). Strategic decisions typically involve various executives, not only the CEO, and therefore organization outcomes are considered the result of group decision processes, rather than individual actions. On the one hand, the TMT's role in temporary megaproject organizations is similar to that in permanent corporate organizations. TMTs members are responsible for making strategic decisions, arranging resources, and acting as a powerful force for project/product implementation. On the other hand, the TMTs in corporations and megaprojects differ in several aspects. First, the organization of the megaproject client/owner is temporary. The board of project client/owner is characterized by a limited period of time of interaction among members (Bakker, 2010). Second, megaprojects are complex endeavors, especially in terms of the organizational aspect. The organization of the megaproject client/owner is evolving with the megaproject implementation (Li et al., 2018). The interaction among TMTs members is highly dynamic. Third, the board of project client/owner is politically sensitive. The TMT members' background is usually in the public sector, and the government influences their interactions.

The upper echelons theory research evolved from focusing on the demographic characteristics to exploring the interactive process of team members (Hambrick, 2007). Behavioral integration (BI) stems from this background and has been defined as a "*meta construct*" that encompasses group process elements that were previously represented by separate constructs, including social integration, frequency and quality of member exchange, and collaboration (Carmeli and Schaubroeck, 2006). In sum, BI includes three dimensions: cooperative behavior, information exchange, and joint decision-making (Hambrick, 2007). Cooperative behavior focuses on spontaneous mutual assistance among team members rather than merely obeying or independently resolving problems. Information exchange reflects the extent to which team members actively share information. Joint decision-making refers to the productive discussion held among members based on a shared understanding and a high interaction level (Simsek et al., 2005).

According to Carmeli and Halevi (2009) and Li et al. (2019), BI facilitates innovation performance, reduces organization degeneration, and copes with the performance dilemma of megaprojects. However, as Davies and Mackenzie (2014) indicated, system integration is difficult in complex megaprojects. The TMT's BI in megaproject practices, such as the London Olympic project (Jennings, 2012), the Zuiderzee line (De Bruijn and Leijten, 2007), and Thailand's development of four million hectares of irrigated lands (Dyer, 2017), is often not satisfactory. All these problems are closely related to the behavioral biases of TMT. Compared with general projects, the megaproject TMT has higher uncertainty and liquidity. In addition, the source of TMT members is wide, which causes difficulties for formal governance (Park et al., 2017). Therefore, managing the TMT's BI is a crucial issue in governing megaprojects. Hence, it is essential to investigate the effect of informal governance mechanisms on BI in megaproject settings from a social capital perspective.

2.2 Social capital and BI

The concept of social capital, referring to individuals' ability to cooperate, originates from community studies (Hongseok et al., 2006). The social capital cuts across formal team boundaries, providing access to ideas and information from members of the team (Mehra et al., 2006). According to the social capital framework proposed by Lee et al. (2015), TMT's social capital is divided into three dimensions: structural, relational, and cognitive. Leveraging the aforementioned literature, this paper defines social capital as "*the opportunity, willingness, and ability of TMT members to exchange resources within a temporary social relationships network*."

The TMT's BI in megaproject involves an extensive network of stakeholders with complex relationships across multiple stages (e.g., design, construction, and operation) and linkages (e.g., political and business links) (Bosch-Rekveldt, 2011). TMT's social capital provides a systematic perspective for exploring TMT's BI. Shipilov and Danis (2006) indicated that social capital promotes the maintenance, exchange, and sharing of information and resources within the team through interactions. Jansen et al. (2011) supported the effectiveness of social capital on decision-making. In sum, social capital enables team members to achieve collective actions with consistent goals through trust and universal recognition

(Carmeli and Shteigman, 2010; Camelo-Ordaz et al., 2014). However, how the three dimensions of social capital affect TMT's BI in megaproject is still unclear.

2.2.1 Structural social capital and TMT's BI

The structural dimension reflects the opportunity provided for TMT members to exchange resources, which includes the interaction intensity and network density (Cao et al., 2016). First, interaction intensity represents the frequency of informal interactions among TMT members. Jiang and Liu (2015) noted that TMT members are more likely to express their thoughts, attitudes, and motivations in social interactions (e.g., unstructured interviews and informal meetings). Jalalkamali et al. (2016) indicated that informal interactions extend communication to a more personal level by promoting recognition and trust among members and improving their willingness to cooperate. Second, network density refers to the number of general contacts among TMT members, reflecting the "clique" phenomenon. Oh et al. (2006) noted that the connection among TMT members in megaprojects changes from being centralized and work-oriented to a more flexible and powerful by increasing the network density. This contributes to overcoming difficulties in daily communication and the lack of willingness to cooperate, leading to more extensive and diversified external information understood and internalized by all TMT members. Meanwhile, high network density prevents the generation of "clique culture," reducing opportunistic behaviors in exchanging information and the transaction cost and ultimately improving the decision's quality (Emmers, 2004). On this base, we proposed the following two hypotheses:

***H_1**: TMT interaction intensity is positively related to BI.*

***H_2**: TMT network density is positively related to BI.*

2.2.2 Relational social capital and TMT's BI

The relational dimension reflects the willingness of TMT members to exchange resources. As the core element of relational social capital (Han et al., 2018), trust contributes to reducing misinterpretations. On et al. (2013) noted that trust could reduce the opportunistic behavior of TMT members, enhance their interdependence, and shape a cooperative atmosphere within the TMT. In addition, trust stimulates collaborative behaviors by improving communication among team members (De et al., 2016). It challenges the sharers' advantage in the process of transmitting the information. Therefore, information sharing only

happens when the owner is willing to take these risks (i.e., trust other TMT members) (De et al., 2016). TMT members with a high level of trust could embrace a state of disagreement in the decision-making process and tolerate others' behaviors and attitudes, viewing them rationally and positively (Parayitam and Papenhausen 2016). Given these findings, we proposed the following hypothesis:

