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The effect of caring ethical climate on employees' knowledge-hiding behavior: evidence from Chinese construction firms

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This research aims to explore the influencing mechanism of a caring ethical climate on knowledge-hiding behavior in large construction firms according to the reciprocity principle of social exchange theory. This is an empirical study based on the analysis of survey data collected from 413 employees working in large construction firms in China. Hierarchical regression is applied to test the research model. This research finds: (1) Caring ethical climate has a negative influence on knowledge-hiding behavior; (2) Caring ethical climate has a positive influence on psychological contract; (3) Psychological contract has a negative influence on knowledge-hiding behavior; (4) Psychological contract mediates the relationship between caring ethical climate and knowledge-hiding behavior; (5) Task interdependence positively moderates the relationship between psychological contract and knowledge-hiding behavior. Based on the social exchange theory, this study provides significant contributions to the theory and practice of knowledge management in large construction firms by highlighting the influence of a caring ethical climate on knowledge hiding among employees. This paper provides suggestions for reducing knowledge hiding and enhancing knowledge sharing among employees in large construction firms, so as to improve the knowledge management ability of large construction firms and enhance their competitive advantages.

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Introduction

Knowledge hiding is an employee's evasive and hiding behavior when receiving knowledge inquiries, assistance, and requests from colleagues or others. Knowledge hiding includes evasive hiding, rationalized hiding, and playing dumb (Connelly et al., 2012). For large construction firms, due to the experience and complexity of construction technology and methods (Guo et al., 2014), the sharing of knowledge often determines the knowledge mastery of construction firms, which is the key to the continuation of the core competitiveness of construction firms (Boamah et al., 2022). However, in order to ensure their scarcity, employees always tend to keep their knowledge (Franco et al., 2004). For example, an employee summarizes the work tips, does not spread them out, and finds excuses to shirk the task that only he can do. What's more, the employee asks other employees not to observe when he is working. Therefore, how to reduce knowledge hiding among employees of large construction firms and cultivating as much knowledge sharing in construction firms as possible has become an important task that all construction firms must solve (Yu and Yang, 2018).

Organizational ethical climate reflects shared beliefs and values (Tseng and Fan, 2011), and it can influence employees' knowledge-hiding behavior (Nadeem et al., 2020). There are five types of organizational ethical climate: caring, instrumental, independence, law and code, and rules ethical climate (Victor and Cullen, 1988). In a caring ethical climate, the organization cares about every employee and employees care about each other, which will encourage employees to repay with social exchange (identification, support, etc.) at the psychological level, and regard the healthy development of the organization as their action criteria. Based on the social exchange theory (Blau, 1964), when employees perceive a caring ethical climate and are concerned for their well-being, they may be more willing to promote reciprocity with positive behaviors (Al Halbusi et al., 2020). Therefore, in a caring ethical climate, employees may reduce knowledge-hiding behavior and care about the future of their organization.

The establishment of a caring ethical climate can increase employee commitment (Cullen et al., 2003). Employee commitment reflects the psychological contract between employees and the organization (Zhou, 2014). The psychological contract is defined as an individual's expectations regarding the obligations that exist between an employee and an organization (Johnson and O'Leary-Kelly, 2003). The psychological contract is typically presented as rooted in social exchange theory (Bal et al., 2010), describing mutual exchanges between employees and their organization (Suazo et al., 2009). Knowledge belongs to knowledge workers (Rulke and Galaskiewicz, 2000). If large construction firms want knowledge workers to share their knowledge with non-knowledge workers, they also need to repay the behavior of knowledge workers. When knowledge workers perceive that the organizational responsibility is well performed, they will have a sense of obligation and responsibility to repay the organization, so they are willing to share the knowledge, and thus knowledge workers establish a psychological contract with the organization. At the same time, due to the integration and complexity of large construction products (Cantarelli, 2022), there is an inevitable task interdependence among all employees of large construction firms (Mishra and Sinha, 2016; Van Der Vegt et al., 1999). Low-task interdependence means that a single project member has all the required resources to complete the tasks; High-task interdependence means that the completion of tasks must depend on each member contributing their unique resources (Zhou and Long, 2014). Task interdependence triggers responsibility, so knowledge workers might view knowledge hiding as an action of betrayal (Černe et al., 2017). Task interdependence is deemed to share more information and leads to a lower likelihood of

employees hiding their knowledge (Jafari-Sadeghi et al., 2022). If knowledge workers are not formally required to exchange knowledge among colleagues (i.e., low-task interdependence), they may become more likely to hide their knowledge (Hernaus et al., 2019). Therefore, task interdependence may also have an impact on knowledge-hiding behavior (Zhang and Min, 2021).

This study focuses on the following reasons for the impact of a caring ethical climate on knowledge-hiding behavior in large construction firms: firstly, in terms of resources and scale, large construction firms usually have more resources, better knowledge management systems, and wider knowledge-sharing platforms (Chen and Fong, 2013), which may make it easier to establish and maintain caring ethical climate, as there are more resources and capabilities to support and promote such a culture. Secondly, in terms of organizational structure and communication channels, large construction firms usually have more complex organizational structures and more layers of management due to the complexity and temporary nature of project teams (Tai et al., 2009). This may result in relatively slow information transfer and communication, making it difficult for a caring ethical climate to spread quickly and be implemented at all levels. Thirdly, in terms of employee participation and identification, large construction firms usually have a larger group of employees, which may lead to a lower level of identification and participation in the organizational culture (Zhang and Liu, 2006), which may affect the formation and dissemination of caring ethical climate.

