

Motivating Knowledge Sharing in Knowledge Management Systems: A Quasi-Field Experiment

Sheng Wang

University of Nevada, Las Vegas

Raymond A. Noe

The Ohio State University

Zhong-Ming Wang

Zhejiang University

Many organizations are using knowledge management systems (KMSs) to facilitate knowledge sharing. However, few studies have empirically investigated how individual characteristics and organizational work practices influence knowledge sharing. Based on accountability theory, the person-situation interactional psychology perspective, and the five-factor model of personality, this study uses a quasi-experimental design to investigate how two accountability-inducing management practices—evaluation and evaluation plus reward—and their interactions with personality characteristics influence knowledge sharing using a KMS. One hundred employees from a Chinese software company participated in the study. The authors found that both evaluation and evaluation plus reward had a positive relationship with knowledge sharing. Greater levels of knowledge sharing occurred in the evaluation-plus-reward condition compared with

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Corresponding author: Sheng Wang, Department of Management, University of Nevada, Las Vegas, 4505 Maryland Parkway, Las Vegas, NV 89154, USA.

E-mail: sheng.wang@unlv.edu

the evaluation condition. Also, knowledge sharing was influenced by the interaction between evaluation plus reward and conscientiousness, neuroticism, and openness to experience. Implications of the study results for research and practice are discussed.

Keywords: *knowledge sharing; knowledge management system; personality; accountability; quasi-experiment*

Knowledge sharing is critical, as it can contribute to knowledge application, innovation, and ultimately an organization's competitive advantage (e.g., Jackson, Chuang, Harden, Jiang, & Joseph, 2006). For our purposes, we define *knowledge* as information processed by individuals, including ideas, facts, expertise, and judgments relevant for individual, team, and organizational performance (Alavi & Leidner, 2001; Bartol & Srivastava, 2002). Knowledge sharing involves providing other employees with explicit knowledge (such as formulas, processes, and routines) as well as tacit knowledge (sharing experiences and know-how) to help others accomplish goals, collaborate with others to solve problems, develop new ideas, or implement policies or procedures (Cummings, 2004; Nonaka & Takeuchi, 1995; Pulakos, Dorsey, & Borman, 2003). Knowledge sharing can occur through face-to-face or technology-enhanced interactions with others through knowledge management systems (KMSs; McFadyen & Cannella, 2004; Voelpel, Dous, & Davenport, 2005).

Many organizations are using KMSs to facilitate knowledge sharing (Carley, 1992). KMSs are technology-supported information systems that help document, distribute, and transfer between employees explicit and tacit knowledge to increase organizational effectiveness (Noe, Colquitt, Simmering, & Alvarez, 2003; Voelpel et al., 2005). Sixty percent of global corporations have spent more than \$4.8 billion on KMSs, including intranets, electronic bulletin boards, groupware such as LotusNotes, and electronic communities of practice (Babcock, 2004; Ewing & Keenan, 2001). For example, Cisco Systems uses electronic communities of practice to share knowledge, post questions, provide space for reference materials, and make available Internet links to professional and legal standards and regulations relevant to the community (Dolezalek, 2004; Powers, 2004).

Some companies, such as Siemens and Xerox, have found that their financial investments in KMSs result in increased sales volume and costs savings, but many others have mistakenly assumed that employees will naturally share knowledge, and as a result, these companies have not realized expected benefits (Ewing & Keenan, 2001; Hickins, 1999; Voelpel et al., 2005; Webster et al., 2008). One estimate is that at least \$31.5 billion are lost per year by *Fortune* 500 companies as a result of employees failing to share knowledge (Babcock, 2004).

The purpose of this study is to examine how accountability-inducing management practices and individual personality influence employee knowledge sharing based on accountability theory, the Big Five personality theory, and the person-situation interactionist perspective. This is important for several reasons. First, research has paid insufficient attention to knowledge sharing between employees, instead focusing on knowledge creation and transfer at the team or unit level or at the organizational level (Foss, Husted, & Michailova, 2010). This is a serious shortcoming in knowledge-sharing research because most scholars acknowledge that accumulation of team and organizational knowledge depends on knowledge sharing between employees (Gupta & Govindarajan, 2000; Jarvenpaa & Staples, 2001;

Nonaka, 1994; Polanyi, 1966; Tsoukas & Vladimirou, 2001), and “the lack of attention to micro-foundations has the potential of making it difficult to come forward with managerial advice” (Foss et al., 2010: 467).

Second, knowledge sharing using a KMS creates conditions for a public-goods social dilemma that is, situations in which individuals’ rational actions of trying to maximize their personal benefits lead to damage to the collective (Kollock, 1998). A public good, such as shared knowledge, represents a shared resource that is provided by the contributions of some community members but is available to all members regardless of whether they contribute to the resource. This motivates employees to free ride, or use the KMS without making a contribution. *Free riding* is the personal strategy that yields the best outcome for employees (cf. Dawes, 1980) in the absence of management practices such as rewards or performance evaluations that hold employees accountable for knowledge sharing. This likely results in less knowledge sharing and a reduction in the benefits that can be realized by all the employees with access to the KMS. Therefore, it is critical to understand how knowledge sharing is influenced by accountability-inducing management practices.

Moreover, although it has been suggested that rewards should foster knowledge sharing (Bartol & Srivastava, 2002; Oldham, 2003), studies examining how extrinsic rewards such as cash bonuses and salary affect employee knowledge sharing have found mixed and equivocal results. For example, Cabrera, Collins, and Salgado (2006) found that perceived extrinsic rewards were positively related to knowledge exchange. Unfortunately, they were unable to distinguish providing knowledge from seeking knowledge in the dependent variable. Based on a multiorganizational survey, Kankanhalli, Tan, and Wei (2005) found a positive relationship between perceived economic benefits for knowledge sharing (e.g., salary, bonus, job security, better work assignment) and self-reported frequency of KMS usage. However, other studies have found that employees’ beliefs that they will receive monetary rewards or learning opportunities for knowledge sharing were negatively related to attitudes toward knowledge sharing (Bock & Kim, 2002; Bock, Zmud, Kim, & Lee, 2005), and external motivation was also negatively related to self-reported knowledge sharing (Foss, Minbaeva, Pedersen, & Reinholt, 2009). Also, Lin (2007a, 2007b) found that expected extrinsic rewards such as salary, bonus, and promotion opportunities were not significantly related to individual knowledge-sharing intentions or general knowledge sharing among employees.

It is important to note that the conclusions and practical implications that can be drawn from these studies are limited because they suffer from several methodological limitations. These limitations include relying on self-report measures; measuring independent and dependent variables at the same time from the same source (which results in not only alternative explanations of results but also common method bias); using measures that do not differentiate knowledge sharing from other types of learning-related behavior such as knowledge seeking; examining knowledge sharing in general, rather than knowledge sharing that occurs using a KMS; and failing to examine the influence of different types of incentives on knowledge sharing (e.g., Bock et al., 2005; Cabrera et al., 2006; Lee, Kim, & Kim, 2006).

Third, despite the development of several comprehensive conceptual models of the antecedents of knowledge sharing (e.g., Bartol & Srivastava, 2002; Ipe, 2003), most studies have separately examined how individual differences (e.g., evaluation apprehension, loss of knowledge power) or contextual or situational factors (e.g., management practices) influence knowledge sharing (e.g., see Bordia, Irmer, & Abusah, 2006). This is a shortcoming of prior research

because knowledge sharing is likely influenced by the interaction between individual differences and contextual or situational factors. As a result, our understanding of knowledge sharing can be enhanced by adopting a person–situation interactionist perspective. According to this perspective, the effect of a situation on behavior varies as a function of how the personality of the individual in the situation shapes perceptions of and stimulates different behavioral responses to the situation (Schneider, 1983; Shoda & Mischel, 1993). Also, the principle of trait activation suggests that personality traits influence behavior as a response to situational cues (see Barrick, Mitchell, & Stewart, 2003; Tett & Burnett, 2003; Tett & Guterman, 2000).

For example, research has shown that individual differences and situational factors interact to influence other types of voluntary employee behavior such as participation in employee development activities and training (e.g., Maurer & Tarulli, 1994; Tharenou, 2001). Similarly, personal dispositions likely affect how individuals respond to accountability-inducing management practices such as evaluation. Also, the person–situation interactionist perspective supports the idea that the equivocal results of research on the extrinsic motivation–knowledge sharing relationship is due to differences across employees in how they perceive incentives (Barber & Bretz, 2000; Heneman & Judge, 2000).

