

Customer Participation and Project Performance: The Mediating Role of Knowledge Sharing in the Chinese Telecommunication Service Industry

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ABSTRACT *Purpose:* Extant literature has devoted more attention to customer value co-creation and knowledge sharing, not only in business-to-customer (B2C) markets, but also in business-to-business (B2B) markets. This study explores and examines the antecedents and consequences of customer knowledge sharing in the context of B2B markets by applying the motivation-opportunity-ability (MOA) framework.

Methodology/Approach: This empirical study involves two structured surveys of project managers from both suppliers ($n = 213$) and customers ($n = 312$), which were conducted in the context of the Chinese telecommunication service industry. The conceptual model of this study was subsequently tested by developing Partial Least Squares (PLS) based structural equation models.

Findings: It was found that customer knowledge sharing is facilitated by four MOA factors: customer orientation, customer perceived benefits, customer socialization, and customer technological capability. It was determined that knowledge sharing has a direct and significant effect on project performance. Furthermore, the study revealed that such relationships vary across suppliers and customers.

Research Implications: This study extends the existing research stream of inter-firm knowledge sharing by examining the antecedents and consequences of customer knowledge sharing from dual perspectives of customers and suppliers, and sheds light on the benefits of customer knowledge sharing. The dyadic perspective embodied in this design facilitates our understanding and management of knowledge sharing between organizations.

Originality/Value/Contribution: This article provides an important contribution to the existing literature of customer knowledge sharing by revealing how to effectively facilitate interorganizational knowledge sharing, particularly knowledge from customers to suppliers, and discovers conditions under which customers are more likely to exchange information, and share knowledge with their suppliers from the dyadic perspective.

KEYWORDS motivation-opportunity-ability, knowledge sharing, project performance, telecommunication service industry, industrial marketing, business marketing

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How to more effectively enable customers to share knowledge with their suppliers has been a perennially compelling issue in the literature of knowledge management for more than three decades (e.g., Lausen and Salter 2006; von Hippel 1976, 1986). Previous research demonstrates that customers, especially lead users, can not merely perceive the future necessity of an innovation but may even invent what they need by themselves or in conjunction with their suppliers (von Hippel 1976, 1986). Thus, knowledge embedded on the customer side of the equation can be an important source for product innovation (Griffin and Hauser 1993; Thomke and von Hippel 2002), and customers are increasingly seen as a firm's co-producers and co-creators of products and services (e.g., Vargo and Lusch 2004; Prahalad and Ramaswamy 2004; Hoyer et al. 2010). Accordingly, firms striving for various ways of identifying, learning, and absorbing new knowledge possessed by their customers are more likely to achieve high innovativeness and sustainable competitive advantage (Cohen and Levinthal 1990).

Customers, however, are not obliged to share knowledge with their suppliers, and their interests may not be well aligned with those of their suppliers. As evidenced by Morrison, Roberts, and von Hippel (2000), more than half of the libraries in the Australian community prefer not to share their own modifications with their system suppliers. Furthermore, if customers perceive that such knowledge sharing behaviors weakens their competitive advantage, they may even impose secrecy on their new ideas or new solutions (Hansen, Mors, and Lovas 2005; Tsai 2002). Therefore, firms must understand how to induce and enable customers to share knowledge easily. Unfortunately, research on how to effectively facilitate interorganizational knowledge sharing, especially knowledge from customers to suppliers, has not received enough attention (Lawson, Petersen, Cousins, and Handfield 2009). Consequently, conditions under which customers are more likely to exchange information, and share knowledge with their suppliers, remain unclear.

The present study attempts to bridge this research gap by applying the well recognized motivation-opportunity-ability (MOA) framework to examine antecedents and consequences of customer knowledge sharing in the context of high-technology industries (Rothschild 1999). This study defines customer knowledge sharing as the extent to which customers exchange their own information, ideas, and expertise with their suppliers. Based on this MOA framework, we argue that customers are more likely to share knowledge with their suppliers when

they have incentives, opportunities, and capabilities to exchange (Ahuja 2000). Consequently, we identify factors from extant research that influence customer knowledge sharing, including customer orientation, customer perceived benefits, customer socialization, and customer technological capability.

This article makes both theoretical and empirical contributions to the existing literature on knowledge sharing. First, this study focuses specifically on knowledge flow from customers to suppliers, an aspect that has received limited attention in the literature. Second, by applying the MOA framework, this study adopts a more holistic perspective to investigate customer knowledge sharing. Although previous research has discussed, to some extent, the incentives, opportunities, and capabilities of knowledge sharing, most studies examine only part of the MOA framework. They thus lack a comprehensive overview of customer knowledge sharing. Finally, most studies on knowledge sharing sample either from suppliers or customers (although Im and Rai 2008 is an exception), and it is unclear whether suppliers and customers have similar views as to how to induce and facilitate customer knowledge sharing. This study addresses this limitation by sampling from both parties and makes comparisons of empirical findings between the two groups.

LITERATURE REVIEW

Customer Co-Creation and Customer Knowledge Sharing

The wide adoption of new information technologies has redefined the roles that customers play in innovation and value creation (e.g., Nambisan and Baron 2009). Customers are increasingly involved in the development of new products and processes in both consumer markets and industrial markets, and the research of customer co-creation has gained growing attention from different academic areas (von Hippel 1976, 1986, 2004; Morrison, Roberts, and von Hippel 2000; Thomke and von Hippel 2002). *Co-creation* can be defined as activities in which customers are involved related to the design and production of superior value they desire by using their knowledge and/or other resources in conjunction with either peer customers, or firms (e.g., suppliers), who also seek value creation (Vargo and Lusch 2004; Prahalad and Ramaswamy 2004; Hoyer et al. 2010). The value achieved from such a co-creation process shifts from a firm-centric perspective, which emphasizes the quality of a firm's products and

service, to personalized customer experiences, in which the importance of customer knowledge sharing is widely acknowledged and well documented in current literature. Two broad streams of literature have explored the impact of customer knowledge on suppliers' new product development and market performance. The open innovation literature suggests a porous organizational boundary for product innovation and argues in favor of active communication between a focal firm and its connected parties (Chesbrough 2003). Compared to the traditional research and development (R&D) model that emphasizes self-reliance and internal R&D for new ideas and product innovations, the open innovation model suggests that firms can use both internal and external pathways to generate and commercialize their new products (Chesbrough 2003). This is because useful knowledge elements are generally widespread in society (Hayek 1945), and a single organization cannot generate and use all relevant knowledge due to the effects of bounded rationality and limited resources. Consequently, firms operating in this contemporary era have to identify, absorb, and integrate external knowledge to gain and maintain competitive advantage (Cohen and Levinthal 1990).

