

Article

Knowledge Loss in Construction Project-Based Organizations: The Role of Project Features, Knowledge Withholding, Fear, and Teams Interaction

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Abstract

Knowledge loss (KL), the disappearance of critical knowledge once a project ends, remains a persistent threat to the sustainability of organizational performance and competitiveness despite ongoing efforts to implement knowledge retention (KR) methods in construction organizations. This study presents a new research model to examine why KL occurs and how valuable project knowledge can be effectively retained. From the conservation of resources (COR) perspective, we aim to investigate how project urgency and temporariness, referred to as project features (PFs), influence knowledge loss through members' knowledge withholding (KW) behavior, how this association is affected by their psychological emotions (fears), and the contingent role relational resources, namely project team interaction (PTI), plays in this association. Data were collected from a sample of 469 construction experts with extensive experience in international engineering projects undertaken by Chinese international companies. Partial least squares path modeling (PLS-PM) analysis using SmartPLS 4 was employed to empirically test the proposed theoretical model. The results show that KW behavior is a critical driver of KL and serves as a mediator of the impact of PFs on KL. PFs were found to be positively associated with members' KW behavior. This linkage was partially mediated by fear of failure (FF), while fear of losing uniqueness (FLU) showed no significant mediating effect. PTI played a moderating role in the relationship between KW and KL. Based on these findings, minimizing KL requires management to focus on reducing FF by fostering a climate of mistake tolerance, and subsequently strengthening PTI to promote effective knowledge exchange. The results of this study offer new theoretical and practical insights into KL risk management within construction organizations.

Keywords: knowledge loss; knowledge withholding; fear of failure; fear of losing uniqueness; project teams interaction; temporary nature; time urgency



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1. Introduction

In today's competitive market, knowledge is regarded as a strategic resource that helps contemporary organizations to create value—forming the basis for innovation, operational efficiency, and adaptive capacity—and maintain a long-term competitive advantage [1–3]. Organizations can lose their core competencies and competitive advantages through the loss of such knowledge. Knowledge loss (KL) negatively affects productivity, increases learning costs, widens capability gaps, decreases absorptive capacity, weakens organizational performance, and depletes organizational identity [4–7]. These adversarial impacts

are particularly evident in construction PBOs, where poor project performance often stems from human and management-related issues [8] and inefficiencies such as “reinventing the wheel” and repeated errors and mistakes still continue to manifest in construction projects [9]. Some researchers have even noted that many construction PBOs still face challenges in managing knowledge effectively due to a lack of lessons learned and/or guidance documents [10]. Considering the unique characteristics of the construction industry, such as temporary organizational structures, workforce mobility, inter-firm fragmentation, and insufficient knowledge management systems [8,11,12], KL is a major concern, particularly in knowledge-intensive environments, such as construction projects.

Existing research indicates that much effort has been exerted on managing KL [5,7,13]; however, most studies “provides solutions for KL already in progress, rather than proposing preventive measures” ([4], p. 1008). Second, while knowledge retention (KR) has become a promising solution for minimizing unintentional KL [14], the focus on retention mechanisms has overshadowed efforts to understand the origins of KL. Specifically, extant research paid much attention to structural or procedural deficiencies in KR systems and employee turnover [7,15], while different types of KL exist due to an incomplete KR cycle and need targeted action [13]. Furthermore, most approaches attempt to capture knowledge at the end of a project [16], while teams disband quickly after current task delivery [17], and due to context-specific nature of knowledge, managers are unaware of what knowledge needs to be retained from departing knowledge workers [9,18]. Thus, many strategies tend to be ineffective and fail to achieve their full potential [5,19,20]. Finally, the effectiveness of any KR system/method depends on an individual’s willingness to share knowledge, as the process relies on voluntary contribution [21,22]. Rather than contributing, despite being inspired and rewarded, employees still choose to withhold their efforts in sharing [23].

Although scholars have affirmed that withholding behaviour is negatively associated with knowledge flow [24], effective dissemination of knowledge [25], and timely and effective knowledge transfer [26], to the best of our knowledge, none of the existing studies has revealed the relationship between KW and organizational KL. Additionally, one’s rational choice to withhold knowledge in teams often stems from situational factors such as task features [23,27,28] owing to the constraints of limited time and resources. Yet, studies in contemporary organizations or PBO literature have not clearly explained what motivates an individual to withhold knowledge in project-based environments. This highlights a critical behavioral gap in the existing literature, as without understanding why individuals choose to withhold knowledge, organizations cannot fully prevent KL or design effective retention strategies.

In response to these gaps, this study aims to address the identified knowledge voids and provide clearer insights into the behavioral mechanisms of KL. To capture the emotional underpinnings of this behavior, we draw upon the Conservation of Resources (COR) theory. We argue that since in the construction context, expertise is closely tied to professional identity and status and project feature heightens knowledge transfer (KT) errors [29–31], fear of losing uniqueness or failure and losing face during the sharing process can provoke avoidance and defensive coping strategies that discourage KS behaviours. Hence, we use fear of failure (FF) and fear of losing uniqueness (FLU) as mediators to examine the impact of PFs on KW.

Importantly, these fears and withholding are not cast in stone, but are strongly shaped by the workplace environment [32,33]. Building on this, Xiao and Cooke [34] proposed that a pivotal component that can reshape workplace behaviours is trust. Trust, as a psychological safety mechanism, minimizes fear [35,36], enables tolerance for mistakes [37], and strengthens willingness to share and document knowledge [38]. In addressing the difficulties of establishing trust in a project environment, prior studies indicated that prior

ties can encourage strong interpersonal relationships such as trust and trigger certain knowledge behavior patterns [39,40]. Accordingly, we present and assess a model in which PTI moderates the impact of KW on KL. We chose PTI because it fosters more effective social exchanges and prevents the emergence of a distrust loop while indirectly assisting in the acquisition and management of expert knowledge [26,41].

In summary, this study empirically investigates the mechanisms underlying KL, its causal components and consequent mitigation and retention strategies. With this in mind, the research questions (RQs) can be stated as:

RQ1. What are the antecedents of KL in project-based organizations?

RQ2: Does these antecedents, directly and indirectly, contribute to the loss of knowledge in construction projects?

RQ3. What strategies can increase organizational knowledge retention while minimizing unintentional knowledge loss?

In addressing these questions, we first establish causal evidence for the antecedents of KL from contextual and behavioral perspectives. Theoretically, by integrating fear into the KL framework, we rigorously examine the emotional mechanism underlying this phenomenon. Drawing on COR theory, we introduced FF and FLU as resource-driven antecedents of knowledge withholding, and revealed important nuances between them, moving beyond a uniform view of fear as a barrier to KS [33,42]. Given the argument that prior interactions and experiences have a tremendous impact on KS behaviors and outcomes has been established [1,43], we advance this line of inquiry by testing PTI as a social resource buffer that mitigates the negative behavioral consequences of project-induced stress.

The remainder of this article is organized as follows. The subsequent section presents the literature review and hypothesis development, followed by the methodology of the study in Section 3, data analysis and results in Section 4, a discussion of the findings and managerial implications in Section 5, and conclusions and limitations in Sections 6 and 7.

2. Literature Review and Hypothesis Development

2.1. Conservation of Resources (COR) Theory

The Conservation of Resources (COR) theory, originally developed by Hobfoll [44], emphasizes that individuals are driven to acquire, preserve, and safeguard resources, “things of value”, that help them achieve goals or prevent loss. These resources may take the form of objects, personal characteristics, conditions, or energies. In accordance with his COR theory, resource loss is more prominent and impactful than resource gain, and individuals experience stress when resources are threatened or depleted. To prevent further loss or restore balance, individual may strategically substitute or invest one resource to replace others [42,45,46]. In recent years, COR has emerged as a valuable lens for explaining individual behaviors such as knowledge sharing [47–49], knowledge hiding [50,51], and withdrawal [52], which can be understood as coping responses to the dynamics of resource loss and gain with work outcomes. For this study, three key arguments support the adoption of COR theory as the foundational framework.

