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Clear terms first and courtesy later: the role of contractual governance in construction project resilience from the integrative perspective

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ABSTRACT

Construction projects are confronted with disruptive events. This study explores the effects of contractual governance on construction project resilience. By adopting an integrative perspective (i.e. integrating the governance stage perspective and the contract content perspective), this study divides contractual governance into contract design (furthermore contract specificity and contract flexibility) and contract application. Besides, this study explores the mediating role of relational ties and the moderating effects of environmental uncertainty. Survey data were collected from Chinese construction firms. The results suggest that contract specificity and flexibility enhance proactive and reactive resilience while relational ties partially mediate the above enhancements. Contract application hampers reactive resilience. Besides, environmental uncertainty strengthens the positive role of contract flexibility. Theoretically, this study investigates the less-explored construction project resilience and its antecedents and contributes to explaining the contradictory role of contractual governance by adopting the integrative perspective. Practically, this study provides recommendations to enhance construction project resilience.

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Construction projects; project resilience; contractual governance; relational ties; environmental uncertainty

Introduction

Due to the increasingly uncertain and disruptive nature of today's global business environment, how to enhance construction project resilience (i.e. the capability of a construction project to prepare for unexpected events, respond to disruptions and recover from them) is gradually receiving academic and practical attention (Yao and Wang 2024, Śladowski et al. 2024). An individual project participant cannot ensure the resilience of the entire project. In contrast, construction project resilience heavily depends on close inter-organisational collaboration between project participants (Yang et al. 2022b). Contractual governance, as the main governance mechanism to facilitate participants' collaboration, may play a significant role in dealing with project disruptions and enhancing project resilience (Wang et al. 2023).

However, few of the previous studies have empirically investigated the role of contractual governance in project resilience. Studies have mainly focused on the role of contractual governance in risk prevention (based on an ex-ante comprehensive risk register) from the view of traditional risk management. Such role has long been inconclusive in relevant studies. Some scholars (e.g. Xue, Yuan, and Shi 2017, Shi et al. 2018) have concluded that a detailed contract defines the rights, obligations and roles of parties, which can effectively prevent and address project risks. But other studies (Yao et al. 2019, Fang et al. 2024) have suggested that increased use of contracts may block cooperation and cause stiffness when confronted with high risks. Furthermore, compared with the view of traditional risk management, the resilience view proposes that many threats are agnostic, so ex ante risk analyses and preventive measures may be ineffective (Kutsch and Hall 2016). This agnosticism may further complicate (e.g. discount) the role of contractual governance, as one that relies on ex ante codified rules and the enforcement of those rules. This role deserves to be explored from the resilience view.

Besides, this study proposes that the above inconsistent conclusions on the role of contractual governance may arise from their failure to differentiate its dimensions. Two perspectives are employed for the differentiation. The first one is the governance stage perspective (Zhang et al. 2024). Based on this perspective, contractual governance can be divided into contract design (ex-ante contractual governance, i.e. the details of contract documents and clauses themselves) and contract application (ex-post contractual governance, i.e. the extent to which designed contracts are strictly applied to monitor, control, assess and penalise parties after the project is underway) (Huo et al. 2016). Detailed contracts can provide safeguards for parties' cooperative behaviour during disruptive events while strict application of contract may harm the adaptability of projects.

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The second perspective is the contract content perspective (Yan and Zhang 2020). Based on it, contract design can be further divided into contract specificity and contract flexibility. The former refers to terms about defining each party's rights, duties, communication procedures, as well as dispute resolution approaches (Yan and Zhang 2020) while the latter involves future contingencies, such as rules, methods, and strategies for dealing with future changes to minimise possible conflicts (Tian et al. 2024). The two dimensions with different contents may play different roles (safeguarding vs. adaptation) in dealing with disruptions. Overall, by adopting the integrative perspective (i.e. integrating the governance stage perspective and the contract content perspective), this study divides contractual governance into contract specificity, contract flexibility and contract application. This integrative perspective and division may provide a more nuanced investigation of the effects of contractual governance on project resilience and may coordinate the inconsistent role of contractual governance.

In order to further uncover the underlying mechanisms of the above role, this study intends to scrutinise the mediating role of relational ties. Relational ties mean the degree of communication frequency, intimacy, trust and information exchange between parties (Hu et al. 2021). In the face of disruptions, collaboration between project participants, such as information sharing and decision synergies, is crucial, and relational ties are one of the most significant drivers (Wang et al. 2023). Contractual governance has been proven to affect inter-organisational relational ties in construction projects (Song et al. 2018). Thus, this study argues that contractual governance may exert effects on relational ties, and in turn, influence project resilience.

The role of contractual governance in project resilience may not adhere to a generic rule and may differ based on the features of a project. In this instance, identifying the contextual factors that shape such a role may be crucial to prudently employ contractual governance to manoeuvre inter-organisational collaboration and enhance project resilience. Environmental uncertainty (i.e. the extent of instability and unpredictable changes in the project's surroundings) has been identified as the primary impediment to collaboration and resilience in construction projects (Yao and Wang 2024) as well as the fundamental driver underlying theories of governance (Schilke and Lumineau 2018). Thus, it may be a significant boundary condition of the effectiveness of contractual governance (Faruquee, Antony, and Irawan 2024).

In summary, this study attempts to answer the following research questions:

RQ1: What effects does contractual governance exert on construction project resilience?
RQ2: Whether do relational ties mediate the above effects?
RQ3: How does environmental uncertainty moderate the role of contractual governance?

By doing this, this study makes the following contributions. First, this study contributes to the less-explored construction project resilience and its antecedents. Prior research has examined the factors that contribute to project resilience at three different levels: individual (e.g. Franke et al. 2022, Qiao et al. 2024); participant (e.g. Esmalian et al. 2022, Kutsch and Hall 2016); and the entire project (e.g. Yang and Cheng 2020, Rahi 2022). Because projects are temporary and one-off in nature, their resilience is strongly correlated with inter-organisational relationship-level features. This study contributes to understanding project resilience antecedents at the inter-organisational level by investigating the role of inter-organisational contractual governance and relational ties. Second, although the topic of the role of contractual governance in project risks is not new, inconsistent findings have been obtained. This study integrates two significant perspectives to delineate contractual governance, especially from the governance stage perspective, which fills up the gap of insufficient attention to contract application. This study proposes that different dimensions of contractual governance may exert different effects on project resilience.

Literature review

Construction project resilience: Definition and dimensions

The concept of resilience, which describes a system's capacity to anticipate, react to, and recover from disruptive events, has gained a lot of attention lately since traditional risk management has proven ineffective in handling unforeseen and disruptive events in highly dynamic environments (Zhang et al. 2023). The risk-based paradigm quantifies the likelihood and effects of an incident in order to identify crucial system components that are vulnerable to various specific dangers (Kutsch and Hall 2016). Thus, it highlights the identification of the risk sources and specific risk events. Many gold risk management principles, such as PMBOK (6th version), guide project managers on how to predict and prepare for risks. In contrast, the resilience-based paradigm adopts a 'threat agnostic' viewpoint. Firms have to reserve redundant resources to deal with these unknown and agnostic threats. The attention of managers needs to be shifted to how to achieve performance goals by accommodating impacts induced by various events, crises, and unexpected occurrences (Linkov and Trump 2019). As Kutsch and Hall (2016) have suggested, conventional probability-theory-based risk management techniques rely significantly on experience and ex-ante risk prediction, which makes them less useful in novel circumstances. Blay (2017) have also stated that traditional risk management is insufficient to increase a system's preparedness and recovery capacity because it mainly concentrates on minimising vulnerabilities.

In construction projects, some unforeseen and disruptive events occur from time to time, including external shocks, such as natural disasters, economic crisis and political instability, and internal discontinuity, such as safe accidents, supply failure and financial shortfalls. Studies on project resilience are in their infancy. They have usually drawn on the studies on organisational resilience and supply chain resilience when defining project resilience (Yang et al. 2022b). In the latter two fields, the definition of resilience is

mainly based on two views: the capability view and the process view. The capability view regards resilience as *a series of capabilities* and investigates the organisational characteristics as resilience drivers, including resources, practices, and structures (Ortiz-DE-Mandojana and Bansal 2016). The process view, on the other hand, regards resilience as inherently dynamic, *a process of adaptation* of organisations or *adjustment* of the relationship between them and their environment. For example, Williams et al. (2017) have defined resilience as *the dynamic process* by which an organisation employs its endowment to achieve positive adjustments that lead to its normal functioning before, during, and after a crisis occurs.

Studies in the field of project management have typically drawn on the above definitions and views. Geambasu (2011) was early to introduce resilience to the project field and has distilled its concept as the ability of a project to make positive adjustments in the event of a disruption. She demonstrates that compared to a permanent organisation, a project as a temporary organisation faces greater challenges. Similarly, Rahi (2022) defines project resilience as the project's capability to be aware of potential disruptions and adapt quickly to disruptions that occur. Wang et al. (2023) defines project resilience as 'the process by which project stakeholders jointly build and use their capability endowments to interact with the environment in a way that positively adjusts and maintains functioning prior to, during, and following adversity' (p.1).

The process view provides a more comprehensive overview of the process of resilience formation and development but it is more difficult to empirically measure resilience based on this view (Ortiz-DE-Mandojana and Bansal 2016). Furthermore, compared to the capability view that emphasises the organisational characteristics for resilience, the process view emphasises the process of organisational adaptive adjustment that is usually highly path-dependent. Thus, the conclusions based on the process view are more difficult to generalise. Therefore, studies, especially empirical studies, have mainly adopted the capability view. This study adopts such a view and defines construction project resilience as the capability of a construction project to prepare for unexpected events, respond to disruptions, and recover from them.