This study contributes in several ways to the management literature specifically as it relates to knowledge sharing. This study is grounded in multiple theories, which despite their potential value for understanding knowledge sharing, have received little attention in the knowledge-sharing literature. The theoretical framework for this study is based on accountability theory (Frink et al., 2008; Frink & Klimoski, 1998), the person–situation interactionist perspective based on interactional psychology (e.g., Schneider, 1983; Tett & Burnett, 2003), and Big Five personality theory. The use of person- and situation-based theories can help us gain better insight into employee knowledge sharing. This study addresses the need for more employee-level knowledge-sharing research by examining the relationship between two management practices that induce accountability (performance evaluation and performance evaluation and explicit rewards) and knowledge sharing and the moderating role of personality traits (the Big Five). The study investigates the necessity of establishing management practices that hold employees accountable for knowledge sharing following implementation of KMSs. Examining personality traits also helps us better understand how internal motivation or drive influence the accountability–knowledge sharing relationship. Last, this study addresses the methodological limitations of previous knowledge-sharing research. We use a quasi-experimental design conducted in a field setting with explicit manipulations of evaluation and rewards, which increases the internal validity of the results. Also, to overcome common method bias concerns and improve the validity of our knowledge-sharing measure, we use expert ratings of knowledge sharing (which take both quality and quantity into consideration) as the dependent variable rather than self-reported intentions to share knowledge or knowledge-sharing behavior.

Theoretical Background and Hypotheses

Accountability

Accountability has been recognized as one of the most fundamental elements in organizations (Frink et al., 2008; Frink & Klimoski, 1998). *Accountability* refers to “the perceived

need to justify or defend a decision or action to some audience(s) which has potential reward and sanction power, and where such rewards and sanctions are perceived as contingent on accountability conditions” (Frink & Klimoski, 1998: 9). It emphasizes that management practices such as performance evaluations provide expectations regarding employees’ behavior (Ferris, Mitchell, Canavan, Frink, & Hopper, 1995). Employees who engage in behavior meeting the accountability requirements inherent in management practices receive positive outcomes (e.g., approval, rewards) from managers who serve as accountability agents. It is well established both theoretically (Frink & Klimoski, 1998; Tetlock, 1985, 1992) and empirically (e.g., Gelfand & Realo, 1999; Tetlock, Skitka, & Boettger, 1989) that individuals tend to respond to accountability in a way that is relatively easier for them to defend and most likely to result in favorable outcomes.

It is important to note that research on the adoption and use of new technology in the workplace is relevant for considering knowledge sharing using a KMS. Research focusing on the adoption and use of new technology has tended to rely on motivational theories such as the theory of reasoned action or the theory of planned behavior. Research on the use and adoption of new technology has not yet used accountability as a theoretical framework. However, congruent with the tenets of accountability theory, norms, management pressure, and clarifying the behavior–outcome relationship have been shown to enhance acceptance and use of new technology (e.g., Marler, Fisher, & Ke, 2009; Morris & Venkatesh, 2000; Venkatesh, Morris, Davis, & Davis, 2003). Because successful adoption of a new KMS requires employees to both withdraw and exchange or deposit knowledge, we believe our understanding of knowledge sharing can benefit from examining it from an accountability perspective. Providing clear expectations for knowledge sharing through accountability-inducing management practices for knowledge sharing are likely necessary for employees not only to use a new KMS to interact with others to recognize what knowledge is available and withdraw it for their own personal benefit but also to exchange or deposit knowledge that might benefit others.

Accountability-inducing management practices may be *necessary* to facilitate knowledge sharing in a KMS for a number of reasons. Knowledge can be considered the individual’s intellectual property. Knowledge can be valuable for individuals by enhancing their job opportunities and helping them increase their performance, resulting in higher levels of compensation. That is, individuals are selected to join companies and to move to better jobs within companies based on their knowledge, skills, and abilities. Knowledge also gives individuals the opportunity to meet or exceed performance standards, resulting in both intrinsic and extrinsic rewards (e.g., increased feelings of self-worth, pay increases). It may also be unnatural for individuals to share knowledge because of self-perceptions that their knowledge is not valued by others or is inaccurate or because of fears that knowledge sharing makes them expendable and puts their job at risk (Davenport, 2005). Although sharing knowledge promotes learning and likely has collective benefits such as increasing the resources that all employees can use to solve problems, in the absence of organizational conditions holding individuals accountable for sharing knowledge, withholding (rather than sharing) knowledge likely results in greater personal benefits (Haas & Park, 2010; Lepak & Snell, 2003). Therefore, we expect there to be low levels of knowledge sharing in an organizational context with management practices that encourage but do not reward or hold employees responsible for knowledge sharing. It is important to investigate what types of accountability-inducing management practices, if any, facilitate knowledge sharing.

One of the most common types of accountability-inducing management practices, performance evaluation, is based on the manager–subordinate relationship (Carnevale, 1985; Frink & Klimoski, 2004). Both performance evaluation and incentives or rewards have been suggested to facilitate knowledge sharing (e.g., Stevens, 2000; Voelpel et al., 2005). Based on accountability theory (Frink & Klimoski, 1998, 2004), accountability-inducing management practices by their very nature enhance employees' perceptions that they are expected to behave in certain ways. As a result, it is reasonable to believe that employees will be more likely to share knowledge when they are held accountable than when they are not. Managers' evaluations of knowledge sharing as part of employees' performance evaluations signal that it is expected behavior and important from the organization's perspective.

Employees can share knowledge by contributing to organizational databases or systems, communicating formally or informally to other employees, and through involvement in voluntary forums (i.e., communities of practice; Bartol & Srivastava, 2002). Knowledge sharing using organizational databases or systems is considered the type of knowledge sharing that is most influenced by rewards (Bartol & Srivastava, 2002). As a result, employees' knowledge sharing is likely enhanced by providing explicit rewards in addition to using an accountability mechanism such as evaluation (Frink & Klimoski, 1998). Incentives likely increase the motivation for employees to share knowledge beyond the influence of accountability created by evaluation through rewarding employees for engaging in the desired behavior (Rynes, Gerhart, & Parks, 2005; Voelpel et al., 2005).

Based on accountability theory and research examining the incentives–knowledge sharing relationship, in this study we consider the influence of three different types of management practices on knowledge sharing. The first type of management practice, encouraging employees to share knowledge, creates an organizational context in which employees have no accountability for knowledge sharing (*no accountability*). The second type of management practice, evaluating knowledge sharing, creates an organizational context in which employees are accountable for knowledge sharing (*accountability*). Finally, the third type of management practice, evaluating and rewarding knowledge sharing, creates the strongest organizational context for knowledge sharing: Employees are accountable and can receive rewards for knowledge sharing (*accountability and incentive*). We expect employees to share more knowledge when management practices induce accountability than when they merely encourage such behavior. Also, greater knowledge sharing should occur among employees when management practices induce accountability through evaluation and provide incentives for knowledge sharing compared with employees in an organizational context in which they are accountable for knowledge sharing but no rewards are provided.

Hypothesis 1: Knowledge sharing will be greater for employees who are evaluated on knowledge sharing (accountability) compared with employees who are encouraged to share knowledge (no accountability).

Hypothesis 2: Knowledge sharing will be greater for employees who are evaluated and rewarded (accountability and incentive) compared with employees who are evaluated (accountability).

The Interactionist Perspective: The Moderating Role of Personality

The relationship between accountability-inducing management practices and knowledge sharing is likely moderated by employees' personality traits. This occurs because employees' behavioral responses to accountability-inducing management practices depend on their personality traits, which affect how they interpret environmental cues (Frink & Klimoski, 1998, 2004; Schneider, 1983). Personality traits are expressed or activated in response to trait-relevant situational cues or features, including job and task demands, group norms, and organizational features such as accountability-inducing knowledge-sharing mechanisms (Tett & Burnett, 2003).

It is important to note that we are not investigating how contextual features (evaluation and rewards) moderate the Big Five–knowledge sharing relationship. Rather, our perspective is to examine the moderating role the individual differences play when an organization introduces or adopts new management practices to facilitate a desired behavior such as knowledge sharing. This approach has been used by other researchers studying how worker characteristics influence the relationship between work design characteristics and behavioral and organizational outcomes (see Morgeson & Humphrey, 2008). Below we provide a theoretical rationale and present hypotheses for how each of the Big Five personality traits is expected to moderate the relationship between accountability-inducing management practices and knowledge sharing. We focus on the Big Five in this study because it is the most widely accepted framework of personality, these traits are an important source of motivation of employee behaviors and performance, and they likely influence how employees respond to management practices that induce accountability (Frink & Klimoski, 2004; Judge & Ilies, 2002).

The Big Five includes extraversion, agreeableness, neuroticism, conscientiousness, and openness to experience (McCrae & Costa, 1989). Studies have shown that the Big Five interact with situational factors to affect performance (e.g., Barrick & Mount, 1993; Colquitt, Scott, Judge, & Shaw, 2006) and influence employees' reactions to incentives and other work practices (e.g., Barber & Bretz, 2000; Fong & Tosi, 2007; Heneman & Judge, 2000). For example, Stewart (1996) did not find a significant main effect of a compensation plan on new sales or customer retention but did find significant interaction effects with extraversion. He suggested the need to examine the effect of motivational work practices and the interaction effect of these practices with personality traits, which we do in this study. Below we discuss the relationship between evaluation and rewards, the Big Five, and knowledge sharing.

