



Delft University of Technology

Examining owners' and contractors' motivations to participate in collaborative risk management of mega infrastructure projects

Li, Yuanli; Xiang, Pengcheng; Chan, Paul W.; Zhang, Jinwen

DOI

[10.1016/j.ijproman.2024.102614](https://doi.org/10.1016/j.ijproman.2024.102614)

Publication date

2024

Document Version

Final published version

Published in

International Journal of Project Management

Citation (APA)

Li, Y., Xiang, P., Chan, P. W., & Zhang, J. (2024). Examining owners' and contractors' motivations to participate in collaborative risk management of mega infrastructure projects. *International Journal of Project Management*, 42(5), Article 102614. <https://doi.org/10.1016/j.ijproman.2024.102614>

Important note

To cite this publication, please use the final published version (if applicable).

Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights.

We will remove access to the work immediately and investigate your claim.

Green Open Access added to TU Delft Institutional Repository

'You share, we take care!' - Taverne project

<https://www.openaccess.nl/en/you-share-we-take-care>

Otherwise as indicated in the copyright section: the publisher is the copyright holder of this work and the author uses the Dutch legislation to make this work public.



Examining owners' and contractors' motivations to participate in collaborative risk management of mega infrastructure projects

Yuanli Li ^{a,b}, Pengcheng Xiang ^{a,c,d,*}, Paul W. Chan ^b, Jinwen Zhang ^e

^a School of Management Science and Real Estate, Chongqing University, Chongqing 400045, China

^b Faculty of Architecture and The Built Environment, Delft University of Technology, Delft 2628BL, the Netherlands

^c International Research Center for Sustainable Built Environment, Chongqing University, Chongqing 400045, China

^d Construction Economics and Management Research Center, Chongqing 400045, China

^e School of civil engineering and management, Guangzhou Maritime University, Guangzhou, 510725, China



ARTICLE INFO

Keywords:

Mega infrastructure projects
Collaborative risk management
Collaborative motivations
Motivation framework

ABSTRACT

Despite the importance of motivation in driving the formation of collaborative risk management, the existing literature lacks recognition of stakeholders' motivations to participate in the collaborative risk management of mega infrastructure projects. By combining interview data with the theoretical framework based on previous literature, this study constructs a motivation framework for stakeholders to participate in collaborative risk management of mega infrastructure projects, comprising four groups of motivations formed by glue identity logic (organizational or individual level) and interest logic (intrinsic drive or extrinsic stimulus). Motivational differences between project owners and contractors are discussed based on the case study of the Hong Kong-Zhuhai-Macao Bridge, indicating that these differences are closely related to the identity of stakeholders and project progress. This study contributes a systematic perspective to recognize the motivations behind participation in collaborative risk management of mega infrastructure projects, aligns managerial intentions with actual motivations, and uncovers new insights into collaborative risk management. It enriches the collaborative risk management theory in mega infrastructure projects and provides guidance and inspiration for practitioners in decision-making and collaborative risk management in such projects.

1. Introduction

Mega infrastructure projects (MIPs) are a type of megaprojects (Gellert & Lynch, 2003), mainly referring to large-scale engineering facilities such as transportation systems, water supply systems, energy systems, or communication systems that provide basic public services for social production, economic development, and residents' livelihoods (Flyvbjerg, 2014). Compared with small- and medium-scale infrastructure projects, MIPs are distinguished by their considerable investment, numerous stakeholders, major political or external influences, and long life cycles (Flyvbjerg, 2014; Kardes et al., 2013). These characteristics imply that MIPs involve numerous potential risks. Once risks occur, they will cause not only substantial internal losses but also unpredictable harm to the social, economic, and natural environment related to the project (Kardes et al., 2013). A proactive approach to identifying, assessing, and responding to risks, often referred to as project risk management, is necessary to safeguard the main objectives of a project

(Rose, 2013). While the scope of traditional risk management is typically confined to a single organization, complex risks with significant life-cycle impacts in MIPs, such as sustainability risks, cannot be identified or effectively managed by a single organization (Lehtiranta & Junnonen, 2014). The resources, knowledge, and authority to address these risks are distributed among multiple stakeholders. Therefore, successful management of MIP risks necessitates collaboration among project participants.

In the practice of MIP risk management, collaborative working of project stakeholders is not easy to achieve. While collaborative approaches may be stipulated by contracts or systems, stakeholder participation typically remains voluntary (Ansell & Gash, 2008). In traditional project contract relationships, many project stakeholders lack the motivation to engage in voluntary collaboration (Xue et al., 2010). The collaborative behavior of stakeholders is driven by motivation, which represents the ideology and goal of development collaboration held by stakeholders (Barrutia & Echebarria, 2021). Stakeholders

* Corresponding author at: School of Management Science and Real Estate, Chongqing University, Chongqing 400045, China.

E-mail address: pcxiang@cqu.edu.cn (P. Xiang).

exhibit higher motivation to participate in collaborative risk management when they perceive that the accomplishment of their goals hinges on collaboration with other stakeholders (Ansell et al., 2020). In situations where stakeholders can achieve their goals individually or through alternative means, the incentive for collaboration diminishes, and they may even decline to engage in collaborative efforts (Ansell & Gash, 2008). Therefore, examining the motivations of project participants is critical in addressing the difficulties of successfully cultivating collaborative behavior in the risk management of MIPs.

Collaborative risk management (CRM), collaborative working on project risk management, refers to project stakeholders working together and sharing capabilities to achieve effective and efficient risk management (Lehtiranta, 2013). However, previous CRM research has primarily focused on the external issues of CRM participation, such as its potential benefits (Friday et al., 2018; Rahman & Kumaraswamy, 2002a), project team collaboration (Marinelli & Salopek, 2020; Rahman & Kumaraswamy, 2004; Rahman & Kumaraswamy, 2005), and CRM systems (Lehtiranta, 2013; Osipova, 2015; Osipova & Eriksson, 2011b). These studies neglect internal questions, i.e., motivation, regarding why project participants invest effort and time in CRM of MIPs. To address the research gap in understanding stakeholders' motivations for participating in CRM of MIPs, there are two points in existing CRM research that merit further exploration.

First, the motivation for stakeholders' participation in CRM of MIPs is new and lacks a conceptual and theoretical base. The limitations of conventional risk management practices serve as motivations for using CRM (Marinelli & Salopek, 2020). CRM has a variety of potential advantages over traditional risk management. For example, it can solve the problem of inefficient risk allocation (Osipova & Eriksson, 2013), reduce misunderstandings and false assumptions (Walker et al., 2017), increase the trust and reliability between parties (Rahman & Kumaraswamy, 2005), make the project objectives more transparent (Choudhry & Iqbal, 2013), and encourage technological innovation in projects (Wang & Pan, 2023). The literature reflects the diversity of collaborative motivations, but the views are fragmented. Consequently, the research question prompts: what motivations drive stakeholders to participate in CRM of MIPs? It is necessary to integrate these motivations into a comprehensive CRM motivation framework.

Moreover, different stakeholders have different attitudes towards participating in project CRM. For example, Rahman and Kumaraswamy (2002a) found that owners recommend a greater number of risks for CRM than contractors, which may indicate that owners are now more willing to engage in CRM than other groups. Marinelli and Salopek (2020) pointed out that contractors as a group demonstrate a higher degree of hesitation when asked to endorse shared responsibility and commitment in the context of CRM. Different motivations can explain the different attitudes towards participation (Barrutia & Echebarria, 2021). These studies provide some evidence of differences in motivations for researching CRM in MIPs. Understanding stakeholders' perceptions and the differences among them is crucial for effective dialogue among parties seeking to build consensus (Wei et al., 2016). Consequently, the second question arises: are there differences in stakeholders' motivations for engaging in CRM of MIPs, and what are the differences? For the successful delivery of MIPs, project owners aim to establish a closer interface with the delivery partner, enhancing integration, coordination, and control through various means (Denicol et al., 2021). Among them, the relationship between project owners and contractors plays a significant role (Marinelli & Salopek, 2020), highlighting the importance of exploring the differences in their motivations.

The purpose of this paper is to investigate the motivations that drive stakeholders to participate in CRM of MIPs and to analyze the differences in these motivations between contractors and project owners. The study makes theoretical and practical contributions. Firstly, this research provides a systematic perspective for categorizing CRM motivations and a motivation framework for participating in CRM of MIPs. Secondly, the findings on the differences in motivations can enrich the

knowledge in CRM motivation research. Additionally, this study can assist practitioners in fully comprehending their own and collaborators' motivations to participate in CRM of MIPs, thereby promoting the success of CRM.

Following this analysis in Section 1, the remainder of this paper is organized as follows: Section 2 describes a theoretical background of the motivation framework for participation in CRM of MIPs based on prior literature. Section 3 then details the case study. This is followed by a description of the analysis and study results in Section 4. Section 5 discusses the implications. Finally, Section 6 presents the conclusions and recommendations for future studies.

2. Theoretical background

2.1. Collaborative risk management

Collaborative risk management is often used interchangeably with various terms, such as joint risk management (Rahman & Kumaraswamy, 2002a), multi-organizational (Lehtiranta & Junnonen, 2014), and partnership- and alliance-related risk management (Lehtiranta, 2011; Yang et al., 2019). In this study, we prefer the term CRM because it combines both concepts of "collaboration" and "risk management", making it the most descriptive and inclusive. Previous CRM investigations have primarily focused on three key aspects.

First, Rahman and Kumaraswamy (2002a, 2002b, 2004, 2005) from China (Hong Kong) conducted a series of studies to emphasize the benefits of CRM. Their surveys of construction industry practitioners revealed that for unforeseen and unquantifiable risks, joint risk management is more effective than providing risk events in the contract and allocating risks to the party best capable of managing them (Rahman & Kumaraswamy, 2002a). Osipova and Eriksson (2013) also confirmed that CRM is the optimal choice for addressing unforeseen risks in construction projects. Friday et al. (2018) identified six capabilities relevant to CRM, including risk information sharing, procedure standardization, joint decision-making, risk and benefit sharing, process integration, and collaborative performance systems.

Second, project team collaboration is a prerequisite for the successful implementation of CRM (Rahman & Kumaraswamy, 2002b). Rahman and Kumaraswamy (2005) asserted that generating collaboration teamwork and improving relationships create an ideal environment for CRM. Mutual trust (Doloi, 2009), open communication among participants (Lehtiranta, 2011), and a shared understanding of each other's objectives (Osipova & Eriksson, 2013) are identified as the most critical factors in establishing teamwork on projects. Walker et al. (2017) demonstrated that risk can be more effectively managed through intimate and open collaboration between the project owner, the design team, and the project delivery teams. Rahman and Kumaraswamy (2004) proposed an effective approach to establish a collaboration team for CRM that dynamically manages risk based on relational contracting principles in the post-contract phase. Marinelli and Salopek (2020) highlighted the achievement of CRM team integration through the diffusion of collaborative values at strategic and practical levels.