In the era of the knowledge economy, knowledge, as the basis of modern economic development, has become an important resource for modern organizations to continuously create competitive advantages (Zhu et al., 2015). However, employees are unwilling to share their knowledge, to ensure their scarcity (Guo et al., 2022). The scarcity of knowledge resources makes employees prefer to hide knowledge so that they can maintain their knowledge advantage in the organization (Yuan et al., 2020). This study attempts to provide some methods for large construction firms to reduce knowledge-hiding behavior among employees. This study aims to explore the formation mechanism and inhibiting factors of knowledge-hiding behavior in large construction firms from the perspective of organizational climate. How does the caring ethical climate affect the knowledge-hiding behavior in large construction firms? What role does the psychological contract play in this process of influence? Will task interdependence affect the knowledge-hiding behavior of members in large construction firms? The practical significance of this research is that it can guide the knowledge management practice of large construction firms, and provide implementing methods for large construction firms to reduce knowledge-hiding behavior.

Theory and hypothesis

Caring ethical climate and knowledge-hiding behavior. A caring ethical climate refers to mutual tolerance and full consideration of the interests of others. In a caring ethical climate, the members of the organization uphold the spirit of altruism, that is, while considering their interests, they also care about the overall interests of others and the organization.

Studies have found that a caring ethical climate significantly affects employees' behavior (Wimbush and Shepard, 1994). A caring ethical climate has a significant positive impact on voice behavior (Wang and Yen, 2023). The caring environment of the organization can make employees feel that they are important members of the organization, so as to make suggestions for the organization (Tan and Liu, 2017), emphasizing that personalized care has a good improvement effect on knowledge hiding

(Zhai and Shu, 2019). It is inferred that a caring ethical climate may hurt knowledge-hiding behavior.

The caring ethical climate can create a context of mutual care, mutual help, and mutual trust among employees in construction firms (Liu et al., 2022). The caring ethical climate enhances trust among employees (Qi and Liu, 2017), enables employees to communicate and conduct activities more openly (Wei et al., 2019), and reduces knowledge-hiding behavior by reducing knowledge workers' concerns when sharing knowledge (Cabrera and Cabrera, 2005).

H1: A caring ethical climate has a negative impact on knowledge-hiding behavior.

The mediating role of psychological contract. The psychological contract is defined as an implicit contract between individuals and organizations that specifies what the parties expect each other to give and receive in this relationship (Egbu et al., 2005).

In a caring ethical climate, there is mutual help, harmonious colleague relationships, and superior-subordinate relationships within the team. Members induce a strong sense of responsibility and obligation to return to the organization (Wei and Zhu, 2019), so as to improve enthusiasm and participation (Qi et al., 2019). Humanitarian care is strengthened by the organization so that people can fully feel the psychological feeling of the owner, to construct a good psychological contract (Wang, 2014) and reduce counterproductive behavior (e.g., knowledge-hiding behavior) to balance the exchange between individuals and organizations (Ghani et al., 2020).

In a caring ethical climate, the members of the construction firm contain each other and fully consider the interests of others (Keikoh, 2017). In this climate, knowledge workers expect to pursue the mutual benefits of all parties (Qi and Liu, 2017). Large construction firms give more humanitarian care to knowledge workers. Knowledge workers and other members care for each other and help each other (Solberg et al., 2020), which will maintain the psychological contract of knowledge workers at a high level. The caring ethical climate will encourage knowledge workers to establish psychological contracts with large construction firms.

H2: Caring ethical climate has a positive impact on the psychological contract.

Psychological contract theory verifies that the dark triad (Machiavellianism (Pan et al., 2016), narcissism, psychopathy) ultimately affects knowledge hiding through the mediation of psychological contract (Pan et al., 2018). In addition, psychological contract breaches will lead to an increase in employees' counterproductive work behavior (Griep et al., 2020), and knowledge-hiding behavior is one of them.

The psychological contract refers to various beliefs of responsibility and obligation formed between employees and the organization on the premise of their relationship with the organization, based on commitment and perception, and related to the satisfaction of employees' various types of needs. Knowledge is a high-value resource, which is acquired or accumulated by knowledge workers who invest a lot of time and energy in the early stage. According to the reciprocity principle of social exchange theory, when the content of the psychological contract of knowledge workers is satisfied, i.e., when the high payoff, career development, and job autonomy expected by knowledge workers are met, it will affect knowledge workers' behavioral motivation. Knowledge workers will increase the behaviors that are beneficial to the organization, so the knowledge workers will reduce the knowledge-hiding behavior of non-knowledge workers.

H3: Psychological contract has a negative impact on knowledge-hiding behavior.

According to psychological contract theory, organizational context influences the establishment of a psychological contract (Rousseau, 1995). The organization pays attention to caring and implements 'mind management' on employees (Zhou, 2011), so as to obtain employees' hard work, identify with the organization (Zhu et al., 2019), enhance employees' self-efficacy, ensure that employees have a high level of psychological contract (Jin et al., 2020), and stimulate employees to transcend personal narrow self-interest (Zhou, 2011), which is embodied in organizational citizenship behavior directed at organizations, individuals, and colleagues. The organization cares for and helps employees on time. In this organizational context, the psychological distance between employees and the organization is greatly shortened, which will strongly affect the behavior of employees (Wu et al., 2020).

The organizational ethical climate will affect the organizational identification of employees. In the caring ethical climate, large construction firms adhere to the principle of altruism and care about the interests of each employee. Each employee also cares about the interests of each other and enhances the trust of knowledge workers to leaders and colleagues. Under this climate, the knowledge workers establish a psychological contract with the large construction firm, so that knowledge workers reduce the knowledge-hiding behavior towards non-knowledge workers.

H4: Psychological contract plays a mediating role in the relationship between a caring ethical climate and knowledge-hiding behavior.