Extraversion. By definition, highly extraverted individuals tend to be sociable, gregarious, assertive, ambitious, and active. One major facet of extraversion is dominance (Gough, 1987; Judge, Bono, Ilies, & Gerhardt, 2002), and sensitivity to rewards is a core characteristic of the trait (Lucas, Diener, Grob, Suh, & Shao, 2000). Extraversion also has been associated with a desire for power, recognition, and status (Barrick, Stewart, & Piotrowski, 2002; Costa & McCrae, 1988; Hogan, Curphy, & Hogan, 1994). Employees low in extraversion may be less responsive to recognition and incentives. Supporting the trait activation perspective,

Stewart (1996) found that rewards interacted with extraversion to affect performance. Specifically, he found a significant positive extraversion–performance relationship only for performance dimensions that were explicitly rewarded, suggesting that extraverts are more sensitive to external rewards.

Management practices such as evaluation and/or reward provide formal recognition for knowledge sharing. It is likely that extraverted employees who desire status and have high need for power view knowledge sharing as an opportunity to increase their expert power. This likely occurs especially when management practices evaluate knowledge sharing because this signals extraverts that they can both enhance their expert power and receive recognition from their supervisors. Also, because of extraverts' greater sensitivity to extrinsic rewards when knowledge-sharing behavior is rewarded, they are likely to engage in more knowledge sharing than introverts are. Therefore, we expect that evaluation and evaluation plus reward will result in greater knowledge sharing for employees high in extraversion because these conditions provide situational cues that enhance the effects of extraversion.

Hypothesis 3a: The relationship between evaluation (accountability) and knowledge sharing is stronger for employees high in extraversion than for those low in extraversion.

Hypothesis 3b: The relationship between evaluation plus reward (accountability and incentive) and knowledge sharing is stronger for employees high in extraversion than for those low in extraversion.

Agreeableness. Agreeable individuals are more predisposed to helping than are less agreeable individuals, who need additional sources of motivation to demonstrate prosocial behavior (Ilies, Scott, & Judge, 2006; Kamdar & Van Dyne, 2007). They are also, by nature, more compliant and passive (Graziano & Eisenberg, 1997). This suggests that agreeable employees are likely to engage in limited knowledge sharing. That is, agreeable employees will share knowledge only as a direct response to others' questions or requests rather than voluntarily initiating their own knowledge sharing. As a result, in the absence of accountability-inducing management practices for knowledge sharing, employees are not likely to share knowledge regardless of their level of agreeableness.

Employees high in agreeableness are more modest and are less likely to become competitive with others, and thus, they are less likely to be motivated by evaluation or rewards to share the most knowledge. Less agreeable employees, on the contrary, tend to be more exchange oriented in deciding whether to provide knowledge, resources, and help to others (Ilies et al., 2006; Wiggins & Trapnell, 1996). Therefore, less agreeable employees are likely to be more sensitive to the positive evaluations from their managers and the extrinsic rewards for knowledge sharing. In sum, compared to agreeable employees, less agreeable individuals' knowledge sharing is more likely to be influenced by accountability-inducing management practices, that is, positive evaluations or positive evaluations and rewards that are provided for knowledge sharing.

Hypothesis 4a: The relationship between evaluation (accountability) and knowledge sharing is weaker for employees high in agreeableness than for those low in agreeableness.

Hypothesis 4b: The relationship between evaluation plus reward (accountability and incentive) and knowledge sharing is weaker for employees high in agreeableness than for those low in agreeableness.

Neuroticism. Individuals high in neuroticism (or low in emotional stability) are insecure, anxious, and lack confidence and do not feel in control of their surroundings. However, there is considerable evidence that the behavior of individuals high in neuroticism can be influenced by management practices that include negative outcomes and rewards. Also, Smillie, Yeo, Furnham, and Jackson (2006) suggest that researchers should investigate situations in which characteristics of neuroticism such as attention to potential threat and avoidance of errors may provide individuals high in neuroticism with a performance advantage. They found that individuals high in neuroticism outperformed individuals low in neuroticism when work demands were high. According to Gray's (1976, 1994) theory on the behavioral inhibition system, individuals high in neuroticism are sensitive to potential negative outcomes or not receiving rewards. Management practices that induce accountability may create anxiety over the outcomes (Hochwarter et al., 2007). Because individuals high in neuroticism are more likely to be fixed on the "threats," such neurobiological sensitivity is accompanied by a predisposition to behave in a way to avoid such outcomes (Carver, Sutton, & Scheier, 2000; Elliot & Thrash, 2002). Also, Raja, Johns, and Ntalianis (2004) found that employees high in neuroticism tended to form transactional contracts with their employers, that is, focus on short-term and economic exchanges, especially for aspects of performance that were not very complex and did not require high initiative. It is likely that knowledge sharing for employees high in neuroticism can become a significant part of their transactional contracts with their employers if contextual cues created by management practices emphasize that knowledge sharing is necessary to avoid potential negative evaluation and to receive rewards. Therefore, employees high in neuroticism are more likely to engage in greater knowledge sharing when management practices emphasize accountability using evaluation or evaluation plus reward because they are more likely to perceive knowledge sharing as a means to reduce the likelihood of receiving negative evaluation from their supervisors and failing to receive rewards.

It should be noted that although employees high in neuroticism likely have overall higher levels of evaluation apprehension compared with employees who are low in neuroticism, previous research has found a negative relationship between evaluation apprehension and knowledge sharing only when perceived benefits were low (Bordia et al., 2006). Therefore, for employees high in neuroticism, accountability-inducing management practices that include rewarding knowledge sharing likely reduce their evaluation apprehension and facilitate knowledge sharing. Employees low in neuroticism are less likely to increase their level of knowledge sharing as a result of accountability-inducing management practices evaluating or evaluating and rewarding knowledge sharing, because their behavior tends to be more highly influenced by relational contracts with their employers that are long-term and broad and that are characterized by loyalty rather than pure economic exchange (Raja et al., 2004; Rousseau & Park, 1993). As a result, in organizational contexts in which accountability-inducing management practices include evaluating or evaluating and rewarding knowledge sharing, we expect that employees high in neuroticism are more likely to share knowledge compared with employees low in neuroticism.

Hypothesis 5a: The relationship between evaluation (accountability) and knowledge sharing is stronger for employees high in neuroticism than for those low in neuroticism.

Hypothesis 5b: The relationship between evaluation plus reward (accountability and incentive) and knowledge sharing is stronger for employees high in neuroticism than for those low in neuroticism.

Conscientiousness. Individuals high in conscientiousness are characterized as being self-disciplined, responsible, organized, dutiful, and dependable, and they behave in a manner that meets others' expectations. We expect conscientiousness to influence evaluation and evaluation plus reward–knowledge sharing relationships differently than agreeableness and neuroticism because high levels of conscientiousness predispose individuals to meet others' expectations. Expectations for knowledge sharing are created by accountability-inducing management practices that evaluate knowledge sharing. In a lab study, Frink and Ferris (1999) showed that more conscientious individuals performed better in an accountability condition where they were led to believe that they would discuss their performance with a team leader, compared with a nonaccountability condition. This suggests that individuals high in conscientiousness tend to be more responsive to such accountability conditions that involve potential evaluation than are those low in conscientiousness. Therefore, in organizational contexts in which management practices evaluate knowledge sharing, we would expect highly conscientious employees to share more knowledge compared with less conscientious employees.

Similar to employees with low levels of neuroticism, employees high in conscientiousness tend to form relational contracts on the basis of expectations. Employees low in conscientiousness tend to be more concerned with economic rewards (Raja et al., 2004). As a result, low-conscientious employees likely need economic incentives to motivate them to share knowledge. We expect that employees low in conscientiousness would respond more favorably to accountability-inducing management practices that make available rewards for knowledge sharing. Employees with high levels of conscientiousness will also increase their knowledge sharing. However, it will be less influenced by rewards because high conscientious employees are intrinsically motivated by their predisposition to be dutiful and meet expectations communicated by managers and the organization. We expect less conscientious employees to be more motivated by rewards, as explicit and more immediate rewards help direct their attention to the desired behavior, that is, knowledge sharing.

Hypothesis 6a: The relationship between evaluation (accountability) and knowledge sharing is stronger for employees high in conscientiousness than for those low in conscientiousness.

Hypothesis 6b: The relationship between evaluation plus reward (accountability and incentive) and knowledge sharing is stronger for employees low in conscientiousness than for those high in conscientiousness.

Openness to experience. Individuals high in openness to experience are broadminded, creative, curious, and cultured. Openness to experience has been shown to be positively related to self-perceptions of learning ability, motivation to learn, and participation in development activities (e.g., Major, Turner, & Fletcher, 2006). This suggests that the higher employees' openness to experience the more likely they may be to share knowledge using a KMS, which is a novel way to learn. However, several studies suggest that in specific types of accountability-inducing situations, employees with low levels of openness to experience

may exhibit higher levels of desired behavior compared with employees with high levels of openness to experience.