First, in project environments, time, energy, and knowledge are critical personal and professional resources. Because project teams are temporarily assembled to complete complex tasks under strict deadlines, members often face high time pressure and emotional strain [53]. Within such demanding contexts, KS requires additional effort and cognitive resource investment [54]; hence, KW can function as a defensive coping mechanism aimed at reducing the loss of other resources, such as energy or valued expertise, or maximizing existing resources.

Second, the principles of COR theory infer that individuals always respond to perceived or actual resource loss or the failure to achieve expected resource gains [49]. Because losses tend to occur in spirals, they inhibit the transition from loss cycles to gain cycles [45,46]. Team members with a strong fear of losing uniqueness may view sharing their specialized expertise as a threat to their distinctiveness or competitive advantage, interpreting it as a form of resource loss. Likewise, those with fear of failure may perceive sharing mistakes or lessons learned as endangering their esteem or professional image. Consequently, with project features leading to the loss of time resources, these fears act as psychological mechanisms through which project features lead to withholding behaviour.

Finally, according to the COR theory, such withdrawal reactions persist unless or until individuals acquire compensatory resources to offset prior resources losses [52]. Given that prior ties facilitate the early development of trust and open communication [39,43], PTI can act as a relational resource to help restore the depleted social and emotional resources. Therefore, frequent project teams interaction are expected to reduce KW and mitigate KL as they promote trust, reciprocity, and the effective transfer of tacit knowledge.

2.2. Project Features and Knowledge Loss

Knowledge loss, which occurs when valuable knowledge is partially or completely lost [55], often arises from different events, such as employee turnover [15,56], constant mobility of knowledge workers [7], and task/job rotation [57], and is seen as a serious problem to organizational performance and competitiveness [20]. In project settings, to a large extent, KL stems from deficiencies in knowledge transfer [13]. Challenges in KT are closely linked to project features, such as the one-off nature “uniqueness” of projects, distance, organizational structure, time urgency, and temporary nature [21,58,59]. Among these, temporariness and urgency are most frequently cited as major contributors to ineffective KT [60] and valuable project KL [61] and are the focus of this study.

Temporariness of projects implies that construction project members’ relationships are short-lived and teams disband quickly after project delivery [17]. The quick disbanding of project teams leaves little incentive and time for the reflection and documentation of experiences [61,62]. As such, valuable lessons remain undocumented, fragmented, and even lost, especially when combined with ineffective organizational routines and memory. In addition, temporariness fosters high mobility and instability of construction project teams [63], which creates communication challenges within and across projects [64], fostering conditions for KT discontinuity. From the perspective of organizational learning, the end of the project cycle signifies the end of collective knowledge and learning [65]. Hence, tacit and socially embedded knowledge carries the potential risk of disappearance at the end of a project.

Teams often measure success by adhering to deadlines and short-term outcomes [66]. As Škerlavaj, Connelly, Cerne and Dysvik [51] emphasize, knowledge actually grows when shared; time, in contrast, certainly does not. The perception that there is a “scarcity of time” available for knowledge sharing causes construction project members to become hyperfocused on project or task completion [62], neglecting, to a certain extent, fostering open communication and collaborative knowledge exchange [21,67]. In addition, time urgency has been documented to deplete team members’ emotional resources [68] and increase superficial knowledge search and processing, which limits their ability to solicit and use shared knowledge to improve knowledge creativity. According to Van Berkel, Ferguson and Groenewegen [67], due to transactive memory nature within projects, time pressure constrains collective knowledge acquisition and utilization. This eventually causes knowledge loss because not all information or knowledge falls in the records [69].

Based on the literature, while prior studies acknowledge that the temporariness and urgency in construction projects can heighten KL risk, not a single study on extant research was found that focused specifically on understanding and testing these mechanisms using theory-driven models, highlighting a critical gap for further research.

2.3. Project Features and Knowledge Withholding

To facilitate knowledge creation, organizations must transfer and retain experts' critical knowledge within a limited timeframe of projects. The effective and successful transfer of such knowledge depends not only on the participants' abilities but also on their willingness to share [32,70]. However, recent studies have shown that under situational pressures, such as time urgency or project complexity, employees often prioritize task completion over reciprocal knowledge exchange, leading to knowledge withholding behavior [51,53]. In such contexts, individuals devote most of their limited resources (e.g., time and energy) to their own tasks rather than communicating and transferring knowledge which in turn diminishes the effectiveness of collaboration and reciprocity [51]. Moreover, the temporary nature of projects and the minimal expectations of future collaboration further reduce incentives to share, as sharing is perceived as "time-consuming" while its benefits may not extend beyond the current project [71].

From the COR perspective, project features (PFs) seem to create a stressful condition in which resource loss (e.g., time) is perceived to be more impactful than resource gain (e.g., knowledge) [46,72], which in turn motivates individuals to protect their resources (time, energy, knowledge, ability, and skills) by withholding knowledge. Thus, it is hypothesized as follows:

Hypothesis 1 (H1). *Project features has a positive effect on knowledge withholding behaviour.*

2.4. Knowledge Withholding and Knowledge Loss

A major concern for contemporary organizations is the potential to lose valuable institutional knowledge [6,73]. According to previous research, individuals are key contributors to knowledge loss [18], given that organizations struggle with the devastating consequences of KL resulting from knowledge workers mobility or departure [7]. KL refers to a situation in which crucial organizational knowledge is partially or fully lost as a consequence of a lack of retention or decay over time; that is, it is forgotten, thereby not being reused [13]. In light of this, while manifestation of knowledge behaviours, such as sharing and transferring, may be effective retention of valuable knowledge [13,74], we believe that the risk of KL is considerably greater when dealing with members showing negative attitudes towards retaining knowledge (such as knowledge withholding).

The intentional tendency of giving less than full effort [23] or not making all efforts for knowledge value creation [75] during sharing is defined as knowledge withholding. Often, when individuals withhold or hide knowledge, they create a "reciprocal distrust loop" which elicits more effort withholding in teams [28,76], thereby affecting workplace relationships [77] and organizational citizenship behavior [78]. As a result, knowledge withholding decreases firms' ability to agglomerate and institutionalize individual skill sets [79]. Yap, et al. [80] underscored that this situation has aggravated valuable knowledge loss due to a small effort to recall prior incidents and employees' memory decay. That is, individuals' withholding behaviour impacts the knowledge retention cycle [81], and a lack of knowledge retention or incomplete retention cycles pose serious risks of knowledge loss [13,82]. Based on the above argument, we posit the following hypothesis:

Hypothesis 2 (H2). *Knowledge withholding behaviour has a positive influence on knowledge loss.*

Based on the preceding hypotheses (H1 and H2), we further believe that project features have a significant indirect effect on knowledge loss through knowledge withholding behaviour. The indirect effect is due to the function of project features, as resource threats hinder the development of strong relational bonds and reciprocal norms, such as trust building and reciprocal learning [43,63]. Without sustained coordination, mutual trust, or shared identity, psychological safety diminishes [32,83], reducing individual's willingness to share knowledge [84]. Simultaneously, considering that individuals actively strive to protect and retain other resources, when some of their resources, such as time and energy, are threatened [51], time pressure intensifies transactional mindsets [72], which, in turn, leads individuals to perceive knowledge as a competitive asset worth hiding or withholding [85]. This withholding disrupts knowledge integration pathways [26] by creating information bottlenecks and impeding the diffusion of valuable knowledge, causing critical expertise to dissipate when projects end [64], thereby institutionalizing knowledge loss [86]. Moreover, in complex projects where project features have been apparent [53], knowledge withholding was found to negatively mediate the influence of project nature on its success (performance). Thus, we hypothesize that:

Hypothesis 3 (H3). *Withholding effort in sharing knowledge mediates the relationships between project features and knowledge loss.*

2.5. Fear of Failure and Knowledge Withholding

Construction project teams involve a high degree of collaboration among diverse experts performing one-time activities over a certain period. Project tasks are unique and team members are bound to deal with uncertain and complex issues that have no well-known solutions. Weak relational ties and different approaches to information processing, problem solving, and decision making can cause mistakes or errors, even if rules, processes, and procedures are followed. Sharing the knowledge gained from mistakes and failures is a starting point for identifying problems and probable causes of failure [87]. However, an increase in the occurrence of knowledge transfer errors prompts knowledge receivers to undervalue the contributions of knowledge donors [53]. Moreover, in project-based organizations, particularly in construction, research has revealed that failures, mistakes, or errors are often viewed as poor performance and negligence [20,88]; hence, they are not acceptable.