Researchers preferring the open innovation model suggest that knowledge from customers is a critical external source for innovation (e.g., Chesbrough 2003). For instance, Chesbrough (2003) illustrated the importance of customer knowledge, citing the example of Intuit which has developed and maintained a close and disciplined relationship with its customers to understand what, precisely, its customers need and how to satisfy those needs using externally acquired technologies. Laursen and Salter (2006) provided some empirical evidence on the open innovation model by linking external search depth and breadth to innovative performance among U.K. manufacturing firms. They generate a list of 16 external sources from which a firm may obtain knowledge. The source of clients or customers is ranked second in terms of reference usage. Therefore, both theoretical and empirical evidence shows that customer knowledge contributes to firm performance, in the area of, for example, new product innovation.

The second stream of literature on customer knowledge sharing relates to user innovation research, which originates from the observation that users, rather than suppliers, can be the source of commercially important new products and processes (von Hippel 1976). As observed by von Hippel in the scientific instruments industry, users not only perceive future development of instrumentation but

also invent and build new prototypes, and even distribute their inventions (von Hippel 1976). To follow such innovative progress, suppliers must encourage their users to share inventions and transfer knowledge from their users.

Von Hippel (1976) concluded that it is the lead users, rather than all users, who contribute most to new products and processes. He defined lead users as "users whose present strong needs will become general in a marketplace months or years in the future" (von Hippel 1986: 791). Compared to non-lead users, lead users tend to have a higher level of leading-edge status, in-house technical skills and incentives to modify existing solutions (Morrison et al. 2000). Lilien and his colleague (2002) demonstrated that firms systematically using lead user processes can facilitate their new product development and generate better sales from new products. All these findings provide evidence on the importance of learning from lead users about their needs and solutions, during which process user knowledge sharing is an indispensable element. Given the tacit nature of technological know-how and personal experiences, it is difficult for a focal firm to learn and transfer customer knowledge and inventions without cooperation from its customers (Kogut and Zander 1992). Thus, it is urgent for firms to understand the conditions under which their customers are willing to share and exchange their proprietary knowledge.

The MOA Framework and Knowledge Sharing

The MOA framework aims to explain the factors that drive a person or an organization to engage in a specific behavior (Rothschild 1999). The first driver is motivation, which refers to the desire or readiness to perform a behavior. There are many factors that can influence personal motivation, such as proper incentives (Ferrin and Dirks 2003), group norms (Blumberg and Pringle 1982; Szulanski, Capetta, and Jensen 2004), and so on. The second driver is opportunity, which refers to a variety of environmental and contextual mechanisms that enable the behavior. This includes communication tools, working conditions, and organizational policies (Blumberg and Pringle 1982). The third driver is ability, which refers to the skills or knowledge base related to the action. In general, the MOA framework argues that an organization tends to perform a specific behavior when it has the motivation, opportunity, and ability to engage in that behavior.

Until now, the MOA framework has been widely used in management research, including topics such as

human resource management policy adoption (Katou and Budhwar 2010), advertising repetition (Batra and Ray 1986), small firm growth (Davidsson 1991), and inter-firm linkage formation (Ahuja 2000). Researchers also use this framework to study the issue of knowledge sharing. For instance, Siemsen, Roth, and Balasubramanian (2008) focused on informal knowledge sharing among individual employees within a workgroup and find that motivation, opportunity, and ability, taken together, drive knowledge sharing behavior. Fey and Furu (2008) investigated only the impact of the motivational factor on knowledge sharing among a multinational company's subsidiaries. Their study shows that when managers' incentive pay is aligned with the collective performance of the MNC, knowledge sharing among units is more likely to happen. Similarly, Quigley, Tesluk, Locke, and Bartol (2007) looked at how motivational mechanisms facilitate knowledge sharing among managers and concluded that group incentive systems and group norms jointly influence the level of managerial knowledge sharing. In general, existing literature supports the importance of the MOA framework in explaining the behavior of knowledge sharing. However, extant research on knowledge sharing across organizational boundaries, especially across vertical levels, is rather limited.

DEVELOPMENT OF HYPOTHESES

According to the MOA framework, when a focal firm tries to induce its customers to share knowledge, it has to ensure satisfaction of three key conditions: First, whether a customer has enough incentives to share knowledge; second, whether a customer has enough opportunities to interact with representatives from a focal firm; and third, whether a customer has something innovative to share. This study identifies four important factors from existing literature that relate to the motivation, opportunity, and ability of a focal firm's customers in terms of knowledge sharing: customer orientation, customer perceived benefits, customer socialization, and customer technological capability. The following segment examines in detail the impacts of these four factors on customer knowledge sharing and subsequent outcomes.

Customer Orientation

The first motivational factor related to customer knowledge sharing is *customer orientation*, which refers to the extent to which a supplier emphasizes the importance

of identifying and fulfilling customer needs (Kohli and Jaworski 1990). Such a focus on customer needs corresponds to increasing competitive intensity and environmental dynamism. As Narver and Slater (1990) have argued, a customer-oriented firm is more likely to establish an organizational culture "that most effectively and efficiently creates the necessary behaviors for the creation of superior value for buyers and, thus, continuous superior performance for the business" (p. 21). Similarly, Deshpande and Farley (1998) concluded that firms with customer orientation are more likely to discover customer needs, genuinely care about customer satisfaction, and offer superior quality products and services. In sum, a firm with a "customer orientation" tends to prioritize its customers' interests and organize its activities to fulfill customers' expressed and latent needs (Narver, Slater, and MacLachlan 2004). The literature has shown that customer orientation helps firms improve innovativeness, sales growth, and profitability (e.g., Atuahene-Gima 1995; Jaworski and Kohli 1993; Slater and Narver 1994).