Denissen and Penke (2008) suggest that individuals low in openness to experience are more likely to attend to predictable stimuli such as those explicitly specified in accountability-inducing management practices. Mitchell et al. (2007) and Maurer, Lippstreu, and Judge (2008) found that individuals low in openness to experience were more sensitive to punishment or failing to receive rewards and were also more likely to set goals that would allow them to demonstrate their competence by avoiding negative reflection of their abilities. Therefore, in situations in which knowledge sharing is evaluated or evaluated and rewarded we would expect employees low in openness to experience to behave in such a manner to avoid negative evaluations or gain rewards. This suggests that employees low in openness to experience are more sensitive to accountability-inducing management practices including evaluation and evaluation plus reward. As a result, we expect that in response to accountability-inducing management practices employees with low levels of openness to experience will be more likely to share knowledge compared with employees high in openness to experience.

Hypothesis 7a: The relationship between evaluation (accountability) and knowledge sharing is stronger for employees low in openness to experience compared with those high in openness to experience.

Hypothesis 7b: The relationship between evaluation plus reward (accountability and incentive) and knowledge sharing is stronger for employees low in openness to experience compared with those high in openness to experience.

Method

Participants

The study was conducted in a large software development company based in a major city in Southern China. The company has 21 offices with over 500 employees around the country. We chose this sample for three reasons. First, this company provided an appropriate setting to study knowledge sharing because knowledge and innovation are considered important success factors in the service industry (Roberts, Andersen, & Hull, 2000). Second, the company was in the initial phase of implementing a KMS for its employees. This provided us with the unique opportunity to introduce the treatment conditions (the evaluation and/or reward work practices) from the time employees started to use the system. Also, this reduced the potential influence of history effects on employees' knowledge sharing in the evaluation and the evaluation-plus-reward conditions (i.e., employees had no experience using the company's KMS prior to the implementation of reward or evaluation policies). Third, the company was interested in participating in the study because management wanted to understand how to best facilitate knowledge sharing. Three departments providing the same type of services (e.g., selling software products, setting up the software systems for clients, and providing after-purchase services) to clients from different industries were carefully chosen, and the types of jobs and human resource practices were similar across the departments.

Despite the three departments being parts of the same company, we believe that the internal validity of the study was not compromised; that is, employees were unaware of the study conditions experienced by the other departments. The nature of the employees' work required them to spend the majority of the time visiting clients. Also, the feedback we solicited from the participants at the end of the project suggested that they were unaware of the study conditions for other departments.

Employees in each department had access to a common intranet sharing board for knowledge sharing. Employees could access the board from their personal computers. Employees reported a high level of familiarity with the intranet board (an average rating of 3.8 out of 5), suggesting that it was easy to access and use. Study participation was voluntary. One hundred and nineteen employees (about 94% of all full-time employees in the three units) agreed to participate in the study. Nineteen employees were not included in the sample because they left the company or were transferred to other departments before the study was completed ($n = 14$) or because they provided incomplete or unusable data ($n = 5$). The final sample included 100 employees (76 were male) with an average age of 25.95 ($SD = 4.58$). There were no significant differences between participants in the three departments in gender, age, educational level, work experience, or familiarity with the intranet sharing board. Also, no differences were found in any of the demographic variables between the employees who completed the study and those who did not.

Procedure

We recruited 142 undergraduate students for a pilot study. The pilot study was used to test the condition manipulations and the clarity of the survey items and to determine the length of time needed to complete the surveys. The results suggested that the manipulations worked effectively, and minor wording changes were made to the surveys.

The main study involved a quasi-experiment with each of three conditions representing different management practices: control (no accountability), evaluation (accountability), and evaluation plus reward (accountability and incentive). The three departments were randomly assigned to each of the conditions. Separate face-to-face meetings were held with employees in each department to communicate the treatment conditions. During the meetings, each of the managers from the three departments emphasized the benefits of knowledge sharing, including how it could help improve individuals' work and how a successful KMS could help improve the company's competitiveness. Employees were encouraged to share their work experiences, expertise, tips, and any work-related topic they read about that might be useful to other employees and to respond to posted questions. They were also informed that postings such as "thank you" or "good idea" would not be considered knowledge sharing.

Each department received a different treatment. In the *control* condition, no further instruction was given (no accountability). Employees in the *evaluation* condition (accountability) were informed that the quantity and quality of knowledge sharing would be evaluated and would be discussed with their supervisors during their quarterly performance evaluation meetings. No specific reward was tied to the evaluation. Employees in the *evaluation-plus-reward* condition (accountability and incentive) were also told that the quantity and quality of their

knowledge sharing would be evaluated and would be discussed with their managers during their quarterly performance evaluation meetings. In addition, they were informed that the top 30% of the contributors to the KMS based on managers' evaluations would each receive a reward (latest models of MP3 players or cell phones). The rewards were chosen based on discussion with company managers, who indicated that these rewards would be valued by their employees at the time. Participants completed the surveys measuring personality variables and manipulation check items at the end of the meetings. All postings were collected from the intranet sharing board at the end of the 17-week period during which the study occurred.

Measures

The conventional back-translation procedure (Brislin, 1980) was used to translate the survey from English to Chinese. The translators were bilingual management researchers. The translated version was pretested with a group of employees from a nonparticipating department in the same company to determine if survey items were understandable. The participants read the Chinese version of the survey.

Personality. The Big Five were measured using the short version of the International Personality Item Pool (Goldberg, 1999). The scale shows high convergent validities with other Big Five measurements such as the NEO Personality Inventory (NEO-PI) and California Psychological Inventory (Goldberg, 1999), and its validity and reliability have been demonstrated in prior research (e.g., Oswald, Schmitt, Kim, Ramsay, & Gillespie, 2004; Ployhart, Lim, & Chan, 2001). Five-point Likert-type scales were used for all items (1 = *very inaccurate* to 5 = *very accurate*). Ten items measured each dimension: extraversion (e.g., "I am the life of the party"), agreeableness (e.g., "I feel others' emotions"), neuroticism (e.g., "I get upset easily"), conscientiousness (e.g., "I like order"), and openness to experience (e.g., "I have a vivid imagination"). This measurement has shown reliability, validity, and acceptable psychometric properties in the Chinese culture (Chan & Drasgow, 2001; Lim & Ployhart, 2004; Ployhart et al., 2001). A recent study of over 1,000 participants in China also found that the Chinese version of the scale had a clear five-factor orthogonal structure that was nearly identical to the structure found in the U.S. samples (Zheng et al., 2008). Cronbach's alphas for extraversion, agreeableness, neuroticism, conscientiousness, and openness to experience were .83, .71, .85, .81, and .75, respectively. These reliabilities are similar to those found in other studies conducted in Chinese culture.

Knowledge sharing. Knowledge sharing was measured using raters' overall rating of knowledge sharing based on their assessments of both the quality and quantity of shared knowledge. We used the overall rating because it accounted for both the quantity of knowledge sharing and the quality of knowledge shared. This is important because KMS effectiveness depends on employees' levels of involvement in sharing knowledge and the value of the knowledge shared (Cabrera & Cabrera, 2002; Lee et al., 2006).

Following Wasko and Faraj (2005), we examined knowledge sharing by focusing on the job-related knowledge postings contributed to a KMS. Two company managers who had

prior experience with knowledge sharing using an intranet board and were blind to the research design and hypotheses served as independent raters. These subject matter experts were not direct supervisors of any of the participants. The raters were asked to consider the quantity and quality of postings. *Quantity* referred to the total number of knowledge-sharing postings. *Quality* referred to the helpfulness and relevance to work of the knowledge shared. For example, individuals who frequently posted messages that were judged to be irrelevant to work or not helpful to their coworkers would receive a low rating even though they provided a large number of postings. For those who did not participate in sharing knowledge, the quality rating was not applicable.

