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Transformational leadership and project success: the serial meditating roles of team flexibility and team agility

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The construction sector is known for its dynamic nature, and numerous construction projects have failed to reach completion due to inadequate development of leadership. As a widely recognized leadership, transformational leadership has shown the positive relationship with project success. However, the mechanisms driving this relationship remain unclear in the context of construction projects. In response to this topic, by adopting the Input-Mediator-Outcome model, this study seeks to investigate the mediating effect of team flexibility and team agility between transformational leadership and project success in the context of construction projects. Data were collected through a survey from 306 construction project members. The Structural Equation Modeling method was employed to test the proposed model. The findings demonstrate that (1) transformational leadership positively impacts team flexibility and team agility; (2) team flexibility and team agility positively impact project success; (3) team flexibility shows a positive mediating effect between transformational leadership and project success; (4) team agility shows no mediating effect between transformational leadership and project success; and (5) team flexibility and team agility play serial mediating roles between transformational leadership and project success.

KEYWORDS

transformational leadership, project success, team flexibility, team agility, construction project management

1 Introduction

Harvard Business Review (2021) reports that "the value of project-oriented economic activity worldwide will grow from $12 trillion (in 2013) to $20 trillion by 2027" (Nieto-Rodriguez, 2021, 5). With increasing investment, the ability to successfully execute projects should be accordingly elevated. However, recent statistics indicate that a high percentage of projects fail to meet intended objectives (Imam and Zaheer, 2021), with an even higher percentage of unsuccessful outcomes reported in developing countries (Gazder and Khan, 2018), including China with the largest construction industry in the world (Ye et al., 2015). Extant literature demonstrates that ineffective leadership has been identified as the cause of 80% of project failures (Fareed et al., 2023). In response, recent research has explored various leadership styles that may impact project success (PS), such as transformational leadership (TFL), servant leadership, shared leadership, empowerment leadership, knowledge-oriented leadership, and ethical leadership (Aga et al., 2016; Latif et al., 2020; Bhatti et al., 2021; Imam and Zaheer, 2021; Ahmad et al., 2022; Nauman et al., 2022).

Among these styles, TFL demonstrates particular promise for project settings characterized by complexity and uncertainty. Specifically, TFL has demonstrated efficacy in yielding favorable outcomes, including knowledge management capability (Le et al., 2022), innovation (Le and Le, 2023), organizational change capability and organizational performance (Le and Le, 2021), organizational justice (Phong and Son, 2020), and employee trust (Cao and Le, 2022). These organizational benefits provide fertile conditions for PS. The meta-analysis of Hoch et al. (2018) also indicated that TFL has a stronger effect than other leadership styles, including ethical, authentic, and servant Leadership, on most positive outcomes. Additionally, compared with other leadership styles, TFL is an effective way to cope with project environments characterized by complexity and uncertainty (Aga et al., 2016; Fareed and Su, 2022). For example, TFL provides team members with clear direction and instills confidence when dealing with high levels of uncertainty (Bass and Avolio, 1990b). Therefore, TFL may serve as a suitable and effective leadership style in the context of projects.

Existing research has revealed a number of mediators linking TFL to PS, including trust and job satisfaction (Fareed et al., 2022), public service motivation (Fareed and Su, 2022), teamwork quality (Ali et al., 2021), and team-building (Aga et al., 2016). However, the intermediary effects of team flexibility (TF) and team agility (TA), between TFL and PS, are limited. Aga et al. (2016) call for further research to examine the mediating mechanisms that transmit TFL's effects onto PS. Similarly, Ali et al. (2021) urge more research on the path from TFL to PS. To answer these calls, this study assumes that TF and TA both play parallel and serial mediating roles between TFL and PS in the context of construction projects in China. These issues are novel, urgent, and important for project-based organizations for the following reasons.

The construction sector is characterized by its dynamic, ever-evolving nature (Kashikar et al., 2016), and construction projects are inherently complex and often executed under uncertainties (Lee et al., 2005). In order to effectively adapt to the swiftly changing environment in the construction industry (Kashikar et al., 2016), TA has emerged as a crucial factor effectively responding to the swiftly changing environment and handling growing complexity (Krüger, 2023). As Denning (2013) highlighted, TA is a fundamental component of project management for long-term success. While leadership is recognized as an antecedent to TA (Akkaya and Tabak, 2020; AlNuaimi et al., 2022), the specific mechanisms linking TFL to TA and PS is less understood. As such, it is necessary for additional theoretical grounding and empirical evidence to elucidate the mediating role of TA between TFL and PS.

Along with TA, TF is another means of contributing to the success of construction projects facing increasing complexity and dynamism (Zhang et al., 2013). Prior research confirms that TF allows teams to achieve positive outcomes in uncertainty environments, especially for projects (Brown and Eisenhardt, 1995; Li et al., 2010). While leadership helps establish TF (Ling et al., 2021), how TF mediates between TFL and PS remains underexplored. This limitation constrains the comprehension of the mechanism by which TFL is able to cooperate with TF to facilitate PS. Therefore, exploring TF's mediating role between TFL and PS contributes to a deeper understanding of how TFL facilitates successful project delivery.

Furthermore, the complexity and dynamism of construction projects suggests TF and TA may play sequential mediating roles from TFL to PS. Transformational leaders develop organizational capacity for flexibility by empowering teams, encouraging innovative thinking, and pushing boundaries (Bass and Riggio, 2006). This flexibility enhances the ability to rapidly reconfigure and adapt when needed, laying the foundations for TA (Santos Bernardes and Hanna, 2009). As noted by Abdelilah et al. (2018), flexibility in teams expands the range of solutions considered, enabling more agile responses. Ultimately, TA strengthens dynamic management capabilities to meet project objectives despite uncertainties (Vázquez-Bustelo et al., 2007). Testing this cascading mediation will provide a nuanced understanding of the underlying mechanisms of how to translate the effect of TFL into PS.

Based on this discussion, three main research questions (RQ) are raised:

RQ1: Does TA serve as a mediator between TFL and PS?

RQ3: Does TF serve as a mediator between TFL and PS?

RQ4: Do TF and TA serve as serial mediators between TFL and PS?

To answer these questions, this study adopts the input-mediator-output (IMO) framework. Employing structural equation modeling (SEM), this study assesses the mediating roles of TF and TA between TFL and PS by surveying 306 project members in China (as illustrated in Figure 1).