Applying the concept of customer orientation to the setting of customer knowledge sharing, we argue that customers are more likely to exchange information and share knowledge with customer-oriented suppliers compared with those who pay no attention to customers. This is because when a supplier is customer-oriented, it prioritizes customer interests and develops a series of programs and activities to both understand and satisfy the customer's needs; this process lays a solid foundation for knowledge sharing with each other. Furthermore, customer-oriented suppliers always tend to react quickly to the demands and feedback of their customers and create more channels or opportunity to exchange knowledge with customers. This usually stimulates a consultative, open, collaborative, and two-way dialogue between suppliers and customers (Saxe and Weitz 1982), which may, in turn, stimulate the motivations and strengthen the actual behaviors of customer knowledge sharing. Moreover, comparatively speaking, there is a high degree of probability that customer-oriented suppliers will resolve customer problems quickly or provide customized, quality solutions. As long as customers recognize the positive outcomes and the friendly attitude of their suppliers, customers may exhibit strong willingness to exchange information actively with their suppliers, lower both the psychological and physical barriers to effective information exchange, and make every effort to achieve better solutions for themselves. Therefore, we conclude that a customer-oriented supplier is more likely to induce customer knowledge sharing.

H1: Customer orientation is positively related to customer knowledge sharing.

Customer Perceived Benefit

The second motivational factor related to customer knowledge sharing is customer perceived benefits, that is, how many benefits a customer expects to gain from a joint project. As Fishbein and Ajzen (1975) suggested, attitudes and subjective norms towards a specific behavior determine the intention to engage in that behavior. If a person adopts a favorable attitude toward a behavior, she/he will be very likely to engage in that behavior. Applying this logic to the setting of knowledge sharing, we argue that the behavior of customer knowledge sharing is more likely to occur when the benefits of such a behavior outweigh the costs (Bock and Kim 2002).

Empirical studies have provided evidence supporting the notion that the greater the benefits associated with knowledge sharing, the more positive the attitudes and intentions for knowledge sharing. For instance, Bock, Zmud, Kim, and Lee (2005) argued that individuals tend to hoard knowledge for various reasons and to induce knowledge sharing, organizations have to provide proper extrinsic motivators, social-psychological forces, and organizational climate. Similarly, Lin (2007) differentiated two types of motivators (extrinsic and intrinsic) to explain employee knowledge sharing intentions. His empirical results derived from 172 employees of 50 large organizations in Taiwan show that motivational factors such as perceived benefits from knowledge sharing are significantly correlated with employee knowledge sharing attitudes and intentions. We argue that the same logic can be extended to the organizational level, and that when customers perceive more benefits associated with sharing knowledge with their suppliers, they are more likely to engage in those kinds of activities.

H2: Customer perceived benefit is positively related to customer knowledge sharing.

Customer Socialization

The two foregoing motivational factors highlight the incentives for customers to share knowledge; in addition, suppliers must create opportunities for customer knowledge sharing to occur, and one possible choice is via customer socialization. *Customer socialization* refers to the level of interaction and communication between

the supplier and the customer (Gupta and Govindarajan 2000). In particular, this study focuses on the informal aspect of customer socialization, which often happens outside of the physical setting of the workplace, such as family parties, off-site meetings, personal gift exchanges, and interest groups (Lawson et al. 2009). Although socialization is a well-accepted concept in the organizational behavior literature, few studies have empirically examined how customer socialization influences information exchange and knowledge sharing within a supplier-customer context (Cousins and Menguc 2006; Gupta and Govindarajan 2000). We argue that a focal supplier can induce higher levels of customer knowledge sharing through active customer socialization due to three potential benefits.

First, customer socialization provides ample opportunities for the representatives from suppliers and customers to become acquainted and understand each other, which helps overcome behavioral and cultural barriers (Chalos and O'Connor 2004; Handfield and Bechtel 2002). Further, interpersonal familiarity and affinity provide more opportunities for open communication and thus facilitate more exchanges of information and know-how (Gupta and Govindarajan 2000). Second, customer socialization means that much wider channels are available for customers to exchange information with suppliers (Daft and Lengel 1986). Without social interaction, a focal firm can only exchange ideas and access customer knowledge through formal meetings and discussions, thus limiting the amount and types of information exchanged. Through various types of customer socializations, a focal firm increases the frequency and intensity of the exchange of ideas and information. Third, interactive customer socialization helps build mutual trust and forms friendships (Handfield and Bechtel 2002). Friends are more likely to exchange tacit and proprietary knowledge, thus leading to more knowledge sharing. Expanding on this notion, in such emerging economies as China, the countless *guanxi* networks used in most business transactions should be more widely acknowledged. For centuries, *guanxi* has been pervasive in every aspect of Chinese organizational activity, where informal customer socialization is very popular and even vital for maintaining quality business relationships.

Empirical research on the role of socialization generally supports the previous arguments and indicates that effective socialization helps increase partner-specific absorptive capacity (Dyer and Singh 1998), allows for higher levels of product integration with suppliers (Ragatz, Handfield, and Petersen 2002), facilitates knowledge transfer (Gupta and Govindarajan 2000), and improves new product

development (Lawson et al. 2009). For instance, Lawson et al. (2009) conducted a survey among U.K. manufacturing firms and found that informal socialization mechanisms exert a positive influence on the level of knowledge sharing within interorganizational product development teams. Similarly, Gupta and Govindarajan (2000) collected data from 374 subsidiaries within 75 MNCs and demonstrated that when a subsidiary's president is active in the socialization process, this subsidiary will have a higher level of knowledge inflow and outflow from peer subsidiaries.

H3: Customer socialization is positively related to customer knowledge sharing.

Customer Technological Capability

The MOA framework implies that ability is an important antecedent of an expected action (Blumberg and Pringle 1982; Rothschild 1999). When a person or an organization possesses good skills or relevant knowledge bases relating to an action, the chance of successfully performing that action increases accordingly. Given the context of high-technology industries, this study focuses on customers' technological capabilities that relate to customers' accumulated knowledge and experience relevant to current projects. We believe that customers are more likely to share knowledge with their suppliers when they are highly innovative and have accumulated a large stock of detailed knowledge. This is true for two reasons. First, customer technological capability forms the premise for knowledge sharing with suppliers (Grant 1996). When customers lack technical skills and competencies, they are less likely to generate new ideas and original knowledge elements, thus reducing the probability of knowledge exchange with their suppliers. Second, when customers are highly innovative, they tend to become more demanding of their suppliers and expect their suppliers to keep pace with their technological development. Consequently, such customers may exchange information and share knowledge frequently with their suppliers.