To avoid potential rating biases, participants' names that appeared in the postings were replaced with numbers prior to raters' independent evaluations of the postings. Based on the process used by Wasko and Faraj (2005) to evaluate knowledge sharing, raters first completed a content analysis of all posted messages to determine the nature of the posts. An "other" category was created to include general announcements and messages that were more social in nature, such as "Thank you!" or "That's very helpful." Knowledge-sharing contributions included all postings except questions and those in the "other" category. The managers content-analyzed all of the 990 postings provided by 75 participants. Among them, 370 postings were considered to be in the "other" category and were excluded from further analysis. Next, the managers counted, recorded, and reached agreement on the number of valid knowledge-sharing postings for each participant. Finally, managers independently read all of the valid knowledge-sharing postings and coded the archival data for overall knowledge-sharing performance. To ensure that these managers considered both quality and quantity, they were first asked to rate the quality for the archived data based on predetermined anchors similar to those used for the overall ratings. Based on Wasko and Faraj's study, we used two Likert-type items to measure the helpfulness and work relatedness of knowledge sharing (e.g., 1 = *not helpful*, "Knowledge that was shared was generally not helpful to other employees or responses to others' questions were usually not helpful to the knowledge seeker," to 4 = *very helpful*, "Shared knowledge that was usually very useful to other employees with detailed explanation/description, and/or provided responses that usually directly answered the questions posted"). Quality ratings were available only for study participants who shared knowledge. Next, the managers provided an overall rating for each participant based on the following question: "Overall, how would you rate this employee's contribution to the intranet BBS board?" A scale with five response categories was provided (e.g., 1 = *very poor*, "Never shared any work-related knowledge helpful to other employees," to 5 = *excellent*, "Very active in sharing work-related knowledge that either directly helped to solve problems at work or was generally very helpful to other employees with their work"). This scale was adapted from Wasko and Faraj's study. The scale and response categories were pilot-tested with the coders to ensure clarity, ease of use, understanding of the scale anchors, and ability of coders to distinguish between the response categories. Minor changes of wording were then made before the scale was used. Based on Wasko and Faraj's study, intercoder reliability was assessed for the overall ratings using weighted Cohen's kappa (Cohen, 1968), which corrects for the expected level of chance correlation between raters and weights agreement by the extent of divergence between raters. Intercoder reliability for overall knowledge sharing performance was .76, which is considered good agreement

based on Fleiss's (1981) criteria. Coding differences were resolved by discussion. Overall knowledge sharing was highly correlated with both quality ($r = .91, p < .001$) and quantity ($r = .81, p < .001$).

Moreover, to further evaluate the reliability of the coded data we were able to obtain knowledge-sharing performance data based on supervisors' evaluations of knowledge-sharing performance for 46 participants who worked in the two departments that received the evaluation condition and the evaluation-plus-reward condition. The supervisors evaluated participants' performance using three items: "To what extent did this employee participate in knowledge sharing?" "To what extent was the content of the postings related to work?" and "To what extent was the knowledge shared helpful to other employees?" (1 = *not at all* to 5 = *to a great extent*). The ratings were averaged and correlated with the coded knowledge-sharing data. Because of missing evaluations on the quality-related dimensions for participants who did not engage in knowledge sharing, 5 cases were excluded from this analysis. A significant correlation between the coded ratings of overall knowledge sharing and supervisor evaluations of knowledge sharing ($r = .85, p < .001$) provided further evidence of the reliability and validity of the coded knowledge-sharing data.

Control variables. Gender, work experience, and familiarity with KMS were considered the control variables. Due to their lack of a significant relationship with knowledge sharing and considering our sample size, we chose not to include these variables in the regression analyses used to test the study hypotheses.

Analysis Strategy

Although the study used a quasi-experimental design, we used hierarchical regression rather than analysis of variance to test the study hypotheses because the personality traits used as moderators were continuous variables. Multiple regression is more appropriate than analysis of variance to analyze data involving interactions between categorical and continuous variables because (1) dichotomization of continuous variables would reduce the statistical power of testing and (2) analysis of variance has limited ability to appropriately handle intercorrelations among independent variables (West, Aiken, & Krull, 1996). Based on the work of Cohen, Cohen, West, and Aiken (2003), two dummy variables were created to represent the three conditions in the study (control, evaluation, evaluation plus reward). Cohen et al. suggested that "the reference group should serve as a useful comparison" (2003: 303). Hypothesis 1 proposed a direct comparison between the control condition and the evaluation condition (accountability), and Hypothesis 2 proposed a direct comparison between the evaluation condition (accountability) and the evaluation-plus-reward condition (accountability and incentive). To simultaneously test Hypotheses 1 and 2, we used the evaluation condition as the reference group. As a result, the control condition was represented by Dummy 1 = 1 and Dummy 2 = 0; the evaluation-plus-reward condition (accountability and incentive) represented by Dummy 1 = 0 and Dummy 2 = 1; and the evaluation condition (accountability), the reference group, represented by zeros on both dummy variables. This scheme of dummy coding allowed us to test Hypotheses 1 and 2 by comparing the control

and the evaluation-plus-reward conditions directly with the evaluation condition (see Cohen et al., 2003). To appropriately test the specified comparisons, the dummy variables were entered into the equation simultaneously to examine the main effects of conditions (Cohen et al., 2003).

For testing the moderation hypotheses, dummy variables were created for each of the conditions, with the control condition serving as the reference group. The evaluation condition (accountability) was represented by Dummy 1 = 1 and Dummy 2 = 0, the evaluation-plus-reward condition (accountability and incentive) was represented by Dummy 1 = 0 and Dummy 2 = 1, and the control condition was represented by zeros on both dummy variables. The use of different dummy-coding schemes does not affect the model statistics. To test for moderation, the personality variables and the dummy variables for conditions were entered in the first step (base model), and the product terms of the two dummy variables of conditions multiplied by traits were entered in the second step (Cohen et al., 2003).

Following the recommendations of Cohen et al. (2003), all personality variables were centered before the interaction terms were computed. When all 10 interaction terms were entered simultaneously into the regression equation, the largest variance inflation factor in the model (9.3) approached 10 (Neter, Wasserman, & Kutner, 1990). Therefore, due to a multicollinearity concern and the relatively small sample size, each set of personality-condition interactions were entered at separate steps, as the two dummy variables together represent the three conditions. This also allows us to determine the variance in knowledge sharing explained by each trait interaction set. Simultaneously including all 10 interactions in the same step produced similar results.¹

Results

Manipulation Checks

For the manipulation check, participants were asked, “Will your department evaluate your performance on the BBS knowledge management forum and provide feedback?” and “If your performance on the BBS knowledge management forum is considered good, are you going to receive any rewards?” (yes or no). The results of overall chi-square tests suggested significant differences among conditions with regard to evaluation, $\chi^2(2) = 59.89$, $p = .000$, and reward manipulation, $\chi^2(2) = 51.82$, $p = .000$. A series of follow-up chi-square tests showed that the evaluation or evaluation-plus-reward group significantly differed from the other two groups on the manipulation questions in the expected direction ($p < .001$), suggesting that participants perceived the assigned conditions as intended. Among all participants, 90% and 86% of them responded correctly to the evaluation and rewards questions, respectively. This suggests that our manipulations were effective. Nevertheless, we examined the correlation between misperceptions about evaluation and rewards and knowledge sharing and found no significant relationship. We did not find these misperceptions to be systematically related to demographics either. Therefore, we retained all participants, to minimize data loss.

Table 1
Descriptive Statistics: Means, Standard Deviations,
Correlations, and Scale Reliabilities

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1. Dummy 1 ^a	0.40	0.49							
2. Dummy 2 ^a	0.27	0.45	-.50**						
3. Extraversion	3.36	0.57	-.17	.14	(.83)				
4. Agreeableness	3.87	0.42	-.09	.10	.43**	(.71)			
5. Conscientiousness	3.89	0.50	-.08	-.05	.27**	.45**	(.81)		
6. Neuroticism	2.59	0.63	.16	.07	-.25*	-.17	-.16	(.85)	
7. Openness	3.67	0.45	-.07	.14	.40**	.47**	.43**	-.07	(.75)
8. Overall knowledge sharing	2.07	1.21	.14	.38**	.16	.02	-.14	.19	.08

Note: *N* = 100 (33, 40, and 27 in control, evaluation, and reward conditions, respectively). Values in parentheses are reliability coefficients.

^aDummy coded; for the three manipulated conditions, two dummy variables were created, with Dummy 1 representing evaluation condition = 1 and the other two conditions = 0, and Dummy 2 representing evaluation-plus-reward condition = 1 and the other two conditions = 0.

p* < .05. *p* < .01

Hypotheses Testing

Descriptive statistics, correlation matrix, and scale reliabilities are provided in Table 1. The means (*SD*) of knowledge sharing for the control, evaluation, and evaluation-plus-reward conditions were 1.21 (0.48), 2.28 (1.09), and 2.82 (1.39), respectively. Table 2 presents the hierarchical regression results for knowledge sharing. Hypothesis 1 predicted that knowledge sharing would be higher for employees who were evaluated (accountability) compared with employees who received only encouragement (control condition). As indicated in Table 2, Model 1 shows that knowledge sharing in the control condition was significantly lower than that in the evaluation condition (accountability; $\beta = -.42$, $p < .01$). Compared with employees who received encouragement but no accountability-inducing management practice, employees who were evaluated engaged in more knowledge sharing. Thus, Hypothesis 1 was supported.

Hypothesis 2 predicted that employees who were evaluated and explicitly rewarded for knowledge sharing (accountability and incentive) would make greater knowledge contributions to the KMS compared with those who were evaluated (accountability). The results (see Model 1) showed a significant effect for the evaluation-plus-reward condition compared with the evaluation condition ($\beta = .20$, $p < .05$). That is, employees in the evaluation-plus-reward condition engaged in more knowledge sharing using the KMS than did employees in the evaluation condition. Thus, Hypothesis 2 was supported.

