Knowledge sharing and knowledge effectiveness: learning orientation and co-production in the contingency model of tacit knowledge

Li-Wei Wu and Jwu-Rong Lin
Department of International Business, Tunghai University, Taichung, Taiwan

Abstract

Purpose – This study focuses on the relationship between knowledge sharing and knowledge effectiveness. By learning orientation and co-production, this study demonstrates the indirect effects of knowledge sharing on knowledge effectiveness. Moreover, the direct and indirect effects of knowledge sharing – which vary with the different levels of tacit knowledge – on knowledge effectiveness are examined.

Design/methodology/approach – The proposed model is tested using a structural equation model that involves LISREL and multi-group analyses.

Findings – Knowledge sharing increasingly affects knowledge effectiveness under the condition of explicit knowledge. The mediating roles of learning orientation and co-production in the process of tacit knowledge sharing become apparent.

Originality/value – Knowledge sharing across organizations can be regarded as a dynamic process. In view of the increasing importance of knowledge sharing across organizations, this study provides insight into the method of receiving useful knowledge across organizations.

Keywords Knowledge management, Relationship marketing, Partnership, Industrial marketing, Learning organizations

Paper type Research paper

An executive summary for managers and executive readers can be found at the end of this article.

1. Introduction

Effective knowledge management is critical for organizations seeking to gain and sustain strategic competitive advantages (Davenport and Prusak, 2000). Clearly, as organizations usually turn to external partners for new products and for processing technologies, the knowledge transferred from these partners potentially becomes an important source of synergy. However, the availability of knowledge should not be equated with knowledge effectiveness. The inability of knowledge recipients to absorb new knowledge is one of the impediments to knowledge transfer (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998, Lane *et al.*, 2001). In other words, knowledge effectiveness occurs only when knowledge is utilized by recipients and when this utilization improves their performance. A successful realization of knowledge sharing across organizations plays a significant role in the receipt of useful knowledge. Generally, knowledge sharing facilitates the receipt of useful knowledge, thus leading to the development of new and innovative ideas (Ambrosini and Bowman, 2001). Thus, organizations need to develop knowledge management to facilitate knowledge sharing (Gold *et al.*, 2001). Given the increasing importance of knowledge sharing in inter-organizational settings, research on this phenomenon should be expanded. Accordingly, the current study explores how knowledge is shared and received effectively across organizations.

Furthermore, this study deals with mechanisms that improve the effectiveness of a knowledge recipient. First, an organization can gain knowledge through organizational learning. By learning from external partners and exploiting the knowledge that is gained, knowledge recipients can potentially create knowledge synergies. This occurrence highlights the importance of the transition of learning from within an organization to across organizations and how this becomes embedded across organizations. Second, knowledge recipients aggressively co-produce their activities to increase the potential for improved performance. Co-production is a reflection of the relationship interconnection. As a mechanism, it shows how knowledge can be generated and distributed. Moreover, co-production leads to dramatic increases in productivity (Vargo and Lusch, 2004). However, few studies have simultaneously considered the interrelationships among knowledge sharing, learning orientation, and co-production. The current study addresses this gap.

Tacit knowledge has become a source of competitive advantage. Therefore, the sharing of such tacit knowledge across organizations becomes an important activity. However, transferring knowledge is difficult. Szulanski (1996) refers to such difficulty of knowledge transfer as "knowledge

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stickiness". In addition, tacit knowledge has been acknowledged as the main barrier to knowledge sharing across organizations (Simonin, 1999). Thus, the current study addresses the question "How does tacit knowledge moderate the knowledge sharing processes?". This study seeks to identify whether learning orientation and co-production play an increasingly important role as mediators in times of rising instances of sharing of tacit knowledge.