The moderating role of task interdependence. Task interdependence is a very important organizational scenario variable, originating from Sbea and Guzzo's (1987) research on group effectiveness. It was defined as the structural connection between individual tasks and tasks of other members of the team, such as the relevance of goals, the degree of the process connection, the degree of resource sharing, and the degree of requirement for cooperation (Wageman, 1995). In the case of high-task interdependence, the completion of any individual task depends on the collaboration with other members (Wageman and Gordon, 2005), which means that employees exchange information more frequently and cooperate more closely with other employees to complete the assigned tasks (Zhang et al., 2022). It is shown that employees usually do not hide knowledge that is strongly related to the task. When asked about such knowledge, it is difficult for employees to give hidden reasons, because it is related to their work content or even their work responsibilities. If they cannot answer, they are considered to be insufficiently capable of work or fail to fulfill their responsibilities (Connelly et al., 2012). Therefore, more knowledge sharing will be generated within high-task interdependence teams. With low-task interdependence, tasks are relatively independent. The realization of common goals does not require members to cooperate. Employees may think that knowledge sharing depends on their context. Other colleagues or superior managers cannot supervise or evaluate it. Even if knowledge workers do not share, it does not matter. It will strengthen employees' knowledge hiding in order to consolidate their own resource advantages (Huang and Li, 2016). In low-task interdependence, a low risk of knowledge hiding is found (Bai and Pan, 2021). Bai and Pan (2021) explored the moderating effect of task interdependence between co-worker ostracism and knowledge hiding. Chang et al. (2022) pointed out that low-task interdependence greatly reduces knowledge hiding caused by status competition.

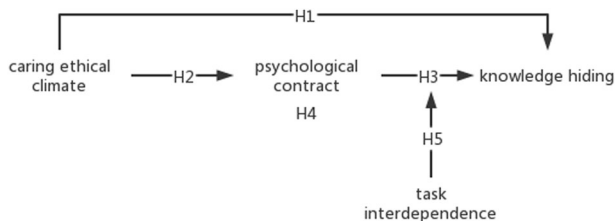


Fig. 1 Conceptual model of this research.

Due to the large workload of large construction firms, time is limited, for example, in the stage of completion and settlement, the cost consultancy is required to carry out a series of work such as calculation of project quantity, application of budget quotas, evaluation of cost reasonableness, analysis of the visa of alternation, claim clauses, and force majeure factors. Due to the large workload, only one knowledge worker is difficult to complete within the deadline and often needs non-knowledge workers to help. At the same time, the technical requirements of the work are relatively high. It is difficult to complete the work with high quality only by the current knowledge and technology of non-knowledge workers. Therefore, non-knowledge workers need to rely on the experience and knowledge of knowledge workers to complete the work. Therefore, the work of employees in large construction firms has high-task interdependence, and because of the psychological contract established between knowledge workers and large construction firms, knowledge workers will be more inclined to impart knowledge to non-knowledge workers and reduce knowledge-hiding behavior to complete the work, that is, high-task interdependence will enhance the impact of psychological contract on knowledge-hiding behavior.

H5: Task interdependence positively moderates the relationship between psychological contract and knowledge-hiding behavior (Fig. 1).

Methodology

Data Collection. Based on social cognitive theory, people’s behaviors and attitudes are influenced by their surroundings (Otaye-Ebede et al., 2020). In large construction firms, the business is larger and has more extensive needs for human, financial, and information resources, management may be more concerned with efficiency and goal orientation (Tai et al., 2009) and less focused on establishing a caring ethical climate. In this environment, employees may be exposed to more social influences and organizational hierarchies, which may have influenced their knowledge-hiding behaviors. In contrast, SMEs may be more intimate and transparent, and communication and interaction between employees may be more direct. Therefore, to explore the effects of a caring ethical climate on employees’ knowledge-hiding behaviors in large construction firms. Data for this study were collected through an anonymous online questionnaire on the Wen Juan Xing survey platform. The questionnaire survey is one of the methods used to collect information in social research, which is used to measure the characteristics, behaviors, and attitudes of the respondents. This paper studies the knowledge-hiding behavior of employees in large construction firms, using the questionnaire survey can be a good measure of employees’ knowledge-hiding behavior. The attitude refers to the willingness, emotion, and other subjective factors of the respondents to a certain thing. The attitude problem often involves something deep inside the individual. The questionnaire survey can be used to measure the psychological contract and caring ethical climate of employees. The characteristics refer to the gender, age, education, and work tenure of the respondents, which are the control

Table 1 Profile of respondents (N = 413).

Variables		Frequency	Percentage
Gender	male	246	59.56%
	female	167	40.44%
Age	25–30 years old	24	5.81%
	30–35 years old	143	34.63%
	35–40 years old	193	46.73%
	over 40 years old	53	12.83%
Education	junior college and below degree	46	11.14%
	undergraduate degree	224	54.24%
	master degree	143	34.62%
Work tenure	4–6 years	12	2.91%
	7–9 years	139	33.66%
	10–15 years	213	51.57%
	over 15 years	49	11.86%

Table 2 Descriptive statistics and correlation coefficient of variables (N = 413).

	Mean	SD	1	2	3	4
KH	2.928	0.975	0.656			
CEC	3.068	0.779	−0.824**	0.544		
PC	3.141	0.944	−0.856**	0.844**	0.67	
TI	3.118	0.962	−0.856**	0.873**	0.899**	0.706

Note: SD standard deviation. *p < 0.05; **p < 0.01; ***p < 0.001. The bolded values are the square root of AVE. KH knowledge hiding, CEC caring ethical climate, PC psychological contract, TI task interdependence.

variables in this study. The survey respondents are engineers, project managers, and other employees with value knowledge in more than ten large construction firms, such as The First Company of China Eighth Engineering Bureau Ltd., and CSCEC Strait Construction and Development Co., Ltd.

Before the final questionnaire survey, we do a pilot test to ask respondents to report on their most recent knowledge-hiding incidents and provide comments on the clarity of the items. Based on their feedback, we revised some words or sentences to increase their comprehension of the questions. The sample size for the pilot is 50. The pilot survey results showed Cronbach’s alpha of the variables is bigger than 0.7.