Third, the collaborative risk management system is crucial for the successful implementation of CRM. Choudhry and Iqbal (2013) concluded that the lack of a formalized risk management system and the absence of a CRM mechanism are barriers to the successful CRM implementation. Yang et al. (2019) demonstrated the necessity for project participants to establish a partnering-based risk management system to collaboratively address the various EPC project risks. In terms of the standard CRM framework, Lehtiranta (2013) summarized the three constructs of CRM, which include a risk workshop, a process involving the contractors in risk management, and a method for utilizing performance feedback in risk management. The collaboration tools of CRM include incentives (Osipova & Eriksson, 2011b), collaboration procurement procedures (Osipova & Eriksson, 2011a), and partnership (Osipova, 2015). Additionally, the higher the utilization of collaborative

tools, the more successful the implementation of CRM (Osipova & Eriksson, 2011a). According to Osipova and Eriksson (2011a), informal practices, such as relational workshops, formulating a statement of common goals, maintaining a joint project database, engaging in team-building activities, and establishing a joint project office, have a significant positive effect on CRM implementation compared to formally implemented cooperation-based procurement approaches.

However, most of these studies have discussed CRM from a project perspective, contributing valuable insights into the critical role of CRM in MIPs. Few studies explain why project participants invest effort and time to engage in CRM in MIPs from a stakeholder perspective (i.e. motivation), rather than perceiving it as a burden or simply giving up. While existing research on the benefits of CRM reflects the diversity of stakeholder participation motivations, these motivations often appear fragmented. Although motivation plays a crucial role in advancing CRM in MIPs, the project management literature lacks a comprehensive and systematic framework for understanding these motivations.

2.2. A theoretical framework of motivation for participation in CRM

Stakeholder theory provides a useful framework for categorizing and integrating these motivations. Freeman (1984) defined stakeholders as any group or individual that can affect or be affected by the achievement of the organization's objectives. The stakeholder theory, mainly based on a review by Kivits (2011) and references therein, emphasizes taking "how interests drive stakeholder behavior" as a starting point to comprehend the interests of stakeholders, predict or understand their behavior, and achieve goals as efficiently as possible. Consequently, two logics of stakeholder involvement in CRM have been identified, namely identity logic (diversity of stakeholder identities) and self-interest logic (diversity of drivers of stakeholder behavior).

First, stakeholders have individual attributes in addition to organizational attributes (Ma et al., 2021). Davis et al. (1997) mentioned that stakeholders merge individual and organizational identities to engage in behavior driven by citizenship and collectivism. Barrutia and Echebarria (2019) argued that the organizational and individual levels are

interlinked, as organizations are managed and represented by individuals. To develop a multi-level view of collaborative motivation, Solheim-Kile and Wald (2019) proposed that both organizational and individual levels should be considered when studying motivation to participate. Therefore, motivations for stakeholders to participate in CRM of MIPs are categorized into individual-level motivations and organizational-level motivations.

Second, stakeholder behavior is influenced not only by external stimuli but also by their inner selves. Some studies have distinguished between intrinsic and extrinsic motivations for stakeholders' behavior (Solheim-Kile & Wald, 2019; Zhao & Wang, 2019). Barrutia and Echebarria (2019) suggested that intrinsic motivation involves people engaging in an activity and deriving spontaneous satisfaction from the activity itself. In contrast, extrinsic motivation does not stem from the activity itself but from the extrinsic consequences of the activity. Therefore, stakeholders' motivations for engaging in CRM are further categorized into intrinsic and extrinsic motivations, corresponding to meeting stakeholders' internal needs and satisfying external demands or pressures, respectively.

Based on the literature review of CRM, stakeholder theory was introduced to glue the two logics together, and motivations were collected from both the organizational and the individual, intrinsic and extrinsic. A theoretical framework comprising four motivation categories was developed for participating in CRM of MIPs, serving as a guide for the collection and analysis of empirical data (Fig. 1).

2.2.1. Organization-level motivation

2.2.1.1. Extrinsic motivations. Some motivations for organizations to participate in CRM are associated with MIP risk management requirements, including access to resources, cost reduction, innovative technology, transferring risk, and gaining legitimacy. MIP risk management requires a variety of resources (Kardes et al., 2013), including financial, human, and technical support. Early research has found that many organizations developed collaborations with the expectation of obtaining critical project resources from external cooperators and

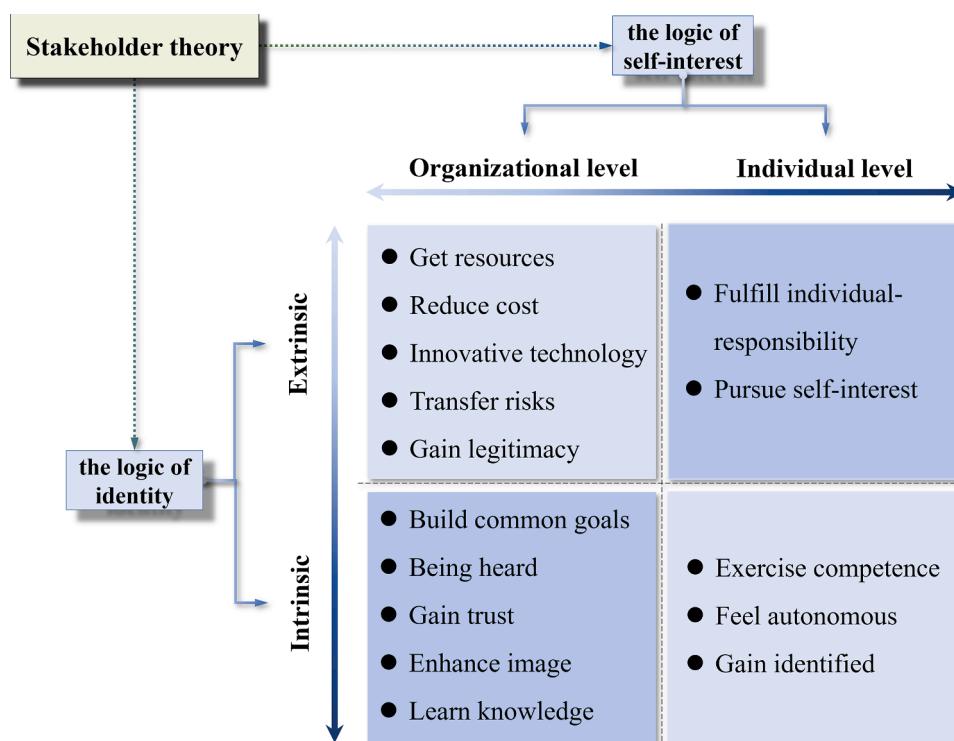


Fig. 1. A theoretical framework of motivation for participation in CRM.

increasing the efficiency of dealing with risks (Friday et al., 2018). In practice, CRM has attracted the attention of many organizations due to project cost and schedule savings, and they recognize the potential value of collaboration in optimizing risk management (Kumaraswamy et al., 2005). MIPs are often exposed to high levels of risk beyond their control, which are difficult to solve by traditional methods and conventional techniques (Qinghua et al., 2021). Through coalescing organizational interactions, CRM of MIPs is expected to break cognitive limitations and incorporate wide-ranging knowledge and expertise, thereby fostering innovation and mitigating risks or reducing risk levels (Ojako et al., 2015). MIP risks cannot be appropriately and exhaustively allocated through contractual conditions alone. Some risks may also require a concerted effort by all parties to the contract to manage them effectively (Rahman & Kumaraswamy, 2002b). CRM is a powerful collaborative strategy for addressing inefficient risk allocation and identifying closer-to-optimal ways of dealing with unforeseen events (Osipova, 2015). In addition, when dealing with risk events, organizations must adhere to the prevailing practices in their environment, comply with laws and regulations, follow procedural rules, and honor contracts. With this awareness, the organization can pave the way for obtaining the necessary approvals and authorizations through the partnerships generated by CRM (Barrutia & Echebarria, 2021).

2.2.1.2. Intrinsic motivation. Empirical studies have demonstrated that organizational participation in CRM is driven by some internal needs, such as establishing common goals, interests being listened to, building mutual trust, enhancing reputation, and learning knowledge. Stakeholders in MIPs often have diverse and even conflicting project goals (Choudhry & Iqbal, 2013). To mitigate the risks associated with inconsistent goals among project participants, participants seek goal alignment through CRM relationship workshops and the development of common goal statements (Osipova, 2015). While striving to achieve common goals, participants need to look after their own interests. Therefore, by participating in CRM in MIPs, they can build relationships with other stakeholders, ensuring that their interests, concerns, and grievances are better heard and understood (Walker et al., 2017). This engagement helps prevent their ideas from being overshadowed by other stakeholders (Ojako et al., 2015), and may even provide opportunities to influence the opinions of other stakeholders. The distrust among stakeholders may fuel competitive behavior. The involvement of multiple stakeholders in CRM can foster mutual trust, facilitate an understanding of conflicting claims and perspectives among stakeholders, alleviate tensions, and thereby establish capabilities that may be challenging for a single organization to achieve (Marinelli & Salopek, 2020). For stakeholders, participating in and successfully implementing MIPs is a rare opportunity to significantly enhance their reputation (Qinghua et al., 2021). Therefore, in order to maintain and enhance its image, the management layer endeavors to avoid accidents, actively promotes CRM to resolve conflicts with other organizations, improve performance, and facilitate the completion of projects. Stakeholders perceive involvement in MIPs as a learning opportunity to enhance long-term competitiveness (Liu et al., 2022). The contracts established with CRM in MIPs demonstrate a higher level of comprehensiveness, providing additional learning opportunities (Marinelli & Salopek, 2020). By participating in CRM, organizations learn from collaborators, gain access to the core technical or managerial competencies of other stakeholders, thereby enhancing the organization's capabilities (Marinelli & Salopek, 2020).

2.2.2. Individual-level motivation

2.2.2.1. Extrinsic motivation. Collaborative relationships between organizations engaged in CRM of MIPs ultimately develop through the actions and interactions of individuals. The most critical individuals in MIP organizations are the top managers (Ma et al., 2021). Some motivations for individuals to participate in CRM are related to external

control or rewards, including fulfilling their responsibilities and pursuing their interests. Agency theory discusses the extrinsic motivations of managers (Barrutia & Echebarria, 2019). First, agency theory emphasizes that agents must do their best to perform their agency duties and obligations in the best interest of the principal (Solheim-Kile & Wald, 2019). To achieve organizational goals and optimize risk management, top managers need to demonstrate organizational responsibility, avoid conflicts, and expend more effort to be familiar with other project participants. Agency theory is based on the premise that managers are self-interested and pursue only their own interests, which implies that they should be controlled and motivated by external rewards to align their interests with those of the organization (Osipova, 2015). The behavior of MIP managers engaged in CRM can be incentivized through external rewards, such as monetary bonuses, promotions, and honors, to mitigate the risk of misalignment between managers' goals and organizational objectives.

2.2.2.2. Intrinsic motivation. Motivations for participating in CRM of MIPs are also inextricably linked to personal values, including gaining a sense of identity, exercising personal competence, and increasing autonomy. Previous studies indicate that individuals, when attached to a group, develop a sense of belonging and derive social and emotional benefits (Barrutia & Echebarria, 2021). Thus, individual stakeholders of MIPs expect to invest their time and energy in the group to participate in CRM, achieve self-assessment through their group's accomplishments, gain a sense of identity, and thus reduce uncertainty. The leadership and abilities of leaders are the driving factors for the success of MIP construction management (Qinghua et al., 2021). Individuals can accelerate learning by participating in CRM of MIPs, sharing experiences and skills with people in various fields and disciplines to compensate for their lack of knowledge and improve their abilities. Furthermore, if the task is aligned with a person's beliefs and self-awareness, they will autonomously engage in collaboration even if the task itself is not appealing (Osipova, 2015). Therefore, when individuals who participate in the CRM of MIPs are interested in the type of work and complexity of the project, they demonstrate autonomy and actively participate and collaborate in managing risk.

