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Empirical study of knowledge withholding in cyberspace: Integrating protection motivation theory and theory of reasoned behavior

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ABSTRACT

This study integrates protection motivation theory and theory of reasoned action to investigate knowledge withholding in cyberspace, which is a highly prevalent counterproductive knowledge behavior but has received limited attention. The research model was tested with 386 valid online survey responses among Chinese Internet users. The results indicate that both threat appraisal (perceived severity, perceived susceptibility) and coping appraisal (response efficacy, self-efficacy) are positively associated with the attitude toward knowledge withholding, and that the attitude toward knowledge withholding and subjective norms about knowledge withholding are positively related to knowledge withholding intentions. In addition, the results also show that attitude toward knowledge withholding significantly mediates the relationships of threat appraisal and coping appraisal with knowledge withholding intentions. We believe that the findings of this study not only provide a new theoretical perspective on understanding knowledge withholding behavior but also offer valuable insights for reducing knowledge withholding behavior in cyberspace. Limitations and future research directions are also discussed.

1. Introduction

The Internet has become a convenient medium that enables millions of people around the world to exchange information and knowledge. It has drastically changed the scope and boundaries of knowledge transfer, thus making knowledge acquisition and sharing substantially easier (Chang & Chuang, 2011). However, as with all pros, the Internet has its cons. Recently, knowledge infringements on the Internet have continually emerged, leading to increasing concern about privacy and security issues in cyberspace (Chen, Podolski, & Veeraraghavan, 2017; Haggart & Jablonski, 2017; Rathore, Sangaiah, & Park, 2018). As a result, an increasing number of Internet users choose to withhold rather than share their knowledge when surfing the Internet (Fang, 2017; Shen, Li, Sun, Chen, & Wang, 2019).

As an overarching concept, knowledge withholding covers different types of counterproductive knowledge behaviors, such as disengagement from knowledge sharing, knowledge hoarding, knowledge hiding and partial knowledge sharing (Shen et al., 2019). Knowledge, with its contextual nature, is often implicit, which makes it difficult to identify a person's knowledge withholding behavior (Tsay, Lin, Yoon, & Huang, 2014). Compared with knowledge withholding, knowledge sharing is relatively easy to identify and evaluate. For this reason, a large body of

literature has attempted to clarify the motivation of individuals to share knowledge. Drawing on uses and gratification theory, social exchange theory, motivation theory, technology acceptance model, etc., previous studies have found that impelling factors such as social interaction, self-presentation, subjective norms, etc., and inhibiting factors such as privacy risk, the cost of knowledge sharing and so on significantly influence people's knowledge sharing behavior (Wang & NOE, 2010). To some extent, it is reasonable to assume that factors fostering knowledge sharing should also reduce knowledge withholding, which leads to a cognitive misunderstanding in previous studies; that is, knowledge withholding was simply regarded as the lack of knowledge sharing (Tsay et al., 2014). However, many scholars have emphasized that knowledge sharing and knowledge withholding do not represent opposite sides of the same continuum; instead, they are two distinct constructs (Connelly, Zweig, Webster, & Trougakos, 2012; Huo, Cai, Luo, Men, & Jia, 2016; Peng, 2013; Serenko & Bontis, 2016). In this regard, they should be motivated by different sources. The practice of organizational management has provided evidence for this viewpoint, since many actions aimed at facilitating knowledge sharing in organizations cannot meet management's expectation (Babcock, 2004). Therefore, scholars in the domain of knowledge management (KM) advocate that more attention should be paid to counterproductive knowledge behaviors, such as

knowledge withholding (Witherspoon, Bergner, Cockrell, & Stone, 2013).

An increasing number of studies have addressed counterproductive knowledge behaviors in recent years. Conceptually, prior research has distinguished knowledge withholding, knowledge hiding, knowledge hoarding, disengagement from knowledge sharing, knowledge sharing ignorance, counter-knowledge sharing, knowledge sabotage, partial knowledge sharing and some other counterproductive knowledge behaviors (e.g., Connelly et al., 2012; Dyne, Ang, & Botero, 2003; Ford, Myrden, & Jones, 2015; Israilidis, Siachou, Cooke, & Lock, 2015; Lin & Huang, 2010; Martelo-Landroguez, Cegarra Navarro, & Cepeda-Carrión, 2019; Serenko, 2019). Theoretically, various psychological and sociological theories, such as psychological ownership theory, territoriality theory, norm of reciprocity, psychological contract theory and social exchange theory, have been used to explain counterproductive knowledge behaviors (e.g., Arshad & Ismail, 2018; Huo et al., 2016; Pan, Zhang, Teo, & Lim, 2018; Singh, 2019). Based on these theories, a series of antecedents were obtained. Specifically, existing research has acknowledged that counterproductive knowledge behaviors are positively associated with knowledge psychological ownership (Ford & Staples, 2010; Huo et al., 2016; Peng, 2013), lack of knowledge sharing rewards (Anaza & Nowlin, 2017), distrust (Webster et al., 2008), knowledge sharing cost (Shen et al., 2019), time pressure (Škerlavaj, Connelly, Cerne, & Dysvik, 2018), fear emotion (Fang, 2017), task and relationship conflicts (Semerci, 2019), and occupational stress (Marques, La Falce, Marques, & De Muylder, 2019); and are negatively related to social identity (Stenius, Hankonen, Ravaja, & Haukkala, 2016), perceived organizational support (Tsay et al., 2014), guilt emotion (Fang, 2017), outcome expectations (Lin & Huang, 2010), leader-member exchange (Zhao, Liu, Li, & Yu, 2019), personality like conscientiousness and openness (Pan & Zhang, 2018). Moreover, the consequences of counterproductive knowledge behaviors have also been explored. For example, such behavior can block employees' creativity (Fong, Men, Luo, & Jia, 2018; Černe, Nerstad, Dysvik, & Škerlavaj, 2014), reduce organizational citizenship behavior (Peng, 2012), damage the relationships between employees (Wei, Du, & Bao, 2018), and result in poor task performance (Evans, Hendron, & Oldroyd, 2015; Singh, 2019).

Although a lot of works have been done, current research on counterproductive knowledge behaviors (e.g., knowledge withholding, knowledge hiding, and knowledge hoarding) is still quite lacking compared to the huge number of studies on knowledge sharing and contribution. Counterproductive knowledge behaviors still cannot be fully and thoroughly understood through the existing limited literature. Therefore, more work is needed to supplement the research in this field. Furthermore, most current studies lie in the realm of formal organizations and failed to capture the social contexts in which knowledge is withheld (e.g., Connelly & Zweig, 2015; Serenko & Bontis, 2016; Singh, 2019; Zhao, Xia, He, Sheard, & Wan, 2016). The Internet has revolutionized the way people acquiesce and share knowledge, online knowledge spaces such as Wikipedia, online virtual communities, social networking sites, are playing an increasingly important role in the process of social knowledge transfers (Hara & Sanfilippo, 2017; Shen et al., 2019). The loose connections among users on the Internet make people more inclined to withhold their efforts; thus, knowledge withholding should be a common phenomenon in cyberspace (Hung, Lai, & Chou, 2015). Meanwhile, Kling (2007) suggested that research on social information behavior should be extended from traditional organizational contexts to online settings. However, very few scholars have chosen online space as their research context to explore counterproductive knowledge behaviors (e.g., Fang, 2017; Shen et al., 2019; Sun, Shen, & Wang, 2015). Therefore, more empirical studies on counterproductive knowledge behaviors in cyberspace are worth conducting to deepen the academic understanding of these phenomena and provide guidance for practice.

To address the research gaps discussed above, an integrated framework based on protection motivation theory (PMT) and theory of reasoned action (TRA) was developed to provide a new understanding of counterproductive knowledge behaviors in cyberspace. In particular, we focus on an overarching concept—knowledge withholding behavior—because it covers various counterproductive knowledge behaviors. According to Anaza and Nowlin (2017), knowledge withholding is a conscious behavior in which one person refuses to transfer knowledge to others and is often symbolic of having knowledge but not sharing it. Consistent with this view, TRA is first adopted to explain knowledge withholding. As one of the most influential social psychology theories, TRA assumes that people are rational and thoughtful about the meaning and consequences of actions before they decide to act. Behavioral intention is the core concept of TRA and posits that individual behavior is driven by behavior intention, with the behavioral intention formed by way of the attitude toward behavior and subjective norms (Fishbein & Ajzen, 1975). Meanwhile, the potential self-protection motivation of knowledge withholding (Dyne et al., 2003; Fang, 2017) is also taken into consideration. In this regard, we adopt PMT, which was developed by Rogers (1975) and offers a viable theoretical framework for social psychology research. This theory postulates that people are motivated to protect themselves when they feel threatened in risky situations (Mohamed & Ahmad, 2012). Threat appraisal and coping appraisal are two aspects of PMT, both of which drive a person's protective motivation, resulting in applicable adaptive responses (Lee, 2011). In a sentence, knowledge withholding in cyberspace is regarded as individuals' rational self-protection behavior in this study.

To integrate the above two theoretical perspectives, an in-depth analysis was conducted, after which we found that behavioral attitude is determined by individuals' beliefs in the behavior. In other words, assessment of behavioral attributes and outcomes determines attitude (Ajzen & Fishbein, 1980). Therefore, based on the premise of retaining the core assumptions of these two theories, this study takes attitude as the proximal factor of behavioral intentions, mediating the relationships between PMT variables and individuals' behavioral intentions. More specifically, we propose that individuals' intention to withhold knowledge in cyberspace is determined by their attitude toward knowledge withholding and subjective norms about knowledge withholding, the former of which is positively associated with the appraisal of the threats caused by sharing knowledge without any withholding (this study focuses on perceived threat severity and perceived threat susceptibility) and the appraisal of adopting knowledge withholding behavior (this study focuses on response efficacy and self-efficacy).

This study contributes to the literature in the following three ways. First, while a large number of studies address knowledge sharing and contribution, this study responds to the call by researchers in the field of KM. We focus on knowledge withholding, which comprises typical counterproductive knowledge behaviors. Furthermore, cyberspace has become the main way of knowledge dissemination in the current era, and knowledge withholding in cyberspace greatly hinders the effective transfer of social knowledge. This empirical research enriches the current extremely limited literature on knowledge withholding in the online context. Second, this study advances theory by integrating PMT and TRA on knowledge withholding in cyberspace. On the one hand, the introduction of new theoretical perspectives helps us understand such social deviance behavior more deeply. On the other hand, by examining the explanatory power of these two theories, this study also extends their application scope in the field of KM and information systems (IS). Third, this study finds that attitude toward knowledge withholding plays a significant mediating role between protective motivational factors and knowledge withholding intentions, which should inspire scholars to conduct more in-depth studies around the important proximal factor in the future.

This paper has been arranged as follows. The existing literature on knowledge withholding and the theoretical basis of this study are systematically reviewed after the introduction. Next, we propose our research model and develop the associated hypotheses. Then, we detail

the methods used in this study, followed by data analysis results. Finally, we discuss the key findings and the implications for theory and practice. Meanwhile, limitations and directions for future study will also be discussed in the final section.