In this study, 500 questionnaires were distributed in July 2022, and 87 invalid questionnaires with obvious quality problems were excluded. A total of 413 valid questionnaires are obtained, with an effective rate of 82.60%. The effective questionnaire subjects are classified according to gender, with 246 males, accounting for 59.56%, and 167 females, accounting for 40.44%. According to age, 24 people aged 25–30 years old, accounting for 5.81%, 143 people aged 30–35 years old, accounting for 34.63%, 193 people aged 35–40 years old, accounting for 46.73%, 53 people over 40 years old, accounting for 12.83%. Classified by education, there are 46 junior college and below degrees, accounting for 11.14%, 224 undergraduate degrees, accounting for 54.24%, and 143 master degrees, accounting for 34.62%. Classified by work tenure, 12 people were 4–6 years, accounting for 2.91%, 139 people in 7–9 years, accounting for 33.66%, 213 people in 10–15 years, accounting for 51.57%, 49 people over 15 years, accounting for 11.86%. The demographic profile of respondents was measured with gender, age, education, and work tenure presented in Table 1. The mean, standard deviation, and correlation coefficient analysis results of the respondents’ questionnaires are shown in Table 2.

Table 3 Test of normality (N = 413).

	Skewness	Skewness standard error	Kurtosis	Kurtosis standard error
KH	-0.122	0.120	-0.468	0.240
CEC	0.067	0.120	-0.460	0.240
PC	-0.204	0.120	-0.464	0.240
TI	-0.152	0.120	-0.460	0.240

KH knowledge hiding, *CEC* caring ethical climate, *PC* psychological contract, *TI* task interdependence.

Measures. The measured variables in the questionnaire, except for the control variables, all use the 5-point Likert scale, from strongly disagree to strongly agree, 1 represents strongly disagree, and 5 represents strongly agree. The following is the use of the scale:

(1) The knowledge-hiding behavior is measured by the scale developed by Rhee and Choi (2017). This scale includes Connelly’s evasive hiding, playing dumb, and Peng’s (2013) intentional hiding (Yang and Tang, 2018). Connelly et al. (2012) specify different types of knowledge-hiding behaviors and Peng (2013) conceptualizes a single dimension of knowledge-hiding that originates from feelings of evaluation apprehension. The item ‘When non-knowledge workers ask me about large construction, design, and other schemes, I try to hide innovative solutions and achievements’ is more in line with the Chinese context. Chinese knowledge workers are more willing to share simple knowledge than innovative solutions and achievements. Combined with the context among employees of large construction firms, the necessary modifications are made to form the scale of this study. The scale includes 4 items such as ‘I agree to help a non-knowledge worker when he or she asks me about professional skills and knowledge such as construction, but I don’t really want to help him or her’. The Cronbach’s alpha of the scale was 0.740.

(2) The scales of caring ethical climate mainly include Victor and Cullen’s. The caring ethical climate is measured by the scale compiled by Victor and Cullen (1988) from two dimensions of care and altruism, which is the most widely used scale to assess this construct. Other scales are mainly measured from other dimensions, which is not suitable for this study. For example, in Shkedi and Harel’s scale, each situation includes a moral dilemma and a potential solution is offered to participants as a means to resolve each moral dilemma. This study needs to consider the care and altruism in organizational climate to determine the influence mechanism of caring ethical climate and knowledge hiding. The scale includes 7 items such as ‘What is best for everyone in the company is a major consideration here’. The Cronbach’s alpha of the scale was 0.743.

(3) Robinson and Morrison provide a global assessment of organizational contract breach and violation. Rousseau for a short list of items. This study adopts the scale developed by Li and Guo (2006) to measure psychological contracts. This scale fully considers the influence of Chinese cultural background on the content and structure of employees’ psychological contracts and formed the scale of this study after necessary modification and deletion in combination with the context among employees in large construction firms. Including 20 items such as ‘This firm pays salaries and bonuses based on my work performance’. The Cronbach’s alpha of the scale was 0.942.

(4) Pearce and Gregersen’s scale estimates each employee’s perceptions of task interdependence. It focuses on its supervisors and coworkers rating these items. Liden’s scale assesses task interdependence at the individual level, but the conceptualization is at the group level (Vidarthi et al., 2014). It is

used to measure the degree of task interdependence among employees (Liden et al., 2006). Thus, task interdependence is measured using a scale developed by Liden et al. (1997). The scale included 3 items, such as: ‘I work closely with non-knowledge workers in doing my work’. The Cronbach’s alpha of the scale was 0.746.

In order to obtain more accurate research results and refer to previous research results, this research determines gender, age, educational background, and work tenure as control variables.

Results

This study uses the hierarchical regression method to verify the relationship among caring ethical climate, psychological contract, task interdependence, and knowledge hiding. AMOS 26.0 is used to analyze the discriminant validity of variables, and SPSS 26.0 is used for exploratory factor analysis, correlation analysis, and hierarchical regression analysis. The normality test is shown in Table 3. From Table 3, all constructs’ skewness/skewness standard error $\leq |1.96|$ & kurtosis/kurtosis standard error $\leq |1.96|$. Thus, the collected data satisfies the normality test.

Exploratory factor analysis. Firstly, this study uses SPSS 26.0 software to calculate the KMO value and Bartlett’s test of sphericity for the data from 413 respondents to see whether they meet the conditions for factor analysis. Through the calculation of the software, it is found that the KMO is 0.971, and Bartlett’s test of sphericity is 7612.003 (df = 561, $p < 0.001$), which meets the prerequisites for factor analysis (Watkins, 2018). In the exploratory factor analysis, this study uses the principal component method to extract factors and the maximal variance method to rotate, using the eigenvalue greater than 1 (Taherdoost et al., 2022), the factor loading is not less than 0.4 (Stevens, 2012), we explain that the total variance is 55.092%, and the internal coefficient Cronbach alpha value of each factor is above 0.7 (Shrestha, 2021). The results are relatively ideal. Table 4 lists the factor loading value of each item.