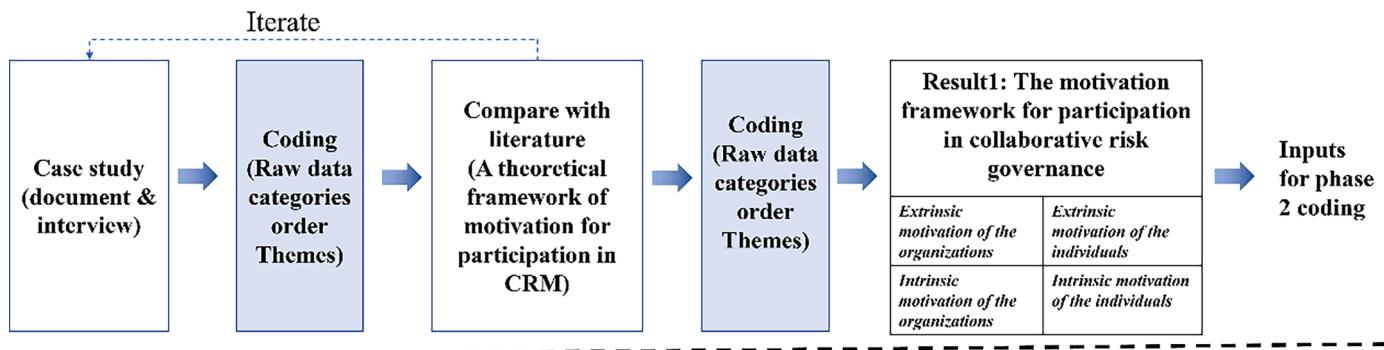
3. Research method

Why do project owners and contractors of MIPs engage in CRM? How do the motivations differ between project owners and contractors? To address these research questions, a reflective multi-approach was employed in two phases to enhance validity. We iterated between theoretical and empirical results, refining our findings and assumptions, as depicted in Fig. 2.

The first phase includes a literature review and an exploratory case study for validation. This phase aimed to explore the motivations of both project owners and contractors to participate in CRM of MIPs and to develop a motivation framework that amalgamates theoretical insights with practical experiences. The perspectives of this framework analysis (i.e., at the individual or organizational level, and considering extrinsic stimuli or intrinsic drives) are supported by previous studies covered in Section 2. Case studies are particularly apt for theory-building research, answering research questions involving "how" and "why" (Eisenhardt & Graebner, 2007). As emphasized in the introduction, it is unclear why stakeholders are engaged in CRM of MIPs. Therefore, this method is suitable in the initial stages of the theory-building cycle.

In the second phase, a comparative analysis was conducted on interview data from project owners and contractors involved in the MIPs case. To truly reflect the motivation of respondents to participate in CRM and capture the differences in their motivational perspectives, we formulated an interview outline. Respondents were prompted to provide specific examples related to MIPs and subsequently explain their answers. This approach provides a more robust foundation for theoretical

PHASE1: The motivation framework for participating in collaborative risk governance of MIPs



PHASE2: Difference in motivations for participating in collaborative risk governance of MIPs

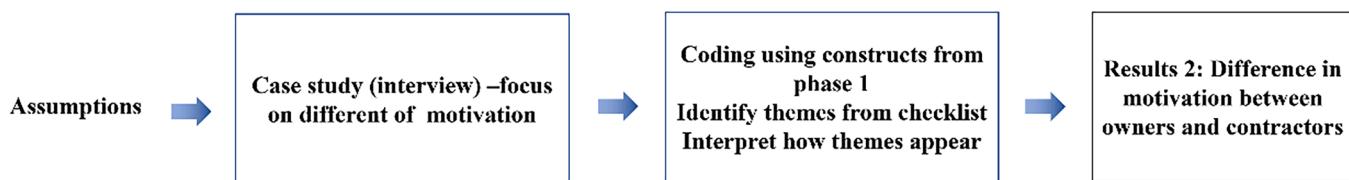


Fig. 2. Overview of the research phases.

insights and minimizes biases.

3.1. Case selection

A single-case study was chosen due to the uniqueness of MIPs and the depth of the research issues. [Yin \(1989\)](#) suggests that the description and analysis of a single case study can provide insights into a more general phenomenon by drawing attention to issues and highlighting discrepancies between theory and practice. Case selection was based on information-oriented sampling ([Flyvbjerg, 2006](#)). Two main criteria guided the selection process. First, the selected case is a large-scale project with substantial social, economic, and environmental impacts, offering a wealth of accessible data for in-depth analysis without making data collection difficult. Second, the selected case involves a variety of stakeholders and has a track record of collaborative risk management among them.

China's infrastructure investment constitutes a substantial portion of the global total, having garnered extensive experience and notable successes in the construction and management of MIPs. Therefore, we have selected a representative MIP in China—the Hong Kong-Zhuhai-Macao Bridge (HZMB)—as a case study.

First, the HZMB project, a national strategic initiative, represents the first large-scale sea crossing jointly constructed by Hong Kong, Zhuhai, and Macao under the political framework of “one country, two systems”. Currently, it is the longest open-sea fixed link globally, encompassing a dual three-lane bridge, a 6.7-kilometer immersed tunnel, two artificial islands, and two connecting roads flanking the estuary's extremities. With a total length of 55 km, a design life of 120 years, and a cost of approximately 127 billion yuan, its construction spanned from 2009 to 2018, totaling a nine-year period. The complex external environment, massive scale, and long construction time have led to the frequent occurrence of risk events in this project, which may provide intriguing and valuable information for CRM.

Second, the HZMB project involves numerous stakeholders. Led by Guangdong Province, the Hong Kong-Zhuhai-Macao Bridge Authority, jointly established by Guangdong, Hong Kong, and Macao, serves as the project owner. To achieve optimal design and construction, the Authority and China Communications Construction Company (CCCC)

Consortium signed a general contract of design and construction of artificial islands and tunnel work. As the lead contractor, CCCC heads the consortium's construction team. Other team members include the construction management consultant AECOM Asia Company Ltd. and Shanghai Urban Construction (Group) Co., Ltd. The design leadership is held by CCCC Highway Consultants Co., Ltd., with contributions from Denmark's COWI A/S consulting company, Shanghai Tunnel Engineering and Rail Transit Design & Research Institute, and CCCC Fourth Harbor Engineering Survey and Design Research Institute. The diverse interrelationships among these stakeholders during the project's risk management process suggest that issues related to CRM in the HZMB project may be complex and confusing, and are worth exploring.

3.2. Data collection

Semi-structured interviews served as the primary data source, supplemented by HZMB documents to increase the richness of the data and avoid retrospective bias in the interviews. Data collection took place between March 2022 and August 2022.

3.2.1. Documents

There have been some useful documents available since the HZMB project was proposed. First, reviewing internal guidance documents can provide an intuitive understanding of HZMB project risk management. These documents include risk management documentation and collaboration agreements implemented by project top managers to control project risks and coordinate participants, such as the “Risk Management Guide for Immersed Tunnel Installation”, the “Construction Risk Management Manual for Immersed Tunnel Installation”, and so on. Second, to improve the integrity and robustness of our data, we also obtained project-related research reports and books. For example, “The Theory and Practice of Engineering Decision-making for the Hong Kong-Zhuhai-Macao Bridge”, “Risk Management Practices for the Installation of Immersed Tunnel in the Hong Kong-Zhuhai-Macao Bridge”, “Cross-border Traffic Management of the Hong Kong-Zhuhai-Macao Bridge”, “Dreaming of the Hong Kong-Zhuhai-Macao Bridge”, and “Exploration and Practice of Island and Tunnel Project Management of the Hong Kong-Zhuhai-Macao Bridge”. These books were edited by practitioners

of the HZMB to summarize their experience in risk control for large-scale projects. Third, to enrich and supplement our data, we gathered some examples of stakeholder participation in collaborative risk management of HZMB from academic papers published by engineers and scholars, and media coverage. Combined with interview data, these documentary materials were used to examine the CRM process in the HZMB project in detail and understand why collaborative relationships were maintained.

3.2.2. Interviews

In-depth interviews were used to explore questions about motivation to participate. The HZMB involves many stakeholders, with project owners and contractors being the key stakeholders. To ensure both quantity and quality of interviews, the identification of the interviewees adopted the theoretical sampling method. Interviewee quality means that interviewees should possess the most comprehensive knowledge of the research subject. All interviewees in this study were key managers of the HZMB project and had worked on the project for at least six years. The number of interviews was determined by theoretical saturation, with sampling ceasing when responses converged to the point that no new concepts or categories could be derived in the analysis. To compare differences in motivation between contractors and project owners, theoretical saturation was required for both types of sampling. Therefore, theoretical saturation was not reached until eight interviews were conducted, including four project owners and four contractors involved in the construction of the HZMB. A description of the interviewees is shown in [Table 1](#). The selected individuals have a high level of expertise in project risk management, with over six years of experience in key roles, thus making them well-suited to provide specific facts, descriptions of events, or examples related to CRM. The titles of some have been shortened and listed only as "Manager" to ensure that they cannot be identified and to allow participants to speak freely. The interviews were conducted one-on-one online using Tencent Conference (video conference software), with recordings made after obtaining consent. The core idea behind the interview question design was to allow respondents to narrate their participation in CRM through storytelling, rather than inducing or directly asking them whether they have the motivations mentioned above. The interview comprised three parts. Some of the main questions were listed, and additional questions were added during the interview based on the respondents' answers to gain a more accurate understanding of their behavior and motivations.

The first part pertains to the background information of the respondents. For example, could you please provide a brief introduction to your position, job responsibilities, and years of experience in the HZMB project?

The second part focuses on the management of risk events within the HZMB project through CRM. For example, what CRM events impressed you during your involvement in the HZMB project? What actions did you and your organization take during these CRM events? Why were those actions chosen at the time? Which other stakeholders were involved in the process? What ideas did other stakeholders express, and what requests did they make? Were there any conflicts? Could you provide more details about these stories?

The third part of the questions relates to the motivation behind participating in the CRM of the HZMB project. For example, why were you and your organization willing to engage in CRM at the time? In your opinion, were the risk events effectively controlled through CRM? What impact do you think participating in CRM has had on you or your organization?

In the end, 963 min of interview videos were collected (each interview lasted approximately 110 min to 2 h).

3.3. Coding and analysis

3.3.1. Phase 1: abductive analysis

We used the content of documents and materials transcribed from interviews as primary data sources. The interviews were coded in an

Table 1
Background information of the interviewees of HZMB.

No.	Stakeholder	Job Position	Job Responsibility	Working Experience	Time length (mins)
1	Owner	Department Manager	Responsible for the overall management and emergency response of employees' health, safety and environmental protection.	9 years	124
2	Owner	Department Manager	In charge of multiple departments, responsible for project planning, progress and contract management.	14 years	108
3	Owner	Professional Executive	In charge of multiple departments, responsible for project quality, progress, site coordination, delivery and completion, and operation preparation.	16 years	125
4	Owner	Department Manager	Responsible for project site management, contract management, progress and operation development.	13 years	121
5	Contractor	Project Manager	Responsible for on-site safety production.	13 years	115
6	Contractor	Project Manager	Responsible for contract management and project cost management.	12 years	126
7	Contractor	Project Manager	Responsible for bid management and construction management.	13 years	127
8	Contractor	Project Manager	Responsible for risk management.	6 years	117

iterative process. As data and existing theory were considered in tandem, the research process might be viewed as transitioning from an "inductive" to a form of "abductive" research (Alvesson & Kärreman, 2007). The coding process of abductive analysis includes data reduction, data display, conclusion drawing, and verification (Silverman, 2016). This process was assisted by the ATLAS.ti software. [Fig. 3](#) depicts how the coding progressed from raw data to multiple dimensions of motivation (Raw data can be found in Appendix 1).