***H_3**: Trust among TMT members is positively related to BI.*

2.2.3 Cognitive social capital and TMT's BI

The cognitive dimension reflects the ability of TMT members to exchange resources—also known as the "*shared vision*" (Tsai and Ghoshal, 1998). Shared vision, usually seen as a "top-level" concept, refers to the consistency of views among TMT members and provides the foundation for the communication of individuals (Matinheikki et al., 2016). Shared vision facilitates the flow and exchange of information and resources within the organization as well as guides the thoughts and actions of team members (Ravasi and Schultz, 2006). More specifically, shared vision, on the one hand, improves coordination efficiency, facilitates understandings among TMT members, and provides a good foundation for members to cooperate and communicate. On the other hand, considering many contradictions and confrontations in megaprojects (Jia et al., 2011), a shared vision reduces misunderstanding and friction among TMT members and contributes to the collective decision-making process (Cao et al., 2016; Brunet and Forgues, 2019). Thus, we proposed the following hypothesis:

***H_4**: Shared vision in the TMT is positively related to BI.*

2.3 Role of affective commitment

2.3.1 Social capital and affective commitment

Eisenberger et al. (2002) noted that members' perceptions of the organization shape their behaviors. From this perspective, affective commitment could link social capital to TMT's BI in megaprojects. First, a strong connection facilitates team members to exchange ideas and enhance their understanding of working tasks (Watson and Papamarcos, 2002). Second, Liu and Wang (2013) revealed a significant positive correlation between trust and affective commitments. Han et al. (2014) emphasized that the organization could not exist without trust among team members. Third, a shared vision can influence TMT members' affective commitment. A shared vision underlies TMT members' interactions, creating a stronger sense of belonging and enhancing their commitment to the team (Lefebvre et al., 2016). The above reasoning

suggests the following theoretical assumption:

***H_5**: (H_{5a-5d}) TMT social capital is positively related to affective commitment.*

2.3.2 Affective commitment and BI

Affective commitment has a positive predictive effect on team members' behaviors (Jafri, 2010). Wang et al. (2014) indicated that an individual's sense of identification with the organization could be internalized as motivations, leading TMT members to devote more time and energy to the project, reinforce their cooperation and communication levels, and exchange information leading to shared decisions. TMT members' commitment to the team demonstrates a strong sense of responsibility to promote the work's advancement rather than procrastinating. By improving members' affective commitment to their TMT, BI can be improved, especially when external institutional pressures are low (Hu et al., 2018). On this basis, we proposed the following hypothesis:

***H_6**: Affective commitment among TMT members is positively related to BI.*

Fig. 1 shows the theoretical framework proposed and tested in this paper.

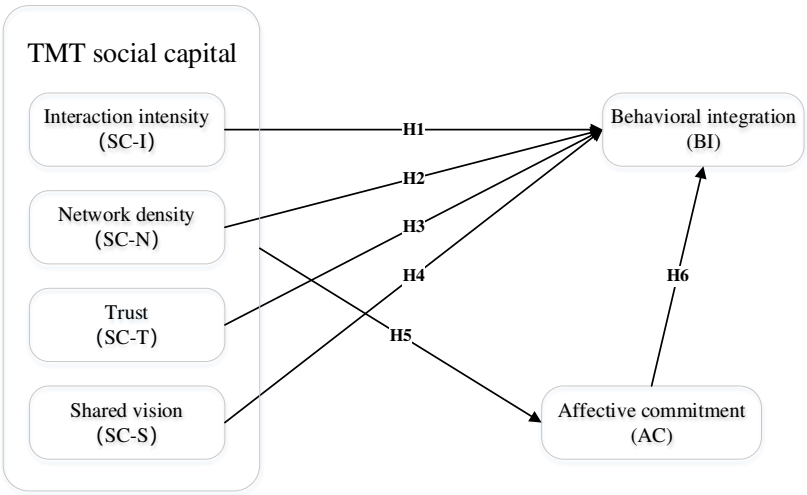

Fig. 1. Theoretical research framework

Research method

3.1 Measurements

The measurement development process began by investigating the theoretical and empirical literature on behavioral integration (BI) and megaprojects. The measurement items used for the constructs were

developed based on existing scales that have been proven reliable. First, social capital is conceptualized based on structural, relational, and cognitive dimensions (Onyx and Bullen, 2016). The structural dimension (i.e., interaction intensity and network density) measures opportunities for exchanging resources among the top management team (TMT) members using five items. The relationship dimension (trust) measures TMT members' willingness to exchange resources with four items. The cognitive dimension (shared vision) measures TMT members' ability to exchange resources and is assessed with three items (Onyx and Bullen, 2016). Second, affective commitment represents team members' attitude and emphasizes their dependence on the TMT measured with three items, according to Yiing and Ahmad (2009). Third, based on Simsek et al. (2005), we used eight items to measure BI's three dimensions, namely, cooperative behavior, information exchange, and joint decision-making. Finally, Carpenter et al. (2004) stated that the characteristics of TMTs might influence organizational behaviors. Thus, age, gender, educational background, and size of TMTs were selected as control variables. Except for control variables, all the selected measurements were rated on five-point scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