H4: Customer technological capability is positively related to customer knowledge sharing.

Customer Knowledge Sharing and Project Performance

The importance of knowledge sharing within and across organizations has been well documented in the literature

(e.g., Grant 1996; Teece, Pisano, and Shuen 1997). In this study, project performance refers to an overall measure of performance consisting of the following items: (1) the degree to which project cost is reduced; (2) the degree to which project cycle is shortened; (3) the degree to which project quality is improved; (4) the degree to which customer complaints are decreased after project completion; and (5) the degree to which the customer's operating cost is reduced. We argue that customer knowledge sharing has a positive effect on project performance. First, when customers are willing to share their information and technological know-how with their suppliers, suppliers can better understand customer needs and problems, which is the basis for improving customer satisfaction (Narver and Slater 1990). Through frequent interaction and knowledge exchange, suppliers can integrate customers' comments and suggestions into the production process and make modifications accordingly. As a result, customer knowledge sharing can reduce customer response time, lower transaction costs, and lead to more cost savings (Carr and Pearson 1999).

Second, customer knowledge sharing helps reduce the psychological barriers between suppliers and customers, thus fostering trust and cooperation (Szulanski et al., 2004). This makes it possible, and more cost-effective, for suppliers to understand what customers really want. Through exchange of internal information and know-how, these dyadic relationships can make full use of all available knowledge for superior project performance. Third, given knowledge components provided by customers, suppliers can broaden their own stock of knowledge and increase the probability of creating new processes or products through recombination (e.g., Fleming, 2001), thus suppliers can offer more innovative outputs to the customers, decrease project costs, shorten project cycle, improve project quality, and/or avoid customer complaints.

H5: Customer knowledge sharing is positively related to project performance.

Figure 1 exhibits the conceptual framework of the antecedents and consequences of customer knowledge sharing.

METHODOLOGY

Sample and Data Collection

The empirical setting for this study is the telecommunication construction and engineering (TCE) service

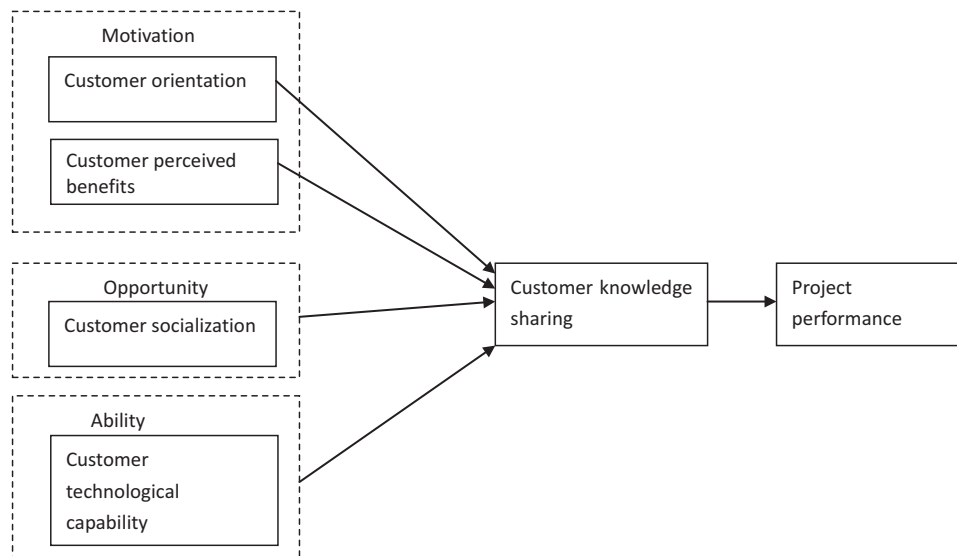


FIGURE 1 Theoretical framework.

industry in China. The TCE service industry is proper for this study because project teams constitute the basic work units in this industry, and customized services as well as intimate interactions with customers are required during the process of project planning, implementation, evaluation, and maintenance. To derive a more holistic overview encompassing the issue of customer knowledge sharing, we designed two studies and collected data from both suppliers and customers, respectively.

Study 1: Project Managers from the Service Providers

We selected three major TCE providers from China as the major source of respondents. We first contacted the general managers of three TCE companies to explain the purpose of the study and invite their participation. The three companies operate within a wide geographic area in China, including Guangdong, Guangxi, Jiangsu, Zhejiang, and Anhui. With permission and assistance of top managers, we constructed an initial sample of 400 project managers actually working within their companies.

The questionnaire for the survey was originally prepared in English, and subsequently translated into Chinese by two management researchers from a top university in China. To avoid cultural bias and ensure validity, the Chinese version was then back-translated into English. We conducted a pilot study to clarify the instrument with 50 project managers. According to feedback from the pretest, we revised the questionnaire to improve clarity. Then the questionnaire was mailed to other project managers, together with an invitation letter from their general

managers. Respondents were asked to finish the questionnaire based on one of their recent projects with which they were most familiar. After one month, we mailed a memorandum to non-responding firms and made a call to remind non-responding project managers to complete and return the questionnaire within another one month.

After two rounds of correspondence, we eventually received 213 effective questionnaires from the supplier side, with a valid response rate of 53.3%. Among them, 136 copies were first-round responses (termed *early responses*) while the rest were second-round responses (termed *late responses*). Following the suggestion of Armstrong and Overton (1977), this study compared early responses with late responses using a *t*-test analysis. The result showed that these two groups of respondents displayed no significant differences across all key variables of this study, that is, customer orientation, customer perceived benefit, customer socialization, and customer technology capability.