Notably, a lack of tolerance towards individuals' mistakes or failures is a widely demonstrated predictor of fear of failure [30]. FF, operationalized as a form of performance anxiety, is often viewed as a psychological state characterized by fear or apprehension about the consequences of making mistakes, namely, receiving criticism, blame, losing credibility, or being judged negatively when failures or errors materialize [89]. Zhou, Yin and Zhu [30] highlighted that failure is a major issue that causes loss of face. A key tenet of the COR theory is that individuals are motivated to conserve their valuable resources, such as knowledge or time, especially under threatening conditions. In line with COR theory, construction project features may make individuals adopt an error prevention strategy [88], which, in turn, shapes their defensive/pessimistic stance as they seek to preserve their other resources "face" [51]. Due to their own preoccupation with and fear of failure, teams' reluctance to contribute their knowledge might reflect a fear of making mistakes or errors, revealing them, or getting caught, indicating a lack of trust among project members. Thus, we anticipate that:

Hypothesis 4 (H4). *The positive indirect relationship between project features and team members' knowledge withholding behaviour is mediated by fear of failure.*

2.6. Fear of Losing Uniqueness, Knowledge Withholding and Knowledge Loss

Knowledge is a source of power for those who own or possess it at the right place and at the right time [90] and is considered unique as it becomes less available and seen as beneficial to both individual and organizational competitiveness [91]. Prior project experience can gradually lead to the possession of specific and unique knowledge because, through interactions of people, tools, and tasks, successes and failures tend to expand one's knowledge base [11,92]. Developing into a skilled professional requires years of experience [29]; therefore, acquired knowledge is usually professionally sacred and viewed as a principal source of competitive advantage [93,94], indispensable, or highly valued.

Employees' resources act as motivational elements that one strives to invest in pursuit of acquiring additional resources [47], and at the same time protect and retain when experiencing depletion [95], in accordance with COR theory. In high-pressure environments, knowledge is context-specific and contributors are expected to deliver immediate solutions within a short time. In such contexts, professionals have limited time to establish reputation and credibility, which makes unique knowledge a key form of identity and bargaining power. Since individuals are increasingly competing based on their knowledge and expertise, expert relationships have shifted from cooperation to serious competition [96]. As such, contributors' greatest fear is the anxiety of giving away valuable knowledge while being offered unequal value in return [33].

The extant literature acknowledges that individuals are less likely to share their expertise and know-how when they perceive them as unique. Anand, et al. [97] and Ma, et al. [98] found that some contributors fear that they may become less valuable in a team or perceive a lack of personal benefit, and thus choose to withhold their knowledge to maintain the advantaged position and to leverage for more power. Moreover, in a competition relationship, giving without knowing what one will get in return is also considered a loss [94]. Hence, members have been highlighted as choosing to engage in partial KS in trying to avoid deskilling, wasting time, or potential loss of their unique value while still providing the receiver with sufficient knowledge [99]. Thus, it is proposed:

Hypothesis 5 (H5). *Fear of losing uniqueness mediates the relationship between project features and withholding knowledge.*

In addition, fear of losing uniqueness might indicate a lack of particular principles, attitudes, and beliefs, that is, an absence of trustworthiness in both team members and top management in organizations [33,100]. Indeed, as pointed out by Renzl [36], trust is the first value that influences members' knowledge-sharing behaviour and willingness to document their unique knowledge by reducing their fear of losing uniqueness. Hence, in light of the critical role of fear in knowledge power loss in predicting the retention of critical knowledge [33,36], it is evident that this fear not only affect sharing intentions but also impacts documenting critical knowledge by increasing codification efforts. Based on COR theory, the greater the psychological ownership of knowledge, the greater the effort to protect it, and the more probable it is that the person will participate in effort withholding as a subtle and covert protecting mechanism to avoid becoming indispensable. Thus, we hypothesize as follows:

Hypothesis 6 (H6). *Fear of losing uniqueness positively moderates the relationship between withholding knowledge behaviour and knowledge loss.*

2.7. Moderating Role of Project Teams' Interactions

The assumption that has been proven by most prior researchers in PBOs is that trust can mitigate the adverse impacts of knowledge-withholding behaviour [26,101]. Trust, as a crucial psychological safety factor, facilitates open communication and reciprocal relationship [63,70], which in turn eliminates fear and improves individuals' willingness to share and document knowledge [36,53]. According to Zhang and He [40], trust, willingness of trustors to accept vulnerability, needs to incorporate mutual understanding and emotional bonds among team members. However, the independent features of construction teams can create difficulties and barriers to developing familiarity and demonstrating trustworthiness [102].

In light of the work of Ni, Cui, Sang, Wang and Xia [1], teams interaction can facilitate communication, collaboration, and the exchange of team members across projects. Through frequent team interactions, members tend to become more familiar with each other's expertise, communication styles, and ways of thinking [103,104]. This familiarity can foster network relationships that act as actual bonds that induce more effective social exchanges and prevent distrust loops triggered by withholding knowledge [41,105]. Imported trust based on prior interactions and experiences contributes to the early and later formation of mutual trust in a new project [106]. Under a trusting climate, knowledge withholding behaviour will not be treated as an act of distrust [26]; hence, team members are likely to develop a willingness to contribute to collective interests [63]. Moreover, considering that KS is a social network interactive process and "no knowledge sharing activity is possible outside the network" ([107], p. 310), team interaction might have the potential to reduce KW behaviors and act as a useful means of managing tacit project knowledge [40,108]. This proposition is supported by scholars indicating that project work attributes grounded on mutual trust and collaboration can moderate the impact of KW on organizational outcomes [75,101].

Thus, in this study, we predict the following:

Hypothesis 7 (H7). *Project teams interaction negatively moderates (weakens) the relationship between knowledge withholding and knowledge loss.*

2.8. Research Framework

Building on the previous discussion, the conceptual framework guiding this study is illustrated in Figure 1. As proposed by the hypotheses, the theoretical model integrates the combined construct of project features made up of two variables (temporary nature and time urgency), psychological emotions, psychological withdrawal, and knowledge loss. Using COR theory as our theoretical lens, the model attempts to link project features with knowledge loss while considering the mediating role of knowledge withholding. The model then attempts to evaluate the impact of the direct and indirect effects of PFs on knowledge withholding through FF and FLU as well as the moderating role of project team interaction in the relationship between KW and KL.