2 Literature review

2.1 TFL

TFL refers to "a leadership style that inspires employees or followers to change their beliefs, values, capabilities, and motives to raise their performance beyond self-interest for the benefit of the organization" (Chua and Ayoko, 2021, 526). The concept was first introduced by Burns (2012) in his seminal work in 1978. Bass (1985) expand the theory and identified the psychological mechanisms underlying TFL. In the 1990s, scholars attempted to examine TFL in a variety of contexts, such as military, government, education, and industry (Bass, 1999). Scholars have explored the antecedents and outcomes related to TFL (Howell and Avolio, 1993), and other leadership styles have been compared to TFL (Bass and Avolio, 1990a).

In the 2000s, researchers began investigating the mediators and moderators between TFL and its consequences, as well as TFL's measurement (Carless et al., 2000; Wang et al., 2011). More recently, the research focus has shifted towards investigating TFL within teams, moving beyond an individual perspective (Bagga et al., 2023). Some scholars have employed the IMO model and studied the mediating effect of team processes and emergent states on TFL (García-Guiu et al., 2016; Lu and Li, 2021).

TFL has been considered an effective input factor in numerous empirical studies, serving as an antecedent of in-role performance (Han et al., 2020) and playing a crucial role in fostering organizational innovation (Chen et al., 2012). Moreover, TFL significantly impacts team processes and emergent states, such as

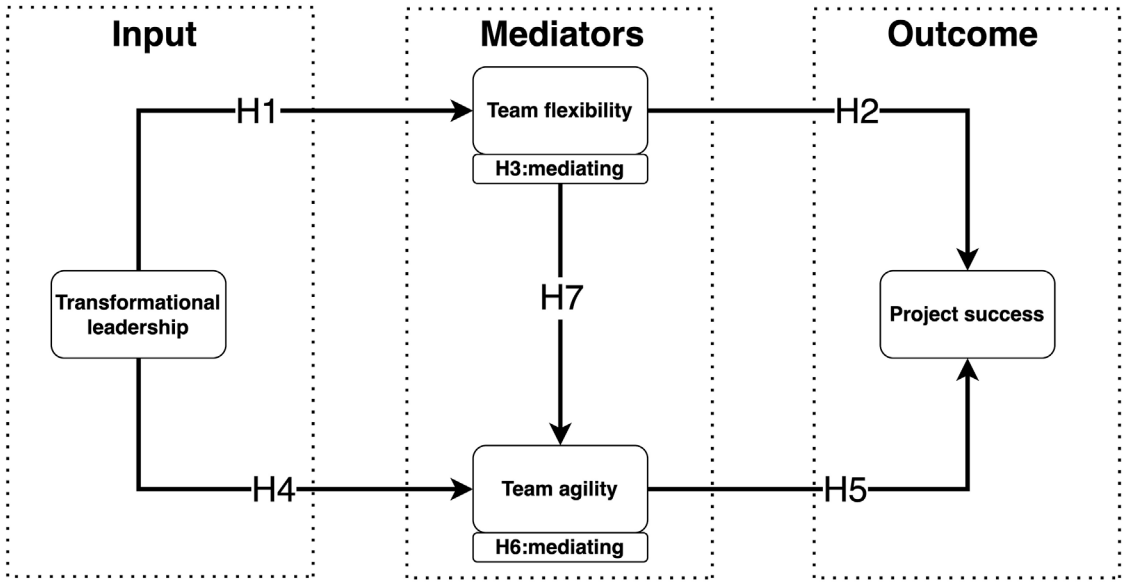

FIGURE 1
Conceptual framework.

communication (Eisenberg et al., 2019) and team efficacy (Lu and Li, 2021). Therefore, in this study, TFL is considered an input that facilitates team emergent states.

2.2 TF

In the 1970s, the need for flexibility emerged as a strategic necessity due to the business environment's instability resulting from increased global competition (Verdú-Jover et al., 2006). Since then, flexibility has garnered attention from scholars. For instance, in manufacture management, flexibility refers to an organization's capacity to adapt with minimal time and cost to address changes arising from an uncertain environment (Upton, 1995). Simultaneously, flexibility has attracted increased attention in organizations, originally stemming from the literature on strategic flexibility and human resource flexibility (Sanchez, 1995). Literature on strategic flexibility has primarily emphasized the cultivation of organizational capabilities and the use of options to effectively adapt to a diverse range of shifts (Volberda, 1996), whereas human resource flexibility refers to employees' capacity to facilitate an organization in exploring various strategic alternatives (Wright and Snell, 1998).

In contrast to the existing literature that has primarily investigated flexibility at the organizational level, TF is inherently focused on the team level (Ling et al., 2021). TF is defined as follows: "team ability in response to environmental changes to ensure survival in the face of uncertainty" (He et al., 2014, 952). Empirical findings suggest positive relationship between TF and positive outcomes. According to Ling et al. (2021), TF positively affects change-specific adaptive and proactive behavior, as well as perceived change fairness. The results of Li et al. (2017) also show that TF is a predictor of project performance. Furthermore, since construction projects are typically characterized by their temporary and unique nature, team members often find themselves in situation in which they lack prior experience in collaborating with one another, leading to increased uncertainty (Kent and Becerik-Gerber, 2010). TF is even more important in engendering positive outcomes when uncertainty occurs (Brown and Eisenhardt, 1995).

Among the antecedents of TF, leadership is considered crucial. For example, change leadership facilitates work teams to adopt flexible measures to effectively navigate changes (Ling et al., 2021). TFL shares similarities with change leadership as it may also foster team adaptability and flexibility (Wang et al., 2017). Furthermore, TFL is an efficient leadership style that plays a pivotal role in achieving high performance within temporary organizations (Raziq et al., 2018). Therefore, in this study, it is expecting that TF may present as a possible mediator between TFL and PS.

2.3 TA

Early studies connected to agility may be traced back to the 1950s in the area of social sciences (Conboy, 2009). Until the 1990s, agility had attracted more attention within the domain of manufacturing (Yusuf et al., 1999) as it is presented as a concept named "agile manufacturing", representing a novel paradigm. This paradigm emphasizes the capacity to adapt a system's arrangement in reaction to unanticipated changes and unforeseen circumstantces (Conforto et al., 2016). Since then, agility has been introduced into areas of management, including supply chain management (Fayezi et al., 2017), strategic management (Doz and Kosonen, 2008), and organizational science (Volberda, 1996).