Study 2: Project Managers from the Customers

Study 2 asked the three TCE service providers to prepare a list of project managers who had worked as their customers and who had collaborated with them in the past. Initially, a name list of 500 project managers was compiled. We followed the same process used in Study 1 to clarify and improve the items in the questionnaire and then mailed questionnaires to the potential respondents. It is to be noted that all instruments used in Study 2 were similar to those in Study 1, except that we changed the wording

TABLE 1 Profile of Respondents

Characteristic	Supplier sample		Customer sample	
	<i>n</i>	Percentage	<i>n</i>	Percentage
Gender				
Male	192	90.14	256	82.05
Female	21	9.86	56	17.95
Total	213	100	312	100
Age				
≤30	143	67.14	86	27.56
31–40	55	25.82	176	56.41
41–45	13	6.10	38	12.18
46–55	1	0.47	10	3.21
≥56	1	0.47	2	0.64
Total	213	100	312	100
Work experience (years)				
0–5	77	36.15	85	27.24
6–10	99	46.48	87	27.88
11–15	27	12.68	84	26.92
16–20	6	2.82	39	12.50
Over 20	4	1.88	17	5.45
Total	213	100	312	100
Education level				
High school	12	5.63	5	1.60
Junior college	42	19.72	51	16.35
Bachelor degree	153	71.83	206	66.03
Master degree	4	1.88	47	15.06
Doctor degree	2	0.94	3	0.96
Total	213	100	312	100
Project duration (months)				
1–3	52	24.41	90	28.85
4–6	69	32.39	97	31.09
7–12	58	27.23	94	30.13
>12	34	15.96	31	9.94
Total	213	100	312	100
Project size				
≤20 workers	76	35.68	112	35.90
21–50 workers	70	32.86	99	31.73
51–100 workers	39	18.31	45	14.42
≥100 workers	28	13.15	56	17.95
Total	213	100	312	100

from “suppliers” to “customers.” Eventually, we received 312 effective questionnaires from the customer side, representing a valid response rate of 62.4%. Table 1 captures the characteristics of both samples, including the gender, age, work experience, and education of respondents, as well as project size and duration.

Measures and Validation

The items used to measure the theoretical constructs were derived from an extensive review of the extant literature. All items were measured using a 7-point Likert

scale anchored from 1 (*strongly disagree*) to 7 (*strongly agree*). Table 2 shows the list of all measures and the results of confirmatory factor analysis.

Project performance was measured by a scale adapted from the well-known study by Bonner, Ruekert and Walker (2002), including project cost reduction, time saving, quality improvement, complaint decrease, and customer cost reduction. The respondents were asked to evaluate the extent to which the above project goals were achieved on a 7-point Likert scale. We applied a subjective performance measure in this study because prior research has provided evidence supporting the reliability

TABLE 2 Confirmatory Factor Analysis Results Based on Partial Least Squares Method

Construct/Items	Supplier sample		Customer sample	
	Standardized loading	Cronbach's alpha	Standardized loading	Cronbach's alpha
Customer orientation				
1. We are aware that customers are important factors that influence the success of our company	0.71		0.61	
2. We emphasize customer related activities and success	0.76		0.27	
3. We have a customer oriented culture	0.77		0.75	
4. Our customers are a focal point of our activities	0.79		0.63	
5. We have a strategy that is based on the understanding of customers	0.86		0.61	
6. We systematically and constantly keep track of the demands of our customers	0.81	0.94	0.71	0.93
7. We respond rapidly if something important happens with regard to our customers' innovation activities	0.70		0.81	
8. We quickly react to the feedback of our customers	0.71		0.80	
9. We quickly react to the demands of our customers	0.77		0.77	
10. We always resolve problems of our customers	0.77		0.81	
11. We always make efforts to provide customized solutions for our customers	0.71		0.81	
Customer perceived benefits				
1. Customers may acquire a lot of benefits through interacting with us	0.73		0.63	
2. Customers' costs can be reduced due to our participation in the innovations during the project delivery period	0.83		0.64	
3. Our participation in the innovations during the project delivery period may improve the capability of customers	0.69	0.89	0.79	0.86
4. Our participation in the innovations during the project delivery period may help our customers accumulate project experiences	0.67		0.84	
5. Customers may get more satisfied results due to our participation in the innovations during the project delivery period	0.78		0.78	
6. Customers may acquire considerable financial rewards for their innovations during the project delivery period	0.75		0.76	
Customer socialization				
1. During holidays or after office hours, we would call our customers or visit them	0.67		0.84	
2. We often invites our customers to have lunch or supper together	0.77	0.88	0.93	0.95
3. On special occasions such as customers' birthday, we would definitely visit and send them gifts	0.86		0.90	
4. We care about and have a good understanding of our customers' family and work conditions	0.89		0.93	

(Continued)

TABLE 2 (Continued)

Construct/Items	Supplier sample		Customer sample	
	Standardized loading	Cronbach's alpha	Standardized loading	Cronbach's alpha
Customer technological capability				
1. Our customers have a lot of relevant experiences of similar projects	0.79		0.61	
2. Our customers accumulate a lot of knowledge required for the current project	0.83		0.67	
3. Our customers have strong capability in innovations for the current project	0.79		0.82	
4. Our customers have strong capability for technological improvement for the current project	0.75		0.82	
5. Our customers have strong technical teams that have enough knowledge for the current project	0.78		0.78	
6. The project team from our customers have strong capability to deal with problems of the current project	0.72	0.91	0.78	0.91
7. The project team from our customers can get valuable feedbacks or suggestions from other teams or colleagues	0.76		0.70	
Customer knowledge sharing				
1. Our customers always provide us valuable information during the project delivery period	0.87		0.77	
2. Our customers always share their expertise during the project delivery period	0.92		0.90	
3. Our customers actively exchange their information, ideas and experiences with us	0.91	0.93	0.87	0.92
4. The exchange of information about techniques and working styles between our customers and our project managers happens frequently	0.81		0.82	
Project performance				
1. Reduced cost of the project	0.78		0.82	
2. Shortened cycle of the project	0.80		0.84	
3. Improved quality of the project	0.84	0.91	0.86	0.93
4. Decreased complaints of customers after project delivery	0.80		0.87	
5. Reduced operational cost of customers	0.82		0.82	

and validity of perceptual performance measures (e.g., Dess and Robinson 1984).