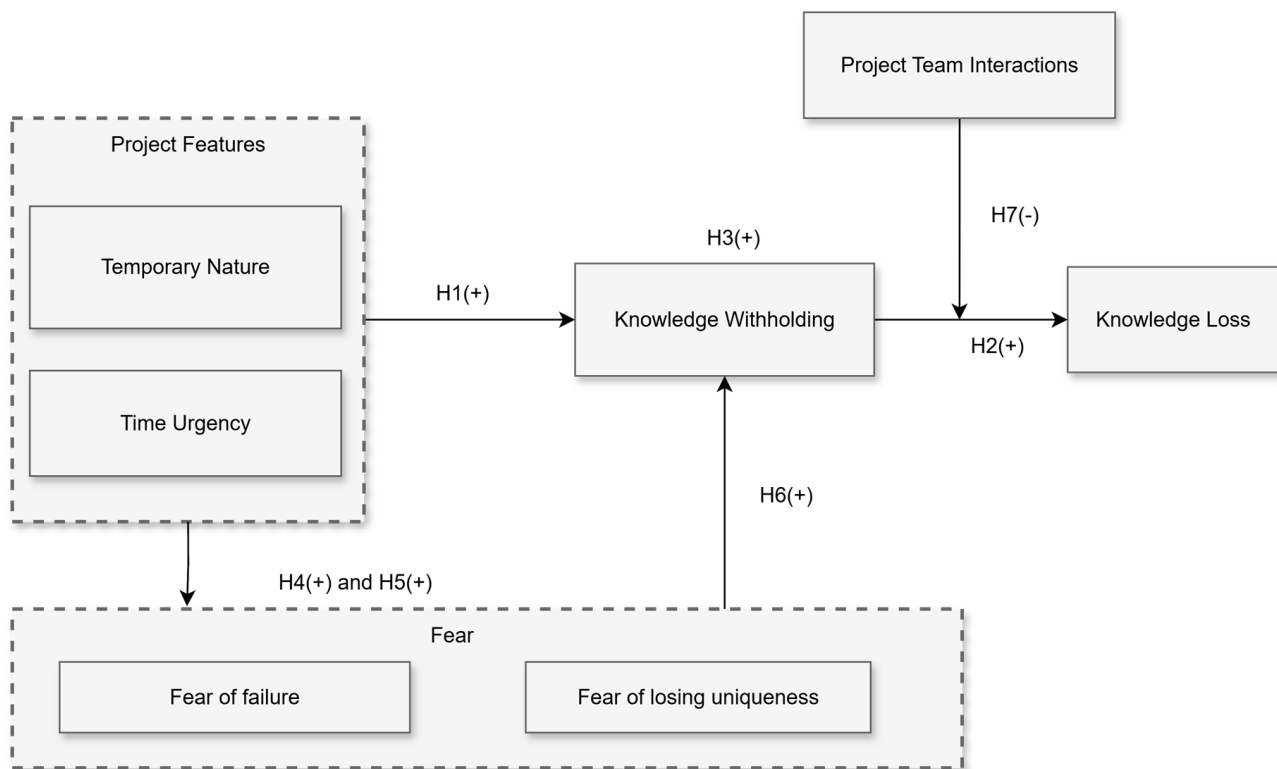


Figure 1. Proposed conceptual framework.

3. Methodology

3.1. Research Setting, Sample and, Data Collection

This research adopted a quantitative explanatory study framework and employed a questionnaire survey-based method, targeting workers with diverse experiences in both domestic and international construction projects and with strong expertise in knowledge and knowledge risk management. The choice of Chinese international firms in Africa's construction sector is not insignificant. The selection of this context is grounded in prior research indicating that (i) success of construction projects requires a collaborative and knowledge-intensive team approach that depends greatly on the expertise and skills of the members involved [107], while (ii) KM remains a persistent challenge for Chinese multinational enterprises [21,109].

Chinese companies are emerging as a competitive force in the international construction market [110], and have recently become central to Africa's infrastructure development [111]. To overcome latecomer disadvantages in already-crowded markets, Chinese companies face increasing pressure to maintain competitiveness through effective knowledge transfer and retention [110,112]. Prior studies emphasize that two-way knowledge transfer, sharing expertise from headquarters to subsidiaries to enhance capabilities and integrating the knowledge and skills developed locally back to the headquarters for enhancement of performance and innovation, is essential for competitiveness. Although these emerging markets have relatively weak local technology and knowledge bases and capabilities, the shared cultural values and historical relations between China and Africa have created greater compatibility and new opportunities for the exchange of knowledge, technology, and expertise [113,114]. However, despite growing research attention and practical initiatives, the evidence of useful and practical knowledge resource transfer is low [111,113,115].

Within this context, KL has emerged as a critical issue, as unrecorded/unshared valuable experiences and technical insights are frequently lost once the contributor leaves [19],

leading to performance inefficiencies and reduced learning capacity across projects. Furthermore, Chinese knowledge workers are influenced by an inclusive cultural orientation, notably low power distance, collectivism, and low uncertainty avoidance, which influence their approach to knowledge sharing and learning [116]. Because it is difficult to quantify the degree of power decentralization or fully capture project-specific variations owing to their unique characteristics [117], project features and psychological emotions may also influence knowledge acquisition, sharing, or withholding.

To capture the responses from these individuals, the study sample included participants using either Chinese or English. Initially developed in English, the questionnaire contained 29 items and was translated into Chinese using the back-translation method following Brislin [118] approach. After three rounds of review and comparison, the translations were refined to ensure equivalent meaning. A pilot study involving six experts (Table 1) was conducted to assess the consistency and clarity of the items and to ensure alignment with industry norms. The questionnaire items (see Appendix ??) were further revised and pretested with 50 knowledge workers to evaluate their statistical properties.

Table 1. Features of pilot study experts.

Expert's Position	Nature of the Project	Years of Experience
Senior Project Manager	Building constructions	24
Project Manager	Infrastructure projects	17
Chief Project Engineer	Building constructions	16
Senior Project Manager	Building constructions	25
Project Manager	Power plant projects	15
Project Departmental Engineer	Water conservancy projects	20

Moreover, this study employed a convenience sampling method, a non-probability sampling technique commonly used in this field [21]. For the main sample collection, similar to the pilot study, questionnaire links were distributed with the support of several organizations' top management teams (TMT) within the scholars' network. To boost data validity, some scales included negatively phrased items as "cognitive speed-bumps" to counter common method bias, and others were made more specific and indirect to minimize social desirability bias [64]. In addition, filter questions like "Are you familiar with knowledge management?" and reverse-coded items, such as "I would give full effort in contributing knowledge" were also used to enhance data quality. After removing responses with missing items, single selections for multiple-item questions or unreasonable answers, and respondents ($n = 14$) exceeding the z-score threshold, 469 valid responses for further analysis were obtained from the 558 questionnaires received.

The sample (see Table 2) consisted of more male respondents (64.2%) than females (35.8%), most of whom were aged 31–40 years, and more than 80% were predominantly well-educated (graduate degree, 48.19%; undergraduate degree, 33.90%). Most of the respondents (55.22%) were engaged in building construction projects as project leaders (48.19%) with more than 11 years of work experience (67.16%). These figures suggest that a significant proportion of the respondents are skilled and experienced knowledge workers, reflecting a considerable representation of professionals in the industry, aligning with our survey's anticipated findings.

Table 2. Descriptive statistics of the participants.

Category	Description	Frequency	
		Number	Percentage (%)
Gender	Male	311	66.31
	Female	158	33.69
Age group	24 or less	37	7.89
	25–30	71	15.14
	31–40	256	54.58
	41–50	92	19.62
	More than 51	13	2.77
Education	Doctorate degree	87	18.55
	Master’s degree	159	33.90
	Bachelor’s degree	139	29.64
	Under Bachelor’s degree	84	17.91
Years of experience	Less than 5	68	14.50
	6–10	86	18.34
	11–15	196	41.79
	16–20	63	13.43
	More than 20	56	11.94
Nature of the project	Building constructions	259	55.22
	Infrastructure projects	81	17.27
	Power plant projects	76	16.20
	Water conservancy projects	53	11.30
Position	Top Management Team (i.e., General Manager, Chief Project Engineer, Senior Project Manager)	57	12.15
	Department Head (i.e., Department Manager, deputy manager)	91	19.40
	Project Leader (e.g., Project Manager, Project Departmental Engineer, Minister)	226	48.19
	General staff	95	20.26

3.2. Study Measures

To ensure a balanced questionnaire design and a comprehensive evaluation of the factors as well as to minimize measurement risk, each construct was measured using at least three items (latent variables) drawn from the literature on knowledge management processes. Where applicable, pre-validated questionnaire scales were employed and some items were refined to fit the study’s context (see Appendix ??). Specifically, we operationalized PFs as a reflective–reflective higher-order construct (R-R- HOC) of two lower-order constructs (LOCs) based on measurement theories from Ren, Deng and Liang [64], Sun, Ren and Anumba [71] and Zhou, Deng, Hwang and Ji [60]. We measured FF with five item-scale based on the “performance failure appraisal inventory” developed by Conroy, et al. [119] and the items were refined to fit the context of construction, to ensure that the specific categories of knowledge essential to project teams were incorporated. For FLU, we evaluated the construct with four items adapted from Wasko and Faraj [120] research work. Project team’s KW behaviour was assessed with four items adapted from Lin and Huang [75] and Tsay, Lin, Yoon and Huang [27]. The PTI construct was evaluated by the five-item scale adapted from Ni, Cui, Sang, Wang and Xia [1]. And lastly, we measured KL with five items generalized and adapted from Lin, Chang and Tsai [7] and Nyallu, Deng and Mgimba [20]. Each item of the questionnaire survey was measured on a five-point Likert scale with 1 = “strongly disagree,” and 5 = “strongly agree.”