In the early 1990s, "agile project management" was introduced, centering on research into software development projects (Brown and Eisenhardt, 1995). Agile project management employs iterative activity cycles specifically crafted to effectively manage change. This

approach equips the project team with adaptable training, empowering them to proficiently handle change requests (Sheffield and Lemétayer, 2013). Although its primary application has been in software development, agile practices and principles have a role to play in projects characterized by uncertainty and complexity, such as construction projects (Layton et al., 2020).

TA is the foundation of the implementation of agile project management (Conforto and Amaral, 2016) and refers to "a team's ability to respond to unpredictable changes in proper ways and to take advantages of these changes as opportunities" (Liu et al., 2015, 297). TA has increasingly been considered a fundamental component of project management, essential for ensuring long-term success (Denning, 2013). Empirical research has provided ample evidence to suggest that TA is associated with positive outcomes. Liu et al. (2015) found that TA positively influences team performance. In the research of Krüger (2023), TA was tested and found to have a positive correlation with shared mental models, enhancing teams' ability to adapt effectively.

Scholars have explored the antecedents of agility and have identified leadership as an effective factor influencing it. AlNuaimi et al. (2022) determined how leadership style impacts organizational agility. Similarly, Akkaya and Tabak (2020) found that three leadership styles had a positive correlation with organizational agility. Therefore, in this study, it is expected that TA may serve as another potential mediator between TFL and PS.

2.4 PS

The concept of PS dates back to the emergence of modern project management in the 1950s. In the 1990s, early definitions equated PS solely with efficiency, measured by quality, schedule, and cost (Atkinson, 1999). Subsequently, criteria were extended to encompass stakeholder satisfaction, including clients and project teams (Jugdev and Müller, 2005). In this period, scholars began to distinguish between project management success and PS from a business perspective (Baccarini, 1999).

In the 2000s, the concept of PS continued to evolve with additional factors and multidimensional constructs. Shenhar et al. (2001) created a framework to evaluate PS with customer impact, efficiency, business success, and readiness. Scholars have further expanded the notion of PS to incorporate sustainability, safety, ethics, and other criteria (Aga et al., 2016). PS has evolved from a traditional emphasis on the iron triangle (budget, quality and schedule) to a more comprehensive understanding that considers multiple perspectives (Pollack et al., 2018). Therefore, employing composite measures such as performance, efficiency, effectiveness, impact, and sustainability to assess PS may offer more comprehensive indicators of overall team performance.

3 Theoretical background and hypotheses

3.1 IMO model

After the introduction of McGrath (1984), the input-process-output (IPO) model dominated team research for decades. This model depicts how input factors drive processes, ultimately resulting in outcomes (McGrath, 1984). However, the IPO model has been criticized for considering processes as a "black box" without exploring mediating mechanisms (Ilgen et al., 2005). To enhance the IPO model, the IMO model was introduced, which distinguishes mediators as two types, including team processes and emergent states.

In the IMO model, inputs are elements influencing interactions among team members (Marks et al., 2001). These inputs encompass various factors that shape the dynamics of team member interactions, including team leadership (Day et al., 2004), cognitive ability (Devine and Philips, 2001), team conflict management (Somech et al., 2009), organizational support (Klasmeier and Rowold, 2020), and culture (Gibson and Vermeulen, 2003). As suggested by Andressen et al. (2012), TFL is a critical input factor.

Mediators play a central role in the IMO model as they link inputs to outcomes (Mathieu et al., 2008). Marks et al. (2001) suggest that team processes and emergent states are two primary types of mediators that link inputs and outcomes. Team processes refer to "a team's interactions with tasks, tools, machines, and systems" (Marks et al., 2001, 357), whereas emergent states refer to "constructs that characterize properties of a team that are typically dynamic in nature and vary as a function of team context, input, processes and outcomes" (Marks et al., 2001, 357). In addition, three mechanisms have been identified: 1) Affective mechanisms, which encompass the emotional bonds and common incentives manifesting among team members; 2) Behavioral mechanisms, which encompass the actions and interplays undertaken by team members for task goals; 3) Cognitive mechanisms, which encompass the collective thinking and mental activity arising within the team as a whole (Grossman et al., 2017). These mechanisms aid in enriching theoretical understanding of how various inputs ultimately translate to team outputs.

TF and TA are both closely aligned with the concept of emergent states in the IMO model as they emerge from team dynamics and fluctuates over time and contexts (Marks et al., 2001). Moreover, TF and TA may engage in cognitive mechanisms in the IMO model. For example, TF may trigger the cognitive mechanisms by facilitating the team's capability for recognizing changes (He et al., 2014), whereas TA may stimulate the cognitive mechanisms through fostering diverse thinking in response to uncertainties (Liu et al., 2015). Thus, TF and TA may act as critical mediators in the IMO model.

Outcomes represent collectively valuable results generated by teams (Mathieu et al., 2000). Typically, these outcomes are evaluated using composite performance measures. For instance, Lester et al. (2002) measured performance through composite measures that consider meeting needs, achieving goals, and identifying critical factors. Van Der Vegt and Bunderson (2005) employed composite measurements encompassing efficiency, productivity, quality, and mission fulfillment to assess performance. These composite measurements, which account for various facets of performance rather than focusing solely on one aspect, are frequently more accurate indicators of overall team performance because teams typically engage in a range of tasks. This paper employed composite measures such as performance, efficiency, effectiveness,

impact, and sustainability to assess PS. Therefore, PS may serve as a suitable output factor.

In summary, the IMO model provides an opportunity to explain how TFL as an input variable may indirectly impact PS as an output through the effects of two emergent states, which are TF and TA, in a comprehensive model, as conceptually depicted in Figure 1.