Hypotheses 3 through 7 predicted that extraversion, agreeableness, neuroticism, conscientiousness, and openness to experience moderated both the evaluation and the evaluation plus reward–knowledge sharing relationship. The base model, the model including all of the main effects, showed that extraversion had a positive significant main effect on knowledge

Table 2
Hypotheses Testing Results of Hierarchical Regression of Knowledge
Sharing on Personality and Situational Conditions

Variables	Model 1 (Hypotheses 1, 2) ^a	Model 2 (base model)	Model 3 (Hypotheses 3a, 3b)	Model 4 (Hypotheses 4a, 4b)	Model 5 (Hypotheses 5a, 5b)	Model 6 (Hypotheses 6a, 6b)	Model 7 (Hypotheses 7a, 7b)
Step 1: Predictors							
Dummy 1 (evaluation) ^b	-.42**	.42**	.43**	.42**	.47**	.46**	.38**
Dummy 2 (reward) ^b	.20*	.54**	.57**	.55**	.57**	.57**	.56**
Extraversion		.22*	.24	.23*	.24*	.23*	.22*
Agreeableness		-.02	-.05	.12	-.04	-.06	-.03
Neuroticism		.12	.12	.13	-.04	.10	.23*
Conscientiousness		-.11	-.11	-.11	-.04	.18	-.15
Openness		.02	-.00	-.00	-.11	-.08	.20
Step 2: Interactions							
Extraversion × Evaluation			.09				
Extraversion × Reward			-.14				
Agreeableness × Evaluation				-.09			
Agreeableness × Reward				-.14			
Neuroticism × Evaluation					-.02		
Neuroticism × Reward					.29*		
Conscientiousness × Evaluation						.01	
Conscientiousness × Reward						-.40**	
Openness × Evaluation							-.02
Openness × Reward							-.32**
Overall <i>F</i>	19.18**	6.57**	5.59**	5.19**	6.15**	7.41**	6.48**
Overall <i>R</i> ²	.28	.33	.36	.34	.38	.43	.39
Adjusted <i>R</i> ²	.27	.28	.30	.28	.32	.37	.33
ΔR^2			.03	.01	.05*	.09**	.06*

Note: Standardized coefficients are reported. Model 2 is the base model for Models 3-7, which test for the moderation effects.

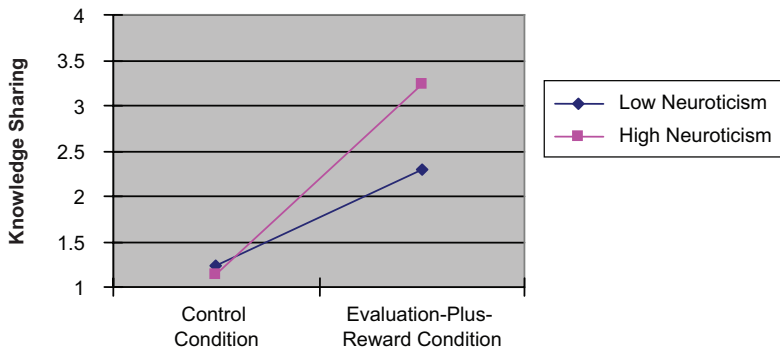
^aModel 1 used a dummy-coding scheme with evaluation condition as the reference group, while the other models used the control condition as the reference group.

^bThe variables were dummy coded.

* $p < .05$. ** $p < .01$.

sharing ($\beta = .22$, $p < .05$; see Model 2, base model, in Table 2). However, it did not moderate the evaluation– or the evaluation plus reward–knowledge sharing relationship. Therefore, Hypotheses 3a and 3b were not supported.

Figure 1
The Moderating Effect of Neuroticism on the Relationship
Between Evaluation Plus Reward and Knowledge Sharing



No significant results were found for agreeableness (Hypothesis 4a and 4b were not supported). Also, Hypothesis 5a was not supported. Neuroticism did not moderate the evaluation condition–knowledge sharing relationship. Hypothesis 5b was supported. As shown in Table 2, the Evaluation-Plus-Reward Condition \times Neuroticism interaction ($\beta = .29, p < .05$) was significant. Consistent with our prediction, the pattern of results showed that the evaluation plus reward–knowledge sharing relationship was stronger for employees high in neuroticism compared with employees low in neuroticism (see Figure 1). That is, on average in the evaluation-plus-reward condition, employees high in neuroticism engaged in significantly more knowledge sharing using the KMS than did employees low in neuroticism.

We found no significant interaction between evaluation and conscientiousness (Hypothesis 6a was not supported). However, Hypothesis 6b was supported. Table 2 shows that the Conscientiousness \times Evaluation-Plus-Reward Condition interaction was significant ($\beta = -.40, p < .01$), with the pattern in the predicted direction (see Figure 2). The evaluation plus reward–knowledge sharing relationship was stronger for employees low in conscientiousness compared with employees high in conscientiousness. On average, in the evaluation-plus-reward condition, employees low in conscientiousness shared significantly more knowledge than did employees high in conscientiousness. Openness to experience did not moderate the evaluation condition–knowledge sharing relationship (see Table 2). Hypothesis 7a was not supported. However, the Evaluation-Plus-Reward Condition \times Openness-to-Experience interaction ($\beta = -.32, p < .01$) was significant. Consistent with our prediction, the pattern of the results shown in Figure 3 suggests that the evaluation plus reward–knowledge sharing relationship was stronger for employees low in openness to experience. That is, in the evaluation-plus-reward condition, employees with low levels of openness to experience engaged in significantly greater levels of knowledge sharing than did employees with high levels of openness to experience. Therefore, Hypothesis 7b was supported.

Figure 2
The Moderating Effect of Conscientiousness on the Relationship
Between Evaluation Plus Reward and Knowledge Sharing

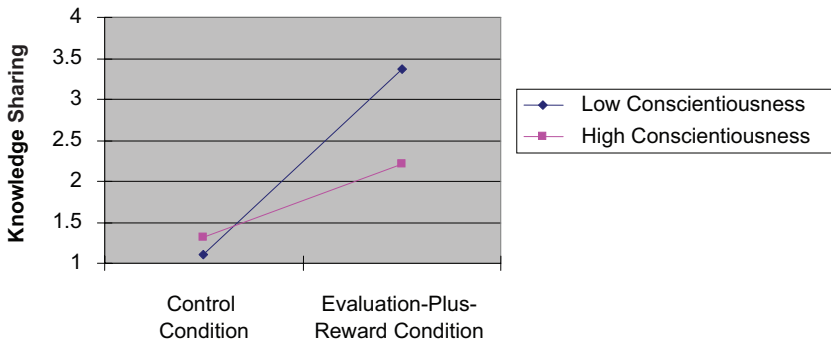
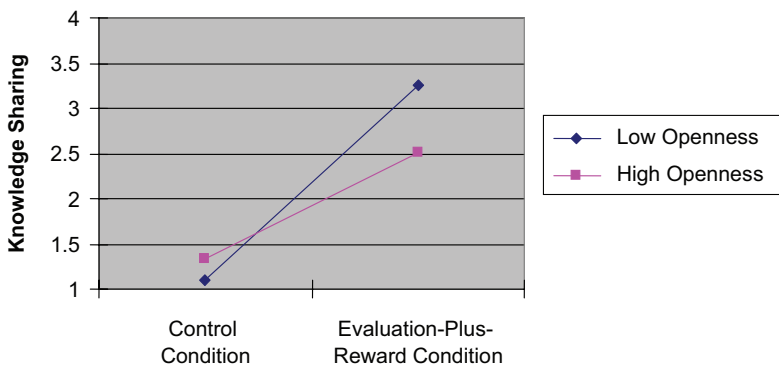


Figure 3
The Moderating Effect of Openness to Experience on the
Relationship Between Evaluation Plus Reward and Knowledge Sharing



Discussion

This study increases our understanding of individual-level knowledge sharing by empirically demonstrating that accountability-inducing management practices and the personality traits of employees who experience them make a difference. The use of a quasi-experimental design conducted in a field setting with explicit manipulations of evaluation and rewards and the use of expert ratings of knowledge sharing strengthen the validity and generalizability of our results.

Consistent with accountability theory and research on how to overcome public-goods social dilemmas, the results emphasize that management practices such as evaluation, which induce accountability, as well as rewards, are necessary to create conditions for employees to share knowledge using a KMS. Although it may not be surprising to find that evaluation and rewards enhance knowledge sharing, it is important to note that employees who were not held accountable for sharing (i.e., the control condition) exhibited very low levels of knowledge sharing (see Figures 1-3). This suggests that pure encouragement in the absence of accountability-inducing management practices alone or combined with incentives was insufficient to facilitate knowledge sharing. Perhaps more important, in the absence of conditions creating a sense of accountability, the resulting low levels of knowledge sharing will not benefit either the employees or the company and will likely lead to a failure of a KMS. Also, accountability and incentives stimulated more knowledge sharing. Evaluating *and* rewarding knowledge sharing was found to have a stronger positive effect than only evaluating knowledge sharing.