3.2 Sampling and data collection

The sample data was collected from Chinese megaprojects. China is experiencing its "biggest infrastructure investment boom," and many megaprojects can, therefore, provide first-hand data for empirical investigations (Guo and Sheng, 2018). In particular, the Belt and Road Initiative has facilitated the delivery of thousands of infrastructure projects globally (Wang et al., 2020b). In this study, some megaprojects are of global influence (e.g., Hong Kong–Zhuhai–Macao Bridge and Shanghai Expo). Fifteen megaproject professionals were selected to participate in a pilot study to evaluate the questionnaire's scope, identify vague expressions, and verify the constructs' rationality. Moreover, they were invited to discuss the relationship between social capital and BI by specific megaproject cases. Based on their feedback, some of the measurement items were revised. For example, many TMT members are also government officials who can mobilize government resources. Therefore, to reflect cooperative behavior, we added the item, "When TMT members require the support of government departments, the corresponding TMT members will actively help to coordinate." The item "Family members of the TMT members are familiar with each other" was added to the network density measurement because people

attach great importance to the family when managing social networks. Acquaintances of TMT family members connect TMT members. The final version of measurement items is shown in Appendix I.

According to Wang et al. (2018), a megaproject is defined as a large-scale infrastructure with a total investment of more than CNY one billion that has a significant influence on social productivity, economic growth, individual livelihoods, and the natural environment. TMT is not a fixed concept and depends on the research context. According to Hambrick (2015), TMT does not necessarily suggest a formalized management-by-committee arrangement, but rather the constellation of several top executives. Scholars tend to define members in terms of the purpose of research and the availability of data. For example, Carpenter et al. (2003) noted that the company lists the executive TMT members separately when conducting an IPO. Boone and Hendriks (2009) defined TMT members as executives identified by the Chief Executive Officer (CEO) as involved in strategic decisions. Carmeli et al. (2011) indicated that TMT members are CEO, Chief Operating Officer, Chief Financial Officer, vice president (s), and above. In the context of megaprojects, the public sector usually acts as a client/owner or even as the main contractor (Locatelli et al., 2017). The client/owner is responsible for making strategic decisions in delivering megaprojects. Thus, this study focused on the project's client/owner and classified TMT members into the following four sources: (1) top executives of the project headquarter (Zhai et al., 2017) or authority (Hu et al., 2018); (2) heads or deputy heads of project departments (e.g., engineering department, finance department, and contract department); (3) heads or deputy heads of sub-projects; (4) government officials involved in engineering construction and coordinating social resources for the project.

To reduce response bias, this study adopted the following measures. First, the respondents' information remained confidential. The cover letter included in the questionnaire emphasized that the data will be collected only for academic purposes, and the responses would be confidential. The respondents in this study did not have to reveal their names. Therefore, it was meaningless for respondents to distort the constructs in the questionnaires (Wu et al., 2018). Second, respondents were asked to complete the survey based on their most recent megaproject. As a result, respondents could provide a relatively clear description of the TMT's situation and avoid preferentially selecting their most successful experience. Third, survey questions were distributed over five different sections. Cover stories were presented between adjacent sections. This made respondents feel that the measure of predictor constructs was not connected with the criterion measure. Finally, this survey included the question, "Are you familiar with the project's

TMT composition and strategic decision-making process?" with the response options of "yes," "no," or "unsure." The "unsure" option was included to prevent respondents from making a forced-choice response (Norton et al., 2014). As a result, only respondents who provided a conclusive response "yes" were retained, while the "no" or "unsure" answers were filtered out of the sample dataset.

To improve the survey sample's representativeness, this study attempted to distribute the questionnaire to diversified respondents from various megaprojects in different regions in China. It is noteworthy that mega infrastructure projects account for only a relatively small part of the construction projects. As Zamani et al. (2020) suggested, a snowball sampling approach is appropriate when the target population members are difficult to identify. In the current study, the snowball sampling procedure included two steps. First, the initial respondents were identified by a series of methods, such as contacting government departments and state-owned enterprises, interviewing professionals who participate in the research sponsored by the National Natural Science Foundation of China, and asking executives in MBA/EMBA programs organized by Tongji University. Second, this study invited selected respondents to introduce knowledgeable participants from other megaprojects.

In 2018, 270 questionnaires were distributed to participants from 55 TMTs involved in megaprojects. After excluding questionnaires with incomplete information, 128 valid questionnaires from participants involved in 48 megaprojects TMTs were ultimately included in the subsequent analysis. The average number of participants per team was 2.67 (SD=2.11), ranging from 2 to 7. Table 1 lists the demographics of the surveyed TMTs.

Table 1. Demographics of the surveyed sample

Variables	Category	Number	Percentage (%)
Size	2-5	5	10.41
	6-10	24	50.00
	11-15	17	35.42
	More than 15	2	4.17
Types of project management entities	Leading Group/Committee	10	20.83
	Headquarters	23	47.92
	Authorities	15	31.25
Project type	Transportation junction	9	18.75
	Highway	6	12.50
	Long-span bridge	7	14.58
	Railway	11	22.92
	Convention & exhibition center	15	31.25
Project location	North China	13	27.08
	East China	17	35.42
	South China	9	18.75
	China Central/West China	9	18.75
Project investment (CNY billion)	10-50	16	33.33
	51-100	24	50.00
	More than 100	8	16.67