The significance of this study is twofold. The first significance of this study is its contribution to the literature on business and industrial marketing by incorporating learning orientation and co-production into the knowledge-sharing process. This study is a first attempt simultaneously to integrate relationship marketing, organizational learning, and knowledge management in a single model. Within the resource-based view, learning orientation focuses to obtain the maximum value from the knowledge of the other firm. The service-dominant logic views strategic alliances, joint ventures, and value-added partnerships in business and industrial context as the co-production and value co-creation networks (Vargo, 2009). Overall, this study seeks to extend these issues and contribute to academic thinking and managerial practice by providing a complete view of two important mediating mechanisms under different levels of tacit knowledge. Specifically, information sharing operates through both learning orientation and co-production mechanisms in increasing knowledge effectiveness within the networks. We examine not only how learning orientation and co-production mediate the effects of knowledge sharing on knowledge effectiveness but also how mediating effects vary depending on tacit knowledge. The second significance of this study is its view of the importance of interorganizational mechanisms. For many electronics companies in Asia, their roles as original equipment manufacturer/original design manufacturer suppliers enable them to upgrade their absorptive capability, and to enhance their strategic position in value chain networks based on knowledge transfer. However, an integrated theoretical framework within the context of knowledge transfer has been inadequately developed from the perspective of the knowledge recipients. Thus, management draws out the differences in optimal strategies for the varying levels of tacit knowledge. Consequently, knowledge recipients may overcome barriers through knowledge sharing across organizations.

The rest of the paper is organized as follows. First, previous conceptualizations of knowledge sharing, learning orientation, co-production, tacit knowledge, and knowledge effectiveness are presented, along with the development of the propositions. Next, the methodology and hypotheses tests are described, and the results and managerial implications are then outlined. Finally, the study's limitations and suggestions for future study are offered.

2. Conceptual model and hypothesis development

2.1 Conceptual framework

This study develops a framework that links knowledge sharing, learning orientation, co-production, and tacit knowledge to knowledge effectiveness (Figure 1). This framework has three main features:

1 it examines the direct effect of knowledge sharing on knowledge effectiveness;
2 it examines the indirect effects of knowledge sharing on knowledge effectiveness through learning orientation and co-production; and
3 it investigates the moderating effect of tacit knowledge on the relationships between knowledge sharing, learning orientation, co-production, and knowledge effectiveness.

2.2 Knowledge sharing and knowledge effectiveness

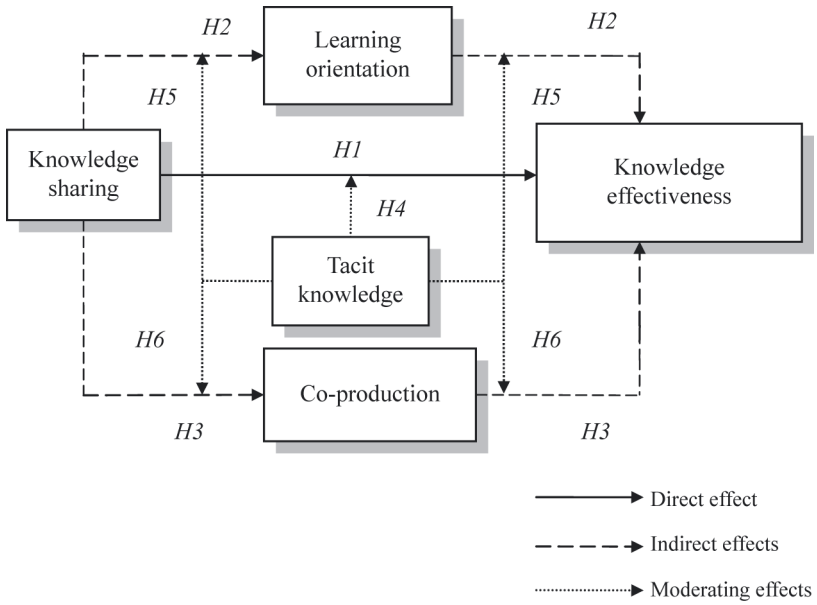
Knowledge sharing is defined as the joint exchange of information and expertise across organizations (Zaheer and Venkatraman, 1995). Knowledge sharing consists of a set of shared understanding related to the provision of access to relevant information, as well as the establishment and use of knowledge networks (Hogel *et al.*, 2003). It shows a mutual expectation that knowledge senders proactively provide information that is useful for knowledge recipients (Zhang *et al.*, 2003). Sveiby (2001) proposes that knowledge sharing across organizations enables them to enhance competency and mutually generate new knowledge. Mohr and Sengupta (2002) mention that knowledge sharing is critical for organizations to respond quickly to change, to innovate, and to succeed.