3.2 Hypothesis development

3.2.1 TFL and TF

TFL may positively influence TF in three ways. Firstly, transformational leaders empower team members to be adaptable and flexible (Bass and Riggio, 2006). Empirical studies have underlined that empowerment plays a key role in driving flexibility (He et al., 2014). Empowered members experience freedom in organizing their tasks and have greater autonomy in achieving performance goals (Kirkman et al., 2004). Consequently, team members are able to respond to changes with increased flexibility. Secondly, transformational leaders cultivate a climate that encourages innovative thinking (Nemanich and Keller, 2007). Leaders' enthusiasm and commitment to innovation motivate team members to think creatively and be receptive to novel approaches (Syrek et al., 2013). This willingness to think openly may also enhance TF. Thirdly, transformational leaders develop followers' capacities through coaching and mentoring, considering team members' diverse growth needs and providing the necessary mentoring or coaching to fulfill those needs, while also encouraging them to achieve their full potential (Avolio and Bass, 1995). As team members gain confidence in their own capabilities, they become increasingly inclined to take initiative and adapt to evolving demands. In summary, by empowering team members, supporting creative thinking, and coaching team members, transformational leaders create flexible teams ready to take on new challenges. Therefore, the following hypothesis is proposed:

Hypothesis 1: (H1). TFL positively impacts TF.

3.2.2 TF and PS

Empirical research has provided evidence that TF positively influences performance (Günsel and Açikgöz, 2013). Flexibility enhances team performance by enabling teams to allocate tasks as required, facilitating workload distribution, and allowing for the use of the most suitable talents for specific tasks (Campion et al., 1993). Furthermore, flexibility allows teams to effectively manage increasing loads of information and rearrange resources for more productive purposes (Ford and Randolph, 1992). Additionally, for a project environment charactered by uncertainty, teams' capability to respond to change is positively related to PS (Reinig, 2003). Rigid teams that lack flexibility in roles and responsibilities are not able to cope with changing project conditions (Edmondson and Nembhard, 2009). It has been noted that, when a project team is able to respond flexibly and effectively to a dynamic environment, project performance is likely to be improved (David Gefen, 2002). Furthermore, flexibility encourages members to offers new ideas and creativity and take action without being constrained by constraints (Lumpkin and Dess, 1996). Members with high levels of creativity are more likely to solve problems effectively, which is critical for PS. Therefore, the following hypothesis is proposed:

Hypothesis 2: (H2). TF positively impacts PS.

3.2.3 The mediating role of TF between TFL and PS

As an efficient input, TFL fosters autonomy, creativity, and empowerment in teams (Arnold, 2017). Empowered teams perceive a greater level of choice in determining how they execute tasks (Seibert et al., 2011). When teams feel empowered, they develop greater flexibility, specifically the capacity to adapt plans, shift roles, and creatively solve problems in dynamic project situations. TF may indeed reshape team members' behavioral and cognitive construction, allowing an entire team to align with the evolving requirements of the professional environment with flexibility, as opposed to a rigid or mechanistic forms (Ling et al., 2021). Moreover, in confronting the uncertainties arising from evolving project requirements (Leybourne, 2009), empowered members proactively anticipate problems and take independent action when faced with risks or uncertainties. These team members also exert influence over goals and operational procedures to enable the production of high-quality work outcomes (Spreitzer, 2008), which may, in turn, significantly influence the success of a project. These processes align with the cognitive mechanisms in the IMO model. Through these pathways, TFL demonstrates the potential to motivate TF, activating beneficial cognitive mechanisms described in the IMO model, which ultimately engendering positive results.

In addition, transformational leaders may effectively coordinate members from diverse backgrounds. In project-based organizations, team members comprise a diverse group of experts with distinct backgrounds who collaborate closely (Chiocchio and Essiembre, 2009). Though this diversity enhances TF, it also presents challenges in terms of project management. However, transformational leaders may improve team cohesion and foster mutual understanding in project teams (Aga et al., 2016). TFL also provides direction and instills confidence in team members (Bass and Avolio, 1990a). In this scenario, when members possess the necessary expertise required to successfully execute the project, they have the capacity to formulate flexible methods for progressing in any facet (McComb et al., 2007). Transformational leaders build emotional bonds with team members through these interactions, enabling an affective mechanism in the IMO model. In summary, TFL encourages affective and cognitive mechanisms that cultivate TF and in turn, boost PS. Therefore, the following hypothesis is proposed:

Hypothesis 3: (H3). TF positively mediates the relationship between TFL and PS.

3.2.4 TFL and TA

TFL may positively impact TA by offering a shared vision, which is the collective understanding and agreement among members in terms of overall vision (Chai et al., 2017). TFL involves inspiring and motivating team members beyond individual interests, fostering a sense of collective purpose and commitment (Bass, 1985). Schippers et al. (2008) also found that TFL has the capacity to create a shared vision that resonates with team members' values and aspirations.

This shared vision not only enhances team cohesion, but also acts as a guiding force during dynamic and uncertain circumstances. Consequently, teams led by transformational leaders generally are able to adjust in response to unpredictable changes.

Furthermore, TFL may also facilitate TA by showing intellectual stimulation. Transformational leaders motivate members to participate in learning activities focused on problem identification and idea generation (Noruzy et al., 2013). Team members engaged in this process formulate novel ideas and innovative solutions to challenges (Nielsen and Daniels, 2012). Moreover, the climate developed by TFL may enhance members' willingness to learn and adapt to new situations (Kark and Van Dijk, 2007). The combined impacts of TFL contribute to cultivating TA, enabling effective responses to unforeseen changes. Therefore, the following hypothesis is proposed:

Hypothesis 4: (H4). TFL positively impacts TA.

3.2.5 TA and PS

Temporary organizations in construction industries normally take the form of projects (Bakker, 2010). A project environment is characterized by uncertainty and ambiguity (Flyvbjerg, 2009). TA may serve as an effective means of overcoming uncertainty and ambiguity. Firstly, an agile team promptly resolves issues through open communication and creative solutions (Cao and Ramesh, 2008). Compared to traditional hierarchical management, agile teams rely on a flatter, team-based structure. The elimination of tiered management effectively removes communication obstacles (Hoda et al., 2012a). Members are more likely to depend on tacit knowledge and intensive communication to generate innovative solutions. When team communications are used in the most efficient way, the project will achieve a higher level of performance.

Secondly, agile teams possess the capability to rapidly adapt to change in order to achieve project objectives. Teams characterized by agility are able to swiftly adjust strategies and reallocate resources for new requirements (Vázquez-Bustelo et al., 2007). Additionally, these teams are able to effectively incorporate emerging needs and handle uncertainties during a project (Conforto et al., 2014). Quick responses prevent delays and deviations, enhancing project performance (Lee and Xia, 2010). In summary, by solving problems effectively and responding to changes rapidly, TA allows teams to successfully meet project objectives. Therefore, the following hypothesis is proposed:

Hypothesis 5: (H5). TA positively impacts PS.