We began by coding the first order constructs. The raw data was decomposed into conceptual units that matched concepts identified in the literature. For example, when the first interviewee was asked to share their motivation for participating in CRM of MIPs, they provided the following statement. "Resources are the main reason we participated in collaborative risk management. We have a lot of resources in construction, but the owners have more social and technical resources that can help us better address risks." The identity terms "we", "owners" and "us" were extracted from this statement. And this statement was

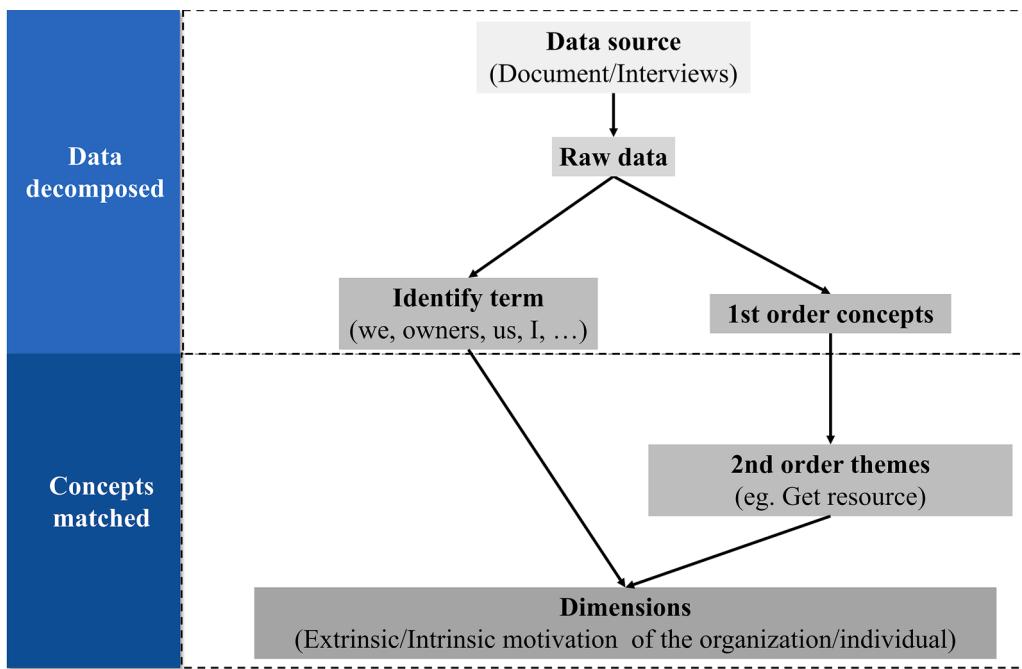


Fig. 3. Coding process phase 1.

understood to be that “obtaining resources from collaborators is an important motivation for participating in collaborative risk management”. In the second stage of coding, a code, “get resources”, was assigned to this conceptual unit. The identity term “we” shows public signs of group membership, which means that the motivational codes corresponding to these expressions can be aggregated to the organizational dimension. Conversely, when participants used terms associated with “I”, it indicated a sense of individuality, which can be summarized in the personal dimension. The same coding process was applied to the books and related documents, followed by triangulation of multiple empirical evidences. Then, we compared the codes obtained from the interviews with the theoretical framework constructed in Section 2. The aim was to assess whether empirical observations aligned with theory and whether new motivations for participating in CRM of MIPs were revealed.

In the second interview, we applied the same method to identify codes and match them to existing theories. Subsequently, we compared codes between the two interviews to assess whether codes with similar connotations could be grouped into broader categories, or if new motivation categories emerged. The remaining interviews followed the same analytical procedures. Through constant comparison, it was found that all codes in the eighth interview could be traced back to codes or categories generated in previous interviews. The interview process ends here. All codes were then reviewed to check whether they made sense in explaining the motivation for participating in CRM of MIPs. If a code didn’t make sense, we went back to the raw data, recoded it, and repeated the analysis process until every code could be interpreted.

Through iterating with the literature on the abductive reasoning process (Silverman, 2016), it was demonstrated that motivation can often be categorized into individual and organizational levels, extrinsic stimuli and intrinsic drives. The theoretical framework of motivation for participating in CRM of MIPs was improved based on the motivation codes derived from interviews and literature.

3.3.2. Phase 2: comparative analysis

While both project owners and contractors agreed that these motivations exist, there were differences in their perceptions of these motivations. Therefore, a comparative analysis of their responses was conducted to explore these differences in depth. In this process, the raw

data from the first phase were encoded with labels such as “owner” and “contractor”. During the comparison, the interviewees’ statements of motivation were quoted directly as evidence. Fig. 4 illustrates examples of coding related to the extrinsic motivation of the organization and individual.

3.4. Reliability and validity

We followed the quality checklist of qualitative research suggested by Silverman (2011) to ensure the reliability and validity of data by inspecting the analysis process and results. Reliability was ensured from two aspects. First, the diversity in respondents’ job responsibilities promoted wider applicability. For example, seven interviewees worked in various departments of the HZMB project. Their professional responsibilities covered the main affairs of the project. Their experience fully reflected the motivation of the project owners and contractors to participate in the CRM of MIPs. Second, triangulating interview data with archival documents ensured reliability. The validity of the data refers to the high explanatory power of conclusions, which is guaranteed by two aspects. First, the respondents were critical managers and decision-makers of the HZMB project, possessing rich work experience and a clear understanding of their organization and personal motivation. Second, the findings of empirical data were at least partially supported by existing theories.

4. Results

4.1. Motivation framework for participating in CRM of MIPs

According to the theoretical framework and interview data, the motivation framework for participation in CRM of MIPs can be comprehensively understood by dividing it into four aspects based on two logics. Each aspect encompasses various motivations, as detailed in Table 2. One logic categorizes motivations into organizational and individual levels. When interviewees referred to terms such as “we”, “they”, “our department”, “owners”, “contractors”, etc., this indicated a public sign of an organizational identity that distinguishes them (inside the organization) from relevant others (outside the organization). This reflects a consensus (organizational motivation) within the shared

Phase 1		Phase 2	
2nd order themes	Aggregate dimensions	Raw data	Codes
Fulfill organization-responsibility		As owners, it is our duty to coordinate, especially when other stakeholders are negatively governing, we must fulfill the owner's responsibility. The social responsibility as a state-owned enterprise.	owner
Get resources		We had to seek more resources, and invited many domestic and foreign experts in the risk governance process. The owners have more resources than our contractors. Whether it's social or technical, they can provide a lot of the resources we need.	contractor
gain legitimacy		After determining the budget adjustment, the owner still needs to solve the legality problem, answer the legal basis, calculation basis, and data for the adjustment? This long and difficult process requires the cooperation of all parties to complete.	owner
reduce cost	Extrinsic motivation of the organization	In the process of budget adjustment, we will feedback the problem to the owner in the early stage, and urge the owner to adjust the estimated budget. In the medium term, we have carried out some corresponding cooperation work, such as collecting data in some basic fields for quota compilation. In order to obtain the approval of the superior at a later stage. If the risks are not dealt with in a timely manner, it will lead to project schedule delays and cost overruns, thereby increasing project investment and bringing financial pressure to the government	contractor
transfer risk		As a contractor, the most basic requirement is to make money and get a reasonable profit. The core goal of collaboration is to benefit everyone. Collaboration can reduce some of our construction costs. By adopting this collaborative approach, most of the technology risk can be transferred to an organization that is better equipped to deal with it	owner
Innovative technology		The owners' ability to take risks is limited because they do not have enough experience, so they try to take as little risk as possible. They have chosen the general contractor approach and want to transfer most of the risks to a competent construction company to take these risks. The existing engineering management knowledge set is difficult to solve the risk problem of this project, so we need to explore something new and consolidate some new management experience.	contractor
Fulfill individual-responsibility	Extrinsic motivation of the individual	As a contractor, in order to overcome some difficulties, both technological innovation and process innovation are our means of addressing risks. Of course, cooperating with other parties can bring more a lot of innovation. I am a decision-maker. When a risk problem occurs, all the solution information comes to me. I have to analyze the risk problem as a whole, determine the optimal solution from various departments, or propose one when there is no best solution. Because everyone is waiting for me to propose a solution.	owner
Purse self-interest		It's not just me personally. During the CRM process, in discussions with contractors' full-time risk managers, some indicated that they didn't want to continue in the job because advancement in the position was slow. If given the opportunity, they would work for a while and then move to a technical position. A dilemma faced by all risk managers.	contractor

Fig. 4. Examples of coding in phase 2.

organizational identity. Additionally, interviewees expressed motivation using terms like "I", "personal" and "my", indicating a sense of individuality. These instances were coded and aggregated as individual-level motivations. Moreover, some interviewees discussed the differences in motivation between organizations and individuals, asserting that "organizations' participation in CRM of MIPs is fulfilling social responsibility, but individuals do not." This proves the reasonableness for dividing motivation into organizational and individual levels. The other logic divides stakeholders' intrinsic and extrinsic motivations. Most interviewees concurred that "the classification of motivation in terms of intrinsic drives and extrinsic stimuli is consistent with actual behavioral logic".

The first group of motivations is related to "extrinsic motivation for organizations to participate in CRM of MIPs." Based on interview data, the set of 5 motivational factors in the theoretical framework has expanded to 6, with "fulfilling organizational responsibility" as a new motivation added to this group. This motivation was mentioned by six interviewees, who described it as "being assigned responsibilities and

obligations through the establishment of a contractual relationship" and "responsible for performing corresponding duties and sharing risks".

The second group of motivations is associated with the "intrinsic motivation for organizations to participate in CRM of MIPs", comprising 6 motivations. Notably, "to increase communication" has been added to the group as a new motive compared to Fig. 1. This addition is based on statements from eight interviewees who described it as "increasing effective and frequent communication" through "information provision and consultation", to "address information asymmetries" and "reduce misunderstandings or disputes among project stakeholders due to indecision and lack of coordination".

The third motivation group is related to "extrinsic motivation for individuals to participate in CRM of MIPs", including "pursue self-interest" and "fulfill individual responsibility". The most frequently mentioned personal interest is that participating in MIPs will aid in the individual's future career development. Material incentives are also crucial. For instance, the first respondent explained, "The contribution of risk management personnel is difficult to quantify, evaluate, and

Table 2

Differences between owners' and contractors' perceptions of motivation.

Dimension	Motivation	Perception	Difference
Organization-level	Extrinsic motivation	Fulfill organization-responsibility	Content
		Get resources	Content
		Reduce cost	Content
		Innovative technology	Content
		Gain legitimacy	Importance & content
	Intrinsic motivation	Transfer risk	Importance & content
		Increase communication	Content
		Gain trust	Content
		Enhance image	Content
		Be heard	Content
Individual-level	Extrinsic motivation	Learn knowledge	Importance
		Build common goals	Content
		Pursue self-interest	Not very different
		Fulfill individual-responsibility	Not very different
	Intrinsic motivation	Feel autonomous	Importance
		Exercise competence	Content
		Gain identified	Not very different

reward. If this person cannot receive the benefits of promotion and salary increase, their enthusiasm for participating in risk management will be difficult to maintain...It's human nature."