4 Data analysis and results

4.1 Factor analysis

Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were employed to analyze the sample dataset. First, EFA was performed on the thirteen social capital items. The Kaiser–Meyer–Olkin (KMO) value was 0.817 > 0.600, and the *p*-value obtained from the Bartlett sphericity test was .000 < .001, which indicates excellent sample adequacy (Field, 2009). Table 2 shows that all the rotated item loadings were greater than 0.6 (Flynn et al., 1994), and the cumulative contribution rate of factor analysis was 72.789%. All these results validated the appropriateness of using these thirteen items to reflect the interaction intensity, network density, trust, and shared vision constructs. Similarly, EFA was applied to behavioral integration (BI) measurement, and no item was deleted from the questionnaire. Next, based on EFA results, the variables were further evaluated using the CFA. CFA analyzed not only social capital and BI variables but also affective commitment. Based on the maximum likelihood, the factor analysis results showed acceptable overall goodness of fit values (RMR=0.023, RMSEA=0.051, GFI=0.984, NFI=0.925, IFI=0.996, TLI/NNFI=0.913, CFI=0.987) of the measurement model (Wang et al., 2018).

Table 2. Evaluation of measurement models

Measurement items	Factor loadings			
	Factor	Factor	Factor	Factor
SC-I 1	.940			
SC-I 2	.822			
SC-I 3	.626			
SC-N 3		.756		
SC-N 2		.738		
SC-N 1		.692		
SC-T 3			.756	
SC-T 1			.732	
SC-T 4			.688	
SC-T 2			.670	
SC-S 2				.790
SC-S 1				.713
SC-S 3				.693
Variance explained (%)	19.412	18.803	17.538	17.036
Variance cumulatively explained (%)	19.412	38.215	55.753	72.789

SC-I: interaction intensity, SC-N: network density, SC-S: trust, SC-S: shared vision

4.2 Evaluation of the measurement model

Before hypothesis testing, the variables must be validated as correctly defined and measured. According to the test results shown in Tables 3 and 4, the composite reliability (CR) of all the constructs was greater than 0.7, and the factor loadings ranged from 0.779 to 0.962 (greater than 0.6), proving a high level of reliability (Hair et al., 2016). The validity test mainly addressed the convergent and discriminant validities. According to the test results shown in Tables 3 and 4, the average variances extracted (AVE) of all the constructs were greater than the minimum requirement of 0.5, which indicated that the corresponding scale had satisfactory convergent validity (Hair et al., 2016). The discriminant validity was confirmed to be satisfactory in two respects. First, the square root of the AVE for each construct in the diagonal was greater than its highest off-diagonal correlation with any other construct. Second, each item's loading on its construct was higher than any of its cross-loadings with other constructs (Gefen and Straub, 2005).

Table 3. Measurement validity and construct correlations

Construct	CR	AVE	Correlation matrix					
			SC-I	SC-N	SC-T	SC-S	AC	BI
SC-I	0.939	0.838	**0.915**					
SC-N	0.836	0.630	0.148	**0.794**				
SC-T	0.848	0.584	0.251	0.214	**0.764**			
SC-S	0.897	0.747	0.301	0.433	0.559	**0.864**		
AC	0.779	0.541	0.183	0.312	0.302	0.325	**0.735**	
BI	0.962	0.741	0.231	0.481	0.442	0.289	0.454	**0.861**

SC-I: interaction intensity, SC-N: network density, SC-S: trust, SC-S: shared vision, AC: affective commitment, BI: behavioral integration

Table 4. Cross loadings for measurement items

Code	Item loadings					
	SC-I	SC-N	SC-T	SC-S	AC	BI
SC-I(1)	**0.997**	0.247	0.337	0.463	0.111	0.333
SC-I(2)	**0.919**	0.173	0.193	0.223	0.299	0.036
SC-I(3)	**0.822**	0.343	0.175	0.299	0.352	0.124
SC-N(1)	0.368	**0.795**	0.347	0.324	0.249	0.201
SC-N(2)	0.414	**0.854**	0.239	0.441	0.191	0.139
SC-N(3)	0.359	**0.727**	0.324	0.276	0.116	0.228
SC-T(1)	0.291	0.284	**0.768**	0.144	0.320	0.272
SC-T(2)	0.348	0.318	**0.669**	0.371	0.269	0.346
SC-T(3)	0.295	0.287	**0.784**	0.183	0.182	0.371
SC-T(4)	0.255	0.447	**0.826**	0.258	0.295	0.231
SC-S(1)	0.329	0.264	0.281	**0.920**	0.170	0.234
SC-S(2)	0.403	0.262	0.341	**0.710**	0.444	0.395
SC-S(3)	0.246	0.355	0.178	**0.943**	0.204	0.119
AC(1)	0.299	0.175	0.152	0.250	**0.687**	0.271
AC(2)	0.474	0.126	0.284	0.171	**0.729**	0.223
AC(3)	0.371	0.249	0.254	0.197	**0.787**	0.413
BI(1)	0.305	0.313	0.219	0.334	0.146	**0.983**
BI(2)	0.525	0.459	0.359	0.349	0.061	**0.747**
BI(3)	0.410	0.145	0.306	0.232	0.305	**0.869**
BI(4)	0.364	0.321	0.215	0.126	-0.135	**0.664**
BI(5)	0.339	0.269	0.227	0.294	0.227	**0.908**
BI(6)	0.254	0.229	0.139	0.285	0.276	**0.825**
BI(7)	0.052	0.219	0.208	0.125	0.409	**0.864**
BI(8)	-0.114	0.274	0.412	0.024	0.770	**0.948**
BI(9)	0.367	0.271	0.191	0.247	0.263	**0.894**

SC-I: interaction intensity, SC-N: network density, SC-S: trust, SC-S: shared vision, AC: affective commitment, BI: behavioral integration