The results provide insight into the boundary conditions of accountability-inducing management practices. We found that the influence of these practices on knowledge sharing varied depending on the personality traits of the employees who experience them. Consistent with our predictions, lower conscientiousness and higher neuroticism were significantly related to higher knowledge sharing in the condition in which evaluation occurred and rewards were available. Accountability-inducing management practices such as performance evaluation in combination with rewards may be the most effective way to motivate knowledge sharing for less conscientious and more neurotic employees. Rewards are likely less effective for highly conscientious individuals because these employees are dutiful and are less influenced by external incentives (Fong & Tosi, 2007). Consistent with Bordia et al. (2006), the results for neuroticism suggest that management practices that provide both evaluation and incentives for knowledge sharing could help overcome the negative effect of evaluation apprehension. One possible explanation for this result is that highly neurotic individuals are more sensitive to negative evaluation and value rewards. As a result, when rewards are available, highly neurotic individuals spend more time and effort sharing more knowledge and making sure the knowledge shared is accurate and useful to others as a way to reduce the possibility of being evaluated negatively and to gain rewards. This finding also is consistent with prior research showing that individuals high in neuroticism tend to set goals that allow them to demonstrate their competence (Elliot & Thrash, 2002). The results also challenge the widely accepted perspective that high levels of neuroticism lead to negative outcomes such as low performance motivation and burnout (Judge & Ilies, 2002; Zellars, Hochwarter, Perrewé, Hoffman, & Ford, 2004). Rather, our results support Smillie et al.'s (2006) perspective that high levels of neuroticism may be beneficial in certain situations.

We found a positive main effect of extraversion on overall knowledge sharing but no interaction effects with accountability-inducing management practices. Highly extraverted employees were more likely to share knowledge even under conditions of low or no accountability, that is, when they received only encouragement. It is possible that because extraversion is associated with a desire to attain status (Barrick, Parks, & Mount, 2005) and frequently sharing useful knowledge with other employees via a KMS is likely to enhance individuals' status among coworkers in a knowledge-sharing community, accountability-inducing

management practices that evaluate and/or reward knowledge sharing are not necessary to activate the trait. Indeed, prior research has shown that extraversion is a significant predictor of performance on tasks that involve a significant social component (e.g., Barrick & Mount, 1991) and on leadership emergence (Judge et al., 2002).

Unexpectedly, agreeableness did not moderate the accountability-inducing management practices–knowledge sharing relationship. It may be that although agreeableness has been found to be related to helping others and involvement in interpersonal interactions, the influence of agreeableness may manifest itself more in face-to-face interactions where interpersonal skills are likely more important than in impersonal online interactions such as those that occur in KMSs.

Employees with higher levels of openness to experience engaged in lower levels of knowledge sharing in the evaluation-plus-reward condition (accountability and incentive), although on average, their knowledge sharing was greater compared with employees in the no (control) or evaluation (accountability) conditions. Our results differ from those of Cabrera et al. (2006), who found that openness to experience was positively, rather than negatively, related to a variable that combined knowledge seeking and sharing. This may be because individuals high in openness to experience are more likely to seek but not necessarily share knowledge due to their natural curiosity (see Cabrera et al., 2006).

Contrary to our results for the evaluation-plus-reward condition (accountability and incentive), none of the Big Five influenced the evaluation (accountability)–knowledge sharing relationship. Knowledge sharing of individuals with different levels of the Big Five was more similar in the evaluation than the evaluation-plus-reward condition. It is important to recognize that evaluation was also part of the evaluation-plus-reward condition in which significant moderating effects were observed. As a result, although it appears that the moderating effects result from the salience of rewards in the evaluation-plus-reward condition, we cannot rule out that it occurred because of the combined influence of evaluation and rewards.

Theoretical Contribution

Our findings contribute to accountability theory, personality theory, and person–situation interactionist theories of behavior and add to our understanding of the rewards–behavior relationship. The results support one of the major tenets of accountability theory: Behavior is influenced by the interaction between individual differences and management practices that induce accountability (Frink et al., 2008). The results also contribute to what we know about how accountability-inducing management practices affect behavior. Specifically, we found that the relationship between evaluation plus reward, an accountability-inducing practice combined with incentives, and knowledge sharing was moderated by personality traits, internal determinants of motivation. Five to nine percent of the variance in knowledge sharing was explained by the significant interactions. Although accountability-inducing management practices alone have been shown to significantly influence employee behavior, the results of this study add to accountability theory by suggesting that adopting a person–situation perspective can help us better understand the mechanisms (e.g., internal motivation) through which accountability-inducing management practices work.

The results extend our knowledge of how the Big Five personality traits influence behavior by examining their relationship with a new outcome: knowledge sharing. The study also extends our understanding of openness to experience. Although openness to experience is the Big Five trait with the fewest significant relationships with work-related outcomes (Barrick et al., 2003), we found that openness to experience seems to be important for understanding knowledge sharing (also see Cabrera et al., 2006). More important, the results support theoretical perspectives such as interactional psychology and person–situation interactionism (e.g., Schneider, 1983; Tett & Guterman, 2000), which emphasize that we can gain a greater understanding of behaviors such as knowledge sharing by developing and testing theories of personality–situation interactions rather than focusing exclusively on trait-based theories that tend to highlight the inherent positive or negative aspects of personality traits (see George & Zhou, 2001; Tett & Burnett, 2003).

The study results add to our understanding of how rewards influence behavior. Although prior research has found lack of consistent support for expected or perceived rewards on knowledge sharing (Brock & Kim, 2002; Brock et al., 2005; Kankanhalli et al., 2005), our results suggest that rewards can have a positive influence on knowledge sharing when used in combination with an accountability-inducing management practice such as evaluation. It is also important to emphasize that the rewards–knowledge sharing relationship appears to be more complex than how it has been studied in previous research; that is, the relationship is influenced by the personality traits of employees who are targeted for rewards. Rewards may be most (or less) effective for individuals who have certain personality traits (conscientiousness, neuroticism, openness to experience) that likely influence internal motivation for knowledge sharing.

Also, our results suggest that rewards did not have any detrimental influence on overall knowledge sharing, which was the focus of this study. However, Cabrera and Cabrera (2002) speculate that one possible trade-off in providing rewards for knowledge sharing to alleviate the public-goods social dilemma is that employees may artificially inflate the number or quantity of KMS contributions at the expense of the quality of contributions. We did not have any specific theoretical rationale for investigating differences in the quantity and quality of knowledge sharing based on employees' exposure to different accountability-inducing management practices or the interaction of these practices with the Big Five traits. As a result, we conducted post hoc exploratory analyses to investigate how accountability-inducing management practices and their interactions with the Big Five were related to the quality and quantity of knowledge sharing.

Due to space limitations, we briefly discuss the results of these analyses. The results are available from the first author upon request. The negative binomial model, a generalized form of the Poisson regression model, was used to estimate quantity of knowledge sharing because it was a count variable and use of ordinary least squares would violate important assumptions. Also, a likelihood ratio test of the overdispersion parameter (α) provided evidence of overdispersion in our data ($p < .001$); that is, the variance of quantity exceeds the mean (Cohen et al., 2003; Long, 1997). The results for quantity were similar to those reported in this article for overall knowledge sharing. The same procedure outlined for hypotheses testing was followed to estimate the quality of knowledge shared. As noted earlier, quality was only applicable to those who shared knowledge ($n = 75$). The quality of

knowledge sharing was assessed by creating a scale based on the average of the two items of knowledge-sharing quality. The intercoder reliability as indicated by weighted Cohen's kappa (Cohen, 1968) was .84, suggesting good agreement (Fleiss, 1981). Coding differences were resolved by discussion. The quality of knowledge shared in the control condition (no accountability) was significantly lower than in the evaluation condition (accountability; $\beta = -.36, p < .01$), and employees high in neuroticism tended to share higher quality knowledge ($\beta = .29, p < .05$).

Contrary to Cabrera and Cabrera's (2002) expectations, the results suggest that the quality of knowledge shared is not compromised by introducing evaluation and rewards to facilitate knowledge sharing. Both employees' quality and quantity of knowledge sharing increased as a result of the presence of evaluation plus reward (accountability and incentive). Interestingly, while the quantity of knowledge sharing was improved by evaluation plus reward compared with evaluation only, we found statistically significant differences only in the quality of the knowledge sharing occurring in these two conditions when we used a less stringent .10 level of statistical significance. Both evaluation and rewards help motivate employees to share knowledge. However, providing rewards in addition to evaluation only made a small incremental improvement in the quality of knowledge sharing.

