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Choosing a better communication style: revealing the relationship between communication style and knowledge hiding behaviour

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In the era of the knowledge economy, knowledge hiding behaviour and its antecedents and consequences have been of great interest to the academic community. Through a survey of 350 employees of Chinese manufacturing enterprises, this paper explores the mechanism of organizational communication on employees' knowledge hiding behaviour. The results of the regression analysis show that (1) cooperative communication will reduce employees' knowledge hiding behaviour; in contrast, competitive communication will increase employees' knowledge hiding behaviour. (2) There is no significant relationship between online communication and employees' knowledge hiding behaviour. (3) Although online communication weakens the inhibitory effect of cooperative communication on employee knowledge hiding behaviour, it can alleviate employee knowledge hiding behaviour caused by competitive communication. This study reveals the association between communication styles and employees' knowledge hiding behaviour, which not only deepens the understanding of the antecedents of knowledge hiding in the academic community but also provides guidance for corporate internal communication and knowledge management practises.

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Introduction

In the era of open innovation, knowledge has become a key resource providing companies the ability to gain a competitive advantage, and information communication and knowledge sharing are important ways in which companies can make full use of this resource (Felin and Hesterly, 2007; Hayter, 2016). However, since the knowledge possessed by employees is not owned by the enterprise, the enterprise cannot force employees to share knowledge (Kelloway and Barling, 2000). A survey of 1700 incumbents showed that more than 3/4 of employees hide knowledge in response to inquiries from colleagues (Wang et al., 2019). Some studies have found that even when employees are encouraged to share knowledge by the implementation of a reward mechanism, this approach is often ineffective (Connelly et al., 2012; Cerne et al., 2014). In response to requests from colleagues, the first reaction of many employees is not to be willing to help but rather to hide knowledge through refusal and avoidance (Bock et al., 2005; Wang et al., 2019). Wittenbaum et al. (2004) claimed that the difficulty of knowledge sharing within an organization is due mainly to the inherent aversion to external things exhibited by human beings.

From the perspective of organizational behaviour, Connelly et al. (2012) defined knowledge hiding as “the behaviour of individuals who intentionally try to avoid or conceal knowledge requests from others”. Additionally, these authors divided this concept into three dimensions according to the characteristics of knowledge hiding behaviour, namely, refusal hiding, deafness hiding and reason hiding. Some studies have indicated that knowledge hiding behaviours may be not negative; for example, white lies can sometimes prevent conflicts in organizations (Saxe, 1991; Erat and Gneezy, 2012). However, conscious knowledge hiding inevitably hinders the normal circulation of information and knowledge within the organization, reduces the efficiency of enterprise operation and management and is not conducive to enterprise innovation activities (Wang et al., 2019; Connelly et al., 2012; Knoll et al., 2021). Based on a survey of enterprises in the Middle East, Arain et al. (2020) proposed that the impact of knowledge hiding on enterprises is negative over the long term, and sustainable growth can only be achieved by eliminating the limitations resulting from knowledge hiding behaviour.

Regarding the incentives for knowledge hiding in organizations, researchers have proposed the following three types of views. The first type holds that the occurrence of knowledge hiding is due mainly to the characteristics of knowledge itself. For example, Ko et al. (2005) found that when the complexity of the knowledge to be shared is too high, individuals tend to exhibit reluctance or impatience. Connelly et al. (2012) noted that employees are generally reluctant to share knowledge with low relevance to their work tasks. The second type of view highlights the fact that knowledge hiding is a direct response to dynamic interpersonal relationships. For example, Bari et al. (2022) found that when trust among organizational members is low, the probability of knowledge hiding behaviour is greatly increased. Similarly, the lack of interpersonal fairness also reduces individuals' willingness to share knowledge (Colquitt et al., 2002). The third type of view emphasizes that knowledge hiding within an organization is closely related to the overall climate of the organization. For example, Cerne et al. (2014) claimed that individuals might initially choose to engage in knowledge hiding due to objective factors. However, when feelings of avoidance and isolation from within the organization are frequently felt, a vicious cycle of knowledge hiding can emerge. Although the literature has explored the motivation for knowledge hiding from multiple dimensions, it has not explored the potential impacts of the methods used to facilitate sharing and communication among individuals on knowledge hiding. In fact, psychological studies

have indicated that when the seeker asks a question in a domineering manner, the other party often chooses to hide the corresponding information even if they know the answer (Bock et al., 2005; Serenko and Bontis, 2016). In contrast, when both parties communicate in a harmonious way, the intention to hide knowledge is significantly reduced (Yue et al., 2020; De Clercq et al., 2022). In addition, some scholars have found that, in many cases, words that cannot be spoken face to face can be transmitted through online communication or indirect communication (Butler, 2001; Zhang and Venkatesh, 2013). Therefore, it can be speculated that certain communication styles and methods may also trigger knowledge hiding behaviours within organizations.

To address the gap in the existing research, this paper constructs a theoretical model of the relationship between organizational communication and employees' knowledge hiding behaviour. Specifically, we focus on the direct effects of two common communication styles (i.e., cooperative communication and competitive communication) on employees' knowledge hiding behaviour and the moderating effect of online communication on these relationships. The relevant results can not only expand our knowledge regarding the incentives for knowledge hiding behaviour in organizations but can also provide guidance to enterprises in how to practice personnel communication and manage knowledge.