2. Literature review and theoretical background

2.1. Knowledge withholding

Although a commitment to promoting knowledge sharing is conducive to improving team creativity and brings about better organizational performance, knowledge withholding is also a common phenomenon, and its impacts on organizational performance cannot be ignored (Babcock, 2004; Connelly et al., 2012; Peng, 2012). Therefore, despite the large number of studies focusing on knowledge sharing and contribution, increasing attention has been paid to counterproductive knowledge behaviors during past few years, such as knowledge withholding, knowledge hiding, knowledge hoarding, knowledge sharing hostility, knowledge sharing ignorance, partial knowledge sharing, disengagement from knowledge sharing, counter-knowledge sharing, and knowledge sabotage (e.g., Abubakar, Behravesh, Rezapouraghdam, & Yildiz, 2019; Anaza & Nowlin, 2017; Husted, Michailova, Minbaeva, & Pedersen, 2012; Israilidis et al., 2015; Martelo-Landroguez, Cegarra; Navarro, & Cepeda-Carrión, 2019; Pan & Zhang, 2018; Serenko, 2019; Singh, 2019; Zhao & Xia, 2017). The concept of knowledge withholding was developed in the expanding literature. In the early stage, researchers regarded it as the aggregation of knowledge hiding and knowledge hoarding, where the former is an intentional attempt to withhold or conceal knowledge that has been requested by others, and knowledge hoarding is the act of accumulating knowledge that is not requested by others (Connelly et al., 2012; Webster et al., 2008). Obviously, this definition is not straightforward, for it is simply a statement about what knowledge withholding covers. Thus, Lin and Huang (2010) defined knowledge withholding as "the likelihood that individuals contribute less knowledge to others in the organization than they could" from the perspective of withholding effort for the first time. This definition has been supported by many scholars. For example, Tsay et al. (2014) and Myung Sook Heo and Cheon (2016) have adopted it in their studies. However, it covers only partial contexts of the behavior in question because it limits the context within organizations. Shen et al. (2019) have further developed the concept of knowledge withholding by not only inheriting the effort-withholding perspective of Lin and Huang (2010) but also extending the coverage of Webster et al. (2008). Specifically, knowledge withholding is defined as "an overarching concept that covers different types of the counterproductive knowledge behaviors", such as knowledge hiding, knowledge hoarding, partial knowledge sharing and disengagement from knowledge sharing (Shen et al., 2019). The definition proposed by Shen et al. (2019) not only covers rich types of counterproductive knowledge behaviors but also can be applied to a wide range of research contexts. Therefore, we adopted their comprehensive definition of knowledge withholding in this study.

In terms of research background, knowledge withholding in organizations has received much scholarly attention (e.g., Aljawarneh & Atan, 2018; Connelly & Zweig, 2015; Lin & Huang, 2010; Serenko & Bontis, 2016), but very few studies have been conducted in online environments (e.g., Shen et al., 2019; Sun et al., 2015). It is worth noting that unlike in organizations where there are strong social ties between employees, the absence of face-to-face contact and the anonymous nature of cyberspace make it an environment with weak ties in which users usually do not know each other. According to Granovetter (1973), although strong ties could activate more information flows and increase communication frequencies, weak ties play a more important role in disseminating information from one group to another (Brown & Reingen, 1987). In other words, both weak and strong ties are critical for knowledge diffusion, but they play different roles in the transmission of knowledge (Fu, Wu, & Cho, 2017). Thus, cyberspace is a powerful place

to widely and efficiently spread social knowledge, knowledge withholding in cyberspace cannot be given more attention.

Regarding the research content, previous researchers have explored various antecedents of knowledge withholding based on different theoretical perspectives, among which some theories, such as social exchange theory, psychological ownership theory, organizational justice theory, interdependence theory, territoriality theory, conservation of resources theory, and norm of reciprocity, have been frequently used. These theoretical perspectives provide different explanations for knowledge withholding. For example, scholars who adopt social exchange theory believe that knowledge withholding and knowledge sharing have similar behavioral manifestations and that knowledge withholding can be regarded as failed knowledge exchange (e.g., Connelly et al., 2012; Fong et al., 2018; Jahanzeb, Fatima, Bouckenooghe, & Bashir, 2019; Khalid, Bashir, Khan, & Abbas, 2018; Rhee & Choi, 2017; Singh, 2019; Tsay et al., 2014). Psychological ownership theory and territoriality theory focus on individual psychology, emphasizing that individuals can easily form ownership feelings when they invest time or energy into something, and thus, sharing knowledge with others will result in a loss of control and negative emotions, triggering territorial behavior, that is, the withholding of knowledge (e.g., Peng and Pierce, 2015; Huo et al., 2016; Peng, 2013; Webster et al., 2008). Those studies using organizational justice theory take notice of the organizational environment, from this perspective, procedural justice, distributive justice and interactive justice have been empirically confirmed to be significantly correlated with an individual's willingness to withhold knowledge (e.g., Abubakar et al., 2019; Huo et al., 2016; Pan & Zhang, 2018). Furthermore, the interdependence theory and norm of reciprocity indicate that an individual's behavior is influenced by others; one is less likely to withhold knowledge when there is high interdependence and positive reciprocity between them; otherwise, knowledge withholding behavior may occur (e.g., Tsay et al., 2014; Zhao et al., 2016). In addition to the above commonly used theories, some fresh perspectives have recently been introduced into this field. Based on the theory of knowledge stickiness, Anaza and Nowlin (2017) found that knowledge withholding has significant relationships with three aspects factors: environment (competition among coworkers, past opportunistic coworker behavior), incentives (lack of knowledge sharing rewards, lack of feedback for knowledge sharing), and individual (neuroticism). From the secondary control perspective, Shen et al. (2019) concluded that the knowledge withholding in online knowledge spaces can be well explained by predictive control (knowledge sharing self-inefficacy, knowledge sharing cost) and vicarious control (explicit social norms attribution, implicit social norms attribution). Drawing on reactance theory and conservation of resources theory, Feng and Wang (2019) found that abusive supervision is significantly related to knowledge withholding via job insecurity. Meanwhile, previous studies also determined the consequences of knowledge withholding. For instance, knowledge withholding in organizations not only inhibits individual creativity and performance (Fong et al., 2018; Jahanzeb et al., 2019; Černe et al., 2014) but also harms team creativity and performance (Bogilović; Černe, & Škerlavaj, 2017; Das, Yi, & Uddin, 2018; Evans et al., 2015). Scholars in the organizational behavior field have pointed out that employees' knowledge withholding behavior could hurt interpersonal relationships (Connelly & Zweig, 2015) and result in less organizational citizenship behavior (Burmeister, Fasbender, & Gerpott, 2019), less job satisfaction (Peng, 2012), and more turnover intentions (Offergelt, Spörrle, Moser, & Shaw, 2019).

According to the above literature review, prior studies have addressed knowledge withholding from many perspectives. However, to the best of the knowledge of the authors, PMT and TRA have not been adopted in the knowledge withholding research field. After careful analysis, we believe these two theories can provide a reasonable explanation for knowledge withholding. By regarding it as an individual's rational self-protection behavior, an integrated framework is proposed based on PMT and TRA in this study. The rest of this section

will briefly introduce the theoretical bases of the study.

2.2. Protection motivation theory

Protection motivation theory (PMT) (Rogers, 1975) offers a viable theoretical framework for social psychology, and it has been noted as one of the most powerful explanatory theories for predicting an individual's protective intentions and behaviors (Anderson & Agarwal, 2010). Drawing from expectancy-value theories, PMT explains the cognitive processes that individuals experience when faced with threats (Gao, Liu, Guo, & Li, 2018). It assumes that people have motivations to protect themselves when they fell threatened in risky situations (Mohamed & Ahmad, 2012). According to PMT, protection motivation arises from the following two aspects: threat appraisal and coping appraisal (Rogers, 1975).

Threat appraisal involves one's assessment of the risk degree of adverse consequences posed by a threatening event or unsafe behaviors (Rogers, 1975; Workman, Bommer, & Straub, 2008). It consists of two items. The first is perceived severity, which represents the severity of the consequences of anticipated threats. In this study, perceived severity is taken to measure the severity of threats caused by unreservedly sharing knowledge in cyberspace. The second is perceived vulnerability, which is the assessment of the likelihood of threat events. In the context of this research, perceived vulnerability captures the probability of bad results if one shares his/her knowledge without any withholding. In PMT, both perceived severity and perceived vulnerability are critical in motivating individuals to adopt adaptive behavior (e.g., knowledge withholding in this study) for self-protection (Rogers & Prentice-Dunn, 1997).

Coping appraisal involves the evaluation of one's capacity to deal with and avoid a threatening event (Lee, 2011; Rogers, 1975). It consists of three sub-constituents: response efficacy, self-efficacy and response cost. Response efficacy is related to one's belief about the perceived benefits of a coping behavior. Here, it is taken to be the effectiveness of withholding knowledge in cyberspace to avert a threat. Self-efficacy is the assessment of one's perceived ability for adaptive behavior, that is, whether a person has the skills and measures to withhold knowledge in cyberspace. Response cost emphasizes potential costs such as time, effort, money, etc. In PMT, a person's protective motivations are positively driven by response efficacy and self-efficacy, while negatively associated with response cost (Rogers & Prentice-Dunn, 1997). This research primarily focuses on the first two sub-constituents for the following two reasons. First, unlike in organizations, the connections among members in cyberspace are loose; people who withhold knowledge in cyberspace will face little to no possible costs in terms of hurting relationships, developing distrust, experiencing negative reciprocity, etc. Second, it is easy for individuals to withhold knowledge in an online context because it requires virtually no mental or physical effort; that is, knowledge withholding in cyberspace is a kind of near-zero-cost behavior. Taken together, we exclude response cost in the research model of this study.

PMT was widely used in the history of health research, including for health threats (Milne, Sheeran, & Orbell, 2000), environmental hazards (Bockarjova & Steg, 2014), and preventive behaviors (Prentice-Dunn & Rogers, 1986). However, recent research has extended it into the IS domain and has been found that PMT is useful in predicting behaviors related to human behaviors on computers, such as personal information security protection behaviors (Menard, Bott, & Crossler, 2017), online safety behaviors (Tsai et al., 2016), the adoption of network security systems (Lee & Larsen, 2009) and anti-plagiarism systems (Lee, 2011). In the context of online space, the knowledge shared by users may be abused or copied without permission, leading to the loss of knowledge control and the power and benefits related to the knowledge. It is possible that the existence of various opinions may lead to interpersonal conflicts or cyberbullying, which results in negative emotions. Motivated by self-protection, individuals tend to withhold their knowledge in cyberspace; thus, PMT is suitable for the current study that aims to investigate knowledge withholding in cyberspace. However, after reviewing the major KM-centric journals, such as Journal of Knowledge Management, Knowledge Management Research & Practice, International Journal of Knowledge Management, and Journal of Information & Knowledge Management, we found that PMT has not been applied in the context of counterproductive knowledge behaviors. Therefore, to fill the research gap, this paper attempts to study individuals' knowledge withholding behavior in cyberspace from the perspective of PMT.

2.3. Theory of reasoned action

Theory of reasoned action (TRA) was introduced by Fishbein and Ajzen (1975) to predict human behaviors under complete volitional control. This theory postulates that an individual will make a rational choice when deciding whether to engage in a certain behavior and that he/she will be thoughtful about it. In TRA, behavioral intention is the immediate antecedent of behavior, indicating an individual's readiness to perform a particular behavior (Ajzen, 1985). Intention is determined by attitude and subjective norms. The former is the degree of one's positive or negative evaluation of a behavior and is shaped by one's beliefs in the outcomes or attributes of the behavior (Ajzen & Fishbein, 1980). That is, people who hold strong beliefs that positive outcomes will result from a certain behavior will have a positive attitude toward it, which increases the likelihood of engaging in the behavior. In contrast, the expectation of adverse consequences will bring about a negative attitude, which further reduces the likelihood of the behavior. Another construct that is closely associated with behavioral intention is subjective norms. As a social-related factor, subjective norms are people's perceptions of whether those around them would perform a given behavior, and reflect the pressure one feels when not participating in the behavior (Ajzen & Fishbein, 1980). For example, if individuals are conscious of the behaviors recommended by people who are important to them, then they will be prompted to engage in the behaviors (Liu, Segev, & Villar, 2017).