3.2.6 The mediating role of TA between TFL and PS

TFL helps to develop a formal, continuous climate that fosters information exchange and two-way communication (Piccolo and Colquitt, 2006). Transformational leaders stimulate innovation and foster adaptability in teams (Bass and Riggio, 2006). In this scenario, team members are more willing to openly discuss the problems that they encounter and engage in positive interactions. This process enhances the team's capability to swiftly respond to changes and adjust strategies, essentially enhancing TA. As noted by Braun et al. (2013), successful projects require positive interactions and effective communication among team members. In addition, members are encouraged by TFL involved in the iterative processes of agile teams, increasing their knowledge and adaptability (Lee et al., 2015). Transformational leaders also make an effort efforts to create a supportive environment (Andersen et al., 2018). As team members gain more knowledge and perceive a supportive environment, they become equipped to collaborate and solve problems effectively, enhancing team performance (Hoda et al., 2012b; Kissi et al., 2013). In summary, TFL, as a favorable input, is key in activating the behavioral mechanisms in the IMO model by facilitating communication and a supportive environment in teams. In turn, the improved agility allows teams to achieve PS, which presents an important team outcome, by handling change effectively (Bergmann and Karwowski, 2019). Therefore, the following hypothesis is proposed:

Hypothesis 6: (H6). TA positively mediates the relationship between TFL and PS.

3.2.7 The serial mediating roles of TF and TA between TFL and PS

Literature has often conflated the concepts of agility and flexibility, using them interchangeably (Eckstein et al., 2015; Um, 2017). To distinguish between these two concepts, a systematic review was conducted by Abdelilah et al. (2018), revealing that flexibility and agility are separate construct, with agility being perceived as the natural evolution of flexibility. Similarly, Santos Bernardes and Hanna (2009) proposed that flexibility and agility are two distinct constructs. Flexibility primarily pertains to teams' inherent attributes, whereas agility is associated with a rapid approach in response to unforeseen changes.

TF and TA sequentially activate cognitive mechanisms to translate the effect of TFL into PS. Both TF and TA are adaptations that occur in response to change (Puriwat and Hoonsopon, 2021). However, flexibility is generally used to depict changes observed in a particular situation, whereas agility is used to reconfigure resources when unforeseeable changes occur (Santos Bernardes and Hanna, 2009). Unlike flexibility only with observations and responses, agility requires anticipating and reacting effectively to unforeseen change. Furthermore, flexibility is considered an antecedent to agility (Werder, 2016). Therefore, TF may be more directly fostered by TFL than TA. Specifically, transformational leaders provide the foundation to develop TF by empowerment, supporting creative thinking, and coaching (Avolio and Bass, 1995; Bass and Riggio, 2006; Nemanich and Keller, 2007). When equipped with TF, teams can enhance the collective cognition to more accurately perceive changes and take advantage of changes. During this process, TF activates the cognitive mechanism by facilitating the team's ability to recognize changes (He et al., 2014).

In addition, flexibility is a fundamental factor in driving agility (Volberda, 1996). Flexible teams possess a versatile skill set and experience with various methods (Bahrami, 2009) essential for swiftly adjusting direction and rapidly reconfiguring resources to address emerging needs in an agile team (Lee and Xia, 2010). Therefore, TF may further promote TA, with TA triggering cognitive mechanisms that promote divergent thinking to address uncertainty (Liu et al., 2015). By responding effectively, teams prevent delays to reach expected performance (Lee and Xia, 2010).

This sequential mediation suggests that TFL facilitates the development of TF, which subsequently fosters TA, thereby facilitating PS. The serial mediating roles of TF and TA activate

cognitive mechanisms that translate the influence of TFL into PS. As such, the following hypotheses are proposed:

Hypothesis 8: (H8). TF positively impacts TA.

Hypothesis 7: (H7). TF and TA play serial mediating roles between TFL and PS.

4 Methods

4.1 Sample and procedure

This study's sample comprised 306 project team members involved in Chinese construction projects including infrastructure and residential development projects. Infrastructure and residential development projects act as twin engines fueling China's rapid urbanization and improving living standards. These factors drive growth in the construction sector and wider economy, their continued progress is vital for China's development. These team members represented various roles within these kinds of construction projects, such as civil engineers, MEP engineers, and quantity surveyors, who were surveyed as part of this study. Data collection was conducted through two primary channels. The first channel was the China State Construction Association, while the second was the alumni association of individuals majoring in construction engineering management and construction engineering cost. This data collection was facilitated through an online survey, chosen for its efficiency and comparable validity to traditional survey methods (Gosling et al., 2004).

Data collection procedure was as follows. Initially, the study recruited 30 project members who had been involved in at least one construction project in China over the past 3 years. To include a diverse range of project team members of various roles within construction projects, twelve civil engineers, seven MEP engineers, and eleven quantity surveyors were chosen. These individuals were identified and invited to participate through both the China State Construction Association and the alumni association representing the field of construction engineering management and construction engineering cost. Subsequently, following the recruitment of the initial 30 participants, a snowball sampling technique was employed to expand the participant pool. Each participant was provided a link to access the questionnaire, which included detailed instructions of the survey process. The confidentiality of the responses was underscored throughout this process. Participants were encouraged to share the questionnaire with other project members who met the inclusion criteria. After approximately 3 months of questionnaire distribution, 343 electronic questionnaires were collected through this survey method, with 306 respondents meeting the inclusion criteria. 37 responses were deemed invalid and excluded from subsequent analysis based on the following criteria:

(1) Responses with a completion time less than 110 s were excluded. This decision was based on a time trial involving 10 students, where it was observed that a minimum of 110 s were necessary for thoughtful consideration while answering the questionnaire;
(2) Unusual patterns, such as marking all answers as either 1,2,3,4 or 5, were identified and addressed;
(3) Responses exhibiting inconsistencies or illogical information, such as an age of 24 with reported experience exceeding 10 years, were carefully reviewed and excluded from the analysis.

Table 1 presents an overview of the demographic information pertaining to the sample.