Reliability and validity analysis. The results of Bagozzi and Yi (1988), and Steenkamp and van Trijp (1991) showed that the convergent validity standard is achieved when the factor loading value of each dimension is significantly greater than 0.5 and the AVE value of each dimension is greater than 0.5, and when the AVE value is greater than 0.4, it is acceptable (Bagozzi and Yi, 1988). The factor loading of this study is greater than 0.5, and the AVE is greater than 0.4, which meets the requirements of convergent validity. Fornell and Larcker (1981) proposed that if the square root of the AVE value of each dimension is greater than the correlation coefficient between the dimension and other dimensions, the two concepts are considered to have good discriminant validity. As shown in Table 5, the correlation coefficients of each dimension in this study are less than the square root of AVE, so they had good discriminant validity.

Confirmatory factor analysis and common method biases. This study uses AMOS 26.0 to analyze the discriminant validity of variables. The results are shown in Table 6. The results show that the 4-factor model is superior to other models, indicating that caring ethical climate, psychological contract, task interdependence, and knowledge hiding have good discriminant validity.

This study uses Harman’s (1976) single-factor test to verify the common variance. The first factor without rotation explains 44.62% of the total variation, which is less than half of the total variation, indicating that the common variance of the data in this study is within the acceptable range.

Table 4 Results of exploratory factor analysis (N = 413).

Item	KH	CEC	PC	TI
KH1	-0.807			
KH2	-0.529			
KH3	-0.686			
KH4	-0.544			
CEC1		0.714		
CEC2		0.532		
CEC3		0.726		
CEC4		0.554		
CEC5		0.425		
CEC6		0.705		
CEC7		0.652		
PC1			0.416	
PC2			0.49	
PC3			0.492	
PC4			0.449	
PC5			0.531	
PC6			0.472	
PC7			0.43	
PC8			0.543	
PC9			0.481	
PC10			0.586	
PC11			0.646	
PC12			0.491	
PC13			0.402	
PC14			0.406	
PC15			0.522	
PC16			0.475	
PC17			0.468	
PC18			0.459	
PC19			0.51	
PC20			0.505	
TI1				0.486
TI2				0.528
TI3				0.421

Note: KH knowledge hiding, CEC caring ethical climate, PC psychological contract, TI task interdependence.

Table 5 Reliability and validity test (N = 413).

Construct	Items	Factor loading	AVE	CR	Cronbach's α
Knowledge hiding	1	0.568	0.4298	0.7494	0.74
	2	0.659			
	3	0.732			
	4	0.653			
Caring ethical climate	1	0.639	0.4152	0.8318	0.743
	2	0.66			
	3	0.652			
	4	0.542			
	5	0.696			
	6	0.654			
Psychological contract	7	0.657	0.4491	0.9419	0.942
	1	0.68			
	2	0.678			
	3	0.635			
	4	0.63			
	5	0.672			
	6	0.711			
	7	0.679			
	8	0.689			
	9	0.601			
	10	0.604			
Task interdependence	11	0.498	0.4979	0.7493	0.746
	12	0.681			
	13	0.685			
	14	0.745			
	15	0.701			
	16	0.67			
	17	0.737			
	18	0.66			
	19	0.719			
	20	0.685			
	1	0.726			
	2	0.713			
	3	0.677			

Regression analysis

Main effect analysis. It could be seen from M1 in Table 7 that when there are only control variables in the model, gender, age, and education are not significant for the knowledge hiding of the dependent variable. It could be seen from M2 in Table 7 that after the caring ethical climate of the independent variable is added to the model, the knowledge hiding of the dependent variable is significant. The caring ethical climate has a significant negative impact on knowledge hiding (Model 2: $\beta = -0.821, p < 0.001$), so H1 is verified.

Mediating effect analysis. This study mainly uses the three-step mediated regression approach proposed by Baron and Kenny (1986). Firstly, the influence of a caring ethical climate on knowledge hiding is significant ($\beta = -0.821, p < 0.001$), as shown in M2 in Table 7. Secondly, it examines the impact of caring ethical climate on psychological contract, as shown in M6 in Table 7, which is also significant ($\beta = 0.840, p < 0.001$); thirdly, the caring ethical climate and psychological contract are put into the model at the same time to test their influence on knowledge hiding, as shown in M3 of Table 7. At this time, the psychological contract has a significant influence on knowledge hiding ($\beta = -0.555, p < 0.001$), and the influence of a caring ethical climate on knowledge hiding is also significant ($\beta = -0.355, p < 0.001$), and this influence is smaller than that before adding psychological contract ($0.355 < 0.821$), which indicates that

psychological contract plays a partial mediating role between caring ethical climate and knowledge hiding. Further, this study uses the Bootstrap method to verify the significance of the mediation model. The results of Bootstrap also support this conclusion. The confidence interval of the indirect effect of caring ethical climate on knowledge-hiding behavior at the 95% confidence level is (LLCI = -0.8523, ULCI = -0.3699), excluding 0. Therefore, H2, H3, and H4 are supported by data.

Moderating effect analysis. As shown in Table 7, in order to test the moderating effect, model M1 is constructed with the control variable as the independent variable and the knowledge hiding as the dependent variable. Then, on this basis, model M4 is constructed with psychological contract and task interdependence as independent variables and knowledge hiding as dependent variables. On this basis, the interaction item 'psychological contract x task interdependence' is added as the independent variable, and the dependent variable is still knowledge hiding, so as to construct model M5. The study finds that the interaction term has a significant impact on knowledge hiding ($\beta = -0.368, p < 0.01$), which indicates that task interdependence positively moderates the relationship between psychological contract and knowledge hiding. As shown in the moderating effect of Fig. 2, the higher the task interdependence, the greater the positive impact of psychological contract on knowledge-hiding behavior, that is, H5 is supported.

Table 6 Discriminant validity and common bias test (N = 413).