Literature review and hypothesis development

The definition of knowledge hiding. Exploring knowledge sharing has increased researchers' awareness of knowledge hiding. However, earlier studies regarded knowledge hiding only as the opposite of knowledge sharing and did not pay much attention to this topic (Husted and Michailoa, 2002; Wittenbaum et al., 2004). These studies usually defined employees' knowledge hiding behaviour in terms of their willingness to share knowledge when analysing tacit knowledge management in organizations. Obviously, this definition weakens the subjectivity and intentionality of knowledge hiding. Subsequently, a more reasonable and thorough definition of knowledge hiding was proposed by Connelly et al. (2012) based on a literature review. Since that time, numerous studies have examined the connotations and antecedents of knowledge hiding from multiple dimensions. For example, some scholars have defined knowledge hiding as the act of deliberately choosing to retain or conceal knowledge when an individual receives an inquiry or request from others; furthermore, they have claimed that thinking in moderation can effectively inhibit the occurrence of knowledge hiding behaviour (Serenko and Bontis, 2016; Wang et al., 2019). Other studies have emphasized that knowledge hiding is not only a static knowledge retention behaviour at the individual level but also a dynamic knowledge hiding behaviour at the group or collective level (Arain et al., 2022; Bari et al., 2022). Accordingly, scholars have constructed a multilevel theoretical model of knowledge hiding that includes both individual and group dimensions. In addition, several studies have focused on the differences between the connotations of knowledge hiding and those of knowledge sharing; these studies have highlighted the fact that knowledge sharing and knowledge hiding are not completely opposite and that they exhibit certain distinctions in terms of their mechanisms of action (Gagné et al., 2019; Cerne et al., 2014). In this context, knowledge sharing is driven mainly by individual factors, while knowledge hiding is more affected by perceptions of the group atmosphere. Additionally, a group of researchers explored the nature of knowledge hiding. These researchers claimed that although knowledge hiding is a conscious behaviour on the part of an individual, its original intention is not always malicious, and

sometimes the good intentions associated with knowledge avoidance may be aimed at sparing the inquirer's feelings (Serenko and Bontis, 2016; Connelly et al., 2012).

In addition to the incentives for knowledge hiding, some scholars have focused on exploring the consequences of knowledge hiding. For example, several studies have proposed that intentional knowledge hiding and avoidance behaviours could create a sense of distrust among employees (Cerne et al., 2014; Wang et al., 2019). This sense of distrust can ferment within the organization, resulting in serious repercussions, which can hinder the enterprise's knowledge absorption and knowledge transfer. In addition, other studies have shown that knowledge hiding among groups and organizations might weaken members' willingness to communicate and reduce the overall cohesion of the team, having a negative effect on innovation activities (Duan et al., 2022) and task performance (Singh, 2019). Based on this literature review, knowledge hiding, as a conscious behaviour associated with knowledge retention and avoidance, has negative effects on the overall operation and management of enterprises. Therefore, the tasks of exploring the antecedents of knowledge hiding and preventing this behaviour at the root have important management significance.

Communication and knowledge management in organizations.

In a broad sense, organizational communication refers to the process of knowledge and information transmission within an organization (Butler, 2001). Such communication enables individuals to interact with other members of knowledge based on work goals and tasks (Deng and Zheng, 2008). Based on different directions of such communication, Ruck and Welch (2012) subdivided organizational communication into upwards communication, downwards communication, peer communication and interactive communication. Based on the channel perspective, Singh et al. (2013) identified two main channels of organizational communication: direct communication and indirect communication. Paulraj et al. (2008) explored organizational communication from the perspective of content and defined the connotations of task-based communication, innovative communication, normative communication, and information-based communication. Some scholars have divided organizational communication into oral communication, written communication, and nonverbal communication (including gestures, expressions, etc.) according to differences in form (Liu, 2015; Mohr and Sohi, 1995). Through a variety of communication methods, knowledge and information can be effectively transferred within the organization.

Previous studies have shown that enterprises that adopt reasonable and effective communication strategies exhibit significantly improved efficiency in terms of knowledge management and knowledge transfer (Deng and Zheng, 2008; Ruck and Welch, 2012). Based on this view, Lovelace et al. (2001) discussed organizational communication from the perspective of style. These authors noted that any form of organizational communication can be classified into two categories, namely, cooperative communication and competitive communication. Cooperative communication embodies an equal and interactive interpersonal relationship that emphasizes the unity of the opinions of all parties in the process of communication with the aim of achieving the greatest satisfaction. In contrast, competitive communication is more compulsive. In the process of communication, the stronger party often uses power and threats to force the other party to compromise. Based on a survey of workplace situations, Saruhan (2014) found that cooperative communication had greater positive effects on knowledge management and knowledge dissemination than competitive communication. Cooperative communication

can effectively enhance the sense of fairness within the organization. Harrison and Doerfel (2006) noted that both cooperative communication and competitive communication were essential for enterprise knowledge management, and significant differences were observed between the roles of those two forms of communication in different situations. Dahl (2014) claimed that cooperative communication and competitive communication were not in opposition to one another and that they had a certain complementary effect on the role of enterprise knowledge transfer. Although the literature has examined the impacts of cooperative communication and competitive communication on knowledge management in terms of different dimensions, most of these studies have been limited to the relationships between these two communication styles and knowledge transfer. Given that both cooperative communication and competitive communication are closely related to organizational climate (Saruhan, 2014; Harrison and Doerfel, 2006), knowledge avoidance and knowledge hiding behaviours are also affected by the relationships among and emotions exhibited by members of the organization (Cerne et al., 2014). Therefore, it can be inferred that communication style is likely to influence employees' knowledge hiding behaviour.

In addition, due to the development of internet technology, organizational members are no longer limited to traditional offline communication, and email and social platforms have gradually become important channels for organizational communication (Zhang and Venkatesh, 2013; Azaizah et al., 2018). Due to the influence of COVID-19, many companies have been forced to work online, which further promotes the popularity of online communication in corporate management. Unfortunately, only a few scholars have explored the impact of online communication on the efficiency of knowledge and information transfer from an internal perspective. Zhang and Venkatesh (2013) found a significant complementary effect between online communication and offline communication and reported that online communication could effectively reduce the intention to engage in knowledge hiding. Palacios-Marques et al. (2015) noted that online communication, as a noncontact method of communication, could instil a sufficient sense of security in communicators, which could further affect communication among employees and the knowledge transfer efficiency of organizations. Although the literature mentioned above can expand the academic community's understanding of the relationship between online communication and knowledge management, it still cannot answer the question of whether this communication method induces knowledge hiding. Therefore, this study constructs a theoretical model of the relationship between organizational communication and the knowledge hiding behaviour of employees to explore the influence of communication style and methods on knowledge hiding behaviour.