The fourth group of motivations is associated with the "intrinsic motivation for individuals to participate in CRM of MIPs", consisting of three motivations. The motivation mentioned most frequently by respondents is the exercise and improvement of personal competence. For example, the sixth interviewee mentioned, "I have participated in this project from beginning to end. In this process, I have collaborated with different people to participate in the judgment and handling of various risk issues, which is undoubtedly the best way to improve my professional ability."

4.2. Difference in motivations for participating in CRM of MIPs

Table 2 summarizes our findings on the differences between project owners' and contractors' perceptions of motivation. These differences primarily manifest in their understanding of the content and the importance of some motivations.

4.2.1. Organization-level motivation

4.2.1.1. Extrinsic motivations. This subsection presents the owners' and contractors' varied perceptions of the extrinsic motivation of the organizations. These four motivations exhibit significant differences in content understanding, and two motivations show obvious differences

in content understanding and importance perception.

The fulfillment of organizational responsibilities, as a motivation for participation in CRM, is perceived differently by project owners and contractors regarding its content. Responsibilities fulfilled by the owner include serving as the principal agent of the government and managing contractual responsibilities with the contractor. Owners viewed coordinating and collaborating with all parties to manage risk as a primary responsibility. For example, the first and second interviewees emphasized that "collaboration is our responsibility as owners, especially when other stakeholders are negatively managing risk". Contractors, on the other hand, have two responsibilities in participating in CRM: one is the responsibility conferred by the contract, and the other is the social responsibility as a state-owned enterprise. The sixth interviewee mentioned, "The HZMB project has garnered widespread attention from society, and any major safety incident could be devastating. We must collaborate with other parties to prevent safety incidents, which also reflects our social responsibility".

To get resources, all interviewees agreed that risk management cannot be solely accomplished by one party, emphasizing the necessity of pooling the resource strengths of all involved parties. The owner relies on the contractor's technical resources, while the contractor depends on the owner's management and social resources. As articulated by the eighth interviewee, "When facing significant on-site risk issues, our primary task is to seek additional resources to collaboratively address these challenges. Owners have more resources than contractors. Whether in social or management aspects, they can provide many of the

resources we need". The owner is also tasked with coordinating on-site resources. As stated by the fourth interviewee, "In the design-build delivery mode adapted in the island tunnel engineering, risks are mainly borne by the contractor. However, in the event of force majeure, as the owner, it is imperative to mobilize social forces, coordinate resources from all parties, and make every effort to assist and provide the contractor with a conducive working platform and conditions".

To reduce costs, project owners and contractors do not have the same concerns. Owners believe that if the risks are not promptly addressed, it could result in project schedule delays and cost overruns, thereby increasing project investment and putting financial pressure on the government. For example, the first interviewer mentioned, "In addressing the issue of incomplete qualifications of immersed tube blasting operators, which could impact the project schedule and capital costs, the director of the HZMB project authority convened a coordination meeting with leaders from the engineering department, safety department, and other relevant departments". Contractors, being profit-driven entities, can achieve substantial profit margins with effective cost control. As explained by the seventh and eighth interviewees, "Collaboration can help reduce some of our construction costs". Contractors further emphasized that "in contrast to general project risk management, cost reduction is not our critical motivation in MIPs".

Project owners and contractors acknowledge that CRM can foster innovation, but the content of innovations they focus on differs. Owners primarily focus on innovation through the integration of technology and management. As the third interviewee mentioned, "Existing project management knowledge proves insufficient in addressing all the risk problems faced by the HZMB project. Collaborating with others, we explored new approaches, crystallized that knowledge into a novel risk management process, accumulated valuable collaborative experience, and provided a solid reference for subsequent projects". On the other hand, contractors' innovations are mainly technological breakthroughs, such as semi-rigid structures for immersed tunnels. The sixth interviewee clarified the difference in technological innovation, stating, "As a contractor, overcoming challenges involves both technological and process innovation. Of course, collaboration with other parties can yield significant innovation as well".

In the process of gaining legitimacy, contractors and project owners behave differently. Owners take the lead in the risk management procedure to obtain legitimacy and oversee the partner's conduct, while contractors assist in the risk management process to obtain legitimacy and approval from their superior. Moreover, owners are more concerned than contractors with gaining legitimacy. For example, the second interviewee presented an example of budget adjustment for the HZMB project, stating, "Faced with the question of whether to adjust the project budget, from the contractor's perspective, they believe it should be adjusted reasonably. However, the governments of the three regions, especially those of Hong Kong and Macau, emphasize contract compliance. As the project owner, we analyzed the actual situation. After determining the budget adjustment, the owner still needs to solve the legality problem and provide the legal basis, calculation basis, and data for the adjustment. This lengthy and intricate process necessitates the collaboration of all parties for completion".

Risk transfer is the greatest disagreement motivation between project owners and contractors. There are obvious differences in the understanding of the content and the importance of this motivation. When the design-build delivery contract was executed for the island tunnel project, the owner believed that the technical risks were transferred to more experienced contractors, whereas the contractor expressed that the owner aimed to transfer all risks. As the fourth interviewee mentioned, "When the project encounters force majeure, as the owner, it is necessary to mobilize social forces, coordinate resources from all parties, and do the best to assist and provide the contractor with a working platform and conditions". However, three contractor interviewees emphasized that "owners have limited risk-taking ability, so they seek to transfer the majority of risks to a competent construction company".

4.2.1.2. Intrinsic motivation. Among these motivations, five indicate differences in content understanding between project owners and contractors, with one motivation carrying varying importance.

To increase communication, project owners and contractors held divergent views on the content of this motivation. Owners perceived communication reached by CRM as a means to persuade participants to manage risks through emotional communication. All four interviewed owners mentioned partnerships, explaining, "As owners, we propose a partnership. Through this form, a strong relationship between contractors and project owners can be established, fostering mutual trust, enhancing communication, mitigating information asymmetry, and collectively addressing challenges more cohesively". Contrastingly, contractors believed that understanding the bottom line of the other party could be achieved through communication with owners and designers in the CRM process. "Although the island tunnel project adopts a design-build delivery model, in the current Chinese context, there are still unscrupulous contractors in the marketplace. Hence, the owner cannot fully involve all contractors in the bidding phase without concern", the contractors reported, "communication mainly occurred during the construction stage, including the resolution of technical and management risks, but was insufficient during the bidding stage".

Building mutual trust is an important motivation in the risk management process to ease tensions between parties, but project owners and contractors hold different perceptions of the level of trust. Owners believe that trust in the partnership means refraining from doubting, shirking responsibilities, or complaining during challenging times. The first interviewee emphasized, "Collaboration does not imply a loss of oversight. While trusting contractors, it is also necessary to monitor the legitimacy of their actions". On the other hand, contractors believe gaining the owner's absolute trust and fairness, especially during the bidding stage, is deemed impossible. The eighth interviewee added, "However, when the contract reaches an impasse, the atmosphere of trust created by the partnership allows for honesty and openness". To establish a long-term partnership, contractors aspire to gain the owner's trust in their skills and to have the owner believe in their full dedication to the project, and allow the government to witness their efforts and provide resources. In addition, the seventh respondent noted, "The design-build delivery model of the island tunnel project provides the contractor with the greatest degree of freedom and trust. In return for this trust, contractors will exert their best efforts to complete the project."

To enhance the image, all interviewers mentioned this motivation and agreed that "the HZMB is a national project, and participating in the project is a rare opportunity for the organization. Overcoming difficulties and excelling in the project can generate good social effects". The owner mainly considers the project's image and the national image, including aspects such as the project's quality, the project's social impact, the political image of the mainland, and the impact on the national industrial development level. The contractor's primary considerations include the company's image and the project's image, involving the company's market presence, industry leadership, company performance, social contributions, and the international impact of the project. As the fifth interviewee mentioned, "Participating in megaprojects always attracts public attention. Perfecting the HZMB project has transformed it into a national emblem symbolizing the highest standards of national bridges, and our company, China Communications Construction Corporation, represents the highest level of the entire Chinese construction enterprise. Therefore, despite encountering challenges, as a state-owned enterprise, we did not unilaterally halt construction. Instead, we collaborated with the government and the owner to jointly address the risks."

The motivation for being listened to is that the organization expresses its needs through participation in CRM, with the hope of being comprehended and accepted by other organizations. Owners strive to convey risk issues to their superiors during coordination meetings, hoping that the government will take their professional insights into

consideration. Simultaneously, they aim to establish authority among their subordinates, fostering the acknowledgment of the owner's management professionalism by contractors. For example, the third interviewee illustrated a case involving automated steel box girder production, explaining, "To solve the challenges of slow production efficiency and unstable quality of steel box beams, the owner proposed adopting an automated production method. After proposing this idea, the crucial aspect was elucidating it to various parties, including experts. Concurrently, to encourage contractors to try this production method, we had to communicate its benefits to their companies. Emphasizing that it could position them as industry leaders and enhance their image played a pivotal role, and eventually, they embraced the idea". Of course, this acceptance came gradually through collaborative behavior. Contractors, on the other hand, primarily sought industry assistance through collaborative meetings or urged owners to present their demands to the government. The sixth interviewee clarified, "When there are risk issues, we have to report our requirements to the owners and the government. Only by listening to our demands can we collaboratively solve the risk problems. If we do not initiate our demands, they will not be aware of the problems we face".

It is clear from the interviewees' statements that owners are more concerned with the motivation of "learning knowledge" than contractors. The third owner interviewee explained, "When faced with certain technical risk issues, conflicts between the owner and the contractor escalated. Contractors perceive themselves as more specialized in technology and are hesitant to embrace our risk management proposals. We also can't propose a risk management plan arbitrarily. In the process of CRM, we not only go abroad to learn advanced technology but also consult with our partners. With a professional cognitive foundation, our advice is reasonable". Owners emphasized that "none of the project participants had implemented such a large project or encountered these special problems". Therefore, to compensate for the knowledge gap, stakeholders were willing to learn and absorb knowledge from other industries together. For instance, the first owner interviewee illustrated, "As owners, to come up with effective and efficient management practices, we should learn about process design and understand design considerations from our partners so that we can accurately assess risks."

There is a common goal between the owner and the contractor, that is, to ensure the success of this national project. The third interviewer elucidated, "If all stakeholders lack a common goal and work independently, risks will not be successfully addressed, and the project will face challenges in completion." Although the goals are the same, the interests behind the goals are different. Project owners want to complete a high-quality project, so they engage in CRM and establish a common goal to regulate contractors' behavior, thereby enabling contractors to smoothly complete the project. Furthermore, the owners emphasized that "achieving a common goal is a gradual process" and that "the way to achieve the goal may not always be the optimal solution for the stakeholders or satisfy the best interests of all stakeholders, but it at least achieves compromise interests that are acceptable to every stakeholder". On the other hand, the contractors aim for profitability, thus engaging in collaboration, establishing a common goal, and seeking assistance from the owner and the government to accomplish the project. For example, the fifth interviewee referred to the case of adjusting the project budget, explaining, "As contractors, we certainly desire budget adjustments, but in order to gain approval from the owner and the government, we have to build consensus with them that everyone is committed to building a successful project". The sixth interviewee, a contractor, said directly, "The driving force for contractors to participate in CRM is to achieve the common goal. Inconsistent goals result in losses for all parties involved."