In analyzing the items, we controlled for gender, age group, prior experience, and position, recognized as antecedents of team members' attitudes and behaviors, especially in the context of KS and creation [23,51]. The SEM results revealed that the inclusion of the marker variable gender ($\beta = -0.052$; $p > 0.000$), age ($\beta = -0.173$; $p > 0.000$), years of experience ($\beta = -0.167$; $p > 0.000$), and position ($\beta = 0.029$; $p > 0.000$), do not affect any of hypothesized relationship, hence, excluded from the final model.

3.3. Analytical Approach

We applied partial least squares path modeling (PLS-PM) analysis, which is a form of variance-based structural equation modeling (SEM), using IBM SPSS statistics 25 and Smart PLS 4 to assess the suggested conceptual framework and test the hypotheses [20]. The PLS-PM approach is particularly promising if the model includes very complex models with multiple levels of dimensionality and when various types of relationships are not sufficiently explored [121,122]. Given that our research model involves LOCs, HOC, and mediators within the model, and few studies have tested its cause-and-effect relationships, the approach is applicable to our study. PLS-PM can process scaled variable-based measurements using a disjoint two-stage procedure, which has been demonstrated to reduce bias in parameter estimates [123]. This is another rationale for selecting such an approach due to the existence of a high-order construct (project features). As our target population was construction experts with knowledge in KM processes and experience in both domestic and international projects, we could only reach them through support within the scholars' network, resulting in a small sample size. According to Guenther, et al. [124] and Becker, et al. [125], unlike covariance-based SEM (CB-SME), PLS-PM requires no distributional assumptions or large sample size. Moreover, it is superior when the study has a predictive aim rather than theory testing, given that PLS-PM focuses on the model's predictive power [72].

4. Data Analysis and Results

4.1. Common Method Bias (CMB) and Multicollinearity

Since the study employed a convenience sampling technique, Harman's single-factor test was executed to check for the existence of CMB [126]. Unrotated exploratory factor analysis, with the value of a single factor being 34.45%, remained below the upper limit of 50% for one factor to be explained by the total variance, suggesting that issues related to CMB is not a serious concern in our data. Moreover, we dismissed any concerns about collinearity (i.e., variance inflation factor (VIF) above the threshold of 3.3). Using a marker variable approach [127], both exogenous and endogenous constructs display a VIF below three (max (VIF) = 2.884), implying that no significant multicollinearity problem exists among the constructs (see Appendix ??).

4.2. Measurement Model

To validate the model, for the reflective constructs, we evaluated the reliability and validity of the measurement items, including internal consistency reliability as well as convergent and discriminant validity tests. Tables 3 and 4 display the relevant indicators and values. Specifically, reliability is assessed based on the items' standardized outer loadings. Except for few items, i.e., FF2 (item of fear of failure), item of project team interaction (PTI2), and knowledge loss (KL5), all other factor loadings exceeded 0.785, indicating sufficient item reliability [128]. Accordingly, these three items were dropped (one by one) from the model. To establish internal consistency reliability, composite reliability (CR) and Cronbach's alpha (α) are examined. All of these are between 0.70 and 0.95. Convergent validity is established when the average variance extracted (AVE) scores of

each latent variable exceeded 0.5. Finally, our measurement model exhibited satisfactory discriminant validity using the two criteria introduced by Fornell and Larcker [129]:

Table 3. Reliability and validity of the measurement items.

Items	Loading	Cronbach's Alpha	CR	AVE	Items	Loading	Cronbach's Alpha	CR	AVE
TN1	0.889	0.878	0.925	0.804	TU1	0.888	0.819	0.892	0.734
TN2	0.919				TU2	0.818			
TN3	0.882				TU3	0.864			
KW1	0.888				FLU1	0.894			
KW2	0.852	0.887	0.922	0.747	FLU2	0.902	0.918	0.942	0.802
KW3	0.854				FLU3	0.900			
KW4	0.862				FLU4	0.886			
FF1	0.883				PTI1	0.879			
FF3	0.878	0.898	0.929	0.766	PTI3	0.857	0.888	0.922	0.748
FF4	0.864				PTI4	0.844			
FF5	0.875				PTI5	0.879			
KL1	0.814								
KL2	0.785	0.825	0.884	0.655					
KL3	0.825								
KL4	0.813								

Table 4. Measurement of discriminant validity.

	TN	TU	FLU	FF	KW	PTI	KL	PFs
TN	0.897	0.574	0.514	0.591	0.63	0.547	0.708	
TU	0.488	0.857	0.542	0.666	0.766	0.609	0.686	
FLU	0.462	0.47	0.895	0.617	0.525	0.502	0.535	0.570
FF	0.527	0.573	0.561	0.875	0.691	0.672	0.780	0.688
KW	0.558	0.654	0.475	0.617	0.864	0.755	0.748	0.775
PTI	0.482	0.521	0.455	0.602	0.672	0.865	0.704	0.630
KL	0.606	0.568	0.468	0.673	0.643	0.604	0.809	0.738
PFs			0.527	0.628	0.702	0.572	0.648	0.909

Note: **Colored values** represent HTMT ratios of all variables, **bold values** show the square root for each construct's AVE, and other values show the values of the Fornell and Larcker criteria.

The square root for each construct's AVE (see bold values in Table 4) in the Fornell–Larcker criterion is higher than the intervariable correlations.

The inter-construct correlations based on heterotrait–monotrait (HTMT) ratios (colored) remain below the conservative threshold of 0.85 (See Table 4).

Our model contains one higher-order construct (HOC) and six lower-order constructs (LOCs). To ensure the HOC (PFs) validity, via PLS-PM analysis, we evaluated a higher-order model following the second stage of the disjoint approach recommended by Sarstedt, et al. [130]. During the process, Figure 2 reveals that there is a strong relationship between the HOC and the two LOCs ($TN \leftarrow PFs = 0.937$, $TU \leftarrow PFs = 0.929$). Moreover, the HOC met the criteria for convergent validity ($AVE = 0.827$), Cronbach's alpha ($\alpha = 0.922$), and composite reliability ($CR = 0.929$) based on the guidance of Hair, et al. [131]. For assessing the discriminant validity of the HOC with all LOCs, the Fornell–Larcker criterion test results (Table 4) are examined. Considering that the square root of $AVE = 0.909$ is higher than the inter-LOC correlations, according to Fornell and Larcker [129], discriminant validity is confirmed.