Customer knowledge sharing was measured by 4 items drawn from Willem and Buelens (2007). This construct examined the extent to which customers exchange their information and expertise with their suppliers. Respondents were asked to indicate whether customers provide valuable information, share their expertise, exchange ideas or compare experiences.

The measure of customer orientation was adapted from Wynstra, Weggeman, and Van Weelee (2003) and

Homburg, Grozdanovic, and Klarmann (2007), and eventually 11 items were retained to measure the extent to which suppliers are concerned about their customers. The measure of customer perceived benefits was adapted from Morrison et al. (2000) and Hars and Ou (2002), and six items were retained to indicate the degree of various benefits that customers expected from a project. Customer socialization included a variety of activities such as off-work phone calls, invited meals, and birthday gifts. We retained four items from Chen and Tjosvold's (2007) study to measure customer socialization. The final

explanatory variable was customer technological capability, which was measured by 7 items adapted from Morrison et al. (2000).

We also controlled for two key variables that might influence project performance: project duration and project size. Project duration was measured as the number of months that a project required to finish. Project size was measured as the number of people involved in a project.

To test unidimensionality, inter-item correlations were calculated and item-to-total correlations were examined, one scale at a time. Also an exploratory factor analysis was conducted to explore the unidimensionality of each scale using an eigenvalue of 1.0 (Steenkamp and Van Trijp 1991).

To test the construct validity, we followed the procedures suggested by Fornell and Larcker (1981) and conducted the confirmatory factor analysis. The general findings showed that our measures had good discriminant and convergent validities. As shown in Table 2,

all composite reliability values were above the suggested threshold of 0.70, with a minimum of 0.86 for customer perceived benefits in the customer sample. In addition, the standardized factor loadings for all items were above the suggested cut-off point of 0.60, and all were significant with strong evidence of convergent validity. Furthermore, as shown in Tables 3 and 4, the average variance extracted (AVE) value of each construct in the model was more than 0.50, which met the requirement that a construct's AVE should be at least higher than 0.50 (Fornell and Larcker 1981). In addition, discriminant validity was demonstrated by the square root of the AVE of each construct being generally higher than the correlations with any other constructs in the model (Fornell and Larcker 1981). Thus, the constructs were shown to be both conceptually and empirically distinct from each other.

As with all self-reported data, there is a potential for common method variance. Therefore, statistical analyses were conducted before hypothesis testing. First, Harmon's

TABLE 3 Correlation Matrix and Descriptive Statistics of Measures with the Square Root of Average Variance Extracted (AVE) (Supplier Sample)

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Customer orientation	5.82	0.93	0.77							
2. Customer socialization	4.67	1.23	0.19*	0.80						
3. Customer knowledge sharing	4.47	1.24	0.40**	0.46**	0.88					
4. Project performance	5.47	0.95	0.55**	0.25*	0.47**	0.81				
5. Customer perceived benefits	5.72	0.90	0.52**	0.23*	0.22*	0.39**	0.75			
6. Project duration	2.34	1.02	-0.01	-0.10	0.10	-0.10	-0.09	1.00		
7. Project size	2.08	1.04	-0.07	0.04	-0.15*	-0.25*	-0.07	0.35**	1.00	
8. Customer technological capability	4.49	1.38	0.18*	0.36**	0.46**	0.17*	0.13*	0.13*	-0.15	0.78

Square root of AVE is on the diagonal. *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level.

TABLE 4 Correlation Matrix and Descriptive Statistics of Measures with the Square Root of Average Variance Extracted (AVE) (Customer Sample)

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Customer orientation	5.60	0.83	0.74							
2. Customer socialization	3.11	1.68	0.25**	0.90						
3. Customer knowledge sharing	5.66	0.97	0.67**	0.17**	0.81					
4. Project performance	5.71	0.91	0.57**	0.12*	0.47**	0.84				
5. Customer perceived benefits	6.23	0.70	0.42**	-0.01	0.39**	0.35**	0.74			
6. Project duration	2.33	1.34	-0.11	0.02	-0.07	-0.07	-0.10	1.00		
7. Project size	2.26	1.44	0.01	-0.04	0.02	0.08	0.01	0.62**	1.00	
8. Customer technological capability	5.62	0.91	0.46**	0.17*	0.42**	0.34**	0.32**	-0.10	0.07	0.78

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level. Square root of AVE is on the diagonal.

one-factor test was conducted (1967) and results showed that six factors explained 76.9% of the variance, with no single factor explaining more than 20% of the variance. Second, a more stringent test was conducted, as well, based on what Liang et al. (2007) suggested. We included in the PLS model a common method factor that links to all the principal constructs' indicators, and calculated each indicator's variances substantively explained by the principal construct and by the method factor. It was found that most of the method factor loadings are insignificant, and that the indicators' substantive variances are substantially greater than their method variances. This implies that the potential problem of common method variance did not appear to be significant in our study.

RESULTS

After establishing confidence in the measurement model, we applied structural equation modeling to test our hypotheses. There are at least two estimation techniques for structural equation modeling: maximum likelihood (ML) covariance structural analysis and partial least squares (PLS) variance analysis. Although the PLS method is not as popular as the ML method, it does provide a way to avoid problems of improper solutions and factor indeterminacy, as well as the violations of distributional assumptions, which can be associated with the ML method. Furthermore, the PLS method has been gaining popularity recently because of its ability to model latent constructs under conditions of nonnormality and small to medium sample size, which is preferable to techniques such as regression assuming error free measurement. In addition, given its exploratory nature and its major concern focused on the predictive power of the research model, this study adopted the PLS method with PLS-Graph 3.0 to develop structure equation models.

Table 5 presents the empirical findings using the PLS approach for both samples. Hypothesis 1 proposed a positive relationship between customer orientation and customer knowledge sharing. In Table 5, we found that the corresponding path coefficients for both samples were positive and significant ($p < 0.01$), providing full support for Hypothesis 1. Hypothesis 2 argued for a positive linkage between customer perceived benefits and customer knowledge sharing. Table 5 indicates that such a relationship only exists for the customer sample. Hypothesis 3 argued that customer socialization had a positive effect on customer knowledge sharing, which only received support in the supplier sample (path coefficient = 0.30, $t = 5.17$).