4.2.2. Individual-level motivation

4.2.2.1. Extrinsic motivations. For the two motivations within the individual-level extrinsic motivation group, there is no significant

difference between contractors and project owners in terms of understanding the motivational content and its importance.

Fulfilling personal responsibility was mentioned by three owner interviewees and one contractor interviewee as their individual motivation for engaging in CRM. For example, the first interviewee (owner) mentioned, "It was my responsibility to communicate and coordinate with other departments on behalf of our department to address safety and productivity risks. Having chosen this career, I must fulfill this responsibility". The third interviewee (owner) also emphasized, "I am a decision-maker. When a risk problem occurs, all the solution information comes to me. I have to analyze the risk problem comprehensively, determine the optimal solution from various departments, or propose one when there is no best solution. Because everyone is waiting for me to propose a solution". At the same time, he also emphasized, "In this position, I am facing a lot of pressure."

When individuals are given more responsibilities and obligations, they will be more actively involved in CRM of MIPs. The fourth interviewee (owner) explained, "In China, democratic centralism should be reflected. Risk solutions require compromise from all parties, and it is unlikely that anyone will be adamantly opposed to them. In other words, when a risk solution cannot be reached, those who are willing to shoulder responsibility will step forward and say, 'You execute, and I will take responsibility if something goes wrong.' Ultimately, a consensus can be reached on the risk solution. This person in charge must be in a high position. The higher the position, the greater the responsibility". The seventh interviewee, a contractor, also explained this motivation, "Personally, it is the manager's responsibility to collaborate with all parties in controlling the risks and ensuring the success of the project."

To pursue personal interests, seven respondents mentioned this motivation. As summarized through the interview content, the interests expected from participating in the HZMB CRM include honorary recognition, personal career development prospects, research achievements, promotion, and salary increase. The third, fourth, and eighth interviewees all stated, "Being able to participate in the HZMB was undoubtedly the most significant experience in my career, and some of the awards and recognitions I received in the project were crucial to my future development". Therefore, the greatest incentives for individuals are honorary recognition and prospects for personal development. The sixth interviewee added that "in addition to aiming for the success of this project, everyone also aspired to realize personal goals by collaboratively addressing risk issues and even achieving scientific research outcomes, making the project a masterpiece and receiving various scientific and technological progress awards". The fifth respondent also highlighted that "to overcome engineering technology challenges and mitigate technical risk, Chief Engineer Lin Ming introduced numerous technological innovations and inventions, contributing to the nation and eventually leading to his election as an academician of the Chinese Academy of Engineering."

However, for managers specializing in risk control, the personal interests they seek are not easily attended to or satisfied. As the first respondent explained, "How do you determine the achievement of risk managers, that is, how do you decide the effectiveness of risk controls? At the time, the most direct experience was to observe whether a risk event had occurred. However, others argue that the event would not have been risky even if the risk manager had not been there to manage it. Without a proper way of recognizing, encouraging or rewarding the efforts of the risk manager, proactive individual behaviors to control risk will not be sustained for long". He further added, "It's not just me personally. During the CRM process, discussions with contractors' full-time risk managers, some indicated, that they were reluctant to continue in the job due to slow career advancement. If given the opportunity, they would work for a while and then transition to a technical position. This dilemma is faced by all risk managers."

4.2.2.2. Intrinsic motivation. This subsection describes the differences in the three motivations in the individual-level intrinsic motivation group between project owners and contractors. The motivation to exercise competence exhibited significant differences in content understanding; to feel autonomous showed differences in perceived importance, while to gain a sense of identity did not exhibit significant differences.

Contractors and project owners interviewed expressed that they could exercise and improve their competencies by engaging in CRM, but they focused on different competencies. Owners uniformly noted improvements in their coordination skills. "Everyone doesn't have a lot of experience with projects of this magnitude, and participating in these types of projects is a rare learning opportunity." The third respondent mentioned, "When dealing with risks they have never encountered before, everyone might have different solutions. For me, the hardest part is synthesizing everyone's ideas and coordinating them to overcome challenges." The fourth interviewee highlighted, "When managing risks, I need to coordinate among five or six different roles to reach consensus, which is a test of my communication and coordination skills."

Contractors emphasized that their risk awareness and risk judgment capabilities have been improved. The seventh interviewee explained, "Maybe I've never been involved in a project with so many unpredictable risks before, so naturally, I wasn't able to predict everything like I could in previous projects. However, during my involvement in the HZMB project, both the project's requirements and my feelings emphasized the importance of being risk-aware in every aspect of the project from start to finish." The fifth interviewee also pointed out, "By participating in the collaborative risk management of the HZMB project, my understanding of project risk management has significantly deepened, especially as my awareness of risk management has been strengthened. Whether in the project setting or my personal life, heightened risk awareness prompts me to anticipate and consider how to react in case such situations arise." The eighth respondent remarked, "The most significant benefit I gained from participating in the HZMB project is an enhanced awareness of risk management. I will be more attentive to controlling project risks in my future involvements."

Feeling autonomous, six interviewees mentioned this motivation for engaging in CRM. The seventh respondent expressed, "Whether it is the manager's qualities or my commitment as a member of the Communist Party, I will not respond passively to risks. Personally, I just want to collaborate with everyone to overcome the difficulties and ensure the success of the project". First, the complexity of risk events may enhance individuals' autonomy in engaging in CRM. The third respondent explained, "people are inherently interested in things that have never been done before. This is the human behavior pattern, also manifested in project risk management. For me, I was particularly interested in overcoming risks, when I encountered things in the HZMB project that I had never experienced in my career. But dealing with these risks, for which I have no prior experience to draw on, cannot be solved by individuals acting alone. Others share the same interest, so we discuss and collaborate on solutions together."

Second, participants' risk awareness may also contribute to increased individual autonomy in engaging in CRM. For example, the fifth interviewee mentioned, "The risk management culture of the HZMB is very pragmatic and has heightened our risk awareness through slogans, documents, and regulations. With the enhancement of risk awareness, I began actively contemplating potential risk issues in various aspects of the project and how I should respond when these challenges arise." Compared to contractors, owners are more likely to be driven by autonomy. The first interviewee stated that "due to the supervision of the owner and third parties, the contractor adopted a passive approach to risk management, focusing on meeting our requirements and ensuring compliance with regulations".

To gain a sense of identification, both owners and contractors have mentioned this motivation, and their views are the same. As the third interviewee mentioned, "Identification with personal values is essential when conducting project CRM, whether serving the nation or the

organization. It is a basic recognition of human nature". Especially for MIPs with significant social impacts, it exerts a strong branding effect, fostering a heightened sense of identity among participants engaged in collaborative risk management. The second respondent explained, "The HZMB is a great brand, and risk management of the HZMB project is part of maintaining the project brand. Therefore, my involvement in risk management unquestionably contributes to maintaining the brand, and I also feel a stronger sense of achievement and mission". The fourth and sixth interviewees echoed, "The HZMB project has earned recognition from national leaders, and we are proud of our participation in the project and have a stronger sense of self-worth". The participants' self-identity aligns closely with the project's image, contributing to a more effective maintenance of the project. For example, the eighth interviewee stated, "I had the opportunity to participate in this great project. The platform was provided by the state, and the company provided the opportunity. I participated in collaborative risk management and solved the major risk issues facing the project. This contributed to a good business card for the nation, established a good image for the organization, and garnered recognition for me, reflecting my value. All these are complementary". This sense of identity remains after the completion of the HZMB project and may stay with participants for the rest of their lives. Both the fifth and eighth respondents said, "Those who have participated in the HZMB project will mention this experience throughout their lives".

5. Discussion

5.1. Theoretical implications

5.1.1. Theoretical framework provides a new perspective on integrating motivation

The study proposes a new conceptual framework for cognizing the motivations for participation in CRM of MIPs from a broad and more systematic perspective. In this framework, motivations are categorized based on two logics provided by stakeholder theory, the logic of interest that divides extrinsic and intrinsic motivations, and a logic of identity that distinguishes between organizational and individual levels. These two logics may lead to different effects.

It is common to distinguish between extrinsic and intrinsic motivation (Zhao & Wang, 2019). In this study, intrinsic motivation refers to meeting stakeholders' internal needs by participating in CRM, while extrinsic motivation aims to satisfy external demands or pressures. This finding is also consistent with the major role that motivation theories attach to intrinsic/autonomous motivations over extrinsic/controlled motivations (Deci & Ryan, 2000). The organizational level and individual level results we consider are also interesting. Collaborative risk management of MIPs represents a relational behavior that involves both individual and organizational levels. Mandell et al. (2017) proposed that language is important in determining the way people behave towards each other. Therefore, we fully leveraged this insight. During the interviews, respondents consistently differentiated between describing organizational and individual motivations in CRM. When expressing organizational motivation, respondents used terms like "we", "they", and "our department" to distinguish them (inside the organization) from others related (outside the organization), indicating organizational consensus. When articulating personal thoughts, they employed words such as "I", "myself", "personal", clearly reflecting individual consciousness. This provided a valuable method for distinguishing organizational-level motivation from individual-level motivation during the coding process. Furthermore, the organizational and individual levels are interrelated, which is reflected in the motivation results. For instance, gaining a sense of recognition is an individual's intrinsic motivation, referring to participants aligning their personal values with the image of the organization and the project. Their strong sense of achievement is influenced by the accomplishments of organization/project, which is a powerful driving force for individual

participants to actively participate in CRM.

Individual and organizational motivations have been identified in several studies in other fields. Solheim-Kile and Wald (2019) directly attributed individual-level behavioral intentions to intrinsic motivation, concentrating economic motivations on the organizational level. This ignores the fact that individuals may also be externally influenced. Although Barrutia and Echebarria (2021) discussed organizational and managerial motivations, they internalized the external incentives received by managers, such as organizational rewards, directly through theoretical derivation to the benefits derived from belonging. A systematic and comprehensive view of motivations for CRM has not been fully developed. Our study integrates the logic of identity and the logic of interest, revealing that it is possible to distinguish between intrinsic and extrinsic motivations at both the individual and organizational levels. The theoretical framework addresses the issue of motivational omission and provides a new perspective for integrating multiple motivational factors. Moreover, it implies that the CRM motivation framework can be enriched by drawing on stakeholder theory.

5.1.2. Motivation framework provides new practical motivations

Based on the interview data, this study ultimately proposes a comprehensive motivation framework for participating in CRM of MIPs. Unlike previous studies that rely on the logic of combining theories, the motivation elements in this paper's motivation framework are actual intentions to participate in CRM of MIPs, rather than merely conceptual motivations deduced from various theoretical paradigms.

Compared to the theoretical framework presented in Section 2, the motivation framework introduces two additional motivations, namely "fulfill organization-responsibility" and "increase communication". "Fulfill organization-responsibility" was mentioned by four owners and two contractors, who explained that relying solely on everyone's autonomy to participate in risk management is not practical. It is necessary to have contractual constraints and a clear division of responsibilities to enable stakeholders to fulfill organizational responsibilities (Rahman & Kumaraswamy, 2002a). This is consistent with the extrinsic drive formulations of collaborative behavior in the literature, and the extrinsic obligations arising from agency theory may contribute to designing more effective governance mechanisms at the organizational level (Solheim-Kile & Wald, 2019).