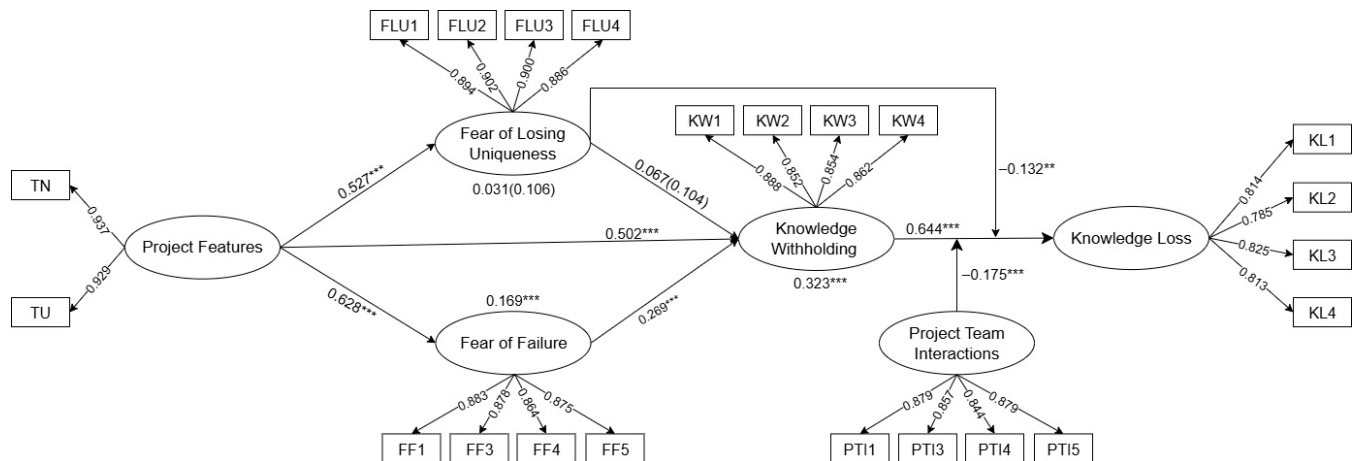


Figure 2. Results of the structural model, ***: Significant at $p < 0.001$ and **: Significant at $p < 0.005$.

4.3. Structural Model

For the structural model, we first used Kock [127] criteria to assess multicollinearity issues. All inner/structural variable VIF values ranged from 1.00 to 2.083, which are below the acceptable threshold of 3.3 [132], indicating no severe multicollinearity. Next, with R^2 values greater than 0.10 (Table 5), ranging from moderate (>0.2) to high (>0.5) [133], and goodness-of-fit (GOF) of 0.554, obtained using geometric means of both R^2 and communality (AVE) for all endogenous variables, exceeding the cut-off value of 0.36 for large effect sizes of R^2 [103,134], our model depicts a stronger statistical in-sample predictive power. In addition, by applying the blindfolding technique with ten folds and ten repetitions [135,136], a Q^2 value of 0.378 for KL suggests a large predictive relevance of the model [128]. During the PLSpredict analysis process, using the cross-validated predictive ability test (CVPAT) outlined by Sharma, et al. [137], we further confirmed the model's high out-of-sample predictive accuracy. Structural model fit is evaluated using bootstrapped-based statistical inference, Normed Fit Index (NFI), and Standardized Root Mean Square Residual (SRMR). The results are satisfactory: SRMR = 0.037 (acceptable if <0.08) [138], NFI = 0.903 ((acceptable if >0.8) [139], and $d_ULS = 0.492$ and $d_G = 0.332$ (acceptable if <0.95) [140].

Table 5. Results of structural model assessment.

		FLU		FF		KL		KW	
Coefficient of determination (R^2)		0.278 ***		0.395 ***		0.415 ***		0.546 ***	
Stone–Geisser's (Q^2)		0.272		0.390		0.378		0.490	
Relationship				95% CI					
Hypothesis	Path	Standardized Coefficient (β)	p -Value	t-Statistics	Lower	Upper	Suggested Effect	Hypothesis Results	
Direct Paths Results									
H1	PFs $\rightarrow$ KW	0.502	***	9.124	0.413	0.594	Positive	Supported	
H2	KW $\rightarrow$ KL	0.644	***	17.929	0.583	0.702	Positive	Supported	
Specific indirect paths results									
H3	PFs $\rightarrow$ KW $\rightarrow$ KL	0.323	***	7.559	0.255	0.396	Positive	Supported	
H4	PFs $\rightarrow$ FF $\rightarrow$ KW	0.169	***	4.940	0.113	0.226	Positive	Supported	
H5	PFs $\rightarrow$ FLU $\rightarrow$ KW	0.031	0.106	1.247	−0.009	0.075	Positive	Not-Supported	

Note: *** $p < 0.001$.

The causal path coefficients of the model and their corresponding p -values are displayed in Table 5. Five of the seven proposed hypotheses are supported in this study. Specifically, knowledge withholding displayed the strongest effect (0.644) on KL, and this behavior was significantly influenced by project features (0.502, $p < 0.001$), thus confirming

H1 and H2. The indirect influences of constructs are established based on 95% confidence intervals (Table 5) and the variance accounted for (VAF) method to indicate the mediation effect. Accordingly, the indirect positive effect of PFs on KL via KW was significant (0.323, $p < 0.001$, 95%CI = 0.255 to 0.396), and the 95% bootstrap confidence interval did not encompass zero. Furthermore, a VAF of 40.56% confirms the partial mediating effect of KW, thereby validating H3. For the effect of PFs on KW via fear, FF yielded positive effects (0.169, $p < 0.001$), whereas for FLU, the effect was not significant (0.031, $p = 0.106$), thereby validating H4 and rejecting H5.

To confirm hypotheses H6 and H7 regarding moderation, we examined the interaction effect results presented in Table 6. In contrast to theoretical expectations, FLU did not strengthen the link between KW and KL, thus disconfirming H6. However, it is noteworthy that we found that the interaction term FLU by knowledge withholding behaviour had a significant negative effect on KL ($\beta = -0.132$, $t = 3.426$, $p < 0.001$). The effect size was small ($f^2 = 0.027$), and as such, to interpret this interaction effect, we used a simple slope analysis. It is evident from the visual representation that higher levels of FLU, as opposed to lower levels, dampen the incremental impact of withholding on knowledge loss (Figure 3a). We found a similar pattern for the project team interaction, as shown in Table 6 and Figure 3b. We observed that PTI has a significant moderating effect on the aforementioned relationship ($\beta = -0.175$, $t = 3.632$, $p < 0.001$), such that the more construction members engage in communication, collaboration, and exchange of skills and know-how “interaction”, the weaker the positive relationship between KW and KL becomes; thereby, our H7 is accepted.

Table 6. Interaction effect results.

Hypothesis	Relationship Path	ΔR^2 (Increase%)	(β) Interaction	t-Value	Effect Sizes f^2 (Magnitude)	Inference
H6	FLU $\times$ KW $\rightarrow$ KL	4.8% (0.415 $\rightarrow$ 0.463)	−0.132 **	3.426 *	0.027	Not-Supported
H7	PTI $\times$ KW $\rightarrow$ KL	7.3% (0.415 $\rightarrow$ 0.488)	−0.175 ***	3.632 *	0.040	Supported

Note: *** $p < 0.001$, ** $p < 0.005$ and * $p < 0.05$.

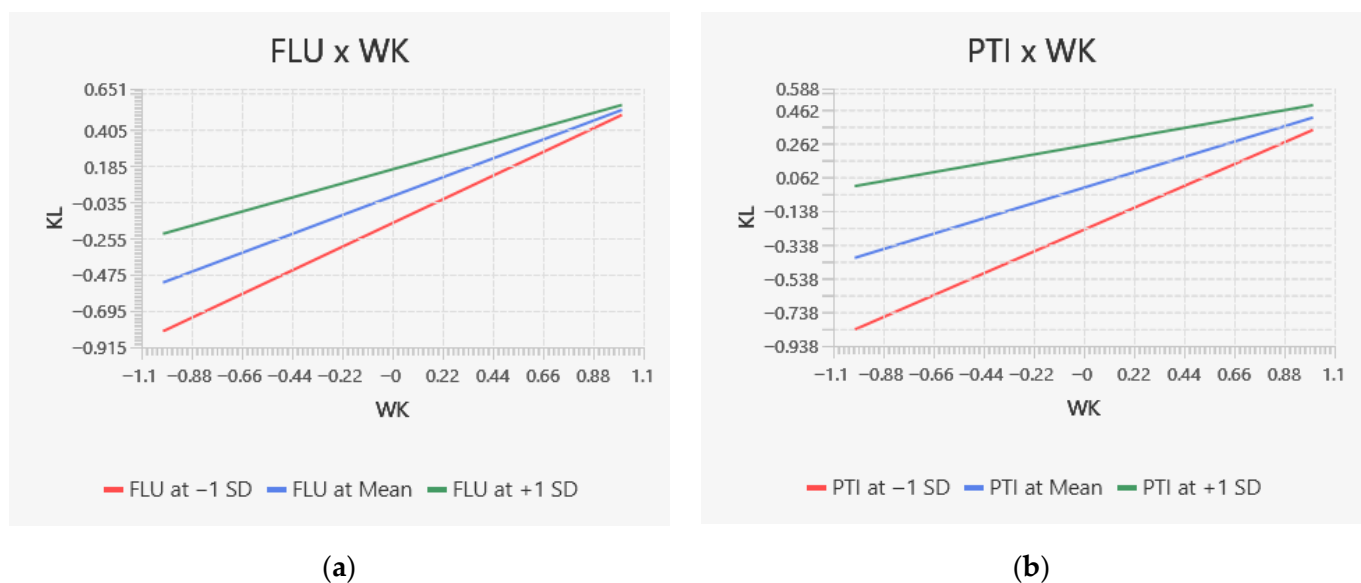


Figure 3. Simple slope plots for interaction effect of (a) FLU, (b) PTI and KW on KL.