4.3 Aggregation and validation of team data

To assess the appropriateness of aggregating individual-level data to the team-level data, the value of the

within-group interrater agreement ($R_{wg(j)}$)[2] was used to test the consistency of variables in those cases in which multiple responses were received (James et al. 1984). The results (Table 5) showed $R_{wg(j)}$ were 0.88, 0.91, 0.90, 0.92, 0.87, 0.90 for the six variables (interaction intensity, network density, trust, shared vision, affective commitment, and BI), exceeding the values of 0.70 and thus indicating a high consistency within the team (Rousseau, 1985). Moreover, the intraclass correlation coefficients[3], including *ICC* (1) and *ICC* (2), were adopted to test differences between the variables at the team-level (Klein and Kozlowski, 2000). We found that the *ICC* (1) of variables were 0.31, 0.46, 0.29, 0.27, 0.25, 0.33, respectively, exceeding the 0.10 threshold; and the *ICC* (2) of variables were 0.77, 0.89, 0.83, 0.81, 0.79, 0.91, respectively, exceeding the 0.75 threshold (Lebreton and Senter, 2007). The results showed that all variables were suitable for data integration at the team-level.

Table 5. Coefficients of the internal consistency

Variable	R_{wg}	*ICC* (1)	*ICC* (2)
SC-I	0.88	0.31	0.77
SC-N	0.91	0.46	0.89
SC-T	0.90	0.29	0.83
SC-S	0.92	0.27	0.81
AC	0.87	0.25	0.79
BI	0.90	0.33	0.91

SC-I: interaction intensity, SC-N: network density, SC-S: trust, SC-S: shared vision, AC: affective commitment, BI: behavioral integration

4.4 Hypothesis testing

Smart PLS 2.0 was used to verify the structural equation model (Lee et al., 2015). As shown in Fig. 2, the R^2 value for the explanatory power of independent variables (i.e., interaction intensity, network density, trust, shared vision) on BI was 0.447, indicating that the theoretical model provided a reasonable explanation for BI (Baker et al., 2019). In addition, we used Q^2 to evaluate the predictive correlation of the model (Geisser, 1974). According to Chin (1998), Q^2 is generally calculated using the blindfolding program. The results for our model showed that Q^2 is greater than 0, which indicated that the model has a good predictive correlation.

[2] The degree to which raters provide essentially the same rating (Bliese, 2000).

[3] The degree to which an individual rating can be considered a reliable assessment of a group-level variable (Bliese, 2000).

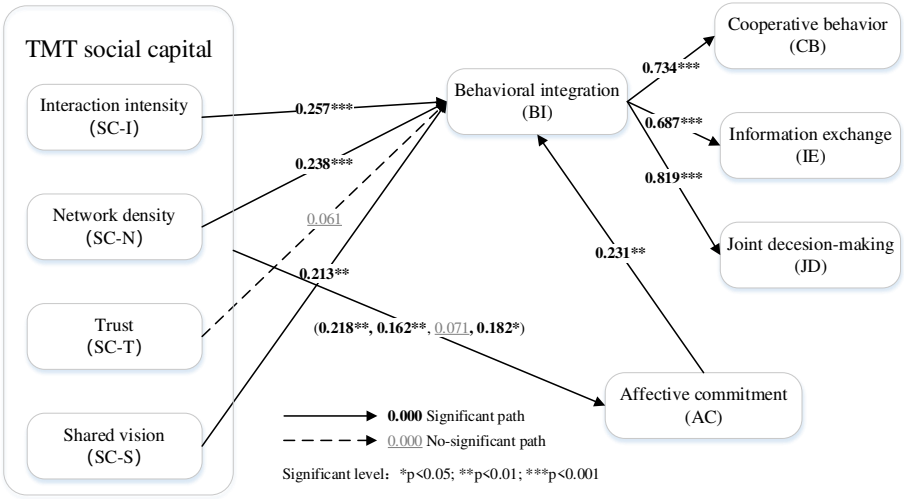

Fig. 2. Partial least squares (PLS) analysis for the research model

The path coefficients between interaction intensity, network density, shared vision, and affective commitment were β=0.218 ($p<0.01$), β = 0.162 ($p<0.01$), and β=0.182 ($p<0.05$), supporting hypotheses H_{5a}, H_{5b}, and H_{5d}, whereas trust and affective commitment links were nonsignificant ($\beta=0.071$, $p>0.05$); therefore, H_{5c} was not supported. When considering the mediating effect of affective commitment, the influences of interaction intensity ($\beta=0.257$, $p<0.001$), network density ($\beta=0.238$, $p<0.001$), and shared vision ($\beta=0.213$, $p<0.01$) on BI were significant; thus, hypotheses H_1, H_2, and H_4 were verified. The path coefficient between trust and BI ($\beta=0.061$, $p>0.05$) was not significant at the 5% level; therefore, hypothesis H_3 required further testing. Based on the above results, we found that the structural dimension has higher explanatory power on BI than the cognitive dimension, and the relationship between the relational dimension and BI was non-significant. This suggests that three dimensions of social capital are complex driving forces of BI.

To further examine the relationship between relational dimension and BI, we established two alternative models. The first model did not include affective commitment (i.e., mediator), and the second subdivided BI into cooperative behavior, information exchange, and joint decision-making, as shown in Fig. 3 and Fig. 4. When the affective commitment was not included in the model, the influence of the trust on BI was still not significant ($\beta=0.077$, $p>0.05$); hence, H_3 was not supported. The second model found that trust affects cooperative behavior and information exchange, whereas no relationship emerged between trust and joint decision-making. The above verification results are summarized in Table 6.