The delineation of resilience dimensions mainly relies on the time of disruption occurrence and handling. One significant division approach commonly used is from Wieland and Wallenburg (2013), who have divided supply chain resilience into proactive and reactive resilience. Research within the field of project management has typically referred to the above delineation. Geambasu (2011) has mainly focused on the post-disruption capabilities, including recovery and continuous adjustment to adapt to changes. Kutsch and Hall (2016) have suggested that project resilience includes not only the capabilities to detect and understand changes in the environment in which a project is located but also response and recovery capabilities.

This study refers to Wieland and Wallenburg (2013) and Kutsch and Hall (2016) and divides project resilience into proactive resilience and reactive resilience. The former refers to abilities to plan, anticipate, alert, and prepare for the threats in the pre-disruption phase while the latter refers to abilities to respond effectively to disruptions and return to the original or desired state in the post-disruption phase (Ali, Mahfouz, and Arisha 2017). Such a division can provide a more nuanced look at the role of contractual governance on resilience.

Contractual governance as a multidimensional construct

Inter-organisational exchanges and cooperation are vulnerable to various hazards. Studies, mainly based on Transaction Cost Economics (TCE), have demonstrated that contractual governance, the degree to which an inter-organisational exchange is governed by a formal and written contract, serves as a crucial mechanism to safeguard against exchange hazards and facilitate close collaboration. A specified contract with detailed clauses can play a safeguarding function by describing key performance indicators, rights and responsibilities of parties and penalties after a default, such as timely payment for compliance and liquidated damages for non-compliance. Thus, an exchange can be safeguarded and project participants' opportunism can be curbed (Shi et al. 2018). Besides, contract specificity may also contribute to facilitating understanding of task division and formal communication between project participants by stating the participants' responsibilities, such as organising routine meetings and submitting monthly progress reports. That is, contract specificity plays a coordination function in a construction project.

However, contract specificity has its limitations, which can be filled up in the following ways. On the one hand, it is often impossible to draft a fully complete contract that covers all the rights and responsibilities due to limited rationality. Consequently, it is necessary to include some contingency principles into a contract, thus ensuring the flexibility and adaptability after different scenarios occur. These principles constitute the content of contract flexibility, playing an adaptation function, which is different from contract specificity based on the contract content perspective. For example, contract flexibility details the renegotiation procedures to bring the two parties to the table instead of being apart after an unexpected event happens. Besides, the principles of price adjustments after external disturbances are crucial for more clear benefit and risk allocation. This dimension has been recognised by some recent studies in the field of construction projects (Yan and Zhang 2020, Tian et al. 2024).

On the other hand, the economic perspective has ignored the social attributes of human beings. From the relational and social perspective, mainly from the view of social exchange theory (SET) and relational exchange theory (RET), even when detailed clauses are in place, they are not always strictly enforced (Yao, Chen, and Tang 2024). Faems et al. (2008) have explicitly scrutinised the concept of contract application and differentiated it from contract design in an alliance. They have found that strict contract application may damage alliance partners' trust. Huo et al. (2016) have empirically explored the separate effects of contract specificity and contract application on opportunistic behaviour in logistics

outsourcing relationships. They have concluded that contract application increases opportunism possibly because of harming cooperative relationships while contract specificity is effective in curing opportunism. Nevertheless, prior research, especially in the construction industry, has rarely paid attention to the division when investigating the role of contractual governance (Yao, Chen, and Tang 2024).

In the construction industry, recognising contractual governance as a multidimensional construct is more crucial. For one thing, due to the typically long period and uncertainty of construction projects, it is less likely to specify all the rights and responsibilities. Thus, it is common to conduct changes and renegotiations, thus reinforcing the need to investigate contract flexibility of construction projects. Second, many construction industry associations, like the Fédération Internationale Des Ingénieurs-Conseils (FIDIC) offer comprehensive standardised contracts (Yang et al. 2022a). Additionally, many construction companies develop their standardised contracts based on prior experience (Xu et al. 2024). Thus, it has been a common practice to draw on a standardised contract. But these clauses may not be applied strictly during project implementation, either because they are not fully applicable to the current project or based on sociological concerns that strict application of the contract may jeopardise the relationship between the parties and lead to a destructive loop of conflict (Yao et al. 2023). Thus, it is necessary to differentiate contract application from contract design in construction projects.

Contractual governance and construction project resilience

Previous studies have explored the drivers of project resilience. For example, some research has supported the role of factors at the individual level, such as project managers' perception and affects (Qiao et al. 2024), project managers' attributions of disruptive events (Franke et al. 2022), and project staff's knowledge and capabilities (Esmalian et al. 2022). The effects of some factors at the entire project level have been examined, such as project management procedures (Rahi 2022) and digital application of projects (Yang and Cheng 2020). Also, the resilience of the construction project must depend on the features of each individual project participants, such as owners' limited resources (Esmalian et al. 2022) and contractors' technological expertise (Kutsch and Hall 2016). However, mere individual participants' resources and capabilities do not necessarily ensure the resilience of the entire construction projects. Project resilience is strongly correlated with factors at the level of interorganizational interactions (Oliveira, Argyres, and Lumineau 2022, Yang et al. 2022b). Among them, the role of interorganisational contractual governance in project resilience began to catch attention.

Some scholars have conducted case studies to explore such a role initially. For example, Blay (2017) has found that a clearer division of responsibility contributes to the coping capabilities of a project, which involve readiness and response. Similarly, Yang et al. (2022b) have suggested that contractual governance can enhance the resilience of megaprojects by clarifying the role and responsibilities of project participants. These case studies have provided valuable insights. But as Wang et al. (2023) have stated, there has been a lack of current research that has empirically validated the effects of contractual governance on project resilience. Thus, they have conducted a questionnaire survey and found that contractual governance can promote resource reconfiguration and thus, facilitate project resilience.

Nevertheless, Wang et al. (2023) have not differentiated between the elements of resilience. More importantly, their study and the case studies mentioned above have typically focused on one dimension of contractual governance (mainly contract specificity) and have not considered the distinguished effects of different dimensions, especially what roles contract flexibility and contract application can play. Therefore, this study draws on the integrative perspective to distinguish the dimensions of contractual governance and investigates the distinguished effects of different dimensions on project resilience. This may also help explain the controversial role of contractual governance, as stated in the INTRODUCTION section.

Hypothesis development

Contractual governance and proactive resilience

Contract specificity, relational ties and proactive resilience

In terms of proactive resilience, situation awareness of the most significant capabilities and the sharing of timely, full and correct information is greatly conducive to identifying potential threats earlier and preparing for them in advance (Ali, Mahfouz, and Arisha 2017). We argue that contract specificity can facilitate communication and information sharing between parties and thus, enhance proactive resilience. High contract specificity can include more procedures and approaches regarding formal communication (Schilke and Lumineau 2018), such as routine meetings and monthly progress reports, making information sharing the formal duties.

Besides, this study proposes that contract specificity can enhance proactive resilience by strengthening relational ties. Parties will enter into and maintain reciprocal relationships with others in the expectation of receiving future benefits (Yao et al. 2023). As Poppo and Zenger (2002) have concluded, only when contracts are explicit in terms of rights, obligations and legal remedies, will parties feel each other's guaranteed commitments, which ensures the development of trust and a reciprocal relationship. Such trust and reciprocity can facilitate informal information sharing, thus enhancing proactive resilience. Especially, disruptions may result in more opportunistic motives since each party thinks of its own interests first (Wang et al. 2023). In such case, if there are no detailed stipulations on parties' rights and obligations, both parties will be engaged in the 'prisoner's dilemma'. That is, they think that the other party will take advantage of contract holes for opportunistic behaviour, so their optimal action will be the same (Yao et al. 2023), which may be manifested in the form of disguising information or refusing to share their private information. Therefore, this study proposes:

H1: *Contract specificity is positively related to proactive resilience*

H2: *Relational ties mediate the link between contract specificity and proactive resilience*

Contract flexibility, relational ties and proactive resilience

Like contract specificity, contract flexibility can reinforce proactive resilience. Contract flexibility usually clarifies parties' responsibilities of information sharing when some signs of unforeseeable changes occur (You et al. 2018). For example, FIDIC Conditions of Contract for Construction, as one of the most influential model contracts in the construction industry, adds the Advance Warning clauses in its second edition, which require that each party should advise the other when they realise any known or likely future adverse occurrences or conditions. Another famous model contract—New Engineering Contract (NEC)—includes similar clauses, called Early Warning Register. These clauses ensure timely information sharing by listing it as the formal duties of parties.

Besides, this study proposes that contract flexibility can enhance proactive resilience through strengthening relational ties. Inter-organisational ties can be developed when parties feel that their exchange is reciprocal and fair. Flexible rules and options in contracts for contingencies align parties' interests and reduce their incentive to break reciprocal commitments (Gao et al. 2018). Proper and detailed price adjustment clauses also ensure fair redistribution of benefits and risks during these events (You et al. 2018), thus ensuring relational ties. The relationship-developing role of contract flexibility has been supported by some studies (e.g. Yan and Zhang 2020, Tian et al. 2024). Strong relational ties, in turn, assure the sharing of genuine and timely information, thus promoting proactive resilience. Therefore, this study proposes:

H3: *Contract flexibility is positively related to proactive resilience*

H4: *Relational ties mediate the link between contract flexibility and proactive resilience*

Contract application, relational ties and proactive resilience

This study argues that flexible contract application is more suitable for preparing for disruptive events rather than strict contract application. Disruptive events are usually unforeseeable and cannot be even realised or planned (Kutsch and Hall 2016). An exact example is COVID, the effects of which on global business have been far more than anyone could have imagined. In such a case, a flexible approach to information sharing, which is not specified in the contracts, is critical for identifying the potential threats.