TRA is described as an intuitive, parsimonious, and insightful model for explaining human behaviors (Bagozzi, 1982). It has been widely applied to predict behavioral intentions in the area of IS adoption behaviors (Mishra, Mishra, & Akman, 2014), consumer purchase behaviors (Hansen, Jensen, & Solgaard, 2004), and knowledge sharing behaviors (Arpaci & Baloğlu, 2016). Many previous studies have verified the significant associations between attitude and subjective norms with behavioral intention in TRA (e.g., Ifinedo, 2012; Tsai et al., 2016; Venkatesh, Morris, Davis, & Davis, 2003). This research regards withholding knowledge in cyberspace as a kind of rational behavior under complete volitional control, which conforms with the precondition of using TRA. Given it has not been previous applied in this domain, the current study intends to expand the existing knowledge withholding literature by applying TRA to aid understanding of individuals' knowledge withholding behavior in cyberspace.

3. Research hypotheses

Through the lens of PMT and TRA, this study develops an integrated framework to investigate knowledge withholding in cyberspace, as depicted in Fig. 1. Two appraisals in PMT—threat appraisal, which includes perceived severity and perceived vulnerability, and coping appraisal, which includes response efficacy and self-efficacy—are hypothesized positively associated with attitude toward knowledge withholding. In line with TRA, this study further assumes that both attitude toward knowledge withholding and subjective norms about knowledge withholding are positively related to knowledge withholding intentions. This study also examines the mediating role of attitude on the relationships between protective motivational factors and knowledge withholding intentions. Fig. 1 depicts the interrelationships among the above constructs. The remainder of this section will develop the hypotheses presented therein.
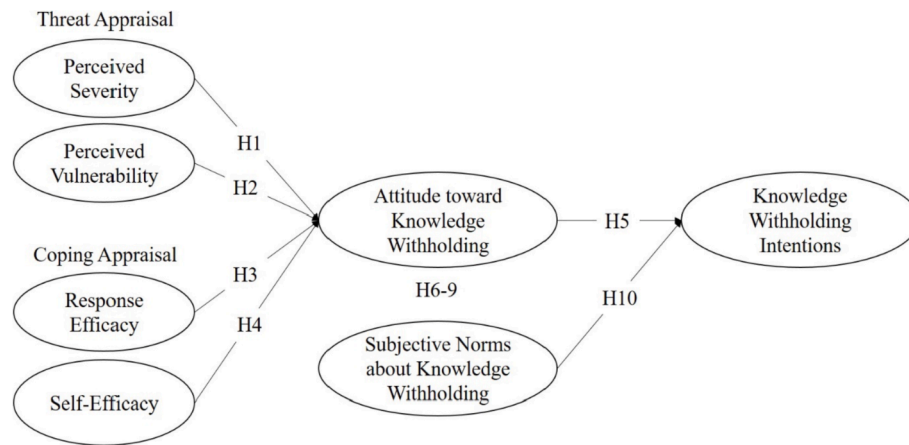
Fig. 1. Research model.

3.1. Threat appraisal and attitude toward knowledge withholding

3.1.1. Perceived severity

Severity is "the degree of physical harm, psychological harm, social threats, economic harm, dangers to others rather than oneself, and even threats to other species" (Rogers & Prentice-Dunn, 1997, p. 115). Perceived severity represents an individual's assessment of the severity of the consequences resulting from threats. The more seriously a person perceives the outcomes of engaging in an unsafe behavior, the more negative his/her attitude toward it is. Correspondingly, a positive attitude toward adaptive behavior will be formed because such behavior is helpful in mitigating the severity of or completely avoiding a threat, forming stronger intentions to adopt adaptive behavior. Prior research has revealed that the perceived severity of a threat could significantly predict people's intentions to comply with IS security policies (Vance, Siponen, & Pahnila, 2012), adopt anti-plagiarism software (Lee, 2011), and exercise (Tulloch et al., 2009).

In the context of cyberspace, sharing knowledge unreservedly is unsafe and may lead to adverse consequences. For instance, Fang (2017) pointed out knowledge hiding behavior in mobile social networking applications can be driven by the following six constructs of fear: fear of losing face, fear of losing power, fear of isolation, fear of opportunism, fear of exploitation, and fear of contamination. Kumar Jha and Varkkey (2018) also stated that sharing knowledge may increase the risk of job insecurity, as the potential advancement of colleagues is a threat to the competitive position of knowledge owners. Consistent with these views, this study further highlights the uncertainty in online space. With a larger audience and wider and faster distribution in cyberspace, the severity of the threat posed by sharing knowledge increases. People who share inappropriate knowledge can be easily attacked and ridiculed by other Internet users (Fang, 2017; Shen et al., 2019). It is also worth noting that intellectual property in online space is difficult to secure, as such, knowledge is at risk of being abused and people may lose the interests that are related to their knowledge (Haggart & Jablonski, 2017). Indeed, when individuals realize that sharing knowledge could result in numerous and serious potential threats, they will actively adjust their attitudes and behaviors. Generally, people are more likely to believe that knowledge withholding is right and beneficial, and that it should be done to protect themselves. Based on the above logic, we suggest the following hypothesis:

H1. Perceived severity is positively associated with the attitude toward knowledge withholding in cyberspace.

3.1.2. Perceived vulnerability

Vulnerability refers to "the conditional probability that the threatening event will occur provided that no adaptive behavior is performed

or there is no modification of an existing behavioral disposition" (Rogers & Prentice-Dunn, 1997, p. 115). When individuals perceive a threat, they adjust their behavior according to the size of the risk and determine whether they are willing to accept it (Workman et al., 2008). In particular, they not only look at the severity of the threat but also consider the possibility of it occurring. Therefore, people are likely to ignore the threat that rarely occurs because of their fluke mind. However, individuals are so loss averse that have reacted to threats that occur with a high likelihood, in which case people have a positive attitude toward the adaptive behavior. The literature generally agrees that the perceived vulnerability of a threat could effectively predict people's security behavioral intentions (Ifinedo, 2012; Lee, 2011; Lee, Larose, & Rifon, 2008).

Similarly, in this study, we expect that the perceived vulnerability of the threat is also an impelling factor for people's positive attitudes toward knowledge withholding. It is easy to understand that when individuals realize how easy it is to get themselves into trouble by sharing knowledge without withholding, they believe that it is wise to withhold their knowledge. Particularly in cyberspace, both the speed and scope of information dissemination are beyond our control, and the dark aspects of the Internet, such as knowledge infringement, cyberbullying, and privacy violation, have drawn substantial attention in recent years (Gámez-Guadix and Mateos-Pérez, 2019; Rathore et al., 2018). Given the above potential threats, people no longer think they should share knowledge unreservedly. Instead, motivated by self-protection, they should be cautious about altruistic behaviors in cyberspace (for example, knowledge sharing in this study) and hold contrary beliefs; that is, it is better for them to withhold knowledge. Thus, we posit the following hypothesis:

H2. Perceived vulnerability is positively associated with the attitude toward knowledge withholding in cyberspace.

3.2. Coping appraisal and attitude toward knowledge withholding

3.2.1. Response efficacy

Response efficacy is one's belief that adoptive measures will work and help one avert potential undesirable threats (Rogers & Prentice-Dunn, 1997). In other words, response efficacy is associated with the perceived benefits of taking action. There is no doubt that individuals will hold a positive attitude toward a certain behavior when they know it is beneficial for them, not to mention when the behavior is effective in protecting the individual. In contrast, people who feel that even if they take actions, threats still remain will not adopt the perceived useless behavior for self-protection. Most prior research based on PMT has suggested a positive relationship between response efficacy and behavioral intentions (Doane, Boothe, Pearson, & Kelley, 2016; Ifinedo,

2012; Tsai et al., 2016). For example, teachers who believe that anti-plagiarism software can effectively detect and prevent students' Internet plagiarism are more likely to use anti-plagiarism software in their teaching (Lee, 2011). Compared to low response efficacy perception, people with high response efficacy have stronger online security intentions (Tsai et al., 2016).

In this study, withholding knowledge is regarded as an individual's adoptive response to threats to knowledge security and information security. According to TRA (Ajzen & Fishbein, 1980), people's beliefs about the outcomes and attributes of a behavior determine their attitudes, Ramayah, Lee, and Mohamad (2010) also claimed that attitudes contain perceived consequences related to behavior. People who believe a behavior to have desirable consequences have a positive attitude toward it (Liu et al., 2017). As such, we posit that when a person thinks withholding knowledge in cyberspace can help him/her avoid threats (e. g., losing power, being exploited or ridiculed), he/she will generally hold a positive attitude toward knowledge withholding behavior. Therefore, we posit the following hypothesis:

H3. Response efficacy is positively associated with the attitude toward knowledge withholding in cyberspace.

3.2.2. Self-efficacy

Self-efficacy is a concept in social cognitive theory that emphasizes the capabilities and competence of individuals to deal with tasks or make choices (Bandura, 1991), and it is a key element that determines an individual's behavior (Bandura, 1986). In PMT, self-efficacy is taken to be an individual's self-evaluation of whether he/she has the ability to exhibit coping behaviors (Rogers & Prentice-Dunn, 1997). As researchers have stated, people are more likely to do things that are not too difficult for them or that they are confident of doing well (Bandura, 1977). Moreover, self-efficacy not only influences people's choice about the behavior to be undertaken but also affects their effort and persistence when they are faced with obstacles or difficulties (Lin & Huang, 2010). The extant literature has consistently acknowledged the positive relationship between self-efficacy and behavioral intentions. For example, people with a high level of self-efficacy are more likely to use new IS than those with a low level of self-efficacy. The relationship between self-efficacy and knowledge withholding has already been explored in the KM domain; Lin and Huang (2010) found that knowledge contribution self-efficacy is negatively related to knowledge withholding. Similarly, Shen et al. (2019) argued that knowledge sharing self-inefficacy is positively associated with knowledge withholding. More directly, the results of Tsay et al. (2014) show that knowledge withholding self-efficacy is significantly and positively related to knowledge-withholding intentions.

Based on the above discussion and the description of attitude in TRA (Ajzen & Fishbein, 1980), this study posits that self-efficacy is also positively associated with an individual's attitude toward knowledge withholding in cyberspace. For a rational person under autonomous control of his/her actions, he/she should do what he/she thinks is right. In the context of online space, if users have no confidence in their ability to withhold knowledge without being noticed, or they do not know how to hide their knowledge, or they are not sure which part of their knowledge should be withheld, it is hard for them to form a positive attitude toward knowledge withholding because of the lack of confidence and potential emotional exhaustion caused by expending efforts doing what is difficult for them. In contrast, people may share only partial knowledge that does not involve personal profit, since they are confident in their capability to conceal knowledge without being discovered. Withholding knowledge in cyberspace is so easy and low cost that people generate a positive attitude toward it. Thus, we suggest the following hypothesis:

H4. Self-efficacy is positively associated with the attitude toward knowledge withholding in cyberspace.