	χ^2	df	χ^2/df	GFI	CFI	NFI	RMSEA
1-factor (KH + CEC + PC + TI)	911.239	521	1.749	0.885	0.946	0.884	0.043
2-factor (KH,CEC + PC + TI)	875.073	520	1.683	0.889	0.951	0.888	0.041
3-factor (KH,CEC + PC,TI)	814.305	518	1.572	0.894	0.959	0.896	0.037
4-factor (KH,CEC,PC,TI)	764.64	515	1.485	0.9	0.966	0.903	0.034

Note: KH knowledge hiding, CEC caring ethical climate, PC, psychological contract, TI task interdependence.

Table 7 Results of direct, mediating, and moderating effect test (N = 413).

	KH					PC
	M1	M2	M3	M4	M5	M6
Gender	-0.024	0.015	0.007	-0.004	-0.004	-0.015
Age	0.018	-0.009	-0.016	-0.027	-0.029	-0.013
Education	-0.011	0.009	0.009	0.021	0.025	-0.001
Work tenure	0.128*	0.043	0.02	0.003	0.001	-0.04
CEC		-0.821***	-0.355***			0.84***
PC			-0.555***	-0.446***	-0.261**	
TI				-0.457***	-0.271**	
PC x TI					-0.368**	
R ²	0.018	0.681	0.769	0.772	0.777	0.714
Adj.R ²	0.009	0.677	0.766	0.769	0.773	0.711

Note: *p < 0.05; **p < 0.01; ***p < 0.001. KH knowledge hiding, CEC caring ethical climate, PC psychological contract, TI task interdependence.

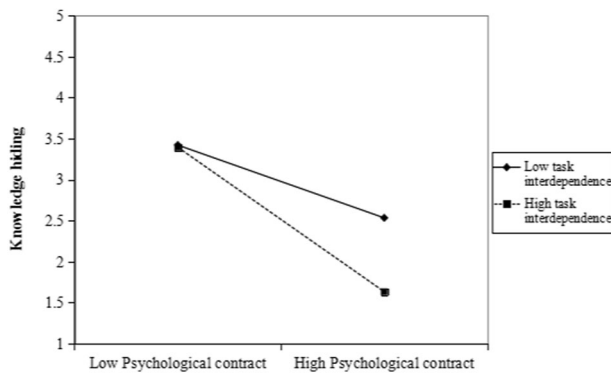


Fig. 2 Task interdependence as a moderator variable.

Discussion and conclusion

Discussion. This study aimed to test the mediating role of the psychological contract between caring ethical climate and knowledge hiding, and the moderating role of task interdependence between psychological contract and knowledge hiding in the Chinese context.

Firstly, the results reveal that a caring ethical climate inhibits knowledge-hiding behavior in large construction firms, which makes Chinese large construction firms pay more attention to building a caring ethical climate to enhance the willingness to share knowledge. When employees of construction firms are aware of the high ethical climate, then they identified their organization (Wang and Yen, 2023), and they will promote ethical behaviors such as caring for others and helping each other (Al Halbusi et al., 2021; Zhang and Sun, 2018), and then share unique knowledge and experience with others (Yang and Li, 2017).

The caring ethical climate emphasizes the principle of altruism (Zhu et al., 2022). Members of construction firms will consider the interests of other stakeholders while caring for their interests (Otake-Ebiede et al., 2020), try to minimize the disadvantage factors, and pursue the balance of interests of all parties. This climate makes employees reduce the behavior of knowledge hiding because of personal interests in Chinese large construction firms.

In addition, a caring ethical climate promotes the establishment of psychological contracts, which is valuable to large construction firms in China. Chinese psychological contract was characterized by mixed contracts aligning with the ideology of ‘Utilitarianistic Guanxi’, which combines the pursuit of profit with objective (Du and Vantilborgh, 2020). The research results indicate that construction firms strengthen humanistic care, create a caring working environment for employees and build a harmonious relationship among employees to help each other, to enhance the spirit of collectivism (Du and Vantilborgh, 2020; Zhu et al., 2022), moreover, to enhance the level of employee psychological contract perception (Wang, 2015). The management practice under the caring ethical climate pays attention to the care of employees, emphasizes mutual help and love among the members of large construction firms (Lin, 2011), and makes them produce strong emotional identity and internalization of organizational values by meeting the emotional needs of employees (Cheng and Wang, 2015), so as to establish a positive utilitarianistic guanxi between employees and organizations, and finally establish a psychological contract between employees and organizations (Coyle-Shapiro and Kessler, 2000; Du and Vantilborgh, 2020). With Confucianism being internalized, Chinese construction firms can be effectively and efficiently managed by Chinese psychological contracts (Kwon et al., 2018).

Besides, the psychological contract has a negative impact on knowledge-hiding behavior in construction firms (Jahanzeb et al., 2020). On one hand, knowledge is a high-value resource (Nguyen et al., 2022), and employees of large construction firms invest a lot of time and energy to acquire or accumulate in the early stage. When a psychological contract breach occurs (Siachou et al., 2021), in order to retaliate against the organization (Chih et al., 2016), the possibility of employees sharing their valuable knowledge resources within the organization will be significantly reduced, and the possibility of knowledge hiding will increase (Ruparel and Choubisa, 2020; Zhang and Huang, 2020). On the other hand, based on Chinese culture, Confucianism positively moderates the correlation between psychological contracts and individual responsibility (Kwon et al., 2018). In Chinese collectivism, the enhancement of other-centered personal responsibility has depressed knowledge-hiding behavior (Chae et al., 2019; Garg and Anand, 2020). The simulation results based on practical data from Chinese firms indicate that psychological contracts enhance internal relationships within organizations through collaborative satisfaction, which is called 'high quality of guanxi' (He, 2017). The high quality of guanxi reduces knowledge-hiding behavior (Tan et al., 2022). This result supports reasons analysis from a practical perspective.

The study found that psychological contract plays a mediating role in the relationship between a caring ethical climate and knowledge-hiding behavior in large construction firms. This conclusion is similar to the research conclusion of Zhao et al. (2021), who points out the mediating role of psychological contract in the relationship between union practice and organizational citizenship behavior, in which union practice includes caring for employees' life.