Besides, some studies (e.g. Huo et al. 2016, Faems et al. 2008) have confirmed that strict contract application may undermine relational ties. As a result, negative responses and conducts in terms of preparing for disruptions. There are two main paths for explaining the above effects. First, the important manifestation of strict contract application is that each party strictly monitors the behaviour, accesses the performance, and punishes the contract breach of the other party (Huo et al. 2016). As a result, the current exchange will turn into a transactional one instead of a relational one. Each party will only calculate its own benefits and losses instead of pursuing the joint maximal solution (Yao et al. 2019), which discourages it from making more efforts to identify potential threats for the sake of the whole project or their joint interests. Worse still, even if it possesses more private information, it may be reluctant to disguise such information to maximise its interests. Second, strict contract application may signal mistrust by attempting to coerce a partner's conduct (Faems et al. 2008, Yao, Chen, and Tang 2024) and employment of coercive power can be considered intrusive. As a result, relational conflicts are enhanced, and thus, effective and timely relational communication can be hindered. Therefore, this study proposes:

H5: *Strict contract application is negatively related to proactive resilience*

H6: *Relational ties mediate the link between contract application and proactive resilience*

Contractual governance and reactive resilience

Contract specificity, relational ties and reactive resilience

Reactive resilience requires prompt and full collaboration among parties during and after disruptions (Ali, Mahfouz, and Arisha 2017). Contracts can reduce the likelihood of blame-shirting during disruptions by specifying the responsibilities and positional power of both parties and thus, avoid delays in the optimal response time to minimise losses. High contract specificity involves a more detailed description of legal remedies for failures to perform (Haaskjold et al. 2019) and thus, ensures that the contract breach of parties is enforceable legally, which inhibits the opportunistic motive during hard times (Wang et al. 2022). Furthermore, highly specified contracts incorporate more detailed statement about performance indicators and payments for goal completion (Gao et al. 2018), thus possibly promoting the motivation for parties to take voluntary measures to respond to disruptions to ensure the realisation of the goals.

Besides, this study argues that relational ties are significant mechanisms by which high contract specificity accelerates recovery and enhances reactive resilience. As H2 argued, high contract specificity provides safeguards for the development of relational ties. Strong ties between parties will allow for more open and in-depth knowledge sharing (Yao, Chen, and Tang 2024), which facilitates post-disruption feedback to develop recovery programs as well as joint training on conducting the program. Effective knowledge sharing even encourages parties to find opportunities beyond the current disruptive events (Marsov et al. 2024) in order to gain a competitive advantage in the marketplace (Ali, Mahfouz, and Arisha 2017). Therefore, this study proposes:

H7: *Contract specificity is positively related to reactive resilience*

H8: *Relational ties mediate the link between contract specificity and reactive resilience*

Contract flexibility, relational ties and reactive resilience

First, this study suggests that an important pathway for contract flexibility to enhance reactive resilience is to incentivise. Price compensation and adjustment formulae included in

high contract flexibility could ensure proper risk sharing and provide incentives for compliance of project participants during disruption (Tian et al. 2024). Second, the effectiveness of responses to disruptions also depends heavily on effective renegotiations and quick mutual consent during the events (Keller et al. 2021). A highly flexible contract usually includes more details on the renegotiation rules and procedures, which allow parties to quickly modify milestones based on developments of events through formal and appropriate negotiation (You et al. 2018), which avoids constant and meaningless arguments.

In terms of the mediating role of relational ties, this study suggests that contract flexibility nourishes a good relationship and a cooperative environment, as H4 argued, and in turn, strong relational ties promote inter-organisational knowledge sharing and joint innovative solutions (Tian et al. 2024), thus facilitating the recovery process, as H8 suggested. Therefore, this study proposes:

H9: *Contract flexibility is positively related to reactive resilience*

H10: *Relational ties mediate the link between contract flexibility and reactive resilience*

Contract application, relational ties and reactive resilience

Strict contract application turns risk responses into inter-organisational routines, which help deal with normal risks. But in terms of disruptions, especially arising from adverse events that are unforeseen or not even realised by parties, such routines could lead to inertia (Faems et al. 2008), thus resulting in rigidity in disruption response processes. In addition, this may lead to parties' overconfidence in preventing and handling project threats, and make them resistant to adjusting the performance goals according to the current situation, let alone identifying new opportunities. Therefore, reactive resilience is weakened. Besides, this study suggests that strict contract application inhibits relational ties, as suggested in H6, thus, lowering reactive resilience, as H8 argued. Therefore, this study proposes:

H11: *Strict contract application is negatively related to reactive resilience*

H12: *Relational ties mediate the link between contract application and reactive resilience*

Moderating role of environmental uncertainty

We argue that environmental uncertainty weakens the positive effects of contract specificity on relational ties. H2 suggests that contracts make parties feel relieved to develop relational ties by specifying the dispute settlement approaches for inhibiting contract violations. But such relief could be discounted by high environmental uncertainty. When the environment is complex, the typical dispute settlement approaches included in the contracts, especially the litigation, are not only costly (Haaskjold, Andersen, and Langlo 2023) but also less effective due to complex attributions of blame (Yao, Chen, and Tang 2024). The judge may even make an inappropriate decision, which leaves room for opportunistic behaviour (Tang et al. 2024).

Besides, this study argues that environmental uncertainty strengthens the positive effects of contract flexibility on relational ties. H4 suggests that the clauses of flexible options and price adjustment in contracts ensure incentive alignment for various contingencies. It is straightforward that high environmental uncertainty further necessitates such clauses since the purpose of designing them is to adapt to uncertainty (You et al. 2018).

Last, we argue that environmental uncertainty strengthens the negative role of strict contract application in relational ties. H6 suggests that strict contract application leads to a transactional relationship so parties may only consider their own interests. Environmental uncertainty provides opportunities for the pursuit of benefits (Tang and Yao 2023). In particular, asymmetric information is intensified when uncertainty is high, which allows the information-advantaged party to conduct opportunistic behaviour. As Shen et al. (2020) have found, strict contract enforcement damages goodwill trust, especially when the relationship is in high uncertainty in the initial stage of the exchange. Therefore, this study proposes:

H13: *Environmental uncertainty weakens the positive effect of contract specificity on relational ties*

H14: *Environmental uncertainty strengthens the positive effect of contract flexibility on relational ties*

H15: *Environmental uncertainty strengthens the negative effect of strict contract application on relational ties*

Figure 1 shows the conceptual framework of this study.

Methods

Referring to Ambulkar, Blackhurst, and Grawe (2015), Figure 2 briefly illustrates the main steps of our survey design, data collection and data analyses. The authors will explain them in the following sections.

Sample and data collection

This study collected survey data from Chinese construction firms. This study focused on the relationship between the owner and its general contractor in construction projects. It is inappropriate to measure the details of contract and contract application based on the average contractual governance of all the inter-organisational relationships in a whole project since different contractual governance approaches are employed in different relationships. Among various inter-organisational relationships in construction projects, the relationship between the owner and its general contractor is one of the most crucial relationships since they are the primary parties for construction project resilience. The owner greatly influences the financial constraints while the general contractor is the major contributor to technical competence and management efforts in the case of handling disruptive events. Contractual governance and relational ties between them are the main drivers of project resilience.

Since the items included in the questionnaire are drawn from studies in English, in order to ensure the appropriateness of translation and the face validity, the authors interviewed three professional experts and two academic experts,

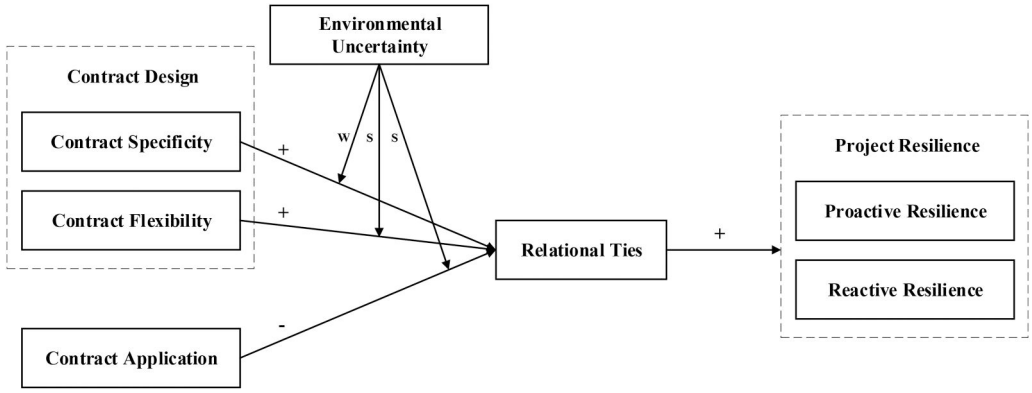

Figure 1. Conceptual framework (w: weaken; s: strengthen).