3.3. Attitude toward knowledge withholding and knowledge withholding intentions

Attitude refers to "the degree to which a person has a favorable or unfavorable evaluation of the behavior in question" (Ajzen, 1991). Indeed, attitude not only reflects one's positive or negative evaluation of a certain behavior but also represents whether one wants to engage in it (Leonard, Cronan, & Kreie, 2004). As described in TRA, attitude is an effective predictor of behavioral intention (Fishbein & Ajzen, 1975). A positive attitude toward a behavior increases the likelihood that an individual will take the corresponding action (Ajzen, 1991; Han, Hsu, & Sheu, 2010). It is plausible that people who hold a positive attitude for a behavior have a stronger intention to exhibit it, whereas those people who negatively evaluate a behavior are less likely to engage in that behavior. The relationship between attitude and behavioral intentions has been widely verified in various research fields. For instance, in the IS field, Venkatesh et al. (2003) found that an individual's attitude toward information technology can significantly predict his/her intention to adopt new information technology. In the field of marketing, Hansen et al. (2004) illustrated that consumers' online buying behaviors are closely related to their attitudes toward such behaviors. In addition, research in the KM domain has also confirmed that employees' attitude toward knowledge sharing positively affects their knowledge sharing intentions (Lin, 2007).

Consistent with prior research, we posit a positive relationship between the attitude toward knowledge withholding and knowledge withholding intentions in the context of cyberspace. This is because attitude is the psychological cognition of withholding knowledge that is formed based on long-term Internet and social experience, and the intention to withhold knowledge tends to be positive when the attitude is positive (Chen & Tung, 2014). In contrast, if a person thinks withholding knowledge incorrect since this deviance behavior inhibits social or self development, he/she will be willing to spend effort to convert knowledge into the form others can understand and absorb and will be pleased by sharing ownership of the knowledge to benefit others or society (Fang, 2017). Thus, the preceding arguments suggest the following hypothesis:

H5. Attitude toward knowledge withholding is positively associated with knowledge withholding intentions in cyberspace.

3.4. The mediating role of attitude toward knowledge withholding

The preceding hypotheses suggest that the protective motivational variables in PMT (perceived severity, perceived vulnerability, response efficacy and self-efficacy) are positively associated with the attitude toward knowledge withholding in cyberspace (H1-H4), and that there exists a positive relationship between attitude and knowledge withholding intentions (H5). Beyond this, we further expect that the attitude toward knowledge withholding would mediate the relationships between protective motivational factors and knowledge withholding intentions. According to TRA, attitude is an important antecedent of behavioral intention (Fishbein & Ajzen, 1975), and it is believed to be a function of one's salient beliefs, which represent the perceived consequences of a behavior (Eagly & Chaiken, 1993). In this study, protective motivational factors correspond precisely to salient beliefs. In terms of threat appraisal, although the object of threat appraisal is potential threats, the appraisal reflects the severity and vulnerability of the consequences if no action is taken. Coping appraisal directly reflects beliefs about the effectiveness and enforceability of a behavior (Rogers & Prentice-Dunn, 1997). Imagine a situation in which even though one knows the serious consequences of completely sharing his/her knowledge in cyberspace and the benefits of withholding knowledge, but for some reasons (such as strong prosocial motivation, strong spirit of selfless dedication), he/she still remains opposed to knowledge withholding because it is wrong in his/her principles. As such, the likelihood

of choosing to withhold knowledge will be low because it is uncomfortable to do what is not allowed according to one's principles. Many previous studies have demonstrated the significant mediating roles of attitude. For example, Doane, Pearson, and Kelley (2014) found that attitude toward cyberbullying perpetration mediates the relationship between empathy toward cyberbullying victims and cyberbullying intentions. The empirical results of Kim, Chun, and Song (2009) also indicate that the attitude toward system use plays a significant mediating role in the relationships between salient beliefs (perceived usefulness, perceived ease of use) and behavioral intention. The same logic can be applied in this study; that is, we suggest the following four hypotheses:

H6. Attitude toward knowledge withholding plays a mediating role in the relationship between perceived severity and knowledge withholding intentions in cyberspace.

H7. Attitude toward knowledge withholding plays a mediating role in the relationship between perceived vulnerability and knowledge withholding intentions in cyberspace.

H8. Attitude toward knowledge withholding plays a mediating role in the relationship between response efficacy and knowledge withholding intentions in cyberspace.

H9. Attitude toward knowledge withholding plays a mediating role in the relationship between self-efficacy and knowledge withholding intentions in cyberspace.

3.5. Subjective norms about knowledge withholding and knowledge withholding intentions

Subjective norms refer to "the perceived social pressure to perform or not to perform the behavior" (Ajzen, 1991), which depends on the tendency for one to comply with people who are important and with normative beliefs (Herath & Rao, 2009). Generally, subject norms about a particular act are mainly formed by consultation or observation of the behaviors of one's significant others (Ifinedo, 2012). Social norms are similar to social influence, which comes from the unified theory of acceptance and use of technology theory (Venkatesh et al., 2003) and measures the influence of social network (such as friends and families) on individuals' behaviors (Tsai et al., 2016). In fact, both are social factors, and as such, we did not make a strict distinction between these two concepts in this study. As Johnston and Warkentin (2010) claimed, individuals' behaviors are motivated by the environmental norms they have observed. If individuals believe that the people around them think they should act, then they will be prompted to engage in such behavior (Ajzen & Fishbein, 1980). In contrast, if individuals realize that no one else is advocating the behavior, they will be more likely to act consistently with others because engaging in unrecognized behavior may result in unfavorable situations, including condemnation and negative social pressure. Prior studies have shown that social influences are powerful predictors of an individual's intention to engage in self-protective behavior (Ifinedo, 2012; Johnston & Warkentin, 2010; Tsai et al., 2016).

In the context of this study, subjective norms are personal perceptions of whether others think it is right to withhold knowledge in cyberspace. Separately, when one's significant others (such as boss or colleague, mentor or classmate, family or friend) advocate sharing knowledge with their full effort, people who withhold knowledge and are noticed by others will be negatively evaluated as selfish, stingy, unamiable or inconsiderate. When most others choose to withhold their knowledge in cyberspace, withholding knowledge is the appropriate choice for an individual; otherwise, he/she will be thought stupid and as giving away secrets. Human behaviors such as this can be explained by the effect of sheep flock. Based on the above discussion, we keep consistent with TRA and previous literature, this study expects a positive relationship between subjective norms about knowledge withholding

and knowledge withholding intentions.

H10. Subjective norms about knowledge withholding are positively associated with knowledge withholding intentions in cyberspace.

4. Research methodology

4.1. Measures development

To minimize measurement risk, all constructs in our study were measured using existing measures with slight modifications to fit the current context. Specifically, the protective motivational factors in PMT, including perceived severity, perceived vulnerability, response efficacy and self-efficacy, were measured with scales adapted from Workman et al. (2008). Attitude toward knowledge withholding was measured with items adapted from Bulgurcu, Cavusoglu, and Benbasat (2010). Items for subjective norms about knowledge withholding came from Lee (2011) and Herath and Rao (2009). Knowledge withholding intentions was measured with items developed by Tsay et al. (2014). All the items were responded to on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Given that the survey was conducted in Mainland China, forward translation (from English to Chinese) and backward translation (from Chinese to English) were applied to ensure no misunderstanding of the questions. Then, a pretest was performed using ten graduate students to evaluate the logical consistency, ease of understanding, and contextual relevance of the measures. Based on their comments, we adjusted the format, layout, and wording of the questions to eliminate ambiguity. The final items are presented in the Appendix.

4.2. Data collection and samples

Considering that this study targets general Internet users, we did not use students as convenience samples. Instead, online survey method was adopted to collect data for examining our research model because of its quick access to a wide range of samples. Specifically, data were collected using the sample service of Sojump.com, which is the largest online survey website in China and has more than 2.6 million active members with diversified experience and backgrounds. At the top of the questionnaire, a detailed description of the survey purpose was given to remind the participants to answer the questions objectively and seriously. In addition, the questions in the survey questionnaire were divided into different pages. To prevent indiscreet answers, we set a minimum time for each page, after which the respondents could proceed to the next page of the questionnaire. Meanwhile, we required each questionnaire be submitted from a unique IP and MAC address to avoid duplication. Finally, a total of 386 valid responses were received. Table 1 reports the demographic characteristics of the respondents.

Table 1
Demographic characteristics of the participants. (N = 386).

Demographic variable	Types	Frequency	Percentage (%)
Gender	Male	148	38.3
	Female	238	61.7
Age	< 25	115	29.8
	25–30	98	25.4
	31–40	139	36.0
	41–50	24	6.2
	> 50	10	2.6
Education	Junior college or below	70	18.1
	Undergraduate	286	74.1
	Postgraduate or higher	30	7.8
Hours on Internet	Less than 1 h	22	5.7
	1–2 h	90	23.3
	3–4 h	178	46.1
	5–6 h	86	22.3
	More than 7 h	10	2.6

Table 2
Construct reliability, validity and correlations.

	Mean	SD	VIF	AVE	CR	PS	PV	RE	SE	AKW	SN	KWI
PS	4.832	1.155	1.665	0.547	0.858	**0.740**						
PV	5.244	1.056	1.778	0.599	0.817	0.517	**0.774**					
RE	4.702	1.102	1.976	0.642	0.877	0.405	0.420	**0.801**				
SE	4.744	1.117	1.728	0.748	0.856	0.265	0.329	0.575	**0.865**			
AKW	5.227	1.187	2.063	0.737	0.894	0.574	0.592	0.494	0.396	**0.858**		
SN	4.893	0.967	1.931	0.563	0.838	0.428	0.480	0.557	0.524	0.529	**0.750**	
KWI	4.843	1.089	1.971	0.592	0.812	0.427	0.484	0.583	0.528	0.512	0.570	**0.769**

Notes: N = 386; PS=Perceived severity, PV=Perceived vulnerability, RE = Response efficacy, SE=Self-efficacy, AKW = Attitude toward knowledge withholding, SN=Subjective norms about knowledge withholding, KWI=Knowledge withholding intentions; The numbers in bold in the diagonal row are square roots of the AVE.

4.3. Common method biases

To avoid the presence of common method bias in the survey design, we arranged the items of dependent variables to follow rather than precede the items of independent variables (Lin & Huang, 2010). After the data were collected, we conducted multiple tests to ensure that there was no common method bias. First, the correlation coefficients (as shown in Table 2) between any two constructs did not exceed 0.60, whereas common method bias usually leads to extremely high correlations (Bagozzi, Yi, & Phillips, 1991). Second, Harman's single-factor test was used, and the results of principal components factor analysis showed that no one factor accounted for a majority of the total covariance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Third, an additional analysis was conducted following the procedure recommend by Liang, Saraf, Hu, and Xue (2007). Table 3 reports the partial least squares (PLS) results of bootstrapping, and the loadings of the substantive factor are high (average 0.786 and lowest 0.572) and significant, with an average substantively explained variance of 62.6%. However, loadings on the common method construct are low (highest 0.255), and most of them are insignificant, with an average method-based variance of 0.9%. Therefore, compared with the average substantively explained variance, the average method-based variance is very small. Altogether, the above results suggest that common method

bias is apparently not a problem in our study.

5. Data analysis and results

The structural equation modeling (SEM) technique was used to validate the proposed model. Specifically, the analysis was conducted using PLS approach, which can simultaneously estimate both the structural model and the measurement model (Chin, 1998). Following the two-step analytical approach suggested by Anderson and Gerbing (1988), the measurement model will be first assessed, and the second step focuses on the structural model to examine the hypothesized relationships between the constructs in this study. In particular, SmartPLS 2.0 M3 (Ringle, Wende, & Will, 2005) serves to analyze the data.