4.2 Measures

To guarantee the content validity and reliability of the latent variables, questionnaire items were adapted from scales previously developed (Avolio and Bass, 2004; McComb et al., 2007; Liu et al., 2015; Aga et al., 2016). To further enhance the clarity of these questionnaires, in the process of adapting the questionnaire items, the study followed a rigorous procedure. Firstly, the items in English from existing literature were translated into Chinese. Secondly, a focus group was created of six individuals with expertise in management, including five graduate students and one professor. This focus group reviewed both the English version of the questionnaire and its Chinese translation, ensuring a high level of consistency between the two versions. This comprehensive approach was taken to ensure the validity and relevance of the items for the research context. Thirdly, the study distributed pilot tests to a small sample of 20 project members, including six civil engineers with 5–15 years' experience, seven quantity surveyors with 6–12 years' experience, four MEP Engineers with 5–15 years' experience, and three Professors majored in engineering management. The feedback obtained during this pre-testing phase was invaluable in refining the questionnaires. Subsequently, the study administered the final questionnaires to participants.

Unless specified otherwise, participants in this study used a five-point Likert scale with 1 "= Strongly Disagree" and 5 = "Strongly Agree." The description of the measurement tools used for each variable are as follows:

TFL. Eight items adapted from Avolio and Bass (2004) were taken to measure TFL. A sample item was the following: "Project manager Instills pride in me for being associated with him/her" (Cronbach's alpha = 0.908);

TF. Four items adapted from McComb et al. (2007) were taken to measure TF. A sample item was the following: "Our team members are flexible with respect to our team's request for changes" (Cronbach's alpha = 0.808);

TA. Four items adapted from Liu et al. (2015) were taken to measure TA. A sample item was the following: "Our team's responsiveness to changing organizational conditions is timely" (Cronbach's alpha = 0.814);

PS. Seven items adapted from Aga et al. (2016). were taken to measure PS. A sample item was the following: "The project was completed on time" (Cronbach's alpha = 0.892).

To account for potential confounding factors, this study incorporated several control variables into the analysis. Gender, education, age, and experience, which are significant demographic and background factors influencing individuals' perceptions, were

TABLE 1 Demographics.

Item		Frequency	Percent (%)
Gender	Male	156	50.98
	Female	150	49.02
Age	20–30	37	12.09
	30–40	107	34.97
	40–50	98	32.03
	>50	64	20.92
Education	Below undergraduate	76	24.84
	Undergraduate	169	55.23
	Master and above	61	19.93
Member experience (years)	<3	5	1.63
	3–5	12	3.92
	5–10	49	16.01
	10–15	56	18.30
	>15	184	60.13
Project duration	<5	65	21.24
	5–10	81	26.47
	10–15	71	23.20
	>15	89	29.08
Project member	<50	103	33.66
	50–100	16	5.23
	100–200	61	19.93
	>200	126	41.18

included (Aga et al., 2016). Additionally, team size (number of project members) and project duration, as recommended by Barrick et al. (2007), were considered in the analysis to ensure a comprehensive examination of the variables under study.

5 Analysis and results

Data analysis was conducted using SPSS version 26 and RStudio Version 2023.03.0. Structural equation modeling (SEM) was employed to evaluate the proposed model and assess the hypotheses. To validate the model, confirmatory factor analysis (CFA) was performed to determine the validity of the model. The SEM approach was used in conjunction with bootstrap methods to thoroughly investigate the proposed indirect relationships in the study.

5.1 Reliability and validity

To evaluate the reliability and internal consistency of each construct, Cronbach's alpha (α) was used. The value of α over 0.7 is typically considered indicative of a high level of reliability (Vaske et al., 2017). The results for each construct are summarized in Table 2.

Composite reliability (CR) was used to evaluate each construct's internal consistency. A CR value over 0.70 is generally considered favorable (Bagozzi and Yi, 1988). In Table 2, the CR values for TFL (0.908), TF (0.808), TA (0.816), and PS (0.892) indicate high internal consistency. Moreover, all items exhibit standardized loadings above 0.50, indicating a satisfactory level of item reliability. Furthermore, the study assessed the average variance extracted (AVE) values that can be accepted at 0.5 or greater (Fornell and Larcker, 1981). Each construct's AVE met the threshold: TFL (0.552), TF (0.513), TA (0.528), and PS (0.543). These results affirm convergent validity, demonstrating that the constructs adequately measure the underlying concepts.

To assess the distinctiveness of each construct within the model, the study examined discriminant validity using the AVE. In each construct, the square root of the AVE is greater than the correlation coefficients between the construct and the others, as shown in Table 2. This finding suggests that each construct is distinct from others and adequately measures its unique underlying concept, indicating satisfactory discriminant validity.

TABLE 2 Reliability and validity.

	Items	Item loading	CR	Cronbach's α	AVE	TFL	TF	TA	PS
TFL	8	0.727 ~ 0.769	0.908	0.908	0.552	(0.743)			
TF	4	0.690 ~ 0.724	0.808	0.808	0.513	0.201[a]	(0.716)		
TA	4	0.683 ~ 0.793	0.816	0.814	0.528	0.210[a]	0.322[a]	(0.727)	
PS	7	0.688 ~ 0.786	0.892	0.892	0.543	0.487[a]	0.505[a]	0.453[a]	(0.737)

[a]Means the correlation is significant at the 0.01 level (2-tailed); Diagonal bolded values in bracket are the square root of AVE.

TABLE 3 Model fitness.

Measure	Estimate	Threshold
CMIN	249.805	—
DF	224.000	—
CMIN/DF	1.115	<3
CFI	0.992	>0.9
GFI	0.936	>0.9
SRMR	0.038	<0.08
RMSEA	0.019	<0.06

CMIN, Chi-square value; DF, degree of freedom; CFI, comparative fit index; GFI, goodness of fit index; SRMR, standardized root mean square residual; RMSEA, root mean squared error of approximation.

CFA was used to evaluate construct validity and conducted using the Lavaan package within the Rstudio software. Table 3 displays the model fit indices and their acceptable ranges, following the guidelines proposed by Doğan and Özdamar (2017). This analysis aided in confirming the suitability of the proposed model for the study.

5.2 Common method variance

Three methods were used to verify the presence of common method variance (CMV). Firstly, based on the exploratory factor analysis, the first principal component explained 34.612% of variance. This result suggests that there is no significant CMV as the first principal component does not explain more than the 50% criterion (Podsakoff et al., 2003). Secondly, in Table 4, the four-factor model shows an improvement in model fit compared to the one-factor model ($\Delta\chi2$ = 1,249.336, $\Delta df = 6$, $p < 0.001$), showing the absence of CMV (Guo et al., 2016). Thirdly, the four-factor model fit is not substantially different from those of the unmeasured latent common method factor (ULCMF) model (ΔCFI = 0.005, ΔTLI = 0.005, ΔRMSEA = 0.007). These findings together collectively suggest that CMV is not a significant issue.