"Increase communication" was cited by all eight interviewees, explaining that being adept at communication can eliminate a lot of risks. This motivation was frequently mentioned along with "gain trust". For instance, the second interviewee stated, "Communication promotes mutual trust," while the third interviewee emphasized, "Communication will only take place after a relationship of trust has been established." Communication and trust are complementary — trust guides communication, and communication promotes trust. Doloj (2009) found that, while trust and effective communication are mutually inclusive, they directly impact the development of capabilities for joint risk management within the partnering organizations. The interview data showed that increasing communication primarily aims to share information and enhance decision-making accuracy, while gaining trust is mainly to alleviate relationship conflicts and foster a positive collaborative atmosphere. Therefore, this research did not amalgamate the two motivations, in alignment with expressions in the literature on communication and trust. Lehtiranta (2013) argued that with increased communication, there is enough time among stakeholders to clarify goals and interpretations, creating a transparent flow of information to reveal hidden details. Additionally, Marinelli and Salopek (2020) pointed out that trust increases expectations of positive reciprocity and can be relied upon for fulfilling promises, acting consistently and predictably, and negotiating fairly in the presence of opportunism.

5.1.3. Motivational differences provide new knowledge for stakeholders to participate in CRM

Some studies have compared the attitudes of contractors and project

owners toward CRM (Rahman & Kumaraswamy, 2002a). Different motivations can explain different attitudes towards participation. This study confirms that differences may exist in the motivations of owners and contractors to participate in CRM of MIPs, mainly reflected in different understandings of motivation content and different concerns about the importance of motivation.

There are differences in the content understanding of the 12 motivations between contractors and project owners, with 11 motivations at the organizational level and 1 motivation at the individual level, as illustrated in Fig. 5. Regarding this individual-level motivation, namely, exercising personal competence, owners frequently mention it for the enhancement of personal coordination skills, while contractors emphasize the reinforcement of risk awareness and risk judgment. It can be inferred that differences in organizational identity result in variations in organizational goals and needs, leading to different understandings of the same motivation. This conclusion is not adequately reflected in the current literature. These differences may elucidate conflicts in the CRM process and explain why employing the same strategy to encourage various stakeholders to participate in project CRM can have different effects.

Project owners and contractors exhibit different concerns regarding the importance of four motivations, including learning knowledge, gaining legitimacy, transferring risk, and feeling autonomous. Compared to contractors, owners have shown greater concern for these four motivations, indicating a higher willingness to participate in CRM, consistent with Rahman and Kumaraswamy (2002a). This study further provides insights into why owners are more willing to participate in CRM. Project owners, in comparison to contractors, may lack certain technical knowledge, preferring collaboration to compensate for this gap and transferring technical risks to more experienced contractors. Additionally, as project leaders, owners exhibit heightened concern for the project and possess greater autonomy. Both of these views are supported by the research findings of Liu et al. (2022). Whether it is explorative learning supported by intensive collaboration and the effective use of external resources at the macro level, or spontaneous problem-oriented experimental learning at the micro level, it is driven by the leadership of the owners, further elucidating their motivation to participate in CRM. Since contract types are typically chosen by the project owners, and the validity of the contract is guaranteed by them, they are more concerned with obtaining legitimacy than contractors.

In addition, three motivations did not show significant differences between project owners and contractors, namely pursuing self-interests, fulfilling individual responsibilities, and gaining a sense of identity. Respondents mentioned in the descriptions of these three motivations that "this is human nature". These motivations are only associated with human nature and are not influenced by one's personal position.

However, these differences are not static. As the project progressed, the differences in motivation between the project owner and the contractor gradually diminishes to achieve a common goal and complete the project. In the initial stage of the project, contractors have a short-term view and the motivation to minimize production costs. When owners propose some innovative technologies, such as the automated steel box girder production line, contractors may not immediately accept these ideas, perceiving potential risks and fearing increased production costs in case of failure. However, as the project progresses, communication between the owner and the contractor increases, and the contractor gradually recognizes the importance of innovative technology in leading the industry and successfully completing a national project. Consequently, the difference in perspectives between the owner and the contractor gradually narrows. Previous studies have rarely focused on stakeholders participating in CRM from a dynamic perspective. We contribute to existing research, showing that motivation evolves with the project environment over time. That is, stakeholders' motivation to engage in CRM needs to transition from a static perspective to a dynamic analysis, representing a novel insight.

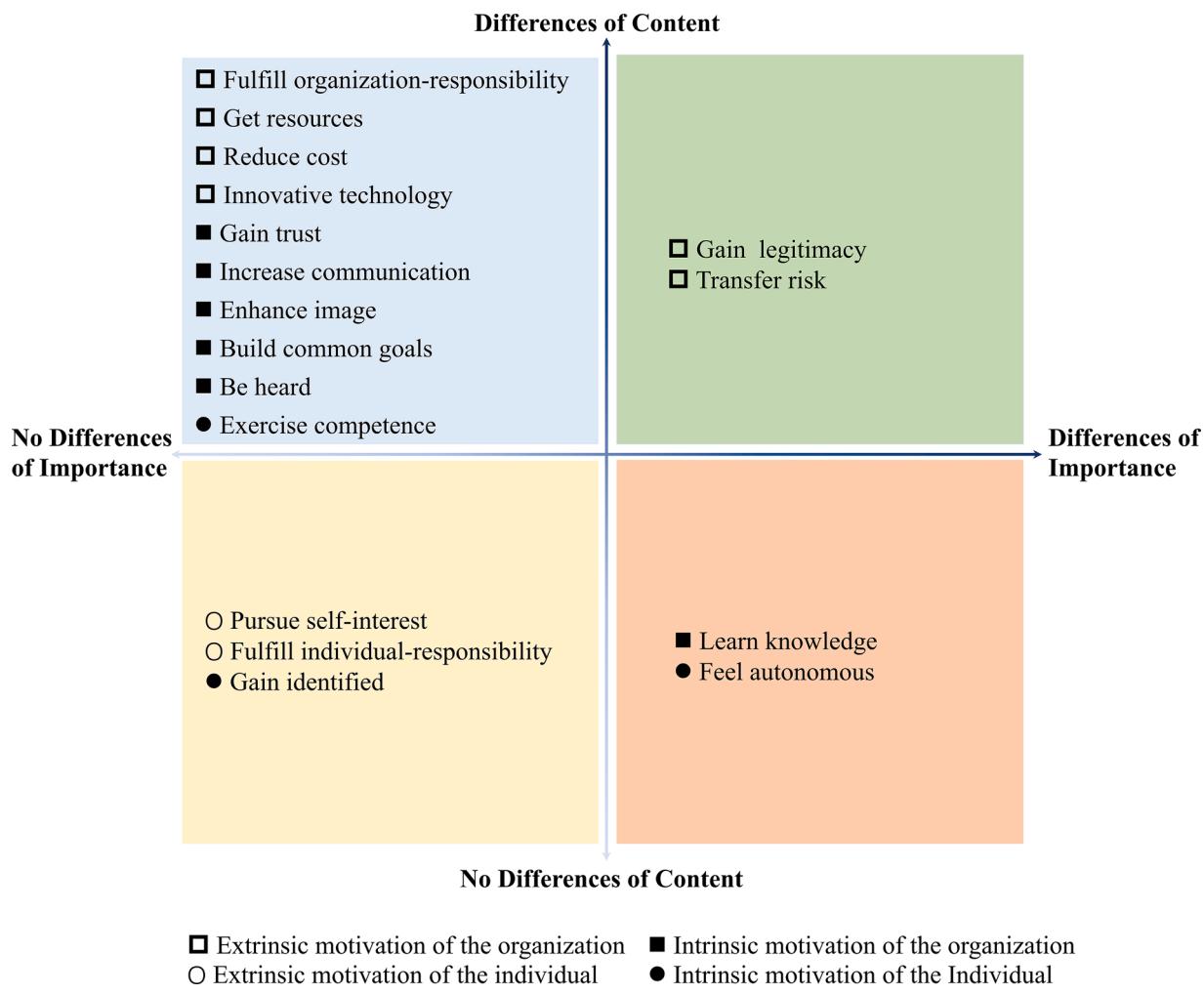


Fig. 5. Differences in motivation between project owners and contractors.

5.2. Managerial implications

Most studies recommend the implementation of CRM for MIPs, showing that CRM can bring many benefits, such as increased productivity, cost savings, and improved quality (Osipova, 2015). Yet it is not clear how to do this. Collaborative behavior is influenced by the motivation of stakeholders to participate. Blindly generalizing strategies to advance collaboration without a thorough understanding of the context and the stakeholders' perceptions of motivation might pose challenges.

The motivation framework constructed in this study, encompassing the motivational factors identified in interviews with practitioners who participated in CRM of MIPs, can guide practitioners in understanding the motivations of both parties. Firstly, organizational and individual motivations should not be confused. Decision-makers within organizations need to understand the motivations that might drive individuals to participate more actively in collaborative management. Secondly, decision-makers can identify the motivations of both parties in terms of external incentives and internal drivers to design a collaborative management solution that is satisfactory to both parties.

The findings on motivation differences also provide insights for risk managers in MIPs. Firstly, the motivation differences between project owners and contractors are primarily manifest in the understanding of motivation content. Thus, managers should actively enhance the information communication between project owners and contractors to promote the sharing demand and realize the CRM behavior. Secondly, concerning motivations that differ in importance, managers should provide guidance to individuals less concerned about motivation,

enabling them to comprehend each other's motivational perspectives and reducing conflicts between the parties. Finally, motivation differences tend to narrow as the program progresses. Therefore, setting common goals (Marinelli & Salopek, 2020) in the project's initial stages can enhance effective communication, information exchange, and frank risk discussion (Doloi, 2009). Especially in the uncertain and ever-changing environment of MIPs, establishing common goals is crucial for saving time and initiating the project earlier (Osipova, 2015).

6. Conclusion

Based on the relevant theories of collaborative motivation and interview data, this study constructed a comprehensive motivation framework for stakeholders to participate in CRM of MIPs. The motivation framework comprises seventeen motivation elements, including two new motivations identified from the interviews. It is categorized into four groups by integrating identity logic (organizational or individual level) and interest logic (intrinsic drive or extrinsic stimulus). This framework provides a broad and systematic view for understanding motivations for stakeholder participation in CRM of MIPs. A comparative analysis of the interview data confirmed the theoretical speculation regarding the "differences in motivations of contractors and project owners to participate in CRM of MIPs". These differences primarily exist in their understanding of the content and importance of certain motivations, primarily regarding motivations at the organizational level. However, these differences are not static. As the project progresses, the differences narrow, focusing on achieving common goals and

completing the project. These findings contribute new knowledge to CRM theory and offer guidance for practitioners in CRM decision-making and management.

Despite the contributions of this study, it has several limitations. Firstly, the data used in the study came from a single case in the Chinese context. Due to the limitations of a single-case methodology and the specific context, the findings of this study can only be generalized after large-scale empirical analysis without contextual constraints. However, given China's significant role in the global megaproject market, the motivation framework identified in this study is not only beneficial to Chinese risk managers involved in CRM of MIPs but also has implications for other countries. Secondly, there is no comparison of the motivations of other stakeholders who participated in collaborative risk management in MIPs. While project owners and contractors are the core stakeholders in the risk management of MIPs, various other stakeholders also participate and collaborate. Future research could enrich our understanding of motivations by exploring differences among other stakeholders in MIPs. Thirdly, the findings of motivation differences mainly relied on interview data, which lacks direct theoretical evidence. Meanwhile, these differences can only explain which motivations are present, not the strength of the differences in motivations. Future research should provide more theoretical support and extend our analysis by verifying the strength of the differences through motivation scores.