5.1. Measurement model

To assess the measurement model, reliability, convergent validity, and discriminant validity are usually evaluated. In this study, we examined the composite reliability (CR) to assess reliability. The results in Table 2 show that the values range from 0.812 to 0.894, all of which are above 0.70, denoting adequate reliability (Fornell & Bookstein, 1982). Convergent validity was assessed using the following two criteria (Fornell & Larcker, 1981): (a) the cross loadings of all items should be

Table 3
Common method bias analysis.

Construct	Indicator	Substantive factor loading (R_1)	$R_1{}^2$	Method factor loading (R_2)	$R_2{}^2$
PS	PS1	0.746***	0.556	−0.019	0.000
	PS2	0.821***	0.675	−0.069	0.005
	PS3	0.807***	0.651	−0.088	0.008
	PS4	0.748***	0.560	−0.002	0.000
	PS5	0.572***	0.327	0.186**	0.034
PV	PV1	0.873***	0.763	−0.071	0.005
	PV2	0.689***	0.474	0.121	0.015
	PV3	0.757***	0.572	−0.050	0.003
RE	RE1	0.890***	0.792	−0.088	0.008
	RE2	0.743***	0.552	0.026	0.001
	RE3	0.790***	0.624	0.046	0.002
	RE4	0.779***	0.607	0.018	0.000
SE	SE1	0.893***	0.797	−0.046	0.002
	SE2	0.839***	0.704	0.045	0.002
SN	SN1	0.764***	0.583	0.006	0.000
	SN2	0.800***	0.640	−0.039	0.002
	SN3	0.794***	0.630	−0.087	0.008
	SN4	0.648***	0.420	0.117	0.014
AKW	AKW1	0.904***	0.817	−0.045	0.002
	AKW2	0.932***	0.869	−0.046	0.002
	AKW3	0.732***	0.536	0.098	0.010
KWI	KWI1	0.584***	0.341	0.255***	0.065
	KWI2	0.876***	0.768	−0.154**	0.024
	KWI3	0.875***	0.766	−0.122*	0.015
Average		0.786	0.626	0.000	0.009

Notes: PS=Perceived severity, PV=Perceived vulnerability, RE = Response efficacy, SE=Self-efficacy, AKW = Attitude toward knowledge withholding, SN=Subjective norms about knowledge withholding, KWI=Knowledge withholding intentions. *p < 0.05, **p < 0.01, ***p < 0.001.

Table 4

Item cross-loadings.

	PS	PV	RE	SE	AKW	SN	KWI
PS1	**0.717**	0.341	0.311	0.163	0.391	0.279	0.397
PS2	**0.754**	0.287	0.331	0.203	0.398	0.307	0.328
PS3	**0.742**	0.404	0.241	0.165	0.416	0.267	0.269
PS4	**0.756**	0.452	0.272	0.164	0.456	0.338	0.289
PS5	**0.729**	0.448	0.348	0.302	0.469	0.413	0.357
PV1	0.416	**0.818**	0.280	0.282	0.477	0.362	0.382
PV2	0.451	**0.787**	0.414	0.329	0.482	0.420	0.394
PV3	0.352	**0.712**	0.277	0.164	0.413	0.334	0.392
RE1	0.338	0.316	**0.812**	0.405	0.381	0.416	0.441
RE2	0.296	0.302	**0.774**	0.485	0.403	0.453	0.449
RE3	0.360	0.353	**0.831**	0.519	0.426	0.471	0.487
RE4	0.305	0.379	**0.786**	0.439	0.376	0.458	0.508
SE1	0.192	0.231	0.498	**0.838**	0.311	0.479	0.432
SE2	0.273	0.346	0.506	**0.891**	0.373	0.438	0.496
AKW1	0.529	0.542	0.379	0.304	**0.867**	0.425	0.455
AKW2	0.495	0.517	0.430	0.345	**0.892**	0.461	0.467
AKW3	0.465	0.466	0.470	0.377	**0.815**	0.477	0.457
SN1	0.305	0.360	0.455	0.440	0.388	**0.774**	0.485
SN2	0.321	0.371	0.424	0.357	0.427	**0.750**	0.410
SN3	0.302	0.328	0.354	0.351	0.369	**0.715**	0.407
SN4	0.383	0.387	0.445	0.423	0.406	**0.761**	0.496
KWI1	0.420	0.471	0.490	0.467	0.516	0.589	**0.842**
KWI2	0.266	0.273	0.453	0.389	0.315	0.376	**0.714**
KWI3	0.305	0.381	0.416	0.377	0.365	0.379	**0.746**

Notes: PS=Perceived severity, PV=Perceived vulnerability, RE = Response efficacy, SE=Self-efficacy, AKW = Attitude toward knowledge withholding, SN=Subjective norms about knowledge withholding, KWI=Knowledge withholding intentions; Bold numbers indicate item loadings on the assigned constructs.

Table 5

Heterotrait–monotrait ratio.

HTMT	PS	PV	RE	SE	AKW	SN	KWI
PS							
PV	0.716						
RE	0.504	0.571					
SE	0.365	0.494	0.784				
AKW	0.713	0.802	0.607	0.536			
SN	0.562	0.684	0.718	0.747	0.679		
KWI	0.590	0.732	0.796	0.795	0.699	0.818	

Note: PS=Perceived severity, PV=Perceived vulnerability, RE = Response efficacy, SE=Self-efficacy, AKW = Attitude toward knowledge withholding, SN=Subjective norms about knowledge withholding, KWI=Knowledge withholding intentions.

larger than the benchmark of 0.70, and (b) the average variance extracted (AVE) should exceed the cutoff of 0.50. Obviously, both criteria are satisfied. The cross loadings in Table 4 show that all items exhibit a loading higher than 0.70 on their respective constructs (range from 0.712 to 0.892), and the AVE values (in Table 2) range from 0.547 to 0.748, all exceeding 0.50. Therefore, our measurement model has good convergent validity.

For discriminant validity, three criteria were used: (a) the square root of AVE should be greater than the correlation coefficients between the particular construct and other constructs (Fornell & Larcker, 1981), (b) the loading of an item on its respective construct should be significantly higher than the loadings on other constructs (Chin, 1998), and (c) the heterotrait–monotrait ratio (HTMT) should be smaller than 0.85, which is a recently proposed method to evaluate discriminant validity by Henseler, Ringle, and Sarstedt (2015). As shown in Table 3, the comparison between the square root of AVE and correlations satisfies the first criterion. Meanwhile, the second criterion is also met (see Table 4). In addition, Table 5 shows that the highest HTMT value between our constructs is 0.818, which further meets the third criterion. Taken together, the discriminant validity of our measurement model is satisfactory.

Furthermore, the potential multicollinearity problem was also examined. Two approaches were applied to assess the degree of multicollinearity: (a) variance inflation factors (VIF) and (b) tolerance values. As shown in Table 2, the VIF values of our constructs range from 1.665 to 2.063, well below the recommended threshold of 3.0 (Diamantopoulos, 2011). The smallest tolerance value of the predictor variables is 0.506, which is far greater than the critical value of 0.1 for potential multicollinearity problem (Miles, 2014). Thus, no significant multicollinearity problem exists in this study.

5.2. Structural model

In PLS analysis, the significance of structural paths and the R^2 of endogenous variables are usually used to evaluate the explanatory ability of a structural model. From the results of PLS analysis depicted in Fig. 2, we can see that the proposed model explained 50% of the variance in attitude toward knowledge withholding and 43% of the variance in knowledge withholding intentions. This provides empirical evidence for the validity and explanatory power of the model. Then, the goodness-of-fit (GoF) was obtained through the formula proposed by Tenenhaus, Amato, and Esposito Vinzi (2004). The GoF of our model is 0.54, which exceeds the cutoff value of 0.36 for a large effect size (Wetzels & Odekerken, 2009). In summary, the model proposed in this study has a good fitting effect.

The support of a hypothesis is determined by judging the significance of the corresponding path. When the P-value is smaller than 0.05 (or the
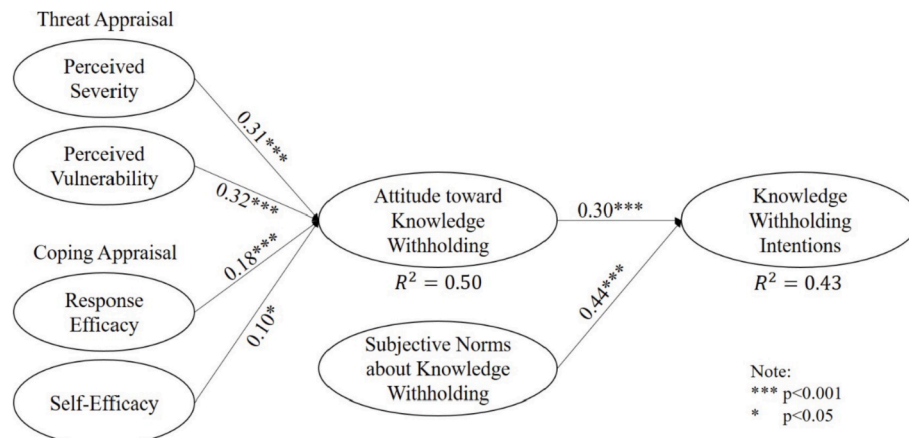

Fig. 2. PLS results.

Table 6
Results of mediating effects.

Independent variable	Mediating variable	Dependen variable	Bootstrapping results			Hypothesis testing
			Indirect effect	LLCI	ULCI	
PS	AKW	KWI	0.039	0.004	0.084	H6 is supported
PV	AKW	KWI	0.044	0.004	0.087	H7 is supported
RE	AKW	KWI	0.022	0.003	0.059	H8 is supported
SE	AKW	KWI	0.014	0.001	0.044	H9 is supported

Note: PS=Perceived severity, PV=Perceived vulnerability, RE = Response efficacy, SE=Self-efficacy, AKW = Attitude toward knowledge withholding, KWI=Knowledge withholding intentions.

T-value is larger than 1.96), we consider the path to be significant. Hence, as shown in Fig. 2, in terms of threat appraisal, both perceived severity and perceived vulnerability are positively related to an individual's attitude toward knowledge withholding, with path coefficients at 0.31 (t = 5.747, p < 0.001) and 0.32 (t = 6.461, p < 0.001), respectively, supporting H1 and H2. Coping appraisal aspect of PMT, response efficacy (β = 0.18, t = 3.307, p < 0.001), and self-efficacy (β = 0.10, t = 2.091, p < 0.05) demonstrate significant and positive relationships with the attitude toward knowledge withholding, providing support for H3 and H4. As expected, the path coefficient from attitude toward knowledge withholding to knowledge withholding intentions is 0.30 and significant at the 0.001 level, indicating that the relationship between attitude and knowledge withholding intentions is significant and positive, which gives sufficient support to H5. Meanwhile, the result also supports H10, the relationship between subjective norms about knowledge withholding and knowledge withholding intentions is significant (β = 0.44, t = 8.428, p < 0.001). Thus far, the hypotheses of direct relationships proposed in this study are all supported.