Hypothesis development

Cooperative communication and knowledge hiding behaviour. Cooperative communication exhibits the characteristics of strong inclusiveness and a high degree of participation. This communication style can absorb very different viewpoints and integrate them effectively (Lovelace et al., 2001; Liu, 2015). Although previous research has not directly explored the association between cooperative communication and knowledge hiding behaviour, many studies have suggested that there may be a negative relationship between these two factors. By examining the characteristics of organizational information networks, Saruhan (2014) found that inclusive communication methods can maintain employees' willingness to share knowledge and promote the formation of a sense of fairness within the enterprise. Therefore, in this environment, employees rarely hide their knowledge and

ideas intentionally. Hsu and Chang (2014) analysed this topic from the perspective of interpersonal relationships. These authors noted that a harmonious communication atmosphere helps cultivate trust among employees and that this trust is an important condition for alleviating the behaviour associated with interpersonal knowledge hiding. Some scholars have emphasized that cooperative communication is a highly participatory knowledge exchange activity, in which context employees can clearly feel the value of their own ideas regarding corporate decision-making. As a result, they share their knowledge more openly (Harrison and Doerfel, 2006; Chiang and Chen, 2021). Based on this literature review, it can be speculated that cooperative communication effectively inhibits knowledge hiding behaviour within the organization. Although a small number of studies have reported that a harmonious and inclusive communication style and organizational climate may increase the occurrence of white lies, this is not common in the process of knowledge transfer (Saxe, 1991; Erat and Gneezy, 2012). Accordingly, this study proposes the following hypothesis:

Hypothesis 1: Collaborative communication reduces employees' knowledge hiding behaviour.

Competitive communication and knowledge hiding behaviour. Unlike cooperative communication, competitive communication exhibits a commanding and coercive character, and this communication style often culminates in the weaker party surrendering or compromising (Lovelace et al., 2001). Although competitive communication is more efficient than cooperative communication and can reach a conclusion quickly, it is difficult to reach a conclusion that satisfies the desires of most members of the organization (Liu, 2015). Previous studies have shown that the excessive use of authority in competitive communication leads to the formation of a sense of inequality within the group (Dahl, 2014) and that this sense of inequality is one of the main incentives for knowledge hiding. In addition, in the context of competitive communication, lower-level employees cannot speak in the context of organizational decision-making, which may dampen employees' self-efficacy and weaken their organizational commitment (Han et al., 2021). In this working environment, employees may adopt a negative attitude towards organizational communication and knowledge exchange, which can lead to the emergence of knowledge hiding behaviours. From the perspective of climate perceptions, Cerne et al. (2014) explored the effect of motivation-based and performance-based climate perceptions on knowledge hiding behaviour. These authors found that when an organization communicates in a command-and-control manner, this communication generates perceptions of a performance climate among employees, thus increasing their knowledge hiding. Harrison and Doerfel (2006) also claimed that the competitive type of information exchange is not conducive to the absorption and transformation of knowledge in the organization and can even force employees to retain their own knowledge, thereby hindering the diffusion and transfer of knowledge. Based on the theoretical conclusions discussed above, we speculate that there may be a positive correlation between competitive communication and knowledge hiding. Therefore, this study proposes the following hypothesis:

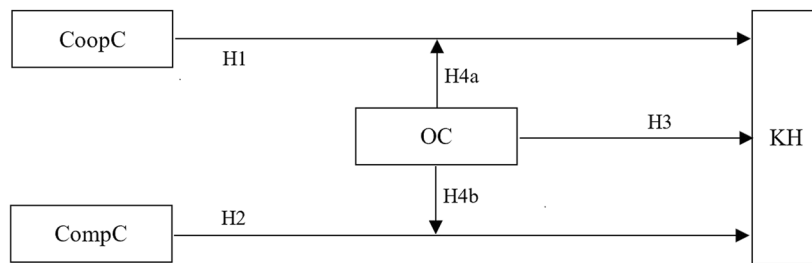
Hypothesis 2: Competitive communication increases employees' knowledge hiding behaviour.

The direct effect of online communication on knowledge hiding behaviour. In the era of 'Internet +', various online communication tools have become indispensable elements of information exchange within an organization. However, in the research on information management and knowledge management, relatively few studies have focused on the impact of online

communication on enterprise knowledge behaviour, and many scholars have viewed online communication as technological progress while ignoring its potential effect on corporate knowledge management (Butler, 2001; Zhang and Venkatesh, 2013). Some studies have claimed that online communication cannot convey individual emotions and body language effectively, thus impacting the effect of knowledge exchange (Matzat, 2010; Ramirez and Zhang, 2007). This situation is also the main reason online communication cannot replace face-to-face communication. However, due to the development of information technology, the method of online communication is no longer merely word communication. The emergence of new functions such as voice and video communication, live broadcasting, and virtual reality has greatly increased the convenience of online emotional transmission (Caspi and Etgar, 2023). Azaizah et al. (2018) found that the frequency of knowledge exchange and the efficiency of knowledge transfer are significantly higher in companies that employ online communication than in those that do not. This finding shows that online communication can effectively reduce employees' knowledge hiding behaviour and enhance their job performance (Gao et al., 2019). Based on a survey of organizational communication networks, Zhang and Venkatesh (2013) noted that online communication can help alleviate the resistance that might arise during face-to-face communication, thereby reducing the possibility of employees engaging in knowledge hiding. Butt (2020) analysed the positive effect of online communication from the perspective of management strategy, claiming that informal communication and online communication can greatly weaken the sense of power distance among members of the organization, which can in turn significantly improve the willingness of managers to communicate and the efficiency of such communication as well as reduce the phenomenon of knowledge avoidance resulting from pressure. Based on the literature mentioned above, it can be speculated that although online communication may reduce the effect of knowledge transfer, it can effectively inhibit knowledge hiding among employees. Based on an analysis conducted in the Chinese management context, Jin et al. (2020) found that the power distance among members of Chinese enterprises was relatively large, which led to a low level of willingness to share knowledge directly between leaders and employees. These authors claimed that in a high-level distance environment, employees' knowledge hiding behaviour can be prevented through informal communication and online communication. Accordingly, this study proposes the following hypothesis:

Hypothesis 3: Online communication reduces employees' knowledge hiding behaviour.

The moderating effect of online communication. As a contactless communication method, online communication not only directly affects interpersonal knowledge activities but may also influence the effectiveness of other communication methods. Based on team-level research, Wood and Smith (2004) found that although online communication increases the convenience of information exchange among members, it is difficult to form a mutually stimulating communication atmosphere in this context. Therefore, this approach is not a good communication style for teams that value cooperative communication. Ramirez and Zhang (2007) claimed that communication through online tools, such as social networks and e-mails, often fails to elicit an effective response on the first occasion, which makes it difficult for organizations to obtain consistent opinions through online communication. Matzat (2010) demonstrated that online communication might limit the positive effect of cooperative communication on knowledge transfer due to the lack of emotional interaction it entails. Saruhan (2014) further noted that although cooperative



Notes: CoopC denotes cooperative communication; CompC denotes competitive communication; OC denotes online communication; KH denotes knowledge hiding.

Fig. 1 Theoretical model. This figure shows the whole theoretical model and the main hypotheses of the study.

communication can improve the enthusiasm of employees for sharing knowledge and reduce the probability of knowledge hiding, these benefits are based on harmonious interaction among organizational members. Given that the effect of cooperative communication is largely limited by the rapport among members, online communication is not conducive to the cultivation of such a benign relationship. Therefore, it can be speculated that online communication may weaken the inhibitory effect of cooperative communication on knowledge hiding behaviours.

The induction of knowledge hiding by competitive communication is mainly due to the sense of unfairness resulting from the suppression of authority and power distance. According to Butt (2020), online communication is an important way to weaken the sense of distance within an enterprise. From this perspective, online communication helps reduce the knowledge hiding behaviours caused by competitive communication. In fact, as in the case of cooperative communication, the effect of competitive communication on knowledge exchange is also affected by the emotions of both parties during the communication process. If the emotional interaction between the two parties is too intense, it may directly lead to communication failure (Lovelace et al., 2001). Online communication can effectively alleviate emotional conflict in the process of competitive communication. Therefore, it can be speculated that online communication is an important way to reduce the probability of knowledge hiding in the process of competitive communication. Fisher (2019) confirmed this speculation, finding that companies that focus on online communication experience significantly fewer conflicts during the communication process than companies that employ offline communication only. Ma et al. (2020) found that although online communication cannot improve the emotional relationships among employees, it can curb the rapid spread of negative emotions at work. This approach helps alleviate the knowledge avoidance and concealment caused by competitive communication. Accordingly, this study proposes the following hypotheses:

Hypothesis 4a: Online communication weakens the inhibitory effect of cooperative communication on employees’ knowledge hiding behaviour.

Hypothesis 4b: Online communication alleviates the inducing effect of competitive communication on employees’ knowledge hiding behaviour.

Based on the theoretical analysis and the research hypotheses, this paper constructs a conceptual model, as shown in Fig. 1.

Design and method

Data collection. Since organizational communication and knowledge hiding behaviour are latent variables, this study used scales to measure the main variables, and relevant data were collected using questionnaires. To ensure the content validity of

the measurement tool, we not only drew on the literature but also consulted 3 experts in the field of organizational behaviour and knowledge management as well as 5 middle managers working in the field of human resource management. After the initial questionnaire design was completed, 30 middle and senior managers were selected from the MBA students at the college to conduct a pilot survey. These students were asked to evaluate the rationality of the questionnaire design and the accuracy of the language. The results indicate that the design and expression of the questionnaire are reasonable and effectively convey the intention of the survey.

To improve the effectiveness of the questionnaire survey, we first selected several target cities, such as Beijing, Shanghai, Guangzhou, and Wuhan. These cities are in different regions of China and exhibit relatively high levels of economic development. Therefore, the companies in these target cities have sufficient diversity and representativeness and can effectively reflect the actual circumstances of corporate management in China. Subsequently, with the support of the network of the research team, we contacted 200 companies operating in various industries and invited them to participate in our survey. Ultimately, 147 companies expressed their willingness to participate in this survey. Given the possibility of common method bias in the question answering process, this study employed a two-stage survey design for data collection. In the first stage of the survey (April 2021), we selected 3–5 employees from each participating company and asked them to answer questions related to cooperative communication, competitive communication, and online communication. To improve the recovery rate of the questionnaires, a contact person was selected in each participating company and given basic guidance and training. The first stage of the survey lasted 13 days; 650 questionnaires were distributed, and 499 questionnaires were recovered. After further quality screening, 476 valid questionnaires were retained, for an effective recovery rate of 73.2%. In the second stage of the survey (July 2021), we contacted employees who provided valid responses in the first stage and asked them to answer questions related to knowledge hiding behaviour. During the two-stage survey, employees were required to give feedback concerning the basic information of both individuals and companies. By comparing the two responses, the validity of the questionnaire data can be further reviewed. The second stage of the survey lasted 9 days; 476 questionnaires were distributed, 363 questionnaires were recovered, and 350 valid questionnaires were obtained after excluding the questionnaires that failed the quality inspection, for an effective recovery rate of 73.5%. Overall, this survey generated 350 valid data points drawn from 91 companies, which met the basic requirements for the sample size of empirical research. The basic information of the respondents and their companies is shown in Table 1.