We also found that in both samples, a positive and significant relationship existed between customer technological capability and customer knowledge sharing, providing full support for Hypothesis 4. Finally, for both samples, the path coefficients between customer knowledge sharing and project performance were positive and statistically significant, providing full support for Hypothesis 5. In addition to the foregoing, we controlled two key other variables that may influence project performance. As indicated in Table 5, negative and positive but significant effects of project size was found for samples of suppliers and customers, respectively, whereas a significant effect of project duration was found for customer sample only.

DISCUSSION

This study extended the existing research stream of interfirm knowledge sharing by examining the antecedents and consequences of customer knowledge sharing from dual perspectives. Specifically, we applied the MOA framework to examine the extent to which customers are willing to share knowledge with their suppliers. We also explored the impact of customer knowledge sharing on project performance. To obtain a holistic view of this issue, we conducted two studies with respondents from both the customer and supplier sides.

Our findings indicate that the MOA framework provides substantial power in explaining the drivers of customer knowledge sharing. First, our results suggest that customer orientation is positively related to customer knowledge sharing in both samples. This indicates that customers are more willing to share their knowledge when their suppliers are concerned about their interests. This finding is consistent with previous literature indicating that motivational factors are important determinants of people's behaviors (Rothschild 1999).

Second, we find that customer perceived benefits are positively related to customer knowledge sharing in customer samples. This means that customers are more likely to exchange ideas and information with their suppliers when they anticipate more benefits from such interaction, thus providing support for the motivational argument. However, such a relationship was not proved in the supplier sample, which is an extremely interesting result. So, from the suppliers' standpoint, the customers' anticipated benefit from a project is not a key driver for customer knowledge sharing. This judgment may be misleading because project managers are actually concerned about the beneficial returns of a project. Further, our findings suggest

TABLE 5 Path Coefficients of Partial Least Squares Based Structural Equation Model

Relationship between variables	Supplier sample (t)	Customer sample (t)
Customer orientation→customer knowledge sharing	0.31** (3.91)	0.56** (11.24)
Customer socialization→customer knowledge sharing	0.30** (5.17)	0.01 (0.17)
Customer perceived benefits→ customer knowledge sharing	-0.04 (0.65)	0.12** (2.67)
Customer technological capability→ customer knowledge sharing	0.31** (4.76)	0.12** (2.43)
Customer knowledge sharing→ project performance	0.46** (6.87)	0.46* (10.62)
Project duration→ project performance	-0.09 (1.33)	-0.13** (2.21)
Project size→ project performance	-0.15** (2.11)	0.15** (2.94)

*Statistically significant at $p < 0.05$. **Statistically significant at $p < 0.01$.

that project managers, on the suppliers' side, seek to provide real value to their customers to obtain more positive input from their customers.

Third, according to the MOA framework, customer knowledge sharing tends to be facilitated when both parties have opportunities to exchange information and new ideas. Our findings show that customer socialization has a positive effect on customer knowledge sharing within our sample of suppliers. Therefore, in the eyes of the suppliers, frequent interactions and friendship building activities can generate a platform to involve customers in knowledge sharing. This conforms to Lawson et al.'s study (2009), indicating that informal socialization mechanisms are positively associated with higher levels of knowledge sharing within inter-organizational development teams. However, such a linkage did not occur in our sample of customers. That is, frequent socialization does not necessarily guarantee that customers would be willing to share their new ideas and internal information. It is found that energizing customer knowledge sharing is a subtle issue: Although project managers, on the supplier side, place more emphasis on generating opportunities for customer knowledge sharing, project managers, from the customers' standpoint, pay more attention to motivational factors such as perceived benefits.

Fourth, our findings indicate that customers' technological capabilities are an important determinant of customer knowledge sharing in both samples. This result confirms previous studies that found that ability is an important antecedent of an expected behavior (Rothschild 1999). The present study's results suggest that, at the project level, if a customer lacks a solid knowledge base or experience in a specific technological area, the customer acts as a pure recipient and cannot contribute meaningfully to the project. Therefore, only when customers have already accumulated certain technological capabilities will they be willing and able to share knowledge with suppliers.

Finally, this study provides further evidence shedding light on the benefits of customer knowledge sharing. In both samples, we found that customer knowledge sharing helps improve project performance, which confirms prior research underscoring the importance of customer knowledge (Lausen and Salter 2006; von Hippel 1976, 1986).

Methodologically, this study contributes to the literature by demonstrating the power of two independent studies addressing the same research question using different samples. Although previous studies have explored the antecedents and consequences of knowledge sharing, little research has investigated this issue from dyadic perspectives. We believe that perception of knowledge sharing, from either single party, is biased to some extent; and, our results are more holistic by considering responses from both customers and suppliers.

A few limitations in this study can be addressed in future research. First, this study is conducted on the basis of the well-known MOA framework and only four antecedents were included in our study. Because there exist other incentives for customers to share knowledge, further studies may integrate more incentives into one framework to reveal a more comprehensive picture of customer knowledge sharing. Second, the MOA framework is predicated not only on main effects, but also on the effects of interaction. For example, even if a customer is motivated, knowledge sharing may not happen at all if there is no opportunity or ability to share information. Thus, future research may explore how these factors interact with each other in influencing customer knowledge sharing. Third, the generalizability of our findings is limited because the sample of this study is drawn from three major TCE service providers from China. Future studies may address this limitation by applying the same framework to different empirical settings. Fourth and last, since prior studies have emphasized both behavioral and cultural aspects of customer

orientation (e.g., Bharadwaj, Nevin, and Wallman 2012), future research may profitably explore the differentiated effects of each aspect.

IMPLICATIONS FOR BUSINESS MARKETING PRACTICE

Findings confirm the importance of customer knowledge sharing in customer value co-creation in B2B markets, and how to induce and facilitate customer knowledge sharing. Specifically, this study, in concert with past research on customer knowledge sharing, implies that strengthening knowledge sharing between customers and suppliers positively impacts project performance. So, from a managerial perspective, the article deepens current understanding of how to induce and enable customers to share knowledge, and thus how to achieve superior project performance. Importantly, managers can use the findings of this article to support their decisions related to customer value co-creation by facilitating customer knowledge sharing since customer knowledge sharing has a positive and significant effect on project performance in samplings of both customers and suppliers.