To examine the mediating role of attitude, we followed the suggestions of Preacher, Rucker, and Hayes (2007), bootstrapping approach was used to verify the remaining four hypotheses. The indirect effects and the associated 95% bias-corrected confidence intervals (LLCI and ULCI) are presented in Table 6 (5000 bootstrap resamples). According to Srivastava, Teo, and Devaraj (2017), when the confidence intervals exclude zero, the indirect effect (mediation in this study) is considered meaningful. The results indicate that attitude toward knowledge withholding significantly mediates the relationships of perceived severity (β = 0.039, LLCI = 0.004, ULCI = 0.084) and perceived vulnerability (β = 0.044, LLCI = 0.004, ULCI = 0.087) with knowledge withholding intentions. The results also suggest that the attitude toward knowledge withholding exerts significant mediating effects in the relationships of knowledge withholding intentions with response efficacy (β = 0.022, LLCI = 0.003, ULCI = 0.059) and self-efficacy (β = 0.014, LLCI = 0.001, ULCI = 0.044). Therefore, the data analysis results provide sufficient evidence for the hypotheses of indirect relationships proposed in this study, that is, H6, H7, H8 and H9 are all supported.

6. Discussion and implications

The objective of this study is to explore an essential but little-studied context topic, knowledge withholding, which is highly prevalent in online space. Drawing on PMT and TRA, we developed an integrated framework to investigate knowledge withholding in cyberspace. Data from 386 online surveys were used to empirically verify our research model. As expected, the results support all our hypotheses. The findings of this study are worth further discussion along with their implications and some directions for further research.

First, this study finds that PMT has strong explanatory power for knowledge withholding behavior. In other words, it is feasible to regard knowledge withholding in cyberspace as a self-protection behavior of Internet users. The results show that all the protective motivational factors, including perceived severity, perceived vulnerability, response efficacy, and self-efficacy, are significantly associated with an

individual's attitude toward knowledge withholding in cyberspace (H1-H4), and they account for half of the variance in attitude toward knowledge withholding. Additionally, by comparing the path coefficients according to the formula proposed by Chin, Marcolin, and Newsted (2003), we obtain additional interesting findings. For example, threat appraisal (β = 0.31, 0.32) is more critical in determining the attitude toward knowledge withholding than coping appraisal (β = 0.18, 0.10). Specific to threat appraisal, perceived vulnerability plays a slightly more important role in the process of attitude formation than perceived severity (0.32 > 0.31, t = 2.475). In terms of coping appraisal, response efficacy is the stronger impelling force of one's attitude toward knowledge withholding (0.18 > 0.10, t = 19.422).

Furthermore, this study also provides evidence that TRA has great explanatory power for knowledge withholding behavior. That is, it is suitable to regard knowledge withholding in cyberspace as users' rational behaviors, rather than impulsive or habitual behaviors. This finding suggests a viable approach to reducing counterproductive knowledge behaviors, that is, to change the balance process of users' trade-offs. In particular, the results demonstrate that both attitude toward knowledge withholding and subjective norms about knowledge withholding are significantly related to individuals' knowledge withholding intentions in cyberspace (H5 and H10) and together explain 43% of the variance in knowledge withholding intentions. Furthermore, subjective norms act as the major facilitator of knowledge withholding intentions, since the path coefficient from subjective norms to knowledge withholding intentions is significantly greater than that from attitude to knowledge withholding intentions (0.44 > 0.30, t = 38.559). This may be due to cultural differences, since this study was conducted in Mainland China, which is a state that advocates collectivism. According to Hofstede (1984), individualism places great emphasis on independence; people in individualistic cultures are largely influenced by their own thoughts and feelings, whereas people in collectivist cultures value the opinions of others, are cooperative and are afraid of being isolated. Thus, Chinese Internet users are more susceptible to social pressures.

Alternatively, we suggest the important role of attitude in the formation of protection motivations, H6 to H9 were all supported, providing effective evidence for this finding. In our study, attitude toward knowledge withholding not only significantly mediates the relationship between threat appraisal (perceived severity, perceived vulnerability) and knowledge withholding intentions but also significantly mediates the relationship between coping appraisal (response efficacy, self-efficacy) and knowledge withholding intentions. More generally, an individual's assessments of potential threats caused by unsafe behavior or inaction, together with the perceived benefits of adopting adaptive behaviors, will motivate him/her to engage in protective behavior by shaping his/her specific attitude toward adaptive behavior, which represents a more proximal determinant of protection motivation. Therefore, from the perspective of psychology, it is possible to reduce knowledge withholding behavior in risky situations (such as online space) by guiding positive attitudes toward knowledge sharing and negative attitudes toward knowledge withholding.

6.1. Implications for research

The theoretical contributions of this study can be understood in the following three ways. First, unlike prior KM research, which focused on positively sharing knowledge to promote production, this study responds to the call to shed light on negative knowledge behaviors. We seek to investigate an overarching concept that covers different types of counterproductive knowledge behaviors, that is, knowledge withholding. Furthermore, unlike existing research, which has paid extensive attention to knowledge withholding within organizations, this study focuses on online space, which is an important but little-studied context in this field. Knowledge withholding in cyberspace greatly hinders the transfer of social knowledge. On the one hand, online space has become the main way for people to acquire and share knowledge in the current information age, and knowledge behaviors in cyberspace should be highly valued. On the other hand, unlike organizations, where employees are closely connected with each other, the loose connection in cyberspace makes it likely for users to withhold their knowledge. In this regard, this study enriches the current extremely limited literature on knowledge withholding in online space by investigating such behavior, providing empirical support for further research on this topic.

Second, through regarding knowledge withholding in cyberspace as rational self-protection behavior, this study advances theory by integrating PMT and TRA on investigating withhold knowledge in cyberspace. Specifically, we construct an integrated framework including protective motivational factors (perceived severity, perceived vulnerability, response efficacy, and self-efficacy) and reasoned action factors (attitude, subjective norms) to help us understand the process by which knowledge withholding intentions are formed. The results of the data analysis support all our hypotheses, indicating that PMT and TRA can provide a good explanation for this counterproductive knowledge behavior. The introduction of PMT and TRA not only provides new theoretical perspectives for understanding this specific behavior but also extends the application scope of these theories by verifying their explanatory power in the current research domain.

Third, this study argues for the first time that attitude should be of great concern in the field of knowledge withholding research. Although many prior studies have confirmed the significant mediating roles of attitude on the relationships between external factors and behavioral intentions, to our best knowledge, it is limited in other research domains. Prior studies on knowledge withholding generally take psychological ownership and territoriality as the proximal antecedents of knowledge withholding behavior, ignoring another important psychological factor, attitude. The results of this study indicate that attitude toward knowledge withholding not only directly and positively associates with knowledge withholding intentions but also significantly mediates the relationships of protective motivational factors and knowledge withholding intentions. Hence, by emphasizing the critical role of attitude in the formation of self-protection motivation, this study argues that attitude deserves more attention from scholars, which also provides potential research ideas for future research.

6.2. Implications for practice

Knowledge withholding, as a series of counterproductive knowledge behaviors, seriously hinders the dissemination and accumulation of social knowledge. It is of great practical value to study individuals' knowledge withholding behavior in the context of cyberspace. This study provides meaningful implications for practice in the following three ways. First, threat appraisal is much more critical in shaping an individual's attitude toward knowledge withholding than coping appraisal, indicating that Internet users usually attach great importance to the negative consequences of sharing knowledge without withholding. In this regard, to avoid users' knowledge withholding behavior, which results in a silent majority in online space, online community operators should take measures to reduce users' psychological perceptions of the threats caused by knowledge sharing. For instance, a strict copyright protection mechanism and infringement punishment policies should be established to prevent infringement. Building a reliable knowledge authorization system is useful to improve users' confidence in online knowledge security. Moreover, websites can also eliminate users' concerns about their privacy and security by formulating effective privacy protection policies and civilized Internet conventions. This study provides evidence that users are less likely to withhold knowledge in online space when they are no longer worried about the threats of sharing knowledge.

Second, the findings of this study show that individuals' beliefs in coping behavior also associates with their attitudes toward such behavior. From this perspective, another possible way to reduce knowledge withholding is to change users' evaluations of such behavior. Obviously, some potential measures should be considered to prevent coping appraisal from growing. For example, online community operators are advised to increase the diversity and richness of community knowledge by attracting a wider user base or rewarding users for sharing their knowledge. While bringing users benefits, it also decreases the perceived value of private knowledge. According to Huo et al. (2016), perceived knowledge value significantly and positively moderates the relationship between individual psychological ownership and territoriality, further leads to knowledge hiding. Therefore, a low level of perceived knowledge value is helpful in inhibiting knowledge withholding. In addition, unlike face-to-face situations, it is easy for users to withhold knowledge due to the loose connection in cyberspace. In this regard, encouraging users to form relatively close bonds within smaller teams by creating subgroups based on their classification might also work. This method can prevent users from developing a high level of self-efficacy because people will consciously increase the frequency of knowledge sharing in a strongly connected environment; thus, withholding knowledge is no longer easy.

Third, according to the results of this study, we suggest reducing knowledge withholding behavior by encouraging subjective norms about sharing knowledge rather than withholding knowledge. For individuals, subjective norms reflect the social influence of others around them, especially in areas where collectivism is emphasized, such as China, the role of social influence on individuals' behaviors is extremely important. It provides valuable advice for online community managers. On the one hand, an atmosphere of positive reciprocity should be created to habituate helping behaviors. On the other hand, the harms of knowledge withholding can be emphasized to help users realize that such selfish behavior hinders social progress. In this way, a community atmosphere that resists counterproductive knowledge behaviors such as knowledge withholding is gradually created. Meanwhile, it is recommended to encourage users to put social and group interests first and share more rather than just obtain knowledge from others.

6.3. Limitations and future research directions

Although this study has several original findings, meaningful theoretical and practical implications, the limitations of this study should also be highlighted so as to benefit future research. First of all, some constructs in PMT, such as response cost, were not explored in the current study. The cost of withholding knowledge in cyberspace may not be obvious, but what about in other contexts? In this sense, it is worth examining the power of complete PMT to explain knowledge withholding behavior in other research contexts. Second, this study was conducted in Mainland China, there will inevitably be an influence of cultural differences. For instance, we find that subjective norms, rather than attitude, exert the major role in determining knowledge withholding intentions in cyberspace. Thus, we suggest that future studies use a wider range of samples to test the robustness of our results or conduct cross-cultural studies to verify our assumptions about cultural differences. Third, to quickly obtain sufficient samples, this study collected data using online survey questionnaires. Although this

approach has its advantages, it may bias the results due to the lack of supervision and the subjectivity of respondents. Therefore, it is recommended that convincing data be obtained through supervised surveys, interviews or experiments. Finally, although our research focuses on online space, we did not limit the participants to specific online communities or platforms in our survey, which enabled the respondents to answer the questions based on their most intuitive feelings, but there may be huge individual differences resulting from technologies. Hence, while calling for additional studies addressing knowledge withholding behavior in online settings, we also advocate selecting a more specific research context to eliminate the influence of technical differences on individual perception.

CRediT authorship contribution statement

Dongming Wu: Conceptualization, Methodology, Investigation, Data curation, Writing - original draft, Writing - review & editing.

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Appendix. Measurement items and their sources

Perceived severity (PS) (Workman et al., 2008).

PS1: Having someone successfully access all my knowledge is harmful to me.

PS2: The threats, uncertainties and risks resulting from sharing knowledge in cyberspace are harmful to me.

PS3: The abuse of my shared knowledge in cyberspace by others is harmful to me.

PS4: Spreading my shared knowledge in cyberspace without my permission is a serious problem for me.