Knowledge sharing and knowledge transfer are commonly used interchangeably in literature (von Krogh *et al.*, 2000). Knowledge transfer is considered distinct from knowledge sharing, with the latter connoting giving or contributing but excludes the receiving and reusing aspect of transfer (Majchrzak *et al.*, 2004). Knowledge transfer occurs when knowledge senders share knowledge that is used by knowledge recipients. Generally, there are different dimensions to the knowledge transfer. For example, Pérez-Nordtvedt *et al.* (2008) identify four dimensions:

1 comprehension;
2 usefulness;
3 speed; and
4 economy.

Comprehension of knowledge transfer refers to the extent to which the transferred knowledge is fully understood by the recipient; usefulness of knowledge transfer refers to the extent to which such transferred knowledge is relevant and useful to knowledge recipients; speed of knowledge transfer refers to how rapidly knowledge recipients acquire new insights and skills; and economy of knowledge transfer refers to the costs associated with the knowledge transfer (Pérez-Nordtvedt *et al.*, 2008). Among these, knowledge effectiveness actually occurs when the received knowledge is manifested as useful. In fact, knowledge usefulness, as a proxy for knowledge transfer effectiveness, has been cited in the knowledge management literature (Menon and Varadarajan, 1992). In addition, Levin and Cross (2004) use the term "receipt of useful knowledge" to denote knowledge effectiveness. Generally, measures of knowledge effectiveness are based on an organization's competitive advantages, such as cost advantage, market advantage, product development advantage and technological advantage (Szulanski, 1996). For example, it relates to effectiveness in terms of budget, time, value, performance, quality, and satisfaction (Hansen, 1999; Levin and Cross, 2004). Similarly, Brachos *et al.* (2007) also use perceived usefulness of knowledge to operationalize knowledge effectiveness, which is dependent on the extent to which knowledge recipients perceive transferring knowledge as meaningful, accurate, valid, and innovative. In accordance with the definition of Brachos *et al.* (2007), the current focus

Figure 1 Conceptual framework



is on knowledge effectiveness, which represents the extent to which received knowledge impedes or promotes the different aspects of project outcomes. In addition, Lyles and Salk (1996) and Tsai (2001) find that absorptive capacity is a very strong contributor to knowledge effectiveness.

Szulanski (1996) considers knowledge transfer as a process of dyadic exchanges of knowledge across organizations, where the effectiveness of knowledge depends to some extent on the ability of both senders and recipients to share and accept knowledge, as well as on the characteristics of the shared knowledge. In general, knowledge effectiveness is associated with gaining access to rare, inimitable and non-substitutable knowledge assets from the alliance partner and utilizing these assets for commercial ends (Pérez-Nordtvedt *et al.*, 2008). Thus, it is critical to the improvement of organizational performance (Argote *et al.*, 2003; Gold *et al.*, 2001; Mohr and Sengupta, 2002; Sarin and McDermott, 2003; Tsai, 2001). However, incomplete sharing of knowledge results in so-called "knowledge depreciation" (Argote, 1999). This depreciation has negative effects, such as a decreased level of productivity, dissatisfaction of partners, and unmet promises on organizational effectiveness (Levin and Cross, 2004).

Knowledge sharing can be done through partnerships outside organizations (Madhok and Tallman, 1998). It can generate positive externalities and enable organizations to capture spillover from partners (Lorenzoni and Lipparini, 1999). Moreover, knowledge of the cost structure and production options shared by partners helps organizations realize the constraints and therefore make the appropriate adjustments in their preferences for transfer projects (Joshi and Sharma, 2004). Schroeder *et al.* (2002) and Smith *et al.* (2005) show that external knowledge sharing across organizations is the strongest contributor to performance. Therefore, organizations must identify knowledge frontiers across which knowledge sharing is to take place. Knowledge can increase effectiveness only when it is shared with and transferred to others. Therefore, the ability and willingness of knowledge senders to share knowledge are crucial to knowledge effectiveness for knowledge recipients. Thus:

H1. Knowledge sharing will have a direct positive effect on knowledge effectiveness.