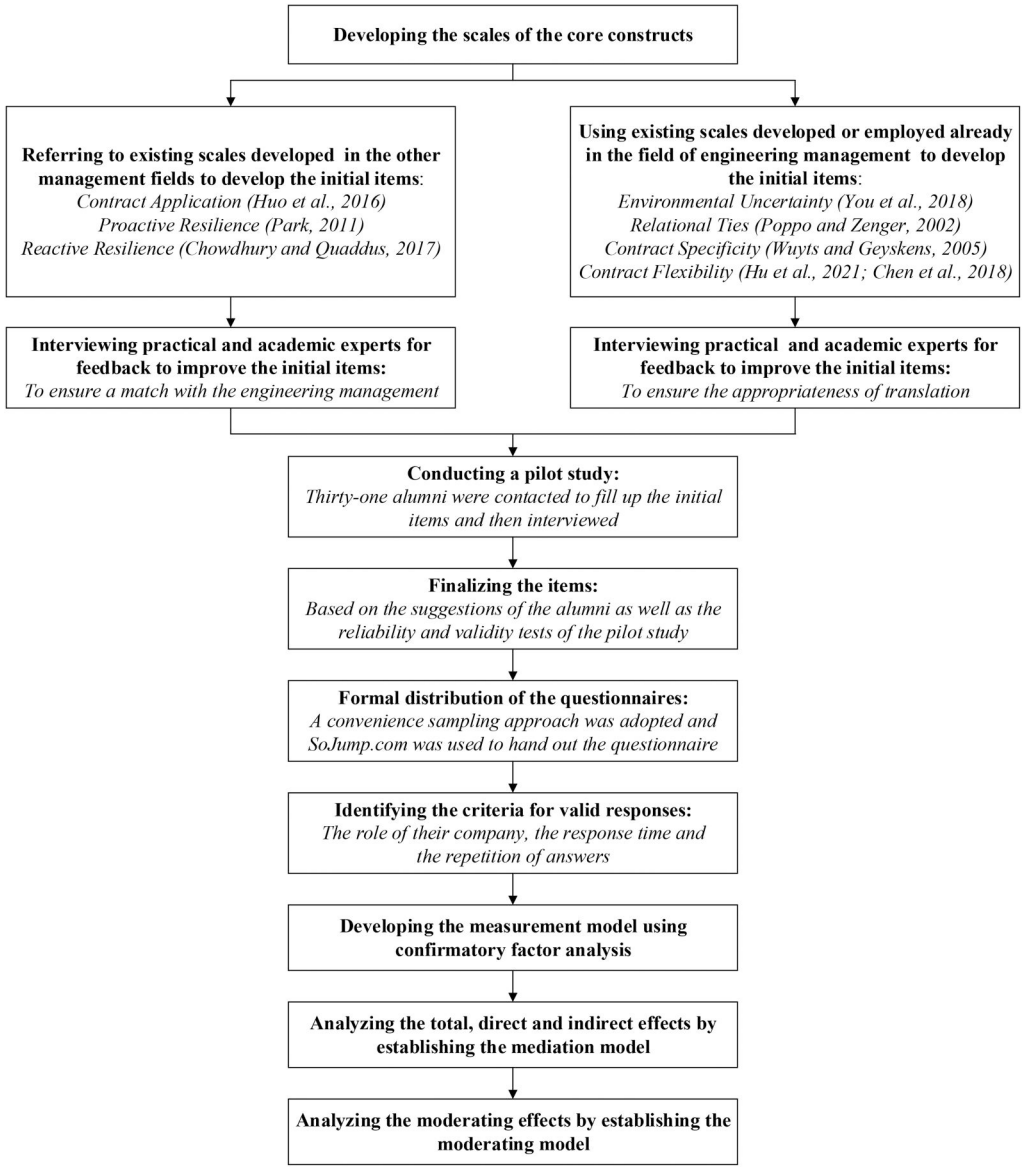

Figure 2. Steps of our survey design, data collection and data analyses.

who have rich experience in dealing with or researching project disruptions. Then, thirty-one alumni, who were contract managers or project managers in construction projects and had more than two years of research experience, were contacted based on the convenience sampling approach to fill out the questionnaire as the pilot study. Their suggestions

served as references for the revisions of the questionnaire based on their work and research experience. The responses were employed to conduct reliability and validity pre-tests.

After that, the authors began the formal distribution of the questionnaires. SoJump.com, the most famous online survey platform in China, was used to design the online questionnaire. Then, WeChat, the most famous social media tool in China, was used to distribute the questionnaires. A convenience sampling approach was adopted. The authors contacted through WeChat the alumni, who had rich experience in handling project disruptions in the construction industry, and sent them the online questionnaire. They were acknowledged that they should stop answering the questionnaire if they did not know well the actual status of the project to which any item corresponds. Besides, they were told that all their choices were confidential and they would be compensated for the responses passing through the screening.

The authors handed out 200 questionnaires. We identified three criteria for determining valid responses before the formal distribution: the role of their company in projects, the response time and the repetition of answers (whether the same option was selected for almost all questions). A total of 24 responses were deleted because they were subcontractors and could not answer the questionnaire based on the relationship between the owner and the general contractor. Based on the pilot study, we thought that the minimum response time was 90 seconds to ensure the quality. But every response took longer than the minimum time, so no response was removed for this reason. Besides, the repetition of answers was not found, possibly because the compensation for the valid responses worked. The whole collection process took a total of 35 days. Finally, a total of 176 responses were recognised as valid. The information on the sample is shown in Table 1, which shows its representativeness.

Table 1. Characteristics of respondents and their projects.

Items	Range	Frequency	Percent
Contract Price (Chinese Yuan)	≤ 50 million	62	35.2%
	>50 million & ≤100 million	23	13.1%
	>100 million & ≤500 million	37	21.0%
	>500 million & ≤1 billion	18	10.2%
	≥1 billion	36	20.5%
Project Duration	≤ 1 year	36	20.5%
	>1 year & ≤2 years	60	34.1%
	>2 year & ≤3 years	38	21.6%
	>3 years	42	23.9%
Work Experience	< 3 years	49	27.8%
	>3 year & ≤5 years	42	23.9%
	>5 year & ≤8 years	22	12.5%
	>8 year & ≤11 years	18	10.2%
	> 11 years	45	25.6%
Position	Project / Department manager	44	25.0%
	Contract manager	72	40.9%
	Staff at the headquarters	32	18.2%
	Others	28	15.9%

Measures

All the measures were adopted from previous studies and modified based on the contexts of construction projects, the interview and the pilot study. The details on the items and the modifications are as follows.

Dependent variables

Proactive resilience. Four items from Park (2011) are adopted. Since his study has focused on the supply chain resilience of the focal firm, the authors modified the items by replacing 'company' and 'supply chain partner' with 'project' and 'project participants'. Some minor revisions were also made based on the suggestions from the interviews mentioned above, the pilot study and studies on project resilience. For example, the interviewee mentioned that 'preventive maintenance programs' did not apply to construction projects so the phrase was deleted. Besides, the third item 'is prepared to manage expected disruptions' did not match the definition of project resilience that emphasised the frequently unknowable crisis so 'expected' was replaced with 'potential'. More importantly, the fourth item 'to minimize the risks' might lead to confusion between risk management and resilience. Thus, the word 'risks' was replaced by 'occurrence of disruptions'. All the measurements of the core variables are shown in Table 2.

Reactive resilience. Three items are adopted from Chowdhury and Quaddus (2017). Their study has focused on supply chain resilience so the authors made similar revisions with proactive resilience.

Independent variable

Contract specificity. Three items from Wuyts and Geyskens (2005) are adopted and modified. The phrase 'in dealing with this supplier' included all the three items are deleted to match the context of project management. Besides, their study has not differentiated contract specificity and flexibility and the fourth item of their study 'our contract precisely states what will happen in the case of events occurring that were not planned' measured contract flexibility. Therefore, we moved this item into its measurement.

Contract flexibility. Three items are adopted from Hu et al. (2021) and the fourth item is drawn from Wuyts and Geyskens (2005). Similar to *Contract Specificity*, the phrase 'in dealing with this supplier' in Wuyts and Geyskens (2005) is deleted to match this study.

Contract application. Three items are adopted from Huo et al. (2016) and we made three main modifications based on the context of this study and our interview. First, we replaced 'in the process of cooperation' with 'during the implementation of the project' in the first two items. Second, 'or fall short of expected demand' is removed from the third item; Third, some minor revisions were made to match this study, such as 'major 3PL providers' with 'parties'.

Mediating variable

Relational ties. Three items are adopted from Poppo and Zenger (2002) while one item is adopted from Liu, Luo, and

Table 2. Measures reliability and validity assessment.

Constructs and constituent items	SFL
Contract specificity ($\alpha = 0.911$; AVE = 0.780; CR = 0.914)	
1. The contract precisely defines the cooperation goals and key performance indicators (KPIs).	0.846
2. The contract precisely defines the rights and responsibilities of each party and states the legal remedies for failures to perform.	0.906
3. The contract precisely states how each party is to perform.	0.896
Contract flexibility ($\alpha = 0.894$; AVE = 0.682; CR = 0.896)	
1. The contract details what will happen in case of events occurring that were not planned.	0.819
2. The contract contains price adjustments in case of events occurring that were not planned.	0.878
3. The contract terms design a series of flexible and quick renegotiation procedures.	0.822
4. The contract terms design a series of flexible and quick procedures for dispute settlements.	0.782
Contract application ($\alpha = 0.952$; AVE = 0.871; CR = 0.953)	
1. During the implementation of the project, the contract is identified as the most effective method to control the opportunistic behaviour of each party.	0.929
2. During the implementation of the project, parties often examine and appraise the conduct of each party regularly based on the contract.	0.969
3. When one party breaches the contract, the other party will punish it strictly based on the contract.	0.900
Environmental uncertainty ($\alpha = 0.899$; AVE = 0.756; CR = 0.902)	
1. The project's external environment (e.g. politics, economics, the law, and natural conditions) is unstable.	0.814
2. Predicting the future environmental condition is a real problem in the project.	0.972
3. Because of the environment changing frequently, owner's requirements or preferences change quite a bit over time.	0.813
Relational ties ($\alpha = 0.909$; AVE = 0.714; CR = 0.909)	
1. Both parties have an extremely collaborative relationship with each other.	0.833
2. Both parties share long- and short-term goals and plans.	0.811
3. Both parties can rely on each other to keep promises.	0.880
4. Problems or conflicts are expected by both parties to be solved through joint consultations and discussions.	0.854
Proactive resilience ($\alpha = 0.920$; AVE = 0.745; CR = 0.921)	
1. The project is able to reduce the likelihood of disruptions through inputting joint resources.	0.822
2. The project participants can monitor project processes to prevent potential disruptions in advance.	0.859
3. The project is prepared to manage potential disruptions.	0.878
4. The project has inspection plans to minimise the occurrence of disruptions in the project.	0.891
Reactive resilience ($\alpha = 0.879$; AVE = 0.718; CR = 0.884)	
1. The project has a response team for mitigating a crisis.	0.768
2. The project can get recovery in a short time.	0.880
3. The project can recover from a crisis at less cost.	0.889

Goodness-of-fit: χ^2 /df = 2.000; GFI = 0.818; RMSEA = 0.076; TLI = 0.921; CFI = 0.934; IFI = 0.935; NFI = 0.878.
Notes: SFL means Standardised Factor Loading; α = Cronbach's alpha coefficient; AVE = Average variance extracted; CR = Composite reliability.