Practical Implications

In today's workplace, the nature of jobs is changing as they become more fluid and more broadly defined in response to the competitive business environment and globalization. Although knowledge sharing may not be explicitly defined in job descriptions, face-to-face and online knowledge sharing is becoming increasingly important as organizations attempt to become more agile in meeting customer and consumer needs (Wang & Noe, 2010). As organizations develop cultures that support knowledge sharing, the introduction of KMSs will likely introduce new tasks that are critical for job success.

The results emphasize that using accountability-inducing management practices, such as performance evaluation, alone or in combination with rewards, can facilitate knowledge sharing in organizations that are interested in leveraging KMSs. Developing and introducing a state-of-the-art KMS and encouraging employees to use it only to share knowledge will likely be a wasted financial investment because of the low level of knowledge sharing that occurs. Evaluating and rewarding knowledge sharing is necessary to signal to employees that they are accountable for knowledge sharing and that it is valued by the organization; this helps create a culture and establish norms conducive to knowledge sharing. Introducing accountability through evaluation or evaluation combined with incentives may be especially important for developing knowledge-sharing norms when a new KMS is introduced in the organization (as was the case in this study) or when the organizational culture does not support use of an already implemented KMS. Management may need to help employees understand why "now" is the time to begin sharing knowledge when management practices involving evaluating or evaluating and rewarding knowledge sharing are introduced after rather than before the implementation of a KMS.

Our results suggest that companies may be able to use accountability and incentives to motivate employees with personality traits associated with less desirable behaviors, such as those who are low in conscientiousness or high in neuroticism. This suggests that companies

need to assess the personality traits of employees (KMS users) to identify which accountability-inducing management practices will best facilitate knowledge sharing. Personality assessments of prospective and current employees using tests such as the NEO-PI may be useful for selecting employees who will be motivated to use a KMS as well as for forecasting the potential influence of evaluation and rewards on knowledge sharing. For jobs and organizations in which knowledge sharing is critical for effective performance, hiring extraverted individuals may increase the likelihood that the positive benefits of KMSs will be realized even if evaluation or reward practices are not used to motivate knowledge sharing. Organizations that tend to hire or currently be staffed with employees who are high in conscientiousness, low in neuroticism, and/or high in openness to experience will likely benefit from using performance evaluation to motivate knowledge sharing using a KMS but not find it cost-effective to provide additional explicit rewards. Using a combination of evaluation and rewards to motivate employees to share knowledge may have the largest payoff when employees are low in conscientiousness, high in neuroticism, and/or low in openness to experience.

Limitations and Future Research

Several study limitations need to be considered. First, the data were collected in China, which has a highly collectivist national culture (Gelfand, Bhawuk, Nishii, & Bechtold, 2004; Hofstede, 1980). We believe our findings are likely more conservative compared with those we would expect to find in a study conducted in a more individualistic culture, such as is prevalent in the United States, because the effect of individual difference variables on knowledge sharing are likely constrained in a highly collectivistic culture. More empirical research on how culture might influence the relationship between evaluation, reward, personality, and knowledge sharing is needed.

Second, this study focused on how accountability-inducing management practices influence knowledge sharing. Evaluation and evaluation plus reward may have fostered the development of knowledge-sharing norms, but we did not measure the level or type of knowledge-sharing norms. Also, organizations may use more informal management practices to develop cultures and norms, such as appealing to employees' concern for group or organizational outcomes (e.g., Voelpel et al., 2005; von Krogh, 1998). However, it may take more time for informal management practices to have a positive impact on knowledge sharing. Future research is needed to investigate whether evaluation and rewards influence the development of knowledge-sharing norms and the effectiveness of informal norm development methods for facilitating knowledge sharing. In addition, although we chose to conduct the study in a single organization to control for contextual factors, more research is needed to examine interorganizational knowledge sharing.

Third, this study was conducted over a three- to four-month time period in an organization in which a KMS was recently introduced, potentially limiting the generalizability of the study results. Future research should examine whether the results found in this study generalize to knowledge sharing measured over a longer time period or organizations that have well-established KMSs, knowledge-sharing cultures, and norms. Accountability and incentives may be important for initially establishing knowledge sharing and may help create a

conducive culture and norms, yet employees may have to experience more valuable career benefits, such as salary increases, from using knowledge derived from a KMS to ensure that sharing continues over a longer time period.

Fourth, the small sample size limited the statistical power needed to detect significant main effects and two-way interactions and to investigate possible three-way interactions. Based on the size of our sample ($N = 100$), more interactions were significant than expected by chance, but not by a wide margin. Future research using larger samples should test both the hypothesized and post hoc relationships investigated in this study as well as possible interaction effects between the Big Five. For example, the relationship between knowledge sharing and the interaction between conscientiousness, agreeableness, and the accountability-inducing management practices should be investigated. Highly disagreeable individuals lack interpersonal skills, which may have a negative influence on the conscientiousness–knowledge sharing relationship (Witt, Burke, Barrick, & Mount, 2002).

Fifth, this study was a quasi-experiment with the departments, but not the participants, randomly assigned to each condition. Efforts were taken in the design process and analysis to reduce the possibility of alternative explanations for the results. The company departments were carefully chosen to minimize the possible differences across conditions. To further examine other possible differences in the field study, we compared participants' job satisfaction and intention to quit across the three conditions. We found no significant differences between the conditions, and these variables were not significantly related to knowledge sharing. Nevertheless, there could be other differences influencing knowledge sharing that we were unable to control, such as in-group/out-group status (Chow, Deng, & Ho, 2000) and group cohesiveness. Future research on knowledge sharing needs to consider these dynamics.

Sixth, as noted earlier, the ratings of quality and quantity helped ensure the subject matter experts considered both dimensions when providing the overall ratings, but they did not provide a rating for each posting made by the participants. Therefore, we cannot rule out the possibility of recall bias. Future research should use other methods of knowledge-sharing evaluation that are less subject to recall bias. For example, a multidimensional measure may more completely assess the criterion space of knowledge sharing by having subject matter experts evaluate more specific facets of each posting such as the timeliness of responding to message postings or considering the content of posts (e.g., helping to develop personal relationships with peers or customers, technical knowledge).

Seventh, in this study we did not ask employees whether they perceived knowledge sharing as an in-role or extra-role behavior. It is possible that because they do not fear that sharing knowledge makes them expendable and puts their job at risk (Davenport, 2005), employees who consider knowledge sharing to be an in-role behavior may be motivated to share more knowledge than those who consider it an extra-role behavior. Also, if knowledge sharing is considered an in-role rather than an extra-role behavior, employees' motivation to share knowledge and the knowledge contribution to a KMS may be more influenced by accountability-inducing management practices. Future research is needed to determine if knowledge sharing is considered by employees to be an in-role or extra-role behavior and whether this influences the effectiveness of management practices designed to motivate knowledge sharing.

This study focused on the moderating effect of the Big Five on knowledge-sharing behaviors. We did not directly measure evaluation apprehension or need for power but instead

focused on the underlying personality traits. Future research should directly assess these variables as well as other individual differences that have been shown to be related to learning and behavior. For example, research has shown that cognitive ability is a good predictor of job performance (Hunter, 1986) and learning in training programs (Ree & Earles, 1991), and potentially high performers may have more ideas and knowledge to share with others in a more established initiative in an organization. Although the hypotheses regarding agreeableness were not supported, it is possible that the narrow facets of this trait (e.g., altruism or compliance) might be more relevant. Negative affectivity, which has been shown to influence individuals' reactions to bonuses, also may affect how individuals react to reward or incentive plans designed to encourage knowledge sharing (Begley & Lee, 2005).

Finally, this study investigated the influence of two types of accountability-inducing management practice (evaluation and evaluation plus reward). There are other important theoretical frameworks for understanding employee motivation to share knowledge that should be investigated in future research, including exchange expectations, normative pressures, social structures, and territorial behaviors (e.g., Constant, Kiesler, & Sproull, 1994; Gray, 2001; Wasko & Faraj, 2000; Webster et al., 2008). The influence of enhancing employees' sense of group identity and personal responsibility and other motivational practices on knowledge sharing needs to be examined. Also, future research needs to investigate how knowledge sharing is influenced by monetary schemes in which rewards are provided based on (1) the results of a lottery in which the more knowledge shared the more chances employees have to win money and other prizes, (2) evaluation and accountability provided by peers or subject matter experts rather than managers, and (3) group- or team-level rather than employee-level knowledge sharing (Boswell, Colvin, & Darnold, 2008; Cabrera & Cabrera, 2002).

Note

1. When all 10 interaction terms were entered simultaneously in addition to the main effects, both interactions of neuroticism and openness to experience with the evaluation-plus-reward condition (accountability and incentive) were significant at the .01 level, and the interaction between conscientiousness and the evaluation-plus-reward condition (accountability and incentive) was significant at the .10 level. These results should be interpreted with caution due to high multicollinearity and very limited statistical power.

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