PS5: Losing control of knowledge resulting from sharing knowledge in cyberspace is a serious problem for me.

Perceived vulnerability (PV) (Workman et al., 2008).

PV1: The likelihood that someone abuses my shared knowledge in cyberspace is high.

PV2: The likelihood of suffering losses if I share all my knowledge without withholding in cyberspace is high.

PV3: The likelihood of knowledge infringements in cyberspace is high.

Response efficacy (RE) (Workman et al., 2008).

RE1: Withholding knowledge in cyberspace is an effective way to prevent losses.

RE2: Withholding knowledge in cyberspace will prevent me from negative influences.

RE3: Withholding knowledge in cyberspace to prevent losses is effective.

RE4: The knowledge withholding measures available to me to stop others from abusing my knowledge are adequate.

Self-efficacy (SE) (Workman et al., 2008).

SE1: I have the skills to implement available knowledge withholding measures to stop others from abusing my knowledge.

SE2: I have the skills to implement available knowledge withholding measures to stop others from negatively affecting me.

Attitude toward knowledge withholding (AKW) (Bulgurcu et al., 2010).

AKW1: Withholding knowledge in cyberspace is a good idea.

AKW2: Withholding knowledge in cyberspace is necessary.

AKW3: Withholding knowledge in cyberspace is beneficial.

Subjective norms about knowledge withholding (SN) (Herath & Rao, 2009; Lee, 2011).

SN1: My boss/mentor thinks that I should withhold knowledge in cyberspace.

SN2: My colleagues/classmates think that I should withhold knowledge in cyberspace.

SN3: Most people whose opinions are valuable to me withhold knowledge in cyberspace.

SN4: Most people who are important to me withhold knowledge in cyberspace.

Knowledge withholding intentions (KWI) (Tsay et al., 2014).

KWI1: I would give less than full effort in contributing knowledge in cyberspace.

KWI2: I would avoid contributing knowledge in cyberspace as much as possible.

KWI3: I would put in less effort to contribute knowledge in cyberspace than I know I can.

References

Abubakar, A. M., Behravesh, E., Rezapouraghdam, H., & Yildiz, S. B. (2019). Applying artificial intelligence technique to predict knowledge hiding behavior. *International Journal of Information Management, 49*, 45–57.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control* (pp. 11–39). Heidelberg, Germany: Springer.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. New Jersey: Prentice-Hall.

Aljawarneh, N. M. S., & Atan, T. (2018). Linking tolerance to workplace incivility, service innovative, knowledge hiding, and job search behavior: The mediating role of employee cynicism. *Negotiation and Conflict Management Research, 11*(4), 298–320.

Anaza, N. A., & Nowlin, E. L. (2017). What's mine is mine: A study of salesperson knowledge withholding & hoarding behavior. *Industrial Marketing Management, 64*, 14–24.

Anderson, C. L., & Agarwal, R. (2010). Practicing safe computing: A multimedia empirical examination of home computer user security behavioral intentions. *MIS Quarterly, 34*(3), 613–643.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103*(3), 411–423.

Arpaci, I., & Baloğlu, M. (2016). The impact of cultural collectivism on knowledge sharing among information technology majoring undergraduates. *Computers in Human Behavior, 56*, 65–71.

Arshad, R., & Ismail, I. R. (2018). Workplace incivility and knowledge hiding behavior: Does personality matter? *Journal of Organizational Effectiveness, 5*(3), 278–288.

Babcock, P. (2004). Shedding light on knowledge management. *HRMagazine, 49*(5), 46–50.

Bagozzi, R. P. (1982). A field investigation of causal relations among cognitions, affect, intentions, and behavior. *Journal of Marketing Research, 19*(4), 562–584.

Bagozzi, R. P., Yi, Y., & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly, 36*(3), 421–458.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215.

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology, 4*(3), 359–373.

Bandura, A. (1991). Social cognitive theory of moral thought and action. In *Handbook of moral behavior and development* (pp. 69–128). Psychology Press.

Bockarjova, M., & Steg, L. (2014). Can protection motivation theory predict pro-environmental behavior? Explaining the adoption of electric vehicles in The Netherlands. *Global Environmental Change, 28*, 276–288.

Bogilović, S., Černe, M., & Škerlavaj, M. (2017). Hiding behind a mask? Cultural intelligence, knowledge hiding, and individual and team creativity. *European Journal of Work & Organizational Psychology, 26*(5), 710–723.

Brown, J. J., & Reingen, P. H. (1987). Social ties and word-of-mouth referral behavior. *Journal of Consumer Research, 14*(3), 350–362.

Bulgurcu, B., Cavusoglu, H., & Benbasat, I. (2010). Information security policy compliance: An empirical study of rationality-based beliefs and information security awareness. *MIS Quarterly, 34*(3), 523–548.

Burmeister, A., Fasbender, U., & Gerpott, F. H. (2019). Consequences of knowledge hiding: The differential compensatory effects of guilt and shame. *Journal of Occupational and Organizational Psychology, 92*(2), 281–304.

Černe, M., Nerstad, C. G. L., Dysvik, A., & Škerlavaj, M. (2014). What goes around comes around: Knowledge hiding, perceived motivational climate, and creativity. *Academy of Management Journal, 57*(1), 172–192.

Chang, H. H., & Chuang, S. S. (2011). Social capital and individual motivations on knowledge sharing: Participant involvement as a moderator. *Information & Management, 48*(1), 9–18.

Chen, Y., Podolski, E. J., & Veeraraghavan, M. (2017). National culture and corporate innovation. *Pacific-Basin Finance Journal, 43*, 173–187.

Chen, M. F., & Tung, P. J. (2014). Developing an extended Theory of Planned Behavior model to predict consumers' intention to visit green hotels. *International Journal of Hospitality Management, 36*, 221–230.

Chin, W. W. (1998). The partial least squares approach to structural modeling. *Modern Methods for Business Research, 295*(2), 295–336.

Chin, W. W., Marcelin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information Systems Research, 14*(2), 189–217.

Connelly, C. E., & Zweig, D. (2015). How perpetrators and targets construe knowledge hiding in organizations. *European Journal of Work & Organizational Psychology, 24*(3), 479–489.

Connelly, C. E., Zweig, D., Webster, J., & Trougakos, J. P. (2012). Knowledge hiding in organizations. *Journal of Organizational Behavior, 33*(1), 64–88.

Das, A. K., Yi, L., & Uddin, M. A. (2018). Knowledge withholding in sharing knowledge within an organisation: The shadowy impediment in spreading innovation. *International Journal of Knowledge Management Studies, 9*(4), 381–402.

Diamantopoulos. (2011). Incorporating formative measures into covariance-based structural equation models. *MIS Quarterly, 35*(2), 335–358.

Doane, A. N., Boothe, L. G., Pearson, M. R., & Kelley, M. L. (2016). Risky electronic communication behaviors and cyberbullying victimization: An application of Protection Motivation Theory. *Computers in Human Behavior, 60*, 508–513.

Doane, A. N., Pearson, M. R., & Kelley, M. L. (2014). Predictors of cyberbullying perpetration among college students: An application of the Theory of Reasoned Action. *Computers in Human Behavior, 36*, 154–162.

Dyne, L. Van, Ang, S., & Botero, I. C. (2003). Conceptualizing employee silence and employee voice as multidimensional constructs. *Journal of Management Studies, 40*(6), 1359–1392.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Harcourt Brace Jovanovich College Publishers.

Evans, J. M., Hendron, M. G., & Oldroyd, J. B. (2015). Withholding the ace: The individual- and unit-level performance effects of self-reported and perceived knowledge hoarding. *Organization Science, 26*(2), 494–510.

Fang, Y.-H. (2017). Coping with fear and guilt using mobile social networking applications: Knowledge hiding, loafing, and sharing. *Telematics and Informatics, 34*(5), 779–797.

Feng, J., & Wang, C. (2019). Does abusive supervision always promote employees to hide knowledge? From both reactance and COR perspectives. *Journal of Knowledge Management, 23*(7), 1455–1474.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, and behavior: An introduction to theory and research*. Reading, Mass: Addison Wessley.

Fong, P. S. W., Men, C., Luo, J., & Jia, R. (2018). Knowledge hiding and team creativity: The contingent role of task interdependence. *Management Decision, 56*(2), 329–343.

Ford, D., Myrden, S. E., & Jones, T. D. (2015). Understanding "disengagement from knowledge sharing": Engagement theory versus adaptive cost theory. *Journal of Knowledge Management, 19*(3), 476–496.

Ford, D. P., & Staples, S. (2010). Are full and partial knowledge sharing the same? *Journal of Knowledge Management, 14*(3), 394–409.

Fornell, C., & Bookstein, F. L. (1982). Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing Research, 19*(12), 440–452.

Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research, 18*(3), 382–388.

Fu, P. W., Wu, C. C., & Cho, Y. J. (2017). What makes users share content on facebook? Compatibility among psychological incentive, social capital focus, and content type. *Computers in Human Behavior, 67*, 23–32.

Gámez-Guadix, M., & Mateos-Pérez, E. (2019). Longitudinal and reciprocal relationships between sexting, online sexual solicitations, and cyberbullying among minors. *Computers in Human Behavior, 94*, 70–76.

Gao, W., Liu, Z., Guo, Q., & Li, X. (2018). The dark side of ubiquitous connectivity in smartphone-based SNS: An integrated model from information perspective. *Computers in Human Behavior, 84*, 185–193.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology, 78*(6), 1360–1380.

Haggart, B., & Jablonski, M. (2017). Internet freedom and copyright maximalism: Contradictory hypocrite or complementary policies? *The Information Society, 33*(3), 103–118.

Han, H., Hsu, L. T., & Sheu, C. (2010). Application of the theory of planned behavior to green hotel choice: Testing the effect of environmental friendly activities. *Tourism Management, 31*(3), 325–334.

Hansen, T., Jensen, J. M., & Solgaard, H. S. (2004). Predicting online grocery buying intention: A comparison of the theory of reasoned action and the theory of planned behavior. *International Journal of Information Management, 24*(6), 539–550.

Hara, N., & Sanfilippo, M. R. (2017). Analysis of roles in engaging contentious online discussions in science. *Journal of the Association for Information Science and Technology, 68*(8), 1953–1966.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115–135.

Heo, M. S., & Cheon, M. J. (2016). An empirical study on the relationship between knowledge and psychological ownership of members and intention to deny knowledge sharing: Focused on motivational factors of members. *Knowledge Management Research, 17*(2), 103–130.

Herath, T., & Rao, H. R. (2009). Protection motivation and deterrence: A framework for security policy compliance in organisations. *European Journal of Information Systems, 18*(2), 106–125.

Hofstede, G. H. (1984). *Culture's consequences: International differences in work-related values*. Newbury Park, California: Sage Publications.

Hung, S. Y., Lai, H. M., & Chou, Y. C. (2015). Knowledge-sharing intention in professional virtual communities: A comparison between posters and lurkers. *Journal of the Association for Information Science and Technology, 66*(12), 2494–2510.

Huo, W., Cai, Z., Luo, J., Men, C., & Jia, R. (2016). Antecedents and intervention mechanisms: A multi-level study of R&D team's knowledge hiding behavior. *Journal of Knowledge Management, 20*(5), 880–897.

Husted, K., Michailova, S., Minbaeva, D. B., & Pedersen, T. (2012). Knowledge-sharing hostility and governance mechanisms: An empirical test. *Journal of Knowledge Management, 16*(5), 754–773.