5. Discussion and Implications

5.1. Discussion

The main motivation for implementing a KR strategy is the critical importance of capturing knowledge and promoting its retrieval and reuse to prevent the risk of valuable KL for an organization's success and sustain competitive advantage [7,19]. According to Levallet and Chan [13], this implies that the management of individual expertise and the transfer of new and existing skills, knowledge, and expertise throughout the organization (temporary "projects" and permanent "firm"). To date, many firms continue to face challenges in preventing KL [141], and it is not that organizations have not taken initiatives to foster KM practices or tools. In this sense, Daghfous, Belkhodja and C. Angell [5] and Levallet and Chan [13] argue that organizations and researchers need to consider more uncovered variables (i.e., objective environmental features, behavioral, or psychological) that have the potential to drive organizational knowledge loss.

Drawing from COR theory, this study explores the link between project features (temporary nature and urgency) and knowledge loss. To provide a thorough comprehension of this subject, we examined the roles of psychological emotions (FF and FLU), psychological withdrawal (KW), and interactions among project teams. Theoretically, the findings demonstrate the possible risk posed by project features and indicate that their influence on KL is manifested through withholding effort during the sharing process. Under urgency characteristic of construction projects and minimal expectations of future collaboration and reciprocity [63,142], this study confirms that team members deliberately withhold knowledge to avoid the time-consuming process of interpreting complex task-related knowledge, "avoid time-resource loss", or to manage their tasks efficiently, "maximize existing resource", rather than engaging in a mere act of disengagement. Previous research has focused more on how task-related variables, such as task characteristics and interdependence, determines one's rational choice to withhold knowledge [23,51]. This study provides empirical evidence that project features can also predict knowledge withholding.

According to Gonçalves, et al. [143], withholding is not the opposite side of the same continuum as sharing, and it differs from a lack of KS. In other words, individuals may share knowledge while simultaneously withholding knowledge [76]. Because decisions on which knowledge to give away or deliberately withhold occur with great regularity, this study provides evidence that this phenomenon inevitably leads to the loss of valuable project knowledge. Although this relationship was previously found to be missing in KL risk management or the consequences of counterproductive behaviour research, this finding aligns with earlier related research that highlighted withholding effort behaviour to:

Seriously hinder complete and relevant knowledge flow and restrain the exchange of ideas and perspectives that are vital for organizational learning, and new knowledge creation [24,144].

Harm drivers of individual and organizational knowledge growth, such as individual and team creativity [41,145], psychological contracts [146], and individual innovation [83,147].

The final results also confirmed that KW behaviour was partially and complementarily mediated (VAF = 40.56%) by the aforementioned link (PFs-KL). This finding adds a psychological-behavioral dimension to Lin, Chang and Tsai [7] and Levallet and Chan [13]'s theoretical model of organizational knowledge retention and loss. While these and other recent studies in related research streams have focused on structural failures in the knowledge retention cycle (e.g., incomplete conversion of individual to collective knowledge and inadequate retrieval/reuse mechanisms) as antecedents of KL, our research demonstrates that KL is actively driven by intentional employee behaviour, and for this study, withholding efforts in sharing knowledge.

The findings of the current study also revealed that FF partially mediated the relationship between PFs and KW behaviour. This finding clarifies prior inconsistencies in task (project) feature research, e.g., [60,71], aligning with prior empirical studies that have highlighted the underlying assumptions regarding the existence of mediating variables [23]. The significant role of FF aligns with COR theory [44] and extends Tsay, Lin, Yoon and Huang [27]’s work on efficacy-based mediation by demonstrating that “threat appraisal” (not just capability) drives effort withholding under project constraints.

Hypothesis 5 stating that ones’ fear of losing unique value would mediate the effect of project task contexts on individuals’ knowledge withholding behaviour was not significant. Contrary to earlier expectations and prior literature [33,36], this finding could stem from the industry’s unique social and operational dynamics. First, experts are evaluated based on their speaking knowledgeably, reputation, and networks [148] and partially based on hard-won knowledge and skills [98]. Second, collective and personal benefits are considered independent aspects [107], such that the main concern is contributing knowledge for more effective work rather than individual benefits, such as recognition, which is a byproduct of KS [149]. As such, construction teams often view KS as a way to strengthen collective outcomes and enhance their own visibility rather than as a threat to their expertise [32].

The moderating role of FLU on the link between KW behaviour and knowledge loss was significant. Unprotected sharing exposes contributors to a high risk of knowledge spillover and loss of competitiveness, as evidenced by Fawad Sharif, et al. [150]. This suggests that in collective, project-based settings, professionals often adopt protective strategies (i.e., share general and (some of) project-specific knowledge to achieve practical solutions [29]). Thus, while FLU directly contributes to knowledge loss ($\beta = 0.162$, $p < 0.001$), its moderating role implies that loss is less contingent on deliberate withholding when employees already operate under strong protective instincts. This aligns with cultural expectations in construction teams, where the focus is on contributing knowledge to solve uncertain issues encountered and operational efficiency to ensure the project’s success [54,70].

However, from the perspective of a single project, it is difficult to assess whether the shared and created knowledge during these processes holds value for other projects, which frequently results in a substantial loss of valuable project knowledge. With construction teams, we found the impact to be moderated by project team interaction. This may be because members who frequently interact have more opportunities to establish norms and form relationships [151], leverage KM practices more efficiently [43], and ultimately drive the retention and reuse of potential knowledge through reciprocated behaviour [39]. In this sense, we advance the literature [1] by showing that communication, collaboration, and exchange among project teams can help recognize the value of relational resources and restore the loss of other resources, such as knowledge.

5.2. Managerial Implications

Knowledge sharing, with its prevalent drive for organizational efficiency and effectiveness, is currently recognized as being of utmost importance to construction team decision-making, innovation, and performance. Yet, as project teams are often temporary and task-oriented, members are reluctant to utilize their limited resource “time” to share knowledge with others. Although our findings indicate that high levels of project task context influence team members’ team withholding behaviour, moderate levels can stimulate project members’ knowledge-sharing behaviour through prosocial motivation and perspective-taking. First, project leaders should help the team determine priorities and time planning beforehand while promptly reminding them of task deadlines to prevent them from spiraling into resource loss cycles. Second, organizations should consider promoting

introjected motivation to stimulate prosocial motivation and knowledge sharing [122]. This can be achieved by designing effective and well-executed incentive systems that reward problem-solving impacts over general participation, promoting a merit-based approach to contribution, thereby reinforcing reciprocal behaviours between project teams. Third, the desire to achieve a deeper understanding of others' thinking processes provides a powerful trigger for perspective taking [152]; hence, managers must create structured opportunities (i.e., think-aloud walk-throughs, shared decision rationales, and after-action mind-trace reviews) for members to externalize and discuss the cognitive steps behind their choices. However, the system can promote effective KS behaviour in an environment or climate that encourages the seeking and implementation of new ideas [87]. As a result, the influence of FF on KW behaviour suggests that managers should encourage construction team members to demonstrate reasonable risk-taking behaviour, such as seeking new solutions and learning from failures. Moreover, experts should be aware that they can share the knowledge gained from failures without blame, shame, or fear. In other words, project managers need to try to establish a no-blame organizational climate to drive members to actively participate in KS. This approach not only reduces unconscious withholding but also encourages deeper reflection and knowledge integration, and further overcomes the shortcomings of project features.