5.3 Hypothesis testing

A path analysis was conducted using the Bootstrap method with 5,000 samples in the Lavaan package within Rstudio to test the hypotheses. Table 5 presents the direct effects of the model, and a detailed analysis of these effects is as follows.

Table 5 presents the results for Hypotheses 1, 2, 4, 5 and 8. As indicated in Table 5, Hypotheses 1 ($\beta = 0.255$, S.E. = 0.079, $p < 0.05$), 2 ($\beta = 0.513$, S.E. = 0.098, $p < 0.001$), 4 ($\beta = 0.194$, S.E. = 0.082, $p < 0.05$), 5 ($\beta = 0.362$, S.E. = 0.078, $p < 0.001$), and 8 ($\beta = 0.389$, S.E. = 0.096, $p < 0.001$) are supported as their coefficients are statistically significant. Furthermore, the results demonstrate that no control variables exhibit a controlling effect in the process.

In Table 6, Hypothesis 3, which proposes the indirect effect of TF between TFL and PS, is supported. The results from the 5,000 bootstrap samples reveal that the coefficients' 95% confidence interval (CI) (0.042, 0.258) does not include zero, which confirms the mediating role of CF between TFL and PS.

Hypothesis 6, which suggests the indirect effect of TA between TFL and PS, is not supported. The *p*-value for this indirect effect is larger than 0.05, indicating that the indirect relationship through TA is not significant. However, as indicated in Table 7, the mediating effect of TA between TFL and PS is positive when only considering TA as mediator independently.

Hypothesis 7, which posits the sequential mediating role of TF and TA between TFL and PS, is supported. The results suggest the serial mediating roles of TF and TA between TFL and PS. The 95% CI (0.011˙0.070) from the bootstrap sampling also excludes zero, confirming the significance of this sequential mediation.

TABLE 4 Fit indices for the measurement models.

Model	χ2	df	χ2/df	CFI	TLI	RMSEA
Four-factor model (TFL, TF, TA, PS)	249.805	224.000	1.115	0.992	0.991	0.019
Single-factor model (TFL+TF+TA+PS)	1499.141	230.000	6.518	0.612	0.573	0.134
Common method factor model (TFL, TF, TA, PS, ULCMF)	210.557	201.000	1.048	0.997	0.996	0.012

TABLE 5 Structural model results.

Hypotheses	Proposed effect	Estimate	S.E.	*p*-value	Results
H1: TFL-TF	+	0.255*	0.079	0.001	Supported
H2: TF-PS	+	0.513**	0.098	0.000	Supported
H4: TFL-TA	+	0.194*	0.082	0.018	Supported
H5: TA-PS	+	0.362**	0.078	0.000	Supported
H8:TF-TA	+	0.389**	0.096	0.000	Supported
control variable					
Gender		0.100	0.077	0.191	Not significant
Age		0.042	0.026	0.112	Not significant
Education		−0.036	0.600	0.597	Not significant
Member experience		−0.038	0.026	0.153	Not significant
Project duration		0.001	0.006	0.869	Not significant
Project members		−0.000	0.000	0.425	Not significant

Notes: $^{**}p < 0.001$; $^{*}p < 0.05$.

TABLE 6 The mediating effect results.

Hypotheses	Proposed effect	Relationship	Estimates	S.E.	*p*-value	Boot 95% CI	Results
H3	+	TFL-TF-PS	0.131	0.056	0.020*	[0.042, 0.258]	supported
H6	+	TFL-TA-PS	0.070	0.041	0.082	[0.009, 0.164]	not supported
H7	+	TFL-TF-TA-PS	0.036	0.015	0.020*	[0.011, 0.070]	supported

Bootstrap sample size = 5,000 times; $^{**}p < 0.001$; $^{*}p < 0.05$.

TABLE 7 The only mediating effect result of TA.

Hypotheses	Proposed effect	Relationship	Estimates	S.E.	*p*-value	Boot 95% CI	Results
H6	+	TFL-TA-PS	0.103	0.040	0.011*	[0.036, 0.192]	supported

Bootstrap sample size = 5,000 times; $^{**}p < 0.001$; $^{*}p < 0.05$.

6 Discussion

Grounded in the IMO model, this study aims to empirically investigate the mediating effect of TF and TA between TFL and PS in the context of construction projects in China. Some significant findings are as follows.

Firstly, this study found that TF serves as a significant predictor for PS. Specifically, teams that demonstrated a higher capacity to respond to environmental changes and uncertainties were able to achieve superior project outcomes. This finding differs from McComb et al. (2007), who found that TF was not related to team efficiency. A possible explanation for this discrepancy comes from how efficiency is defined and operationalized. In this study, by conceptualizing PS more broadly beyond short-term resource efficiency, the model captures the multidimensional benefits flexible teams conferred across outcome indicators. The research highlights that the adaptive capacities underlying TF may manifest in long-term gains beyond immediate cost or time savings. Overall, the study demonstrates TF's positive effects on comprehensive project performance when assessed from a holistic perspective. This finding underscores the adaptive capacities underlying TF, highlighting its potential for long-term gains in comprehensive project performance.

Secondly, the study also found that TA is another important predictor of PS. This finding is consistent with an existing study that found that TA is positively related to team performance (Krüger, 2023). Compared to Werder (2016), who demonstrates that TA has a positive impact on team performance in software development organizations, this study found similar results in the context of construction projects. This evidence suggests that the beneficial role of agile practices and principles may extend to other types of projects, such as construction projects. By investigating the TA-PS relationship, this study contributes to increasing the understanding of how TA facilitate PS in multiple contexts.