Ifinedo, P. (2012). Understanding information systems security policy compliance: An integration of the theory of planned behavior and the protection motivation theory. *Computers & Security, 31*(1), 83–95.

Israilidis, J., Siachou, E., Cooke, L., & Lock, R. (2015). Individual variables with an impact on knowledge sharing: The critical role of employees' ignorance. *Journal of Knowledge Management, 19*(6), 1109–1123.

Jahanzeb, S., Fatima, T., Bouckenooghe, D., & Bashir, F. (2019). The knowledge hiding link: A moderated mediation model of how abusive supervision affects employee creativity. *European Journal of Work & Organizational Psychology, 28*(6), 810–819.

Johnston, A. C., & Warkentin, M. (2010). Fear appeals and information security behaviors: An empirical study. *MIS Quarterly, 34*(3), 549–566.

Khalid, M., Bashir, S., Khan, A. K., & Abbas, N. (2018). When and how abusive supervision leads to knowledge hiding behaviors: An Islamic work ethics perspective. *The Leadership & Organization Development Journal, 39*(6), 794–806.

Kim, Y. J., Chun, J. U., & Song, J. (2009). Investigating the role of attitude in technology acceptance from an attitude strength perspective. *International Journal of Information Management, 29*(1), 67–77.

Kling, R. (2007). What is social informatics and why does it matter? *The Information Society, 23*(4), 205–220.

Kumar Jha, J., & Varkkey, B. (2018). Are you a cistern or a channel? Exploring factors triggering knowledge-hiding behavior at the workplace: Evidence from the Indian R&D professionals. *Journal of Knowledge Management, 22*(4), 824–849.

Lee, Y. (2011). Understanding anti-plagiarism software adoption: An extended protection motivation theory perspective. *Decision Support Systems, 50*(2), 361–369.

Lee, D., Larose, R., & Rifon, N. (2008). Keeping our network safe: A model of online protection behaviour. *Behaviour & Information Technology, 27*(5), 445–454.

Lee, Y., & Larsen, K. R. (2009). Threat or coping appraisal: Determinants of SMB executives' decision to adopt anti-malware software. *European Journal of Information Systems, 18*(2), 177–187.

Leonard, L. N. K., Cronan, T. P., & Kreie, J. (2004). What influences IT ethical behavior intentions - planned behavior, reasoned action, perceived importance, or individual characteristics? *Information & Management, 42*(1), 143–158.

Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. *MIS Quarterly, 31*(1), 59–87.

Lin, H. F. (2007). Effects of extrinsic and intrinsic motivation on employee knowledge sharing intentions. *Journal of Information Science, 33*(2), 135–149.

Lin, T. C., & Huang, C. C. (2010). Withholding effort in knowledge contribution: The role of social exchange and social cognitive on project teams. *Information & Management, 47*(3), 188–196.

Liu, Y., Segev, S., & Villar, M. E. (2017). Comparing two mechanisms for green consumption: Cognitive-affect behavior vs theory of reasoned action. *Journal of Consumer Marketing, 34*(5), 442–454.

Marques, F. M. F. R., La Falce, J. L., Marques, J. M. R., & De Muylder, C. F. (2019). The relationship between stress and maturity in knowledge management. *International Journal of Organizational Analysis, 27*(5), 1504–1521.

Martelo-Landroguez, S., Cegarra Navarro, J. G., & Cepeda-Carrión, G. (2019). Uncontrolled counter-knowledge: Its effects on knowledge management corridors. *Knowledge Management Research and Practice, 17*(2), 203–212.

Menard, P., Bott, G. J., & Crossler, R. E. (2017). User motivations in protecting information security: Protection motivation theory versus self-determination theory. *Journal of Management Information Systems, 34*(4), 1203–1230.

Miles, J. (2014). *Tolerance and variance inflation factor*. Wiley StatsRef: Statistics Reference Online.

Milne, S., Sheeran, P., & Orbell, S. (2000). Prediction and intervention in health-related behavior: A meta-analytic review of protection motivation theory. *Journal of Applied Social Psychology, 30*(1), 106–143.

Mishra, D., Mishra, A., & Akman, I. (2014). Theory of reasoned action application for green information technology acceptance. *Computers in Human Behavior, 36*, 29–40.

Mohamed, N., & Ahmad, I. H. (2012). Information privacy concerns, antecedents and privacy measure use in social networking sites: Evidence from Malaysia. *Computers in Human Behavior, 28*(6), 2366–2375.

Offergelt, F., Spörrle, M., Moser, K., & Shaw, J. D. (2019). Leader-signaled knowledge hiding: Effects on employees' job attitudes and empowerment. *Journal of Organizational Behavior, 40*(7), 819–833.

Pan, W., & Zhang, Q. (2018). Withholding knowledge in teams: An interactionist perspective of personality, justice, and autonomy. *Social Behavior and Personality: International Journal, 46*(12), 2009–2024.

Pan, W., Zhang, Q., Teo, T. S. H., & Lim, V. K. G. (2018). The dark triad and knowledge hiding. *International Journal of Information Management, 42*, 36–48.

Peng, H. (2012). Counterproductive work behavior among Chinese knowledge workers. *International Journal of Selection and Assessment, 20*(2), 119–138.

Peng, H. (2013). Why and when do people hide knowledge? *Journal of Knowledge Management, 17*(3), 398–415.

Peng, H., & Pierce, J. (2015). Job- and organization-based psychological ownership: Relationship and outcomes. *Journal of Managerial Psychology, 30*(2), 151–168.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879–903.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*(1), 185–227.

Prentice-Dunn, S., & Rogers, R. W. (1986). Protection motivation theory and preventive health: Beyond the health belief model. *Health Education Research, 1*(3), 153–161.

Ramayah, T., Lee, J. W. C., & Mohamad, O. (2010). Green product purchase intention: Some insights from a developing country. *Resources, Conservation and Recycling, 54*(12), 1419–1427.

Rathore, S., Sangaiah, A. K., & Park, J. H. (2018). A novel framework for internet of knowledge protection in social networking services. *Journal of Computational Science, 26*, 55–65.

Rhee, Y. W., & Choi, J. N. (2017). Knowledge management behavior and individual creativity: Goal orientations as antecedents and in-group social status as moderating contingency. *Journal of Organizational Behavior, 38*(6), 813–832.

Ringle, C. M., Wende, S., & Will, A. (2005). *SmartPLS 2.0 (M3) beta* (2005), Hamburg Germany.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change 1. *Journal of Psychology, 91*(1), 93–114.

Rogers, R. W., & Prentice-Dunn, S. (1997). Protection motivation theory. In D. S. Gochman (Ed.), *Handbook of health behavior research I: Personal and social determinants* (pp. 113–132). New York: Plenum.

Semerci, A. B. (2019). Examination of knowledge hiding with conflict, competition and personal values. *International Journal of Conflict Management, 30*(1), 111–131.

Serenko, A. (2019). Knowledge sabotage as an extreme form of counterproductive knowledge behavior: Conceptualization, typology, and empirical demonstration. *Journal of Knowledge Management, 23*(7), 1260–1288.

Serenko, A., & Bontis, N. (2016). Understanding counterproductive knowledge behavior: Antecedents and consequences of intra-organizational knowledge hiding. *Journal of Knowledge Management, 20*(6), 1199–1224.

Shen, X. L., Li, Y. J., Sun, Y., Chen, J., & Wang, F. (2019). Knowledge withholding in online knowledge spaces: Social deviance behavior and secondary control perspective. *Journal of the Association for Information Science and Technology, 70*(4), 385–401.

Singh, S. K. (2019). Territoriality, task performance, and workplace deviance: Empirical evidence on role of knowledge hiding. *Journal of Business Research, 97*, 10–19.

Škerlavaj, M., Connelly, C. E., Cerne, M., & Dysvik, A. (2018). Tell me if you can: Time pressure, prosocial motivation, perspective taking, and knowledge hiding. *Journal of Knowledge Management, 22*(7), 1489–1509.

Srivastava, S. C., Teo, T. S. H., & Devaraj, S. (2017). You can't bribe a computer: Dealing with the societal challenge of corruption through ICT. *MIS Quarterly, 40*(2), 511–526.

Stenius, M., Hankonen, N., Ravaja, N., & Haukkala, A. (2016). Why share expertise? A closer look at the quality of motivation to share or withhold knowledge. *Journal of Knowledge Management, 20*(2), 181–198.

Sun, Y., Shen, X. L., & Wang, N. (2015). Knowledge withholding in online brand community: A neutralization perspective. In *International conference on information systems: Exploring the information frontier*. ICIS 2015.

Tenenhaus, M., Amato, S., & Esposito Vinzi, V. (2004). A global goodness-of-fit index for PLS structural equation modelling. In *Proceedings of the XLII SIS scientific meeting* (pp. 739–742). Padova: CLEUP.

Tsai, H. S., Jiang, M., Alhabash, S., LaRose, R., Rifon, N. J., & Cotten, S. R. (2016). Understanding online safety behaviors: A protection motivation theory perspective. *Computers & Security, 59*, 138–150.

Tsay, C. H. H., Lin, T. C., Yoon, J., & Huang, C. C. (2014). Knowledge withholding intentions in teams: The roles of normative conformity, affective bonding, rational choice and social cognition. *Decision Support Systems, 67*, 53–65.

Tulloch, H., Reida, R., D'Angeloa, M. S., Plotnikoff, R. C., Morrina, L., Beatona, L., et al. (2009). Predicting short and long-term exercise intentions and behaviour in patients with coronary artery disease: A test of protection motivation theory. *Psychology and Health, 24*(3), 255–269.

Vance, A., Siponen, M., & Pahnila, S. (2012). Motivating IS security compliance: Insights from habit and protection motivation theory. *Information & Management, 49*(3–4), 190–198.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478.

Wang, S., & Noe, R. A. (2010). Knowledge sharing: A review and directions for future research. *Human Resource Management Review, 20*(2), 115–131.

Webster, J., Brown, G., Zweig, D., Connelly, C. E., Brodt, S., & Sitkin, S. (2008). Beyond knowledge sharing: Withholding knowledge at work. *Research in Personnel and Human Resources Management, 27*(8), 1–37.

Wei, Z., Du, Z., & Bao, Y. (2018). Outsourcer knowledge protection, psychological contract schema, and project performance: A vendor's perspective. *IEEE Transactions on Engineering Management, 65*(1), 128–140.

Wetzels, M., & Odekerken, G. (2009). Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration. *MIS Quarterly, 33*(1), 177–195.

Witherspoon, C. L., Bergner, J., Cockrell, C., & Stone, D. N. (2013). Antecedents of organizational knowledge sharing: A meta-analysis and critique. *Journal of Knowledge Management, 17*(2), 250–277.

Workman, M., Bommer, W. H., & Straub, D. (2008). Security lapses and the omission of information security measures: A threat control model and empirical test. *Computers in Human Behavior, 24*(6), 2799–2816.

Zhao, H., Liu, W., Li, J., & Yu, X. (2019). Leader–member exchange, organizational identification, and knowledge hiding: The moderating role of relative leader–member exchange. *Journal of Organizational Behavior, 40*(7), 834–848.

Zhao, H., & Xia, Q. (2017). An examination of the curvilinear relationship between workplace ostracism and knowledge hoarding. *Management Decision, 55*(2), 331–346.

Zhao, H., Xia, Q., He, P., Sheard, G., & Wan, P. (2016). Workplace ostracism and knowledge hiding in service organizations. *International Journal of Hospitality Management, 59*, 84–94.