Liu (2009). Some minor revisions are made based on our contexts.

Moderating variable

Environmental uncertainty. Three items are adopted from You et al. (2018).

Control variable

Firm size. The size of the firm may affect the resources that it could allocate and thus, affect project resilience. One choice item was included in the questionnaire to measure it: 'The annual turnover of the general contractor is (ten thousand Chinese yuan): i)≥80000 (large-sized enterprises); ii)≥6000 &<80000 (medium-sized enterprises); iii) ≥300 &<6000 (small-sized enterprises); or iv)<300 (micro-sized enterprises)'.

Contract price. Larger projects frequently have more resources available to address project disruptive events. One choice item was included in the questionnaire to measure it: 'The contract price (CP) of the project is (Chinese yuan): i) CP $\leq$ 50 million; ii) 50 million $<$ CP $\leq$ 100 million; iii) 100 million $<$ CP $\leq$ 500 million; iv) 500 million $<$ CP $\leq$ 1 billion; or v) CP $\geq$ 1 billion'.

Project duration. Projects with longer duration are more likely to be subject to external disturbances. One choice item was included to measure it: 'The project duration (PD) of the project is: i) PD $\leq$ 1 year; ii) 1 year $<$ PD $\leq$ 2 years; iii) 2 year $<$ PD $\leq$ 3 years; or iv) PD $\geq$ 3 years'.

Prior experience. Organisations with more prior experience on similar projects are more likely to handle the disruptive events in the current project. One choice item was included in the questionnaire to measure it: 'How many projects of the same type have been completed by your organization before this project: i) 0; ii) 1 to 3; iii) 4 to 6; iv) 7 to 9; or v) more than 9'.

Disruption impact. It is more difficult to enhance resilience for projects that experience more severe interruptions. One choice item was included in the questionnaire to measure it: 'Interruptions (such as natural disasters, financial crises, major accidents or fires, epidemics, etc.) occur from time to time during the implementation of the project (1 = strongly disagree while 7 = strongly agree)'.

Strategic importance. The resources that the focus organisation is willing to commit to handling the disruptions may be influenced by the strategic importance of the project to the organisation. One choice item was included in the questionnaire to measure it: 'This project is of strategic importance to our organization (1 = strongly disagree while 7 = strongly agree)'.

Firm competence. The competence of the general contractor may affect project resilience greatly since the general contractor is the main party for identifying and handling project disruptions. One choice item was included in the questionnaire to measure it: 'The expertise of the general

contractor is well known in the industry (1 = strongly disagree while 7 = strongly agree)'.

Work experience. To relieve the concerns about the confounding impacts of respondents' work experience, we treat it as the control variable. One choice item was included in the questionnaire to measure it: Number of years of your work experience: i) <3; ii)>3 &≤5; iii)>5 &≤8; iv)>8 &≤11; or v)>11'.

Reliability and validity

In order to examine the reliability of the scale, the authors employed SPSS 25 to calculate Cronbach's α. The results showed that the values of α for the core variables range from 0.879 to 0.952, all of which were over 0.8, indicating a good reliability. Besides, a confirmatory factor analysis (CFA) based on AMOS 28 was conducted to examine the validity. The results indicated a satisfactory model fit, shown in the last row of Table 2. Further, this study calculated the construct reliability (CR) value for every core variable, which showed that all the variables are greatly over the benchmark of 0.7, ranging from 0.884 to 0.953. The value of the average variance extracted (AVE) for each core variable was calculated, showing that all the variables are greatly over the benchmark of 0.5, ranging from 0.682 to 0.871. These results imply a satisfactory convergent validity. Last, the authors computed the correlation coefficients (CO-CO) of each variable with other variables using SPSS 25 and compared them with the square roots of the AVE value (SR-AVE) for this variable. Table 3 demonstrates the results of the comparison. A strong discriminant validity may be seen by the fact that the SR-AVE value for each variable (the values on the diagonal) is over its CO-CO with other variables (the values on the non-diagonal).

Results

The authors employed SPSS 25 and the Process software program to examine the link between contractual governance and project resilience as well as the mediating role of relational ties. Table 4 shows the main results and the mediating analyses.

The results show that all the hypotheses are supported except H5, H6 and H12. That is, both contract specificity (CS) and contract flexibility (CF) enhance proactive resilience (PR) and reactive resilience (RR), and relational ties (RT) mediate the enhancing effects. In terms of unsupported H5 and H6, this study finds that contract application (CA) has no significant effect on PR, and RT play no mediating role. The test results of H12 demonstrate that although CA exerts a significantly negative effect on RR (H11), RT are not the mediating path.

The authors further examine the moderating role of environmental uncertainty (EU) by employing SPSS 25. The results are shown in Table 5. **Model 3** incorporates the moderating variables and the three interaction terms. In order to further confirm the separate moderating role of the EU, **Model 4**, **5** and **6** adds the three interaction terms, respectively. All the results indicate that only the moderating effect of the EU on the link between CF and RT is significant.

Discussion

Contractual governance and project resilience

The results support the positive role of contract design (both contract specificity and contract flexibility) in project resilience. The findings are consistent with many of the previous case studies. For example, Yang et al. (2022b), by conducting a comparative case study, have found that contractual governance clarifies the role and responsibilities of parties and thus, enhances construction project resilience. Blay (2017) has found based on case studies that project resilience relies heavily on the clarity of the delineation of obligations.

This study supports the above findings and enriches them in the following three ways. First, this study demonstrates the positive roles of a specified contract are reflected in both facilitating ex-ante preparedness and promoting ex-post responses and recovery. Second, this study confirms that incorporating more detailed provisions regarding adjustments for future contingencies also enhances project resilience. The findings are in line with the insightful studies that have investigated the role of contract flexibility. For example, Suprapto et al. (2016) have suggested that projects with flexible terms can ensure incentive alignment and project success. Wang, Ma, and Wang (2021) have concluded that based on the buyer-supplier relationship, contract flexibility facilitates information exchange and prevention of transaction hazards. Third, this study supported the conducive role of detailed contracts in project resilience by conducting an empirical study.

The findings are supported by the trend on construction industrial practice. Various authoritative bodies of the industry have published more detailed model contracts. A typical example is FIDIC's 2017 version of the model contracts are

Table 3. Means, standard deviations, and correlations.

	1	2	3	4	5	6	7
1. Contract specificity	**0.883**						
2. Contract flexibility	0.629**	**0.826**					
3. Contract application	0.122	0.156*	**0.933**				
4. Environmental uncertainty	−0.095	−0.054	−0.055	**0.870**			
5. Relational ties	0.537**	0.526**	0.119	−0.063	**0.845**		
6. Proactive resilience	0.530**	0.530**	0.094	−0.073	0.609**	**0.863**	
7. Reactive resilience	0.416**	0.421**	−0.086	0.069	0.505**	0.582**	**0.847**

Notes: Boldface signifies that the number is greater than the off-diagonal correlation.
*$p < 0.05$.
**$p < 0.01$.

Table 4. Results of the main effects and mediating analyses.

CS to RT to PR	Estimates	S.E.	Lower bounds	Upper bounds	Significance	Hypothesis
Total effects	0.295	0.082	0.133	0.458	Yes	**H1✓**
Direct effects	0.186	0.079	0.029	0.342	Yes	
Indirect effects	0.110	0.052	0.022	0.223	Yes	**H2✓**
CF to RT to PR	Estimates	S.E.	Lower Bounds	Upper Bounds	Significance	Hypothesis
Total effects	0.272	0.075	0.123	0.420	Yes	**H3✓**
Direct effects	0.165	0.073	0.021	0.308	Yes	
Indirect effects	0.107	0.047	0.030	0.213	Yes	**H4✓**
CA to RT to PR	Estimates	S.E.	Lower Bounds	Upper Bounds	Significance	Hypothesis
Total effects	0.001	0.038	−0.073	0.076	No	**H5×**
Direct effects	−0.007	0.035	−0.076	0.063	No	
Indirect effects	0.008	0.018	−0.024	0.050	No	**H6×**
CS to RT to RR	Estimates	S.E.	Lower Bounds	Upper Bounds	Significance	Hypothesis
Total effects	0.240	0.108	0.026	0.453	Yes	**H7✓**
Direct effects	0.126	0.107	−0.086	0.338	No	
Indirect effects	0.114	0.057	0.018	0.241	Yes	**H8✓**
CF to RT to RR	Estimates	S.E.	Lower Bounds	Upper Bounds	Significance	Hypothesis
Total effects	0.311	0.099	0.116	0.506	Yes	**H9✓**
Direct effects	0.199	0.099	0.005	0.394	Yes	
Indirect effects	0.112	0.061	0.020	0.256	Yes	**H10✓**
CA to RT to RR	Estimates	S.E.	Lower Bounds	Upper Bounds	Significance	Hypothesis
Total effects	−0.105	0.050	−0.203	−0.007	Yes	**H11✓**
Direct effects	−0.114	0.048	−0.208	−0.019	Yes	
Indirect effects	0.009	0.019	−0.030	0.047	No	**H12×**

Notes: $\alpha = 0.05$. Estimates mean unstandardised estimates; S.E. means standard error; CS means contract specificity; CF means contract flexibility; CA means contract application; RT means relational ties; PR means proactive resilience; and RR means reactive resilience.