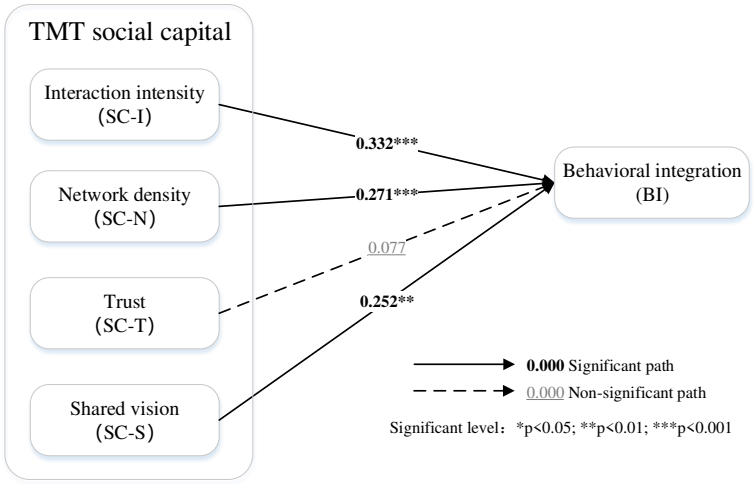

Fig. 3. PLS analysis of the alternative research model 1

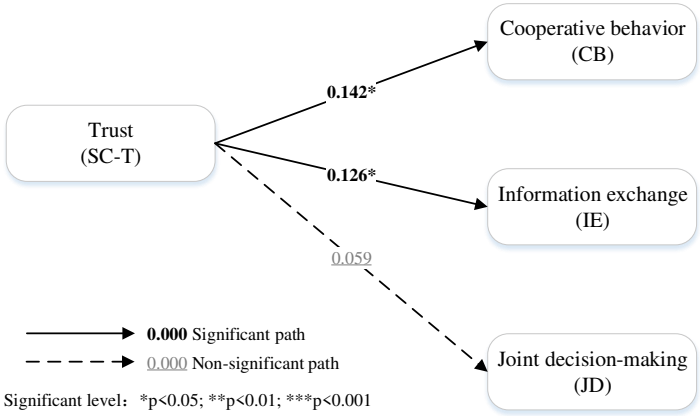

Fig 4. PLS analysis of the alternative research model 2

Table 6. Hypothesis testing results

Variable	R^2	Hypothesis	Hypothesis path	Path coefficient	P-value	Result
AC	0.377	H_{5a}	SC-I-AC	0.218	p＜0.01	Supported
		H_{5b}	SC-N-AC	0.162	p＜0.05	Supported
		H_{5c}	SC-T-AC	0.071	p＞0.05	Not Supported
		H_{5d}	SC-S-AC	0.182	p＜0.05	Supported
BI	0.447	H_1	SC-I-BI	0.257	p＜0.001	Supported
		H_2	SC-N-BI	0.238	p＜0.01	Supported
		H_3	SC-T-BI	0.061	p＞0.05	Not Supported
		H_4	SC-S-BI	0.213	p＜0.01	Supported
		H_6	AC-BI	0.231	p＜0.001	Supported

SC-I: interaction intensity, SC-N: network density, SC-S: trust, SC-S: shared vision, AC: affective commitment, BI: behavioral integration

To verify the mediating effect of affective commitment on the relationship between social capital and BI, we adopted the causal steps approach (Andrews et al., 2004). As shown in Fig. 3, the relationships between interaction intensity (β=0.332, p＜0.001), network density (β=0.271, p＜0.001), shared vision (β=0.252, p ＜0.01), and BI were statistically significant, but trust had no significant influence on BI. Therefore,

affective commitment did not mediate the relationship between trust and BI. Second, the relationships between the three types of social capital (i.e., interaction intensity, network density, shared vision) and affective commitment were analyzed separately. As shown in Fig. 2 and Fig. 3, the path coefficient between affective commitment and BI was significant ($\beta=0.231$, $p<0.01$); after adding the mediator (i.e., affective commitment), the path coefficients between interaction intensity ($\beta=0.332$, $p<0.001 \rightarrow \beta=0.257$, $p<0.001$), network density ($\beta=0.271$, $p<0.001 \rightarrow \beta=0.238$, $p<0.001$), shared vision ($\beta=0.252$, $p<0.01 \rightarrow \beta=0.213$, $p<0.01$), and BI decreased but were still significant. In summary, affective commitment partially mediated the relationship between social capital (except for trust) and BI.

5 Discussion and implications

5.1 Discussion

This study investigated behavioral integration (BI) of the top management team in megaprojects through the lens of social capital. This study's findings support the hypotheses linking social capital with BI (H_1, H_2, and H_4), providing empirical evidence to support the role of the determinants of interaction intensity, network density, and shared vision in fostering BI.

5.1.1 Effect of the structural dimension of social capital

The structural dimension had a positive influence on BI, supporting hypotheses H_1 and H_2. This finding is consistent with those of Pinheiro et al. (2016) and Lee et al. (2015), who reported that providing members with adequate communication opportunities improves BI's quality. Meanwhile, it is notable that the structural dimension exceeded the relational dimension and became the leading factor in shaping BI. This is contrary to the findings of Bartsch et al. (2013), who argued that the relationship dimension occupies the central position within the social capital dimension. This intriguing result stems from the complexity of megaprojects. *First,* in comparison to small- or medium-sized projects, megaprojects involve a wider range of stakeholders (Aaltonen, 2011; Guo and Sheng, 2018). TMT members from various agencies or departments represent the (usually diverging) interests of different groups. This creates an urgency to establish stable communication channels for TMT members to balance conflicts among stakeholders (Aaltonen and Kujala, 2016). As one of TMT members in the Tianjin Rail Transit megaproject noted:

"*In the formal meeting, the TMT has to reach an agreement with a high speed due to time constraints and heavy tasks. More haste, less speed. Poor communication or misunderstanding often leads to greater troubles. TMT members need more informal opportunities to exchange opinions in advance*".