Table 1 Descriptive statistics.

Variables	Category	Quantity	Percent	Variables	Category	Quantity	Percent
Gender	Male	144	41.1	Firm size (employee number)	Under 10	5	1.4
	Female	206	58.9		11-50	44	12.6
Age	18-25	62	17.7	51-200	132	37.7	
	26-35	197	56.3	201-500	82	23.4	
	36-45	70	20.0	Over 500	87	24.9	
	Over 46	21	6.0	Firm age	Under 2 years	6	1.7
Education	Under college	49	14.0		3-5 years	49	14.0
	Undergraduate	270	77.1		6-10 years	103	29.4
	Master	22	6.3		11-25 years	134	38.3
	Doctor	9	2.6	Over 25 years	58	16.6	
Working years	1-3 years	87	24.9	Firm ownership	State-owned	100	28.6
	4-6 years	140	40.0		Private	201	57.4
	7-10 years	82	23.4		Foreign	40	11.4
	Over 10 years	41	11.7		Others	9	2.6
Positions	Employee	124	35.4	Industry	Information and Communication	104	29.7
	Lower manager	138	39.4		Materials and Chemicals	53	15.1
	Middle manager	66	18.9		New energy	52	14.9
	High manager	22	6.3		Others	141	40.3

Variable measures. This study mainly includes variables such as competitive communication, cooperative communication, and employee knowledge hiding. To ensure the content validity of the scale, the translation/back-translation method was used to translate mature scales in the extant literature, and only a few items were processed to render them suitable for the Chinese management context. The specific items included in each scale are shown in Appendix 1 (see Supplementary Information).

Regarding the measurements of cooperative communication and competitive communication, this study referred to the scale developed by Lovelace et al. (2001). In addition, in the process of translation and design, we drew on the question expression method developed by Mao (2008) and ultimately obtained a scale featuring 11 items. Regarding the measurement of online communication, based on the definition and classification of online communication methods provided by Zhang and Venkatesh (2013), this study designed a scale featuring three items based on the perspectives of email, social media, and online meetings. With respect to the measure of knowledge hiding behaviour, Connelly et al. (2012) developed a 12-item scale consisting of three dimensions: declarative hiding, deafness hiding, and reasoning hiding. However, in the pilot survey, we found that some items exhibited a high degree of content overlap, which might cause some confusion among the respondents. Accordingly, this study further referred to the practice of Wang et al. (2019), streamlined and optimized the original items, and ultimately obtained a scale consisting of 6 items.

In addition, given that the communication style and knowledge hiding behaviour of organizational members may be affected by other factors, this study further included the following control variables. At the firm level, drawing on the views of Wang and Jiang (2020), firm size, firm age, ownership, and industry characteristics were used as control variables. In this context, firm size and firm age were included as degree variables, while ownership and industry characteristics were dummy variables. At the individual level, referring to the practice of Wang et al. (2019), gender, age, education, and job position were included as control variables. In this context, gender took the form of a dummy variable, while the other three were included as degree variables. The mean, standard deviation and correlation coefficient of each variable are shown in Table 2.

Analysis and results

Reliability and validity. To test the reliability of the questionnaire data in further detail, this study used SPSS 25.0 software to conduct reliability analysis on constructs such as cooperative communication, competitive communication, online communication, and knowledge hiding behaviour. Referring to the extant research paradigm, we used Cronbach's α coefficient to determine whether the reliability of the scale met the requirements. According to the results shown in Table 3, the Cronbach's α of each construct is higher than 0.7, the CITC value of most items is higher than 0.5, and the Cronbach's α coefficient after deleting the item is significantly lower than the Cronbach's α coefficient of the corresponding construct. These findings indicate that the measurement of each construct exhibits high internal consistency and that the reliability of the scales meets the requirements for data analysis.

Since the measurement indicators of this study were all derived from previously developed mature scales, content validity can be guaranteed. Accordingly, we constructed a structural model for the research variables and used confirmatory factor analysis to examine the structural validity of each variable. Table 3 shows that the factor loading coefficient between each item and the corresponding construct is higher than 0.5 and significant at the level of 0.001, indicating that the construct validity of each scale meets the basic standards for data analysis. In addition, we determined the discriminant validity among the scales by comparing the AVE of each variable with the squares of the correlation coefficients among the variables. As shown in Tables 2 and 3, all squares of the correlation coefficients among the variables are less than the AVE of the corresponding variable, indicating that the scales exhibit sufficient discriminant validity.

Other data tests. This study used a two-stage method to collect data. Although this method can reduce the homology bias of the questionnaire survey, it may also lead to a lack of consistency in the overall data. Accordingly, we used variance analysis to test this problem. First, 50 observations were randomly drawn from the data collected during the two stages. Second, we conducted variance analysis and compared the personal information and enterprise information between the two subsamples. The results showed that the differences in the F value of each index between the two samples were not significant, thus guaranteeing the quality of the data used in this study.

Table 2 Correlation coefficient matrix.