Table 5. Results of the moderating analyses.

	Relational ties					
Dependent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Control variables						
Firm size	0.151†	0.157*	0.145*	0.160*	0.149*	0.154*
Contract price	−0.034	0.019	0.022	0.018	0.026	0.012
Project duration	−0.053	−0.010	−0.002	−0.015	−0.005	−0.010
Prior experience	−0.043	−0.104	−0.088	−0.095	−0.087	−0.103
Disruption	0.100	0.024	0.046	0.037	0.048	0.031
Strategic importance	−0.003	−0.049	−0.031	−0.037	−0.025	−0.050
Firm competence	0.321***	0.170*	0.169*	0.166*	0.171*	0.164†
Work experience	−0.018	0.034	0.041	0.031	0.045	0.025
Independent variables						
Contract specificity (CS)	—	0.293***	0.317***	0.282***	0.310***	0.292***
Contract flexibility (CF)	—	0.313***	0.288***	0.321***	0.298***	0.305***
Contract application (CA)	—	0.037	0.057	0.042	0.057	0.038
Moderating variable						
Environmental Uncertainty (EU)	—	—	−0.056	−0.058	−0.066	−0.026
Interactions						
CS*EU	—	—	**−0.034 (H13×)**	0.077	—	—
CF*EU	—	—	**0.197** (H14✓)**	—	0.184**	—
CA*EU	—	—	**−0.038 (H15×)**	—	—	−0.048
R^2	0.111	0.361	0.380	0.359	0.386	0.356
$\triangle R^2$	0.111	0.250	0.019	−0.002	0.025	−0.005
F	3.744***	9.980***	8.147***	8.527***	9.448***	8.434***

Notes.
†<0.100.
*$p < 0.050$.
**$p < 0.010$.
***$p < 0.001$. R-squared is the percentage of the dependent variable's variation that a linear model explains. F is the probability that the null hypothesis for the full model is true.

more detailed than the 1999 version. The trend may respond to the increasingly dynamic business environment that necessitate more detailed contracts based on our findings. Besides, many companies have devised detailed model contracts, which are enriched continuously based on experience (Xu et al. 2024), so as to help reduce disruptions in future projects.

Nevertheless, some studies have proposed the opposite view that contractual governance may hamper risk management and resilience, both in the field of project management (Yao, Chen, and Tang 2024) and in the other management fields, such as supply chain management (Huo et al. 2016) and strategic management (Faems et al. 2008). Our findings contribute to resolving the inconsistency since this study

finds that contract application could damage reactive resilience despite the positive role of detailed contracts. As a Chinese proverb says, *to specify terms clearly at first and to use a good deal of courtesy later*. The former involves designing a very detailed contract before the project begins while the latter involves flexible contract application during the implementation. Our findings challenge the viewpoints that strict contractual governance during the execution of construction projects has always been highlighted by many good practices (Yao et al. 2023). The findings are also supported by Yao et al. (2019) who have suggested that strict contract enforcement may lead to ossification in construction projects. Such ossification is particularly destructive in the face of disruptions. The distinct (even positive versus negative) effects of contract design and contract application imply the importance to differentiate contractual governance based on the governance stage perspective when investigating the role of contractual governance.

In contrast, the negative effect of contract application on proactive resilience is not supported. We argue that strict contract application may play a 'bright' role. As Keller et al. (2021) have proposed, communication issues are predominant when alliance partners sense disruptions. This study argues that strict application of contract provisions, especially those concerning formal communication, can facilitate timeliness of information sharing. Its 'bright' and 'dark' effects may counterbalance each other.

Mediating role of relational ties

The mediating role of relational ties in the link between contract specificity and project resilience is supported. Some scholars (Wang et al. 2023, Yang et al. 2022b) have found the significantly positive role of relational mechanisms in project resilience, which is consistent with the findings of our studies. Our studies have further complemented them by differentiating the dimensions of project resilience and confirming that both preparedness and recovery are driven by relational ties. Besides, some 'good practices' have warned the high cost and fragility of relational ties in construction projects due to the one-off nature compared with long-term supply chains or alliances (Chow, Cheung, and Chan 2012). Thus, they have proposed that it may be uneconomic to develop relational ties in projects. But this study challenges the viewpoint since we have found a strong explanatory power of relational ties in the contexts of project disruptions.

Besides, since the direct effect of contract specificity is significant, as shown in Table 4, relational ties play a *partially* mediating role. It implies that other paths could explain the role of contract specificity. As Wang et al. (2022) have suggested, a specified contract usually includes more provisions on routinised communication. Despite possibly being considered non-relational or even tedious, such communication is beneficial for recognising potential hazards. Besides, high contract specificity includes more legal remedies for performance failures (Gao et al. 2018), thus 'pushing' both parties back to the renegotiation table and ensuring joint problem-solving instead of being determined to part, which is conducive to promoting rapid recovery. Such conduct may be motivated by self-interest rather than relational considerations.

The mediating role of relational ties in the link between contract flexibility and project resilience is supported as well. Song et al. (2018) have found that contract flexibility could promote cooperative relationships. The outcomes are significant drivers for relational ties. Like contract specificity, the role of contract flexibility in resilience is also partially mediated by relational ties. As the Hypothesis Development suggests, many contracts including FIDIC and NEC cover approaches of formal communication when some signs of hazards appear, thus facilitating well-preparedness. In addition, flexible contracts consist of renegotiation rules and procedures. As Keller et al. (2021) have suggested, renegotiation arrangements in contracts ensure the effectiveness of ex-post negotiation and foster adaptation to changes. All the above behaviour may be transactional instead of relational.

The mediating role in the link between contract application and project resilience is not supported though. Table 5 further demonstrates that contract application exerts no significant effects on relational ties. The results are inconsistent with the developed hypothesis as well as some of the previous studies. For example, Faems et al. (2008) have highlighted the potentially destructive effects of contract application on goodwill trust and Lumineau and Henderson (2012) have found that over-dependence on contractual control may discourage cooperative relationships during the negotiation in the process of exchange.

The differential findings may result from the specific nature of construction projects. Faems et al. (2008) have conducted their studies based on R&D alliances, where many details cannot be written in the contracts due to high technological uncertainty and contractual governance may be ineffective. Thus, parties have a psychological expectation that the other party will employ relational mechanisms more and overly strict contract application may violate such expectations, thus signalling distrust. In contrast, it seems to be a tradition to apply contracts in the construction industry since severe contract enforcement can serve as effective safeguards for ensuring compliance (Yan and Zhang 2020). More broadly, Lumineau and Henderson (2012) have covered multiple industries, including manufacturing, chemicals, electrical and so on, which may have ignored the differences among different industries.

Moderating role of environmental uncertainty

Our findings support the strengthening role of environmental uncertainty in the positive effects of contract flexibility on relational ties. Flexible terms provide a framework that allows organisations to easily modify contracts based on changes when environmental uncertainty is high, as You et al. (2018) have concluded. Lu, Zhang, and Zhang (2016) have suggested that flexible terms are crucial since they reduce the likelihood of terminating the exchange and allow for a long-term relationship, which are necessary to develop social ties.

In contrast, this study does not find the significantly moderating role of environmental uncertainty in terms of

contract specificity although the coefficient of the interactive item is negative. The Hypothesis Development section states that high environmental uncertainty may discount the effectiveness of third-party dispute resolution methods thus reducing the safeguarding efficiency of a specified contract. The insignificantly negative coefficient may imply that the effectiveness may be discounted but not significantly so. As Illankoon et al. (2022) have suggested, third-party dispute resolution methods are predominant and effective in various construction projects. Furthermore, some opportunistic conducts and sequent disputes may result from a changing environment (You et al. 2018), which necessitates detailed dispute settlement procedures to ensure the relationship continuity. The findings also imply that it is necessary to differentiate the dimensions of contractual governance based on the content perspective when exploring its role.

The above argument may also contribute to explaining the insignificant moderating role of environmental uncertainty regarding the link between contract application and project resilience. That is, the changing environment may be the source of some opportunistic conduct. Then, as Jia et al. (2020) have concluded, contract application could help curb opportunism to ensure relationship continuity.

Conclusions

This study examines the role of contractual governance in construction project resilience and the mediating role of relational ties as well as the moderating effects of environmental uncertainty. Contractual governance is differentiated by integrating the governance stage perspective and the content perspective. Data were collected through the questionnaire survey based on the relationship between an owner and its general contractor of construction projects. The results show that contract specificity and flexibility enhance proactive and reactive resilience and that relational ties mediate the above enhancements. Besides, contract application hampers reactive resilience but exerts no significant effects on proactive resilience and relational ties. Last, environmental uncertainty strengthens the positive role of contract flexibility.