Contrary to some prior assumptions [36], our findings suggest that fear of losing unique value (FLU) does not drive team members to withhold knowledge. However, to maintain one's knowledge value and superiority within project teams, it is inevitable for members to retain knowledge. Strategic sharing behaviour remains evident, as employees selectively contribute to collective objectives while safeguarding their uniqueness [33]. As evidenced by Webster, et al. [153], an individual's feelings of ownership over knowledge provide greater commitment and effort. To leverage this, managers need to cultivate mutual recognition and a shared vision while ensuring that team members are aware that "the interactive process can add value to the originally shared knowledge, benefiting both the knowledge contributor and receiver" ([32], p. 190). One way to implement this is to allow project team interactions beyond task–process interactions. A social interaction climate increases familiarity and mutual trust, which forms the basis for effective KS [1]. Therefore, strengthening the interaction and linkage between construction teams through formal and informal engagements during the early phases of the project, peer mentoring and collaborative troubleshooting, and rotating team assignments or co-locating specialists to foster relationship-building and reduce silos between knowledge holders seems to be an effective initiative.

6. Conclusions

The negative impacts of KL on organizational performance and competitive advantages, whenever construction experts decide to retire or move to other organizations, underscore the necessity of preventive measures. To eliminate the existing issues and develop effective KR strategies, it is crucial to concentrate on the main elements within the organizational contexts that influence KL. Hence, grounded in COR theory, we propose and test a theoretical model of the relationships among PFs, FF, FLU, and KW on KL. The novelty and contribution of our research are evident in two aspects. The first is the integration of behavioral and emotional resource conservation mechanisms into a project-based context to understand why KL remains a persistent challenge in PBOs. The second is the introduction of PTI as a social resource that mitigates the negative behavioral consequences of project-induced stress. In conclusion, this study provides evidence that project environments characterized by tight schedules, temporary team structures, and performance pressures create conditions of resource loss, prompting individuals to reduce

the loss of other resources, such as cognitive and emotional resources, by engaging in KW behaviour. The findings of this study demonstrate that PFs has an indirect impact on KL through KW, and that FF acts as an emotional conduit through which project pressures shape KW behavior. However, in an environment where individuals operate under high FLU, KL becomes less contingent on deliberate KW. Moreover, the results suggest that PTI is an essential resource-restoring mechanism that can minimize the positive impact of KW and KL.

7. Limitations and Recommendations for Future Research

Despite its contributions, this empirical research is not exempt from limitations that should be addressed in future studies. First, the present study involves only two antecedents and two self-referenced fears—FF and FLU—as mediators and moderators for effort withholding behaviour in its KL model. However, project task variables (such as complexity as other possible antecedents), other dimensions of fear “other-referenced fears”, and moderators (e.g., knowledge leadership behaviour, team learning culture or reward systems) may also be considered to further enhance key effects and foster more meaningful relationships and explore the relevance and underlying mechanisms with KL. Second, this research is the possibility of inference results on causal relationship using a cross-sectional self-reported data. Therefore, future researchers are encouraged to combine cross-sectional and longitudinal designs to address causality bias. Third, despite the due care in ensuring a robust and unbiased research methodology, and that CMB was not identified as a significant concern, we cannot entirely rule out the possibility of social desirability bias due to the use of a non-probability sampling approach. Therefore, future research should consider employing stratified and snowball sampling as an auxiliary survey strategy to improve representativeness. Fourth, we empirically tested the relationship between fear and KW, with the sample confined to construction teams influenced by collectivist culture. As evidenced by prior studies, these individuals have a tendency to be concerned with dominant values “collective interests” and, at the same time, are more concerned about their face or social standing. Future studies can build upon current research findings (e.g., H4–H6) and determine the extent to which the effects of FF and FLU are valid across other project-intensive sectors and cultures, leading to more robust and generalizable research findings. Finally, at its core, the experience of fear serves as an integral part of self-protection strategies against threats, resulting in responses such as psychological withdrawal or avoidance behaviours. Apart from effort withholding behaviour, other responses, such as resistance to change and turnover intention, have been identified. Accordingly, while we confirm the central role of KW behaviour in explaining front-end KL (i.e., failures in knowledge capture/conversion), within the KR cycle, future studies could investigate other variables as antecedents to back-end KL (i.e., failures in retrieving and reusing knowledge).

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Institutional Review Board Statement: Ethical review and approval were waived for this study in accordance with Article 32 of the “Measures for Ethical Review of Life Science and Medical

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Informed Consent Statement: Participation in this research was entirely voluntary. Respondents were informed of the study’s purpose and assured of the anonymity and confidentiality of their responses. Completion of the questionnaire was considered implied consent to participate.

Data Availability Statement: The data presented in this study are available on reasonable request from the corresponding author. The data are not publicly available due to confidentiality assurances given to participants during the data collection process.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. Questionnaire Items and VIF Values

Construct	Items		VIF
	Abbreviation	Name	
Temporary Nature	For the projects contracted by our company [...]		
	TN1	The relationship between project team members is temporary: members usually disband or leave even before project completion	2.058
	TN2	Members integrated to project teams are mostly cooperating for the first time	2.495
	TN3	After completion of the project, team members probability of being assigned to different projects is very high	1.958
Time Urgency	In comparison to the projects that were previously contracted by our company [...]		
	TU1	The project team assigned tasks are highly demanding with little free time	2.211
	TU2	The owner often checks the project schedule	1.624
	TU3	In the process of construction, cross-departmental members are often changed	1.938
Knowledge Withholding	To cope with work intensification in the process of projects, [...]		
	KW1	I would give unequal collaborative effort in contributing knowledge	2.297
	KW2	I would leave knowledge contribution to other members	1.932
	KW3	I would be willing to accept others’ knowledge without contributing	1.874
Fear of Losing Uniqueness	KW4	I would avoid contributing knowledge as much as possible	2.027
	During knowledge sharing [...]		
	FLU1	If I provide everybody with my entire know-how, I am afraid of being replaceable	2.365
	FLU2	I don’t gain anything if I share my know-how	2.884
	FLU3	If I share my know-how, I will lose my knowledge advantage	2.659
	FLU4	Knowledge sharing means losing power	2.057

Construct	Items		VIF
	Abbreviation	Name	
Fear of Failure	I am afraid of making mistakes in sharing knowledge because [...]		
	FF1	I worry that teammates will ridicule me	2.319
	FF2	I fear that I might disappoint others	-
	FF3	I am concerned that it will make others doubt my professional abilities	2.325
	FF4	I am scared it might negatively affect my future opportunities in the project team	2.062
	FF5	I worry that others will lose interest in including me in team activities	2.187
Project Teams Interaction	In our organization [...]		
	PTI1	The work contact and exchange are close among different project teams	2.249
	PTI2	The work contact and learning exchanges are intimate between project teams and departments	-
	PTI3	Project members from different project teams and departments communicate with each other frequently	1.980
	PTI4	You can be allocated to another project team or department	1.872
	PTI5	Sometimes it can be arranged for you to undertake multiple projects simultaneously	2.127
Knowledge Loss	In our organization [...]		
	KL1	Critical technical knowledge is severely lost	1.743
	KL2	Specialized knowledge and unique experience are severely lost	1.677
	KL3	The skills and knowledge to manage construction projects are severely lost	1.765
	KL4	Knowledge of routines and methods used is severely lost	1.808
	KL5	Problem-solving capacity and decision-making skills used are severely lost	-
Note: FF2 (item of fear of failure), item of project teams interaction (PTI2), and knowledge loss (KL5) were removed at the initial stage due to low loading			

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