	1	2	3	4	5	6	7	8	9	10	11	12
1. CoopC	1											
2. CompC	-0.454**	1										
3. OC	-0.119*	0.297**	1									
4. KH	-0.438**	0.731**	0.238**	1								
5. FS	0.057	-0.092	-0.096	-0.098	1							
6. FA	0.131*	-0.054	0.036	-0.189**	0.423**	1						
7. Ownership	0.013	0.003	-0.037	-0.053	0.325**	0.264**	1					
8. Industry	0.159**	-0.105	-0.106*	-0.014	0.039	0.054	0.007	1				
9. Gender	0.137*	-0.033	-0.077	0.044	0.094	-0.022	-0.079	0.119*	1			
10. Age	0.140**	-0.105*	-0.135*	-0.163**	0.155**	0.335**	0.131*	0.057	0.055	1		
11. Education	0.041	0.005	-0.081	-0.016	0.111*	0.067	0.196**	0.099	0.067	-0.027	1	
12. Position	0.254**	-0.097	-0.111*	-0.056	0.046	0.119*	0.126*	0.129*	0.148**	0.205**	0.285**	1
Mean	5.518	2.657	5.390	2.203	3.580	3.540	0.290	0.550	0.410	1.970	1.930	1.790
Standard error	0.834	1.088	0.738	1.004	1.040	0.983	0.452	0.498	0.493	0.607	0.458	0.716

CoopC cooperative communication, CompC competitive communication, OC online communication, KH knowledge hiding, FS firm size, FA firm age.
*Significance at the level of 0.05; **significance at the level of 0.01.

Table 3 Reliability and validity.

Variables	Items	CITC	Cronbach's α after deleting the item	Cronbach's α	AVE	Factor loadings
Cooperative communication (CoopC)	CoopC1	0.681	0.775	0.823	0.539	0.811
	CoopC2	0.637	0.785			0.769
	CoopC3	0.680	0.775			0.812
	CoopC4	0.498	0.820			0.591
	CoopC5	0.502	0.819			0.609
	CoopC6	0.647	0.783			0.778
Competitive communication (CompC)	CompC1	0.532	0.839	0.842	0.615	0.687
	CompC2	0.691	0.799			0.819
	CompC3	0.683	0.800			0.812
	CompC4	0.654	0.810			0.787
	CompC5	0.684	0.800			0.809
Online communication (OC)	OC1	0.726	0.720	0.827	0.744	0.887
	OC2	0.690	0.755			0.867
	OC3	0.638	0.807			0.833
Knowledge hiding (KH)	KH1	0.694	0.870	0.887	0.644	0.795
	KH2	0.687	0.871			0.788
	KH3	0.709	0.867			0.805
	KH4	0.775	0.857			0.857
	KH5	0.645	0.877			0.753
	KH6	0.719	0.865			0.812

CITC Corrected Item-Total Correlation.

Additionally, we investigated whether there was collinearity among the variables by examining the value of the variance inflation factor (VIF). The calculation results show that the VIF value corresponding to each variable does not exceed the reference value of 5, thus indicating that there is no serious multicollinearity problem regarding the variables used in this study.

Hypothesis testing. In this study, regression analysis was used to test the hypotheses, and the results are shown in Table 4. Considering the need to test the moderating effects, we conducted centralized processing for the interaction terms before determining model fit to avoid potential issues with multicollinearity. Based on the regression results of Model 1, when the control variables are introduced into the model, only the regression coefficients of employee age and firm age are significant at the levels of 0.1 and 0.05, respectively, whereas the coefficients of the other control variables are not significant. Furthermore, the R^2 of Model 1 is only 0.051, and the corresponding F value is not significant; thus, the overall effect of the control variable on

knowledge hiding behaviour is small. Employee age and firm age have certain inhibitory effects on knowledge hiding behaviour, indicating that knowledge hiding or knowledge avoidance behaviour gradually decreases as individuals and enterprises mature. This finding is consistent with Connelly et al. (2012).

Model 2 examines the direct effects of cooperative and competitive communication on knowledge hiding behaviour. According to the regression results, the coefficient of cooperative communication is -0.176 , which is significant at the level of 0.01, indicating that cooperative communication can effectively alleviate knowledge hiding behaviour among employees. Therefore, Hypothesis 1 is confirmed. In contrast, the coefficient of competitive communication is 0.619, which is also significant at the level of 0.01, indicating that competitive communication increases the probability of knowledge hiding within the enterprise. Thus, Hypothesis 2 is confirmed.

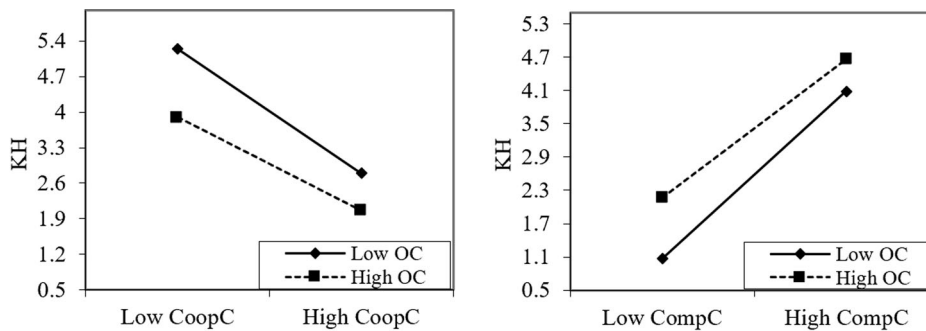
Model 3 introduces online communication to examine its direct impact on knowledge hiding. The fitting results show that the regression coefficient between online communication and

Table 4 Results of regression analysis.