Second, as mentioned above, many conflicts arise among TMT members. Eastern cultures value interpersonal relationships and emphasize the "*mianzi*" (i.e., the recognition by others of one's social standing) (Buckley et al., 2006). In this case, maintaining good relationships and protecting one's "*mianzi*" and prestige are crucially important. During formal meetings, TMT members may be reluctant to

contradict others; consequently, potential problems are not always adequately discussed. To avoid an escalation of problems and promote efficiency, informal communication channels become fundamental and should be adequately planned and established. Therefore, providing opportunities to exchange resources among members is essential.

5.1.2 Effects of the relational dimension of social capital

The hypothesis that the relational dimension (i.e., trust) significantly influences BI has not been verified; hence, H_3 was not supported (Fig. 2). This result is inconsistent with previous studies that have emphasized the strong explanatory power of relational social capital on BI (Cerić, 2015; de Oliveira and Rabechini, 2019). This unexpected result could be closely related to the distinct characteristic of megaprojects. Compared with small- or medium-sized projects, megaprojects involve far more complex tasks (Mihić et al., 2019) and enormous pressures, especially from the public and government (Zhai et al., 2017). A TMT member involved in the Tianjin High-Speed Rail Station Transportation Hub noted that:

"*The construction of megaprojects is more like a political task for us. We are under great pressure. In this context, no matter whether we are familiar with or trust each other, we need to maintain active cooperation to ensure the smooth delivery of the project*."

Therefore, the effect of subjective willingness (emphasized by relational social capital) in megaprojects is relatively weak. Further analysis revealed that the relational dimension exerts significantly positive effects on cooperative behavior and information exchange in BI but not on joint-decision-making (Fig. 4). Interpersonal trust is an important social resource that facilitates collaboration and enables coordinated social interactions (Cerić and Sertic, 2019; Zheng et al., 2019). Trust attenuates the sense of vigilance among TMT members, promoting their free exchange of ideas (Cerić, 2015). However, this also increases the tendency to blindly believe and follow the opinions of others. Only when all TMT members fully share their views can potential risks be reduced, decision-making quality enhanced, and the TMT's role given effective play.

5.1.3 Effect of the cognitive dimension of social capital

The cognitive dimension had a significant effect on BI (i.e., H_4 is verified), consistent with prior studies' results (Ravasi and Schultz. 2006; Camelo-Ordaz et al., 2014). Cognition helps improve team cohesion and creates a good communication and collaborative atmosphere for TMT members, who can then develop a

shared understanding of project goals and undertake consistent actions (Simsek et al., 2005). The complex management of megaprojects requires establishing a highly unified leadership institution to expand the scope of resource integration and mobilize different forces (Wan et al., 2020). The unity of TMT is reflected in not only the goal but also the thought. As the "*central nervous system*" of megaprojects, TMT members can reach a consistent cognition only when they maximize the holistic management operational efficiency and capitalize on various stakeholders' strengths to ensure efficient project delivery.

5.1.4 Effect of the affective commitment

The mediating effect of affective commitment was partially verified. Due to the temporary nature of "headquarters" and "authority" in megaprojects, the members' dependence on the TMT tends to be underestimated. The current study showed that the social relationship among TMT members is transmitted to team behaviors through affective commitment, which has a positive effect on BI. This finding explains how social capital translates into team interactions (Di Vincenzo and Mascia, 2012; Pinheiro et al., 2016). Affective commitment helps members better integrate into the team and develop "*behavioral inertia*" (Morrow et al., 2012). Members are willing to continue to be involved in team behaviors and social capital formation when establishing a rapport with other TMT members. Otherwise, socio-interaction among members probably evolves into special relationships beyond the working scope, which further leads to "*hidden rules*," "*unethical behavior*," "*corruption*," and other dark behaviors (Locatelli et al., 2017; Owusu et al., 2019). The partial mediating phenomenon may have emerged because the influence of social capital on BI of TMT members in megaproject is complex and dynamic, exerting indirect influences on other factors besides affective commitment.

5.2 Implications for practice

The number of megaprojects planned and delivered globally is growing, especially in emerging countries. It is, therefore, imperative to improve BI in delivering megaprojects (Li et al., 2019). Our findings have several implications for TMT members to enhance BI in megaprojects.

The communication channels for TMT members should be expanded through breaking down barriers, overcoming "*sectarian bias*," and promoting horizontal (management hierarchy levels) and vertical (functional departments) information exchange. Apart from the formal communication channels, the importance of informal social interaction should be adequately acknowledged, considering megaprojects'

organizational complexity (Micelotta et al., 2017). For example, some TMTs organize "*breakfast meetings*" during which TMT members interact in a relaxed and informal atmosphere. By increasing the intensity of this informal interaction, TMT members could obtain valuable information and gain tacit knowledge that cannot be quickly obtained in daily meetings, documents, or announcements. Moreover, it is also imperative to build a strong network among TMT members through, for example, establishing the supervision department to prevent group differentiation and the formation of internal cliques and ensure that TMT members' responsibility is consistent with the power. Internal cliques can significantly harm the effectiveness of decision-making (Zhang et al., 2015).