Secondly, given the significant effects on knowledge sharing in both samples of customers and suppliers, customer relations managers can strive to stimulate their suppliers to become more customer oriented, whereas managers of suppliers can try their best to become more customer oriented. Moreover, customer managers can devote attention to enhancing their technological capability, while managers of suppliers can evaluate and help strengthen the technological capability of their customers.

Thirdly, managers should also recognize the perception gap between customers and suppliers so as to bridge the gap or take effective measures to adapt the gap. For instance, suppliers tend to emphasize the relative importance of customer socialization, whereas customers stress the significance of customer perceived benefits in achieving superior project performance by facilitating knowledge sharing.

In sum, this article highlights areas where managers could focus more attention on motivation, opportunity, and ability, doing so simultaneously to achieve superior project performance through facilitation of customer knowledge sharing. Managers must maintain the right balance among motivation-related, opportunity-related, and ability-related factors to arrive at an optimal solution that, given the existence of perception gaps between the two parties, addresses the needs of both customers and suppliers.

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Customer Orientation

1. We are aware that customers are important factors that influence the success of our company
2. We emphasize customer related activities and success
3. We have a customer oriented culture
4. Our customers are a focal point of our activities
5. We have a strategy that is based on the understanding of customers
6. We systematically and constantly keep track of the demands of our customers
7. We respond rapidly if something important happens with regard to our customers' innovation activities
8. We quickly react to the feedback of our customers
9. We quickly react to the demands of our customers
10. We always resolve problems of our customers
11. We always make efforts to provide customized solutions for our customers

Customer perceived benefits

12. Customers may acquire a lot of benefits through interacting with us
13. Customers' costs can be reduced due to our participation in the innovations during the project delivery period
14. Our participation in the innovations during the project delivery period may improve the capability of customers.
15. Our participation in the innovations during the project delivery period may help our customers accumulate project experiences
16. Customers may get more satisfied results due to our participation in the innovations during the project delivery period
17. Customers may acquire considerable financial rewards for their innovations during the project delivery period

Customer socialization

18. During holidays or after office hours, we would call our customers or visit them
19. We often invite our customers to have lunch or supper together
20. On special occasions such as customers' birthday, we would definitely visit and send them gifts
21. We care about and have a good understanding of our customers' family and work conditions

Customer technological capability

22. Our customers have a lot of relevant experiences of similar projects
23. Our customers accumulate a lot of knowledge required for the current project
24. Our customers have strong capability in innovations for the current project
25. Our customers have strong capability for technological improvement for the current project
26. Our customers have strong technical teams that have enough knowledge for the current project
27. The project team from our customers have strong capability to deal with problems of the current project
28. The project team from our customers can get valuable feedbacks or suggestions from other teams or colleagues

Customer knowledge sharing

29. Our customers always provide us valuable information during the project delivery period
30. Our customers always share their expertise during the project delivery period
31. Our customers actively exchange their information, ideas and experiences with us
32. The exchange of information about techniques and working styles between our customers and our project managers happens frequently

Project performance

33. Reduced cost of the project
34. Shortened cycle of the project
35. Improved quality of the project
36. Decreased complaints of customers after project delivery
37. Reduced operational cost of customers

Control Variables:

Project duration (How many months does it take from initiating a project to the end of the project?)

1. 1 month–3 months
2. 4 months–6 months
3. 7 months–12 months
4. over 12 months

Project size (How many workers are involved directly in this project?)

1. below 20 workers
 2. 21–50 workers
 3. 51–100workers
 4. Over 100 workers
-

Customer Orientation

1. Suppliers are aware that customers are important factors that influence their success
2. Suppliers emphasize activities and success related to customers
3. Suppliers have a customer oriented culture
4. Suppliers consider customers the focal point of their activities
5. Suppliers have a strategy that is based on the understanding of customers
6. Suppliers systematically and constantly keep track of the demands of their customers
7. Suppliers respond rapidly if something important happens with regard to their customers' innovation activities
8. Suppliers quickly react to the feedback of their customers
9. Suppliers quickly react to the demands of their customers
10. Suppliers always resolve problems of their customers
11. Suppliers always make efforts to provide customized solutions for their customers

Customer perceived benefits

12. We may acquire a lot of benefits through interacting with our suppliers
13. Our costs can be reduced due to suppliers' participation in the innovations during the project delivery period
14. Suppliers' participation in the innovations during the project delivery period may improve our capabilities
15. Suppliers' participation in the innovations during the project delivery period may help us accumulate project experiences
16. We may get more satisfied results due to suppliers' participation in the innovations during the project delivery period
17. We may acquire considerable financial rewards for our innovations during the project delivery period

Customer socialization

18. During holidays or after office hours, suppliers would call us or visit us
19. Suppliers often invite us to have lunch or supper together
20. On special occasions such as our birthday, suppliers would definitely visit and send us gifts
21. Suppliers care about and have a good understanding of our family and work conditions

Customer technological capability

22. We have a lot of relevant experiences of similar projects
23. We accumulate a lot of knowledge required for the current project
24. We have strong capability in innovations for the current project
25. We have strong capability for technological improvement for the current project
26. We have strong technical teams that have enough knowledge for the current project
27. Our project team have strong capability to deal with problems of the current project
28. Our project team can get valuable feedbacks or suggestions from other teams or colleagues

Customer knowledge sharing

29. We always provide suppliers valuable information during the project delivery period
30. We always share our expertise during the project delivery period
31. We actively exchange our information, ideas and experiences with suppliers
32. The exchange of information about techniques and working styles between us and project managers of suppliers happens frequently

Project performance

33. Reduced cost of the project
34. Shortened cycle of the project
35. Improved quality of the project
36. Decreased complaints of customers after project delivery
37. Reduced operational cost of customers

Control variables

Project duration (How many months does it take from initiating a project to the end of the project?)

1. 1 month–3 months
2. 4 months–6 months
3. 7 months–12 months
4. over 12 months

Project size (How many workers are involved directly in this project?)

1. below 20 workers
 2. 21–50 workers
 3. 51–100workers
 4. over 100 workers
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