	Model 1	Model 2	Model 3	Model 4	Model 5
Gender	0.113	0.133*	0.136*	0.169*	0.115
Age	-0.185*	-0.086	-0.076	-0.079	-0.064
Education	-0.014	-0.079	-0.073	0.011	-0.059
Position	-0.031	0.085	0.088*	0.090	0.037
FS	-0.030	0.033	0.037	0.017	0.051
FA	-0.141**	-0.137***	-0.143***	-0.129**	-0.136***
Ownership	0.037	-0.042	-0.041	-0.010	-0.051
Industry	-0.005	0.153**	0.158**	0.093*	0.131*
CoopC		-0.176*** (-3.562)	-0.179*** (-3.614)	-2.143 *** (-6.320)	
CompC		0.619*** (16.958)	0.607*** (16.029)		1.380*** (6.480)
OC			0.062 (1.211)	-1.438*** (-3.990)	0.419*** (3.520)
CoopC × OC				0.309*** (4.850)	
CompC × OC					-0.131*** (-3.400)
R ²	0.051	0.585	0.587	0.320	0.584
Adjusted R ²	0.028	0.573	0.573	0.298	0.571
F value	2.271	47.746***	43.598***	14.440***	43.270***

The meaning of the abbreviations is the same as that in Table 2. CoopC × OC denotes the interaction of CoopC and OC, CompC × OC denotes the interaction of CompC and OC. *t* values are listed in the parentheses.

*Significance at the level of 0.1; **significance at the level of 0.05; ***significance at the level of 0.01.



Notes: CoopC denotes cooperative communication; CompC denotes competitive communication; OC denotes online communication; KH denotes knowledge hiding.

Fig. 2 Comparison of the moderating effect of online communication. This figure shows the moderating effect of online communication on the relationship between two communication styles and knowledge hiding behaviour.

knowledge hiding behaviour is not significant, thus indicating that online communication does not have a direct impact on knowledge hiding behaviour among employees. Therefore, Hypothesis 3 is not confirmed. Models 4 and 5 further introduce the interactions between the two types of communication styles (i.e., cooperative communication and competitive communication) and online communication to test the moderating effects. According to the results, the coefficient of the interaction of cooperative communication and online communication is 0.309, which is significant at the level of 0.01, thus indicating that online communication weakens the inhibitory effect of cooperative communication on knowledge hiding behaviour. Thus, Hypothesis 4a is confirmed. The coefficient of the interaction of competitive communication and online communication is -0.131, which is also significant at the level of 0.01, reflecting the fact that online communication can alleviate the inducing effect of competitive communication on knowledge hiding among employees. Therefore, Hypothesis 4b is also confirmed.

Further analysis. Based on the results of the regression analysis, several implicit conclusions can also be drawn. First, by comparing the regression coefficients and *t* values of cooperative communication and competitive communication in Model 2, the

inducing effect of competitive communication on knowledge hiding behaviour is stronger than the inhibitory effect of cooperative communication on knowledge hiding behaviour. Accordingly, the key to mitigating knowledge hiding behaviour among employees is to avoid competitive communication. Second, in Model 4 and Model 5, although the two interaction coefficients are significant, the *R*² values of the two models are both lower than the *R*² of Model 3, indicating that cooperative communication and competitive communication are not incompatible and that they usually coexist in most Chinese companies. In addition, the directions of the two moderating effects are opposed to one another, which further reflects the double-edged sword effect of online communication on corporate knowledge management.

To reflect the moderating effect of online communication, this study referred to split-plot analysis and drew linear diagrams of the relationships between the two communication styles and knowledge hiding behaviours under conditions of both high- and low-intensity online communication. Figure 2 shows that under the condition of high-intensity online communication, the fitting lines of the two communication styles and knowledge hiding behaviour are both flattened, indicating that online communication weakens these two relationships, which is consistent with the results of the data analysis.

Discussion and conclusion

Research findings. Based on an investigation of organizational communication style and employees' knowledge hiding behaviour, this study examines the direct effects of cooperative communication, competitive communication and online communication on knowledge hiding behaviour and reveals the moderating effect of online communication. After the construction of the conceptual model as well as data collection and analysis, we obtain the following findings.

First, cooperative communication can inhibit knowledge hiding behaviour among employees, while competitive communication can exacerbate knowledge hiding behaviour within an organization. Although some studies have shown that organizational communication methods can impact the effectiveness of employees' knowledge exchange (Deng and Zheng, 2008; Ruck and Welch, 2012), these studies have not focused on the relationship between communication style and knowledge hiding behaviour. This conclusion fills the above research gap effectively. It not only verifies the claim that communication style has a direct impact on employees' knowledge hiding behaviour but also highlights the differences in the effects of different communication styles on knowledge hiding behaviour. It should be emphasized that according to the literature, both cooperative and competitive communication have significant impacts on the employee relationship and the overall atmosphere of the organization (Cerne et al., 2014; Saruhan, 2014). Therefore, these two variables may act as mediators, and factors related to these two variables, such as corporate culture, organizational structure, leadership style, and employee satisfaction, may moderate the relationships between the two communication styles and knowledge hiding behaviour.

Second, online communication has no significant effect on knowledge hiding among employees; thus, Hypothesis 3 is not verified. On the one hand, this finding may be because although online communication can alleviate the spread of negative emotions caused by face-to-face communication, it cannot effectively facilitate the interaction between body language and a positive climate (Matzat, 2010; Ramirez and Zhang, 2007). On the other hand, it may also be because the overall score of online communication in the research sample is low, which cannot effectively reflect the inhibitory effect of online communication on knowledge hiding. In addition, according to Caspi and Etgar (2023), the use of voice, video and broadcast enables online communication to convey more emotion than was previously possible, which may weaken its direct effect on knowledge hiding behaviours. This conclusion reveals the direct relationship between online communication and employee knowledge hiding, which can further deepen academics' understanding of the impacts of communication methods on knowledge behaviour.

Finally, online communication weakens the inhibitory effect of cooperative communication on knowledge hiding behaviour; however, it can also alleviate the inducing effect of competitive communication on knowledge hiding behaviour. The results reported above verify that it is more difficult to convey the emotions of individuals in the process of online communication than in face-to-face communication, which may weaken the effects of various communication methods on knowledge behaviours. This finding is consistent with the claims of Matzat (2010), Saruhan (2014), and Butt (2020). Moreover, in contrast to the extant literature, this finding further reflects the fact that online communication has a double-edged sword effect on organizational communication and knowledge hiding behaviours, thereby providing a new direction for related research on corporate knowledge management and communication management.