What's more, task interdependence positively moderates the relationship between psychological contracts and knowledge-hiding behavior in large construction firms. Based on the Chinese sample indicates that from the perspective of firm employees, task independence positively moderates the influence of helping behaviors on task performance achievement (Bachrach et al., 2007). They have confirmed the positive correlation between helping behavior and psychological contract (Coyle-Shapiro, 2002) and the negative correlation between knowledge-hiding behavior and performance (Zhang and Min, 2021). From the perspective of firm's leaders, task independence positively moderates the impact of empowering leadership on team creativity (Hon and Chan, 2013). The psychological contract of empowering leadership and employees reduce knowledge-hiding behavior and increases team creativity, which is moderated by task independence (Fong et al., 2018). Our study confirms the conclusion of this study from the perspective of knowledge-hiding behaviors. From the whole model, task independence negatively moderates the influences of a caring ethical climate on knowledge-hiding behavior. It is consistent with the conclusion that task independence negatively moderates the influences of an abusive supervision climate on team creativity in the Chinese context (Men et al., 2021). There is a significant difference between Chinese samples and US samples. The US samples indicate the influencing of task independence negatively moderating helping behavior on task performance (Bachrach et al., 2007).

Previous studies have shown that task interdependence has a positive moderating effect between team members' positive psychology and team cooperation behavior (Yang et al., 2012). Related studies have pointed out that task interdependence positively moderates the relationship between organizational identity and knowledge sharing (Huang and Liu, 2020). There is a certain overlap between psychological contract and organizational identification in emotional commitment, but organizational

identification is a kind of contract and responsibility of self-definition (Mostafa, 2018), which is a one-way relationship, and psychological contract is a two-way relationship of responsibility and obligation between members and organizations (Coyle-Shapiro et al., 2019). Although psychological contracts and organizational identification are different in the relationship between members and organizations (Kutaula et al., 2020), both of them can affect the behavior of members (Choi et al., 2022). Psychological contract reduces knowledge hiding (Luu, 2016), organizational identification increases knowledge sharing (Zhu, 2016), and task interdependence can positively moderate the relationship between them. Therefore, the research of Huang and Liu (2020) strengthens the confirmation of the conclusion of this study.

This study focuses on exploring the relationship between a caring ethical climate and knowledge-hiding behavior within large Chinese construction firms. Similar research conducted by Mohsin et al. (2022) targeted employees in SMEs, emphasizing the significant impact of workplace factors on employees' knowledge-hiding behavior, thereby further validating the results of this study. This partly reflects the prevalence of knowledge-hiding behavior, extending beyond solely large construction firms. However, distinct differences exist between large construction firms and SMEs. Large firms generally possess more abundant resources and capital, and undertake larger and more complex projects, thus demanding higher levels of project management and technical capabilities (Toor and Ogunlana, 2009). Consequently, this leads to more intricate organizational structures and management hierarchies that lean towards institutionalized and standardized management practices, lacking the closeness often found in SMEs. In contrast to the flatter organizational structures of SMEs, large construction firms may encounter obstacles in knowledge sharing due to their complex hierarchical structure, presenting additional challenges for employees (Chen and Fong, 2013). This complex environment further influences employees' tendencies towards knowledge-hiding behaviors.

Finally, it is found that in M1, the gender, age, and education of control variables have no significant effect on knowledge hiding, while work tenure affects knowledge hiding (Riaz et al., 2019; Yuan et al., 2020), while in M2-M6, work tenure has no significant effect on dependent variables. Previous studies have shown that work tenure may influence employees' knowledge behavior (Zhao et al., 2019). Therefore, it is important to control for these potential factors that may affect the measured variables.

Theoretical implication. This study makes theoretical contributions in three ways. This study expands previous research by discussing a caring ethical climate that affects knowledge-hiding behaviors and provides empirical support regarding the influence of knowledge hiding in the large construction firm's context (Zhang and Sun, 2020). Therefore, this study's first theoretical contribution to knowledge hiding is its establishment of the relationship between a caring ethical climate and knowledge hiding in large construction firms.

This research has provided theoretical implications to advance further the literature on the impact of organization factors such as caring ethical climate and psychological factors such as psychological contract on knowledge-hiding behavior (Bari et al., 2020; He et al., 2021). The second contribution is that this study empirically explores and explains why knowledge workers will reduce knowledge-hiding behavior when establishing psychological contracts with large construction firms. This process is based on the social exchange theory (Pradhan et al., 2019). This research, to some extent, indicates that managing

employees' psychological contracts may be a useful way to reduce knowledge hiding in large construction firms.

Finally, the findings enrich the knowledge-hiding literature by revealing a boundary condition for the impact of a caring ethical climate on knowledge hiding, and the study also addresses the latest request for more investigation of the link and benefits between organizational climate and knowledge management for employees and large construction firms. More specifically, this new insight provides additional insight into the existing theories of task characteristics by high-task interdependence to facilitate more cooperation and communication among employees (Shen et al., 2022), thereby preventing negative actions from resulting in negative consequences (Hua et al., 2021).

Practical implication. The research conclusion also has some guiding value for managers of large construction firms to effectively intervene in employees' knowledge-hiding behavior.

Create a caring ethical climate. The altruism principle of a caring ethical climate and the emphasis on mutual help among members of the organization create a good support environment for large construction firms, which can effectively affect the thinking mode, judgment ability, and work behavior of employees within the organization, 'allow' employees to share knowledge, reduce knowledge-hiding behavior, and enable large construction firms to effectively carry out knowledge management. The caring ethical climate increases the openness of employees, enabling more open communication and activities among employees and between employees and leaders, stimulating employees' internal motivation, thus affecting employees' initiative behavior and reducing employees' knowledge-hiding behavior in large construction firms.

Therefore, large construction firms should pay attention to the care of employees, be concerned about the interests of employees, and strive to create a caring ethical climate in the daily management practice.