Theoretical contributions

The following theoretical developments are made by this study. First, although previous studies have examined the roles of project resilience drivers at different levels, this study contributes to them by confirming the significant effects of the antecedents at the inter-organisational level (i.e. contractual governance and relational ties). Some insightful studies have investigated such effects by conducting case studies, but they have neither considered the generalisability of their findings (conducting cast studies) nor distinguished contractual governance from the integrative perspective (treating it as one dimension and mainly focusing on contract specificity). Second, previous studies have obtained inconsistent findings on the role of contractual governance in handing project risks (and transaction risks in other fields of management, such as supply chain management and strategic management). In contrast, this study explores such role from the resilience view. Also, this study finds that different dimensions of contractual governance have distinguished influences on project resilience, which indicates that an integrative perspective contributes to coordinating the contradictory conclusions. Furthermore, the revelation of the role of relational ties and environmental uncertainty helps to answer the mechanism of the above effects.

Practical implications

Increasingly dynamic and uncertain business environment has highlighted the significance of enhancing engineering project resilience. This study provides recommendations for practitioners to enhance project resilience through inter-organisational contractual governance. Overall, project managers are recommended to 'specify clear terms first and use a good deal of courtesy later'. In terms of the former, they should design more specified provisions on rights and obligations as well as flexible provisions on price adjustments and renegotiation procedures. Considering that many commonly used model contracts are detailed and comprehensive, it is advisable to use a model contract and add to it clauses adapted to the specific characteristics of the current project. In terms of the latter, although it may be a common industrial practice that parties apply contract provisions strictly to govern a project due to the one-off nature, project managers should be careful since strict contract application may jeopardise project resilience. Besides, it may require much time and effort to develop relational ties, thus, discouraging project managers from doing so, which may account for the adversarial environment in engineering projects compared with other industries. But this study suggests that relational ties are an effective mechanism in the contexts of project disruptions. Thus, informal and personal interactions should be encouraged. Also, managers should also realise that a detailed contract is a critical tool for developing ties. In particular, when environmental uncertainty is high, more provisions on future contingencies are expected to be incorporated for strengthening relational ties.

Future research directions

This study has some limitations and may imply some future research directions. First, this study finds that relational ties play a partly mediating role in the link between detailed contracts and project resilience. Although we propose other possible paths, this study does not empirically test these arguments, which is worth investigating by future studies. Second, future research can examine the research question raised by this study using data from developed nations and contrast the findings between those nations and China. Third, this study focuses only on the relationship between the owner and the general contractor since this relationship is one of the most significant drivers of project resilience. Nevertheless, there are other types of relationships, such as contractor-subcontractor relationships, owner-consultant relationships, owner-government relationships, and contractor-

supplier relationships. It is interesting to investigate the role of contractual governance or inter-organisational ties of those relationships in project resilience.

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Data availability statement

Some or all data, models, or code that support the findings of this study are available from the corresponding author upon reasonable request.

References

Ali, A., A. Mahfouz, and A. Arisha. 2017. "Analysing Supply Chain Resilience: integrating the Constructs in a Concept Mapping Framework via a Systematic Literature Review." *Supply Chain Management: An International Journal* 22 (1): 16–39. https://doi.org/10.1108/SCM-06-2016-0197.

Ambulkar, S., J. Blackhurst, and S. Grawe. 2015. "Firm's Resilience to Supply Chain Disruptions: Scale Development and Empirical Examination." *Journal of Operations Management* 33-34 (1): 111–122. https://doi.org/10.1016/j.jom.2014.11.002.

Blay, K. B. 2017. "Resilience in Projects: Definition, Dimensions, Antecedents and Consequences." PhD., Loughborough University.

Chow, P. T., S. O. Cheung, and K. Y. Chan. 2012. "Trust-Building in Construction Contracting: Mechanism and Expectation." *International Journal of Project Management* 30 (8): 927–937. https://doi.org/10.1016/j.ijproman.2012.03.002.

Chowdhury, M. M. H., and M. Quaddus. 2017. "Supply Chain Resilience: Conceptualization and Scale Development Using Dynamic Capability Theory." *International Journal of Production Economics* 188: 185–204. https://doi.org/10.1016/j.ijpe.2017.03.020.

Esmalian, A., F. Yuan, A. A. Rajput, H. Farahmand, S. Dong, Q. Li, X. Gao, et al. 2022. "Operationalizing Resilience Practices in Transportation Infrastructure Planning and Project Development." *Transportation Research Part D: Transport and Environment* 104: 103214. https://doi.org/10.1016/j.trd.2022.103214.

Faems, D., M. Janssens, A. Madhok, and B. Looy. 2008. "Toward an Integrative Perspective on Alliance Governance: Connecting Contract Design, Trust Dynamics, and Contract Application." *Academy of Management Journal* 51 (6): 1053–1078. https://doi.org/10.5465/amj.2008.35732527.

Fang, F., W. VAN DER Valk, B. Vos, and H. A. Akkermans. 2024. "Down the Drain: The Dynamic Interplay of Governance Adjustments Addressing Setbacks in Large Public–Private Projects." *Journal of Operations Management* 70 (1): 80–106. https://doi.org/10.1002/joom.1277.

Faruquee, M., P. Antony, and C. A. Irawan. 2024. "The Dual Effect of Environmental Dynamism on Proactive Resilience: can Governance Mechanisms Negate the Dark Side?" *Production Planning & Control* 35 (15): 2113–2130. https://doi.org/10.1080/09537287.2023.2291378.

Franke, H., F. Wynstra, F. Nullmeier, and C. Nullmeier. 2022. "Project Managers' Reactions to Project Disruption: sponsor Actions versus

Environmental Uncertainty." *International Journal of Operations & Production Management* 42 (13): 335–357. https://doi.org/10.1108/IJOPM-02-2022-0103.

Gao, N., Y. Chen, W. Wang, and Y. Wang. 2018. "Addressing Project Complexity: The Role of Contractual Functions." *Journal of Management in Engineering* 34 (3): 04018011. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000613.

Geambasu, G. 2011. "Expect the Unexpected: An Exploratory Study on the Conditions and Factors Driving the Resilience of Infrastructure Projects." PhD., Swiss Federal Institute of Technology in Lausanne.

Haaskjold, H., B. Andersen, O. LæDRE, and W. Aarseth. 2019. "Factors Affecting Transaction Costs and Collaboration in Projects." *International Journal of Managing Projects in Business* 13 (1): 197–230. https://doi.org/10.1108/IJMPB-09-2018-0197.

Haaskjold, H., B. Andersen, and J. A. Langlo. 2023. "Dissecting the Project Anatomy: Understanding the Cost of Managing Construction Projects." *Production Planning & Control* 34 (2): 117–138. https://doi.org/10.1080/09537287.2021.1891480.

Hu, Z., G. Wu, X. Zhao, J. Zuo, and S. Wen. 2021. "How Does the Strength of Ties Influence Relationship Quality in Chinese Megaprojects? The Mediating Role of Contractual Flexibility." *Baltic Journal of Management* 16 (3): 366–385. https://doi.org/10.1108/BJM-09-2020-0347.

Huo, B., D. Fu, X. Zhao, and J. Zhu. 2016. "Curbing Opportunism in Logistics Outsourcing Relationships: The Role of Relational Norms and Contract." *International Journal of Production Economics* 182: 293–303. https://doi.org/10.1016/j.ijpe.2016.07.005.

Illankoon, I. M. C. S., V. W. Y. Tam, K. N. Le, and K. A. T. O. Ranadewa. 2022. "Causes of Disputes, Factors Affecting Dispute Resolution and Effective Alternative Dispute Resolution for Sri Lankan Construction Industry." *International Journal of Construction Management*, 22 (2): 218–228. https://doi.org/10.1080/15623599.2019.1616415.

Jia, Y., T. Wang, K. Xiao, and C. Guo. 2020. "How to Reduce Opportunism through Contractual Governance in the Cross-Cultural Supply Chain Context: Evidence from Chinese Exporters." *Industrial Marketing Management* 91: 323–337. https://doi.org/10.1016/j.indmarman.2020.09.014.

Keller, A., F. Lumineau, T. Mellewigt, and A. ARIñO. 2021. "Alliance Governance Mechanisms in the Face of Disruption." *Organization Science* 32 (6): 1542–1570. https://doi.org/10.1287/orsc.2021.1437.

Kutsch, E., and M. Hall. 2016. *Project Resilience: The Art of Noticing, Interpreting, Preparing, Containing and Recovering*. London, UK: Routledge.

Linkov, I., and B. D. Trump. 2019. *The Science and Practice of Resilience*. Switzerland: Springer Cham.

Liu, Y., Y. Luo, and T. Liu. 2009. "Governing Buyer–Supplier Relationships through Transactional and Relational Mechanisms: Evidence from China." *Journal of Operations Management* 27 (4): 294–309. https://doi.org/10.1016/j.jom.2008.09.004.

Lu, W., L. Zhang, and L. Zhang. 2016. "Effect of Contract Completeness on Contractors' Opportunistic Behavior and the Moderating Role of Interdependence." *Journal of Construction Engineering and Management* 142 (6): 04016004. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001110.

Lumineau, F., and J. E. Henderson. 2012. "The Influence of Relational Experience and Contractual Governance on the Negotiation Strategy in Buyer–Supplier Disputes." *Journal of Operations Management* 30 (5): 382–395. https://doi.org/10.1016/j.jom.2012.03.005.

Marsov, A., O. LæDRE, B. Andersen, and N. O. E. Olsson. 2024. "Opportunity Management Enablers in Construction Projects: A Systematic Literature Review." *Production Planning & Control* 1–15. https://doi.org/10.1080/09537287.2024.2362861.