Practical implications. The relevant conclusions of this study have practical implications for the knowledge management and

organizational communication of manufacturing enterprises. First, given that cooperative communication has an inhibitory effect on knowledge hiding behaviour, enterprises should focus on cultivating a harmonious communication atmosphere when conducting internal communication. For large companies, once knowledge hiding behaviour is triggered, it may have a serious chain reaction, which can have a significant negative impact on the overall development of the enterprise (Cerne et al., 2014). Therefore, managers of large enterprises should pay more attention to the tasks of shaping corporate culture and guiding organizational members to engage in cooperative communication by establishing a harmonious culture with the goal of mitigating the adverse consequences of knowledge hiding behaviours. For small businesses, leaders have the vigour necessary to participate in discussions among organizational members; thus, they should focus on their own leadership style and management methods. By setting an example, leaders can embed a cooperative communication style into the organization's daily communication, thereby reducing the occurrence of knowledge hiding behaviour.

Second, because competitive communication may induce knowledge hiding among employees, managers should use their powers carefully when participating in discussions and exchanges with the goal of reducing the oppression experienced by lower-level employees in the process of organizational communication, which can prevent the knowledge hiding behaviours that result from power distance and competitive communication. Notably, bureaucracy and competitive communication are common in many state-owned enterprises. For these enterprises, the first steps include optimizing their organizational structure, reducing organizational hierarchy, and thus weakening the power distance among members. Additionally, it is necessary to develop an efficient and open communication platform to ensure that members at different levels can participate in organizational communication. Moreover, it is important to implement a good management system that can encourage cross-level and cross-departmental communication and regulate the abuse of power in the context of organizational communication.

In addition, considering the dual effect of online communication on knowledge transfer, enterprises should choose a reasonable communication method that fits the actual situation. For important issues and decisions that require the general approval of members or involve the core interests of the company, it is best to communicate and engage in discussion via offline communication, which can promote the positive effect of cooperative communication in knowledge transfer. In contrast, for common issues or decisions associated with less interest, online communication can be used more heavily to improve the efficiency of knowledge transfer and mitigate the knowledge hiding behaviour caused by competitive communication. Overall, regarding internal communication, enterprises should focus on cooperative communication as the leading form and improve the efficiency of knowledge exchange and organizational decision-making while protecting the rights and interests of all parties. It is important for managers to recognize the double-edged sword effect of online communication and avoid overreliance on online communication.

Limitations and directions for future research. This study also has some limitations that can provide directions for future research. First, sample selection and data collection must be improved. On the one hand, this study did not consider the potential natural differences among different industries and regions when conducting sample screening. In the future, empirical research in specific industries or regions can be conducted in these two dimensions. On the other hand, the questionnaire survey exhibited strong subjectivity and randomness.

Although this study employed a two-stage design to reduce homology bias and used variance analysis to test the overall consistency of the data, many uncontrollable factors remain. Follow-up research can combine questionnaire surveys with objective statistical data to further improve the effectiveness of data collection.

Second, the theoretical framework continues to require expansion and optimization. This study mainly examines the inducing mechanism of communication styles on knowledge hiding behaviour in terms of the dimensions of styles and channels and does not discuss other dimensions, such as frequency or content. Therefore, future research should investigate this issue. Furthermore, when discussing the mechanism underlying the influence of communication style on knowledge hiding, this study omits the potential effect of third factors such as organizational climate, organizational structure, and power distance. Subsequent research can examine the roles played by these factors in the relationship between communication style and knowledge hiding. In addition, this study explores knowledge hiding behaviour only from the perspective of its antecedents and lacks an in-depth analysis of how knowledge hiding behaviour caused by communication styles further affects business activities and performance. According to Cerne et al. (2014), Duan et al. (2022), and Singh (2019), knowledge hiding behaviours may influence trust, innovation, and team performance. Thus, future research can focus on these points and introduce the antecedents and consequences of knowledge hiding behaviours into the same framework.

Finally, the definition of knowledge hiding behaviour in this study is insufficiently detailed. Connelly et al. (2012) identified three different types of knowledge hiding: declarative hiding, deafness hiding and reason hiding. However, this study simply combined these three types of knowledge hiding behaviours in the analysis and did not consider the possibility of differences in the effects of communication methods on these three types of knowledge hiding behaviours. In addition, some studies have highlighted possible differences in the incentives of knowledge hiding behaviours in the context of different motivations. For example, well-intentioned knowledge hiding is more likely to consider the psychological feelings of the inquirer (Serenko and Bontis, 2016). Accordingly, future research can focus on a more detailed decomposition of knowledge hiding behaviour.

Data availability

The data generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Author contributions

The authors' contributions are as follows: ZJ: wrote original draft, revised draft, editing, investigation, analysis; ZW: modification and optimization; CF: wrote original draft, analysis, methodology, and optimization. All the authors have read and approved the final manuscript.

Competing interests

The authors declare no competing interests.

Ethical approval

This study was not medical research nor regarded human experimentation as stated in the Declaration of Helsinki. Moreover, all the respondents were 18 years old and over and informed consent was obtained from all participants before survey. Also, the investigation was strictly anonymous and the collected information was only used for research purposes. Therefore, the Ethics Committee of Jiangnan University deemed the questionnaire and methodology for this study to be exempt from ethical review (without an approval number) in January 2021.

Informed consent

Informed consent was obtained from all participants for participation in the study. We contacted the companies via email to seek for cooperation, and then selected a contact person in each company that was tested. The contact person was responsible for the distribution and collection of the questionnaires. Before the questionnaire items, we enclosed a letter containing a consent statement and only respondents who agreed to participate in the study would go through all the questions. Thus, informed consent was obtained from all participants before we conducted the survey.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1057/s41599-023-02063-5>.

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