The development of trust among TMT members is expected to provide an excellent foundation for interpersonal communication and remove psychological barriers to sharing information. Administrative instruction or requirement (e.g., government command) will not compel TMT members to share information fully. A "high pressure" policy only ensures formal basic cooperation among TMT members. TMT members will actively exchange their tacit knowledge and share their inner strengths only when establishing a trusting relationship (de Oliveira and Rabechini, 2019). Meanwhile, TMT members' ideological independence should be emphasized to produce constructive suggestions during joint decision-making.

The cognitive competence of TMT members should be appropriately considered. Since cognitive social capital has a significant role in BI, in addition to focusing on the "*hard power*" of executives (e.g., the agency to which one belongs, administrative levels, and academic background), their "*soft power*" (e.g., the view of the megaproject, the understanding of the critical technology, and the attitude facing difficulties) needs to be of particular concern. As Mazur et al. (2014) suggested, the cognitive ability of a project manager is essential in establishing high-quality cooperative relationships among heterogeneous members. The establishment of a shared vision contributes to reducing the fragmented distribution of TMT's attention (Su et al., 2020).

This study's empirical results showed that TMT members' affective commitment plays an important mediating role in the relationship between social capital and the TMT's BI. Consequently, TMT members' psychological state should be carefully monitored to prevent the TMT's psychological contract breach. Notably, a psychological contract breach usually occurs when members believe that their team has failed to fulfill promises, thereby triggering an undesired change in their affective commitment. According to Wang et al. (2017), commitment is vital in building a responsive and collaborative atmosphere. In many cases,

megaprojects usually focus on the frontline project managers' psychological state rather than the TMT. The absence of clear expectations over contract elements conveyed to TMT members is likely to cause psychological contract breach. Frequent communications about the terms of psychological contracts help prevent the formation of distorted perceptions in the long run (Lapointe et al., 2013). These practices provide the foundation for TMT members' increased affective commitment during the megaproject delivery process over a relatively long period.

6 Conclusions

The number of megaprojects has been growing globally, especially in emerging countries undergoing large-scale urbanization (Sheng and Lin, 2018). Governance challenges arising from insufficient TMT capability have attracted widespread attention. The positive influence of informal governance enhances interactions among TMT members. However, research on this influencing mechanism is limited. To address this research gap, we explored the internal driving factors influencing the path of TMT's behavioral integration (BI) in megaprojects. Using the lens of social capital theory, we developed and validated a theoretical model incorporating four dimensions of social capital, three dimensions of BI, and affective commitment as a mediator.

Overall, structural (interaction intensity and network density) and cognitive dimensions positively affected BI. The relational dimension influenced only cooperative behavior and information exchange, and affective commitment played a mediating role in this process. However, unlike previous research in corporate settings, the structural dimension had a stronger effect on BI compared to the relational dimension and thus became the most crucial factor in shaping BI. Nevertheless, we did not detect a significant relationship between the relational dimension and joint decision-making.

This study makes three main contributions to megaproject governance. First, our study revealed two significant paths, namely, reinforcing informal communication and cultivating common cognition to facilitate BI among megaproject TMTs. However, increasing mutual trust did not significantly promote BI, as expected. The three paths revealed different aspects of project governance and shed new light on informal governance's role boundaries, thereby contributing to TMT management in megaprojects.

Second, our study contributes to clarifying the antecedents of BI. Previous studies have shown that social relationship among TMT members plays an important role in boosting their positive behaviors. However, most of them focused on a single dimension (de Oliveira and Rabechini, 2019). Theoretical framework incorporating various social-exchange motivators to predict integrated behaviors has not been established. Our results highlight the importance of informal governance in increasing the level of BI.

Furthermore, although many studies have explored project integration, most of them focused on inter-organizational integration (Love et al., 2010) or systematic integration of projects (Davies and Mackenzie, 2014). Few studies have investigated internal team integration based on the micro-foundation.

This study analyzed the BI of TMTs, responding to the call to explore the TMT's behavior mechanism in megaproject settings (Li et al., 2019) and extending the application scope of the upper echelons theory.

Third, our study uncovered the "*black box*" between informal governance and team behavior, identifying the mediation mechanism to improve team integration. Although governance mechanisms significantly affect team operations (Peltokorpi and Tsuyuki, 2006; Zheng et al., 2019), little is known about the origins of these effects. Prior studies have shown that the interaction between members could shape their psychological attachment to the team (Han et al., 2014) and the commitment to the team is expected to improve collaborative efficiency (Wang et al., 2014). However, the relationship between these three factors has not been fully explored in the context of megaprojects. By investigating the underlying mechanism of affective commitment in shaping the relationship between informal governance and BI, this study sheds new light on TMT's psychological conditions in megaproject governance.

It is important to bear in mind three limitations of the present study that can be addressed by future research. First, this study focused on TMT members' internal social capital and did not account for the external environment (e.g., institutional pressures). Future research could compare and analyze the role of internal social capital and the external institutional environment in shaping BI. Second, this study was based on Chinese megaprojects. Although some of them have global influence, this sampling approach might narrow the findings' generalizability. Future research could investigate the effects of social capital on the megaprojects in different countries/regions through the lens of social capital. Third, this study analyzed cross-sectional data collected using self-reported questionnaires. Future research could employ the qualitative approach (e.g., in-depth and longitudinal case study) to complement the relationship between social capital and BI.

Conflict of interest

There is no conflict of interest

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