Pay attention to the psychological contract management of knowledge workers. At present, Chinese large construction firms pay more attention to tangible contracts such as contracts and protocols, but generally ignore psychological contract management. This invisible contract is implicit (Conway and Briner, 2009), and not easily perceptible, and its management needs to be specifically formulated in the employee relationship management plan. The formation of a psychological contract is a gradual process. At the same time, large construction firms and employees are developing dynamically (Rousseau et al., 2018). The needs of both parties are not constant. Construction firms should take an active attitude, strengthen communication, and timely and dynamically understand the psychological needs of employees, to better achieve the dynamic balance of the psychological contract of employees in large construction firms, which can fully mobilize the enthusiasm and initiative of knowledge workers, stimulate organizational citizenship behavior, reduce the knowledge-hiding behavior of employees, maintain the firm's vitality, and establish the core competitiveness of firms.

The caring ethical climate effectively enhances the stability of employees' psychological contracts and provides a good organizational climate for knowledge sharing among employees, thus improving the efficiency of knowledge management and promoting the rapid development of firms to a certain extent. Therefore, we must pay attention to the large construction of psychological contracts, to provide employees with good benefits, to provide Glodon, CAD and other software learning and

constructor, cost engineer, and other qualification examination training. It has important practical significance in solving psychological contract problems.

Enhance task interdependence among employees. In the practice of organizational management, especially for typical knowledge-based firms such as large construction firms, while encouraging team members to share knowledge and avoid knowledge hiding, it is also necessary to improve the task interdependence of employees. Therefore, in the process of work design, large construction firms need to realize the importance of interaction within the team and coordination among members, attach importance to team building in large construction firms, form the concept of coordinated promotion of individual and team development, and enhance the interdependence of team members in the implementation of work and related supporting information and resources (Ahmad and Karim, 2019), so as to promote team knowledge sharing (Navimipour and Charband, 2016), make the connection between team members closer, and provide support for employees to reduce knowledge hiding and realize knowledge sharing in large construction firms.

In high-task interdependent environment, employees have the responsibility to share work-related knowledge, and cannot hide work-related knowledge, information, or skills, objectively forcing employees to carry out interpersonal interaction and knowledge exchange to complete tasks. Therefore, it is necessary to establish some kind of structural interdependence among employees in construction firms (De Clercq et al., 2015). For example, a high-task interdependence relationship (such as an apprenticeship) can be arranged by managers in large construction firms, which can prompt employees to reduce knowledge-hiding behaviors.

This research also guides the operations of SMEs. SMEs can integrate values of care, respect, and support for their employees into their organizational culture. This includes offering training, establishing transparent communication channels, providing developmental opportunities, and aiming to increase employees' trust and sense of belonging to the company, thereby reducing occurrences of knowledge-hiding behavior. Additionally, SMEs in the construction sector can employ incentive mechanisms, reward systems, or encourage teamwork to promote knowledge sharing and enhance cooperation and mutual assistance among employees. Leaders play a significant role in this process by becoming champions in establishing a caring ethical climate and motivating employees through their behavior and values.

At the government level, timely policy adjustments are crucial to support the development of SMEs. Governments can offer platforms for resource sharing, including technical training and management consulting, to assist SMEs in accessing more business resources, specialized knowledge, and market information, thereby enhancing their overall market competitiveness. Moreover, governments can improve legal regulations to safeguard the legitimate rights of SMEs, reduce the risks associated with entrepreneurship and operations, and create a more stable and favorable environment for their development. Furthermore, implementing policies more conducive to the development of SMEs, such as tax reduction policies, entrepreneurship support, and financing assistance, can alleviate the economic burden faced by these businesses.

Conclusion. Based on the reciprocity principle of social exchange theory, this study explores how caring ethical climate affects psychological contract, which in turn affects knowledge-hiding behavior, and analyzes the boundary conditions of these relationships from the perspective of task interdependence in the context of employees in large construction firms. Overall, our

analysis helps to further understand the mechanism of the relationship between organizational climate and knowledge hiding and confirms the importance of establishing a psychological contract between employees and large construction firms and improving task interdependence among employees.

Additionally, this study is not only applicable to large firms in China but also offers valuable insights for businesses in other countries. Through the conclusions drawn in this study, a deeper understanding of how different cultures and environments influence the ethical climate and its impact on employee behavior can be gained. International exchange of experiences and comparative learning will facilitate the enhancement and innovation of management practices among firms globally.

Limitations and future research. The ethical climate only considers the caring ethical climate, and the influence of other types of ethical climates, such as rule-based and instrument-based climates, on knowledge hiding needs further discussion.

Due to the dynamic nature of psychological contracts, psychological contracts will likely be violated. Then, will psychological contract violation have an impact on knowledge hiding? Future research should also examine whether psychological contract violation will damage knowledge hiding, in order to grasp the interaction between psychological contract and knowledge hiding more comprehensively and accurately.

This study explores the mediating role of psychological contracts with a holistic definition and does not explore whether there are differences in the mediation of specific types of psychological contracts, such as transactional and relational, etc.

In future research, the scope of the study will be expanded to include a representative sample of countries around the world, so that providing more empirical support for a comprehensive understanding of how to reduce knowledge-hiding behaviors. In addition, a comparative study of the differences between East and West cultures will be conducted in future research to enhance the generalizability of the study's findings.

Data availability

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy.

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Author contributions

The authors' contributions are as follows: ZC: conceptualization, writing—review and editing, supervision; ZT: methodology, writing—original draft, investigation, and analysis. All the authors have read and approved the final manuscript.

Competing interests

The authors declare no competing interests.

Ethical approval

The study's ethical approval was obtained from the Beijing University of Civil Engineering and Architecture (No. EA202205002). All research was performed in accordance with the 1964 Helsinki Declaration.

Informed consent

Informed consent was obtained from all individual participants included in the study. All individual participants received an Informed Consent Form before the questionnaire. This form explained the study's purpose and indicated that the questionnaire was anonymous. The questionnaire occurred in July 2022.

Additional information

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