Thirdly, despite the observed positive influence of TFL on TA and the positive impact of TA on PS, the mediating effect of TA between TFL and PS was not found to be significant. According to the results of Tables 6, 7, TA demonstrated a mediating effect

between TFL and PS independently, but did not show a mediating effect when considered in conjunction with TF. One possible explanation is that TF might exhibit more potent mediating effects, potentially overshadowing or diminishing the impact of TA. TF is an ability to adapt to changes (He et al., 2014), whereas TA is the ability of teams to not only react, but also act proactively and effectively in answering to changes (Liu et al., 2015). In the context of leadership, TF may be more directly fostered by transformational leaders who empower their followers, stimulate innovative thinking, and cultivate adaptability (Nemanich and Keller, 2007; Syrek et al., 2013). Furthermore, flexibility, in contrast to agility, encompasses a broader range of adaptive responses. Due to this broader conceptual scope, flexibility may potentially play a more central role as a mediator between TFL and PS. These findings suggest that TF may offer more substantial benefits than focusing on alignment with agile values or principles alone.

Fourthly, as expected, the mediating role of TF between TFL and PS was found. This finding suggests that the positive impact of TFL on PS is most pronounced when teams exhibit high levels of TF. This study represents the first empirical examination demonstrating the mediating role of TF between TFL and PS. Extant literature has identified TF as a mediator to translate the effect of change leadership into organizational change outcomes (Ling et al., 2021). Based on this logic, this study examined and confirmed the mediating role of TF between TFL and PS in the context of projects. By verifying TF's function as a key intermediary mechanism, it was possible to integrate and extend leadership and TF research streams to elucidate how TFL impacts PS through the effect of TF.

Finally, and perhaps more importantly, this study's findings indicate that TFL is correlated to PS through a serial mediating roles of TF and TA. This study is the first attempt at exploring the intermediary effect of TF and TA in this particular relationship. Different from Maqbool et al. (2017), who focused on the direct relationship from TFL to PS in a construction project context, this study has explored mechanisms underlying the relationship between TFL and PS more deeply. By focusing on TF and TA as two constructs that are critical aspects of team adaptability (Werder and Maedche, 2018; Ling et al., 2021), this study makes contributions to a more profound understanding of how team adaptability successfully transfers the effect of TFL into PS.

6.1 Managerial implications

Firstly, the findings in this study suggest that TF plays a pivotal role in driving PS. Accordingly, project-based organizations are recommended to prioritize the implementation of training programs aimed at enhancing TF capabilities within teams. This strategic focus on equipping teams with the requisite mindsets and tools for effectively managing uncertainties has proven particularly advantageous within the intricate and constantly evolving construction landscape of China (Zou et al., 2007). Moreover, considering China's cultural context, characterized by a strong emphasis on collectivism (Hofstede, 2001), it is recommended that organizations foster initiatives such as collaborative iterations and team learning. By incentivizing these behaviors, project-based organizations may unlock the power of collectivist culture to build resilient, nimble project teams suited to China's highly uncertainty context.

Secondly, TA is found to be a driver for PS in the context of construction projects in China. Adopting agile management approaches that emphasize short iterative cycles could significantly reduce the risk of failure of complex construction projects with long duration. Specifically, construction project managers should adopt practices from agile software development that facilitate iterative progress through rapid prototype-test-feedback loops. This process could involve breaking down build phases into smaller milestones, increasing team reflexivity and iterations at multiple checkpoints. These iterative cycles and feedback mechanisms make it easier to incorporate adjustments due to China's fluid regulatory or environmental shifts.

Finally, the empirical findings show that TF and TA play serial mediating roles between TFL and PS. Based on this finding, project managers should receive site-level leadership training for TFL behaviors, including communicating inspiring vision, inspirational motivation, and empowerment. These behaviors promote flexible, agile team abilities that drive PS. In addition, the findings reveal that TF is positioned as an earlier precursor that sets the stage and enables the development of agile capacities that engender PS. As such, project managers should prioritize the cultivation of flexible team dynamics as an initial focus. Strategies may include team-building initiatives, fostering a culture of adaptability, and incorporating flexibility consideration into team development plans.

7 Limitations and conclusion

Though the findings shed light on the positive impacts of TFL on PS through mediating variables, it is crucial to acknowledge the limitations inherent in this study. The cross-sectional data collection restricted the study's ability to establish definitive causal relationships. The observed relationships among TFL, TA, TF, and PS are correlational in nature and do not inherently suggest causation. To address this limitation, future research could adopt a longitudinal approach, allowing for a more robust examination of how these variables may evolve over time.

Another crucial limitation is the sole reliance on a single respondent for questionnaire completion. Employing a single data collection method to assess various constructs from the same source concurrently may introduce CMV, which may affect hypothesized relationships in the proposed model (Podsakoff and Organ, 1986). However, this study used three methods to evaluate CMV, and the results suggest that common method bias is not a major issue here.

Moreover, the identification of a partial mediation effect for TA and TF suggests the existence of additional mechanisms influencing the relationship between TFL and PS. Future research endeavors could delve into uncovering these mechanisms. Furthermore, the inclusion of more control variables, such as project type and project roles, could enhance the exploration of this relationship in future research.

Finally, it is important to acknowledge the limitation of single-country data collection and its potential impact on generalizability. Cultural nuances may influence the applicability of this study's empirical findings. Thus, future researchers should conduct multi-country studies, particularly in culturally diverse settings, to enhance the external validity of the results.

In summary, this study sought to investigate the underlying mechanisms between TFL and PS in the context of construction projects in China. The findings of this study underscore the underlying mechanisms between TFL and PS, with TF emerging as a crucial mediator, and further, revealing a serial mediation involving both TF and TA. Exploring the underlying mechanisms how TFL impacts PS improve the theoretical understanding of this relationship. In addition, understanding the mechanisms raise the effect of TFL on PS can offer practical implications for project-based organizations in China that eager to fully take the effects of TFL. Moreover, This study responds to the calls by Ali et al. (2021) and Aga et al. (2016) for a more nuanced exploration of these relationships. Notably, this study has not found the mediating role of TA between TFL and PS when interacting with TF. However, according to the results, TA has shown a mediating effect between TFL and PS independently. Future research could focus on the mediating roles of TA and combination with other mediators to advance theoretical explanations of this relationship.

Data availability statement

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Solbridge institutional review board. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because In the research, it has been explicitly stated that the survey data will be used for research purposes only and will not be utilized for any other purposes.

Author contributions

HH: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Resources, Supervision, Validation, Writing–original draft. FM: Investigation, Software, Visualization, Writing–review and editing. XL: Data curation, Validation, Writing–review and editing.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fbuil.2023.1334413/full#supplementary-material

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