Oliveira, N., N. Argyres, and F. Lumineau. 2022. "The Role of Communication Style in Adaptation to Interorganizational Project Disruptions." *Journal of Operations Management* 68 (4): 353–384. https://doi.org/10.1002/joom.1183.

Ortiz-DE-Mandojana, N., and P. Bansal. 2016. "The Long-Term Benefits of Organizational Resilience through Sustainable Business Practices." *Strategic Management Journal* 37 (8): 1615–1631. https://doi.org/10.1002/smj.2410.

Park, K. 2011. "Flexible and Redundant Supply Chain Practices to Build Strategic Supply Chain Resilience: Contingent and Resource-Based Perspectives." Doctor of Philosophy, University of Toledo, College of Business and Innovation.

Poppo, L., and T. Zenger. 2002. "Do Formal Contracts and Relational Governance Function as Substitutes or Complements?" *Strategic Management Journal* 23 (8): 707–725. https://doi.org/10.1002/smj.249.

Qiao, L., W. Wang, W. Cao, L. Mi, Y. Zhang, and G. Ni. 2024. "How Do Construction Projects Deal With Extreme Weather? Improving Organizational Resilience From the Perspective of Managers' Perception and Affect." *IEEE Transactions on Engineering Management* 71: 11585–11598. https://doi.org/10.1109/TEM.2024.3422069.

Rahi, K. 2022. "Project Resilience: A Conceptual Framework." *International Journal of Information Systems and Project Management* 7 (1): 69–83. https://doi.org/10.12821/ijispm070104.

Schilke, O., and F. Lumineau. 2018. "The Double-Edged Effect of Contracts on Alliance Performance." *Journal of Management* 44 (7): 2827–2858. https://doi.org/10.1177/0149206316655872.

Shen, L., C. Su, X. Zheng, and G. Zhuang. 2020. "Between Contracts and Trust: Disentangling the Safeguarding and Coordinating Effects over the Relationship Life Cycle." *Industrial Marketing Management* 84: 183–193. https://doi.org/10.1016/j.indmarman.2019.06.006.

Shi, C., Y. Chen, J. You, and H. Yao. 2018. "Asset Specificity and Contractors' Opportunistic Behavior: Moderating Roles of Contract and Trust." *Journal of Management in Engineering* 34 (5): 04018026. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000632.

Śladowski, G., B. Sroka, B. Szewczyk, and K. Barnaś. 2024. "Identification of Strategies for Enhancing the Risk Resilience of Construction Projects as Systems." *Automation in Construction* 166: 105621. https://doi.org/10.1016/j.autcon.2024.105621.

Song, H., F. Zhu, J. Klakegg Ole, and P. Wang. 2018. "Relationship between Contractual Flexibility and Contractor's Cooperative Behavior: The Mediating Effect of Justice Perception." *International Journal of Managing Projects in Business* 11 (2): 382–405. https://doi.org/10.1108/IJMPB-07-2017-0088.

Suprapto, M., H. L. M. Bakker, H. G. Mooi, and M. J. C. M. Hertogh. 2016. "How Do Contract Types and Incentives Matter to Project Performance?" *International Journal of Project Management* 34 (6): 1071–1087. https://doi.org/10.1016/j.ijproman.2015.08.003.

Tang, Y., Y. Chen, H. Yao, and Y. Chen. 2024. "When Does Control Curb Opportunistic Behaviour: evidence from the Construction Industry." *Production Planning & Control* 35 (11): 1232–1246. https://doi.org/10.1080/09537287.2023.2166882.

Tang, Y., and H. Yao. 2023. "Watch out for the Hidden Costs of Subcontracting in Construction Projects: The Impacts of Subcontractor Dispersion." *Journal of Construction Engineering and Management* 149 (11): 04023113. https://doi.org/10.1061/JCEMD4.COENG-13307.

Tian, B., J. Fu, Y. Xu, and L. Sun. 2024. "How Does Contract Flexibility Affect the Sustainability Performance of Public–Private Partnership Projects? A Serial Multiple Mediator Model." *Engineering, Construction and Architectural Management* 31 (1): 28–47. https://doi.org/10.1108/ECAM-03-2022-0222.

Wang, L., X. Yang, F. Zhu, and O. J. Klakegg. 2023. "How Governance of Interorganizational Projects Develops Resilience: Mediating Role of Resource Reconfiguration." *Journal of Management in Engineering* 39 (2): 04022076. https://doi.org/10.1061/JMENEA.MEENG-4936.

Wang, N., S. Ma, and Y. Wang. 2021. "Uniting in the Letter but Breaching in the Spirit: Contract Flexibility and Interfirm Collaboration Based on the Contracts as Reference Points Theory." *Industrial Marketing Management* 97: 193–204. https://doi.org/10.1016/j.indmarman.2021.07.009.

Wang, Y., Y. Chen, W. Wang, Y. Chen, and M. Jin. 2022. "Revisiting the Relationship Between Contract Governance and Contractors' Opportunistic Behavior in Construction Projects." *IEEE Transactions on Engineering Management* 69 (6): 2517–2529. https://doi.org/10.1109/TEM.2019.2945551.

Wieland, A., and C. M. Wallenburg. 2013. "The Influence of Relational Competencies on Supply Chain Resilience: A Relational View." *International Journal of Physical Distribution & Logistics Management* 43 (4): 300–320. https://doi.org/10.1108/IJPDLM-08-2012-0243.

Williams, T. A., D. A. Gruber, K. M. Sutcliffe, D. A. Shepherd, and E. Y. Zhao. 2017. "Organizational Response to Adversity: Fusing Crisis Management

and Resilience Research Streams." *Academy of Management Annals* 11 (2): 733–769. https://doi.org/10.5465/annals.2015.0134.

Wuyts, S., and I. Geyskens. 2005. "The Formation of Buyer—Supplier Relationships: Detailed Contract Drafting and Close Partner Selection." *Journal of Marketing* 69 (4): 103–117. https://doi.org/10.1509/jmkg.2005.69.4.103.

Xu, C., Y. Chen, H. Yao, and L. Zhang. 2024. "The Opportunism-Inhibiting Effects of the Alignment Between Engineering Project Characteristics and Contractual Governance: Paired Data From Contract Text Mining and Survey." *IEEE Transactions on Engineering Management* 71: 15110–15124. https://doi.org/10.1109/TEM.2024.3480254.

Xue, J., H. Yuan, and B. Shi. 2017. "Impact of Contextual Variables on Effectiveness of Partnership Governance Mechanisms in Megaprojects: Case of Guanxi." *Journal of Management in Engineering* 33 (1): 04016034. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000476.

Yan, L., and L. Zhang. 2020. "Interplay of Contractual Governance and Trust in Improving Construction Project Performance: Dynamic Perspective." *Journal of Management in Engineering* 36 (4): 04020029. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000791.

Yang, J., Y. Chen, H. Yao, and B. Zhang. 2022a. "Machine Learning–Driven Model to Analyze Particular Conditions of Contracts: A Multifunctional and Risk Perspective." *Journal of Management in Engineering* 38 (5): 04022036. https://doi.org/10.1061/(ASCE)ME.1943-5479.0001068.

Yang, J., and Q. Cheng. 2020. "The Impact of Organisational Resilience on Construction Project Success: evidence from Large-Scale Construction in China." *Journal of Civil Engineering and MANAGEMENT* 26 (8): 775–788. https://doi.org/10.3846/jcem.2020.13796.

Yang, X., L. Wang, F. Zhu, and R. MüLLER. 2022b. "Prior and Governed Stakeholder Relationships: The Key to Resilience of Inter-Organizational Projects." *International Journal of Project Management* 40 (1): 64–75. https://doi.org/10.1016/j.ijproman.2021.10.001.

Yao, H., Y. Chen, Y. Chen, and X. Zhu. 2019. "Mediating Role of Risk Perception of Trust and Contract Enforcement in the Construction Industry." *Journal of Construction Engineering and Management* 145 (2): 04018130. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001604.

Yao, H., Y. Chen, and Y. Tang. 2024. "Contract Violations in the Construction Projects: How Contractual Obligations Are Reached Affects Contractual and Reputational Enforcement." *IEEE Transactions on Engineering Management* 71: 7160–7172. https://doi.org/10.1109/TEM.2023.3257883.

Yao, H., Y. Chen, Y. Zhang, M. Zhang, and Y. Zhang. 2023. "Managing Contract Violations in Construction Projects: A Moderated Mediating Model of Enforcement Decisions." *Production Planning & Control* 34 (8): 677–688. https://doi.org/10.1080/09537287.2021.1951390.

Yao, H., and K. Wang. 2024. "Concentrated or Dispersed: The Effects of Subcontracting Organizational Arrangements on Construction Project Resilience." *Journal of Management in Engineering* 40 (3): 04024017. https://doi.org/10.1061/JMENEA.MEENG-5870.

You, J., Y. Chen, W. Wang, and C. Shi. 2018. "Uncertainty, Opportunistic Behavior, and Governance in Construction Projects: The Efficacy of Contracts." *International Journal of Project Management* 36 (5): 795–807. https://doi.org/10.1016/j.ijproman.2018.03.002.

Zhang, L., Y. Fu, J. Lai, and Y. Chen. 2024. "Complements or Substitutes? Recipes of Contract Design, Contract Enforcement, and Trust for Enhanced Project Performance." *International Journal of Project Management* 42 (3): 102587. https://doi.org/10.1016/j.ijproman.2024.102587.

Zhang, S., F. Zhang, B. Xue, D. Wang, and B. Liu. 2023. "Unpacking Resilience of Project Organizations: A Capability-Based Conceptualization and Measurement of Project Resilience." *International Journal of Project Management* 41 (8): 102541. https://doi.org/10.1016/j.ijproman.2023.102541.