CRediT authorship contribution statement

Yuanli Li: Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing, Conceptualization, Data curation, Formal analysis. **Pengcheng Xiang:** Conceptualization, Data curation, Funding acquisition, Investigation, Supervision, Writing – review & editing, Resources, Project administration. **Paul W. Chan:** Conceptualization, Investigation, Methodology, Resources, Supervision, Writing – review & editing. **Jinwen Zhang:** Formal analysis, Investigation, Resources, Supervision, Writing – review & editing.

Declaration of competing interest

The author(s) declared no potential conflicts of interest for the research, authorship, and/or publication of this article.

Acknowledgments

This research is supported by the Key Program of China National Social Science Foundation (21AGL033), Major Program of Philosophy and Social Sciences Planning of Sichuan Province (SC22ZDYC05), and the Fundamental Research Funds for the Central Universities (No.2023CDJSKZK02).

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.ijproman.2024.102614](https://doi.org/10.1016/j.ijproman.2024.102614).

References

Alvesson, M., & Kärreman, D. (2007). Constructing mystery: Empirical matters in theory development. *Academy of Management Review*, 32(4), 1265–1281. <https://doi.org/10.5465/AMR.2007.26586822>

Ansell, C., Doberstein, C., Henderson, H., Siddiki, S., & t'Hart, P. (2020). Understanding inclusion in collaborative governance: A mixed methods approach. *Policy and Society*, 39(4), 570–591. <https://doi.org/10.1080/14494035.2020.1785726>

Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory*, 18(4), 543–571. <https://doi.org/10.1093/jopart/mum032>

Barrutia, J. M., & Echebarria, C. (2019). Comparing three theories of participation in pro-environmental, collaborative governance networks. *Journal of Environmental Management*, 240, 108–118. <https://doi.org/10.1016/j.jenvman.2019.03.103>

Barrutia, J. M., & Echebarria, C. (2021). Public managers' attitudes towards networks: Different motivations, different attitudes. *Public Management Review*, 23(7), 1006–1031. <https://doi.org/10.1080/14719037.2019.1708440>

Choudhry, R. M., & Iqbal, K. (2013). Identification of risk management system in construction industry in Pakistan. *Journal of Management in Engineering*, 29(1), 42–49. [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000122](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000122)

Davis, J. H., Schoorman, F. D., & Donaldson, L. (1997). Toward a stewardship theory of management. *Academy of Management Review*, 22(1), 20–47. <https://doi.org/10.5465/AMR.1997.9707180258>

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior". *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

Denicol, J., Davies, A., & Pryke, S. (2021). The organisational architecture of megaprojects. *International Journal of Project Management*, 39(4), 339–350. <https://doi.org/10.1016/j.ijproman.2021.02.002>

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

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1), 25–32. <https://doi.org/10.5465/amj.2007.24160888>

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219–245. <https://doi.org/10.1177/1077800405284363>

Flyvbjerg, B. (2014). What you should know about megaprojects and why: An overview. *Project Management Journal*, 45(2), 6–19. <https://doi.org/10.1002/pmj.21409>

Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Marshfield: MA: Pitman.

Friday, D., Ryan, S., Sridharan, R., & Collins, D (2018). Collaborative risk management: A systematic literature review. *International Journal of Physical Distribution and Logistics Management*, 48(3), 231–253. <https://doi.org/10.1108/IJPDLM-01-2017-0035>

Gellert, P. K., & Lynch, B. D. (2003). Mega-projects as displacements. *International Social Science Journal*, 55(1), 15–25. <https://doi.org/10.1111/1468-2451.5501002>

Kardes, I., Ozturk, A., Cavusgil, S. T., & Cavusgil, E. (2013). Managing global megaprojects: Complexity and risk management. *International Business Review*, 22(6), 905–917. <https://doi.org/10.1016/j.ibusrev.2013.01.003>

Kivits, R. A. (2011). Three component stakeholder analysis. *International Journal of Multiple Research Approaches*, 5(3), 318–333. <https://doi.org/10.5172/mra.2011.5.3.318>

Kumaraswamy, M. M., Ling, F. Y. Y., Rahman, M. M., & Phng, S. T. (2005). Constructing relationally integrated teams. *Journal of Construction Engineering and Management*, 131(10), 1076–1086. [https://doi.org/10.1061/\(ASCE\)0733-9364\(2005\)131:10\(1076\)](https://doi.org/10.1061/(ASCE)0733-9364(2005)131:10(1076))

Lehtiranta, L. (2011). Relational risk management in construction projects: Modeling the complexity. *Leadership and Management in Engineering*, 11(2), 141–154. [https://doi.org/10.1061/\(ASCE\)LM.1943-5630.0000114](https://doi.org/10.1061/(ASCE)LM.1943-5630.0000114)

Lehtiranta, L. (2013). Collaborative risk management processes: A constructive case study. *Engineering Project Organization Journal*, 3(4), 198–212. <https://doi.org/10.1080/21573727.2013.832671>

Lehtiranta, L., & Junnonen, J. M. (2014). Stretching risk management standards: Multi-organizational perspectives. *Built Environment Project and Asset Management*, 4(2), 128–145. <https://doi.org/10.1108/BEPAM-06-2013-0019>

Liu, Y., Houwing, E. J., Hertogh, M., Yuan, Z., & Liu, H. (2022). Explorative learning in infrastructure development megaprojects: The case of the Hong Kong-Zhuhai-Macao Bridge. *Project Management Journal*, 53(2), 113–127. <https://doi.org/10.1177/87569728211065574>

Ma, T., Wang, Z., Skibniewski, M. J., Ding, J., Wang, G., & He, Q. (2021). Investigating stewardship behavior in megaprojects: An exploratory analysis". *Engineering, Construction and Architectural Management*, 28(9), 2570–2591. <https://doi.org/10.1108/ECAM-07-2020-0479>

Mandell, M., Keast, R., & Chamberlain, D. (2017). Collaborative networks and the need for a new management language. *Public Management Review*, 19(3), 326–341. <https://doi.org/10.1080/14719037.2016.1209232>

Marinelli, M., & Salopek, M. (2020). Joint risk management and collaborative ethos: Exploratory research in the UK construction sector. *Journal of Engineering, Design and Technology*, 18(2), 343–361. <https://doi.org/10.1108/JEDT-03-2019-0071>

Ojiako, U., Papadopoulos, T., Stamat, T., Anagnostopoulos, D., & Marshall, A. (2015). Collaborative governance in Greek infrastructure projects. *Proceedings of the Institution of Civil Engineers-Management Procurement and Law*, 168(3), 135–145. <https://doi.org/10.1680/mpal.1400037>

Osipova, E. (2015). Establishing cooperative relationships and joint risk management in construction projects: Agency theory perspective. *Journal of Management in Engineering*, 31(6). [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000346](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000346)

Osipova, E., & Eriksson, P. E. (2011a). The effects of cooperative procurement procedures on joint risk management in Swedish construction projects. *International Journal of Project Organisation and Management*, 3(3–4), 209–226. <https://doi.org/10.1504/IJPOM.2011.042029>

Osipova, E., & Eriksson, P. E. (2011b). How procurement options influence risk management in construction projects. *Construction Management and Economics*, 29(11), 1149–1158. <https://doi.org/10.1080/01446193.2011.639379>

Osipova, E., & Eriksson, P. E. (2013). Balancing control and flexibility in joint risk management: Lessons learned from two construction projects. *International Journal of*

Project Management, 31(3), 391–399. <https://doi.org/10.1016/j.ijproman.2012.09.007>

Qinghua, H. E., Junyan, X. U., Wang, T., & Chan, A. P. C. (2021). Identifying the driving factors of successful megaproject construction management: Findings from three Chinese cases. *Frontiers of Engineering Management*, 8(1), 12. <https://doi.org/10.1007/s42524-019-0058-8>

Rahman, M., & Kumaraswamy, M. M. (2002a). Risk management trends in the construction industry: Moving towards joint risk management. *Engineering, Construction and Architectural Management*, 9(2), 131–151. <https://doi.org/10.1108/eb021210>

Rahman, M. M., & Kumaraswamy, M. M. (2002b). Joint risk management through transactionally efficient relational contracting. *Construction Management & Economics*, 20(1), 45–54. <https://doi.org/10.1080/01446190110089682>

Rahman, M. M., & Kumaraswamy, M. M. (2004). Potential for implementing relational contracting and joint risk management. *Journal of Management in Engineering*, 20(4), 178–189. [https://doi.org/10.1061/\(asce\)0742-597x\(2004\)20:4\(178\)](https://doi.org/10.1061/(asce)0742-597x(2004)20:4(178))

Rahman, M. M., & Kumaraswamy, M. M. (2005). Assembling integrated project teams for joint risk management. *Construction Management and Economics*, 23(4), 365–375. <https://doi.org/10.1080/01446190500040083>

Rose, K. H. (2013). A guide to the project management body of knowledge (PMBOK (R) Guide), Fifth Edition. *Project Management Journal*, 44(3), E1. <https://doi.org/10.1002/pmj.21345>. -e1.

Silverman, D. 2011. "Interpreting qualitative data. a guide to the principles of qualitative research".

Silverman, D. (2016). *Qualitative research*. London: SAGE Publications Ltd.

Solheim-Kile, E., & Wald, A (2019). Extending the transactional view on public-private partnership projects: Role of relational and motivational aspects in goal alignment. *Journal of Construction Engineering and Management*, 145(5). [https://doi.org/10.1061/\(asce\)co.1943-7862.0001643](https://doi.org/10.1061/(asce)co.1943-7862.0001643)

Walker, D. H. T., Davis, P. R., & Stevenson, A. (2017). Coping with uncertainty and ambiguity through team collaboration in infrastructure projects. *International Journal of Project Management*, 35(2), 180–190. <https://doi.org/10.1016/j.ijproman.2016.11.001>

Wang, Q., & Pan, L. (2023). Tripartite evolutionary game analysis of participants' behaviors in technological innovation of mega construction projects under risk orientation. *Buildings*, 13(2). <https://doi.org/10.3390/buildings13020287>

Wei, H. H., Liu, M. Q., Skibniewski, M. J., & Balali, V. (2016). Conflict and consensus in stakeholder attitudes toward sustainable transport projects in China: An empirical investigation. *Habitat International*, 53, 473–484. <https://doi.org/10.1016/j.habitatint.2015.12.021>

Xue, X., Shen, Q., & Ren, Z. (2010). Critical review of collaborative working in construction projects: Business environment and human behaviors. *Journal of Management in Engineering*, 26(4), 196–208. [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000025](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000025)

Yang, Y., Tang, W., Shen, W., & Wang, T (2019). Enhancing risk management by partnering in international EPC projects: Perspective from evolutionary game in Chinese construction companies. *Sustainability (Switzerland)*, 11(19). <https://doi.org/10.3390/su11195332>

Yin, R. K. (1989). Case study research: Design and methods. *Applied Social Research Methods Series*, 5. <https://doi.org/10.2337/diacare.20.9.1482>

Zhao, D. Z., & Wang, D (2019). The research of tripartite collaborative governance on disorderly parking of shared bicycles based on the theory of planned behavior and motivation theories: A case of Beijing, China. *Sustainability*, 11(19). <https://doi.org/10.3390/su11195431>