2.3 Learning orientation

Learning orientation is defined as a set of organizational values related to the propensity of organizations to utilize knowledge (Baker and Sinkula, 1999). This set of values consists of organizational commitment to learning, shared vision, and open-mindedness (Baker and Sinkula, 1999). Similarly, learning orientation refers to the ability to create, disseminate, and utilize knowledge (Sinkula *et al.*, 1997). Thus, learning orientation is a behavioral characteristic of learning organizations. Learning orientation does not take place solely within an organization, as the process can be enhanced through interaction outside organizations. Accordingly, Brachos *et al.* (2007) view learning orientation as a bonding mechanism that helps different organizations integrate or combine knowledge. The more that learning takes place, the more likely new information will resonate with existing knowledge (Cohen and Levinthal, 1990). Thus, learning orientation is positively associated with absorptive capacity (Burpitt, 2004). Selnes and Sallis (2003) also suggest that, through relationship learning, both parties can identify ways to reduce or remove redundant costs, improve quality and reliability, and increase flexibility.

Knowledge sharing across organizations is a starting point and a necessary element for mutual learning (Selnes and Sallis, 2003). After the sharing process, the collection of shared knowledge is acquired by knowledge recipients. Thereafter, it is utilized for their learning orientation. Calantone *et al.* (2002) state that learning orientation facilitates the generation of resources and skills essential for improving firm performance. Organizations with high learning orientation find value in organizational learning and the creation of new knowledge; hence, they are likely to seek

new practices. Therefore, the learning orientation of an organization is positively related to performance, such as new product success, organizational innovativeness, and superior growth and profitability (Brachos *et al.*, 2007; Hanvanich *et al.*, 2006; Westerlund and Rajala, 2010). Through learning orientation, organizations can understand the value of inter-organizational partnering and the process by which this can be achieved (Baker and Sinkula, 1999; Vera and Crossan, 2004). In conclusion, organizations can increase absorptive capacity by designing inter-organizational routines that facilitate knowledge sharing (Dyer and Singh, 1998). They can continually accumulate their knowledge bases and absorb advanced knowledge by learning orientation to improve knowledge effectiveness (Huang and Chu, 2010). Thus:

H2. Knowledge sharing will have an indirect positive effect on knowledge effectiveness through learning orientation.

2.4 Co-production

Co-production is defined as constructive participation in the creation and delivery process. It requires meaningful and cooperative contributions to the process (Auh *et al.*, 2007). Muthusamy and White (2005) emphasize that co-production across organizations fosters a climate of reciprocity. In addition, organizations involved in co-production move toward increased mutual understanding (Mohr and Bitner, 1991), which results in positive outcomes (Auh *et al.*, 2007). Jean and Sinkovics (2010) also argue that joint decision-making can increase the quality of shared knowledge and help one better understand the needs of the other. Thus, knowledge recipients should engage in this process. In effect, they become co-producers, and such joint planning and joint problem solving offer them access to the knowledge stock of partners (Hansen, 1999). In addition, co-production is also an important mechanism through which absorptive capacity is developed (Frost and Zhou, 2005).

Knowledge sharing is central in establishing strong relationships (Sharma and Patterson, 1999). It enables organizations to interact more, thus enhancing mutual understanding. Thus, knowledge sharing establishes the foundation for coordination (Jones *et al.*, 1997) and collaboration (Min *et al.*, 2005; Wu *et al.*, 2007). Similarly, knowledge sharing increases the incidence of co-production (Auh *et al.*, 2007), which reflects a process dimension of a relational governance mechanism that involves carrying out focal activities by both parties in a cooperative or coordinated way (Ballantyne and Aitken, 2007; Zaheer and Venkatraman, 1995). In general, co-production improves productivity (Reagans and Zuckerman, 2001), increases performance (Tsai, 2001), and fosters innovation (Levin and Cross, 2004; Singh, 2005; Tsai, 2001). It increases absorptive capacity by creating a shared understanding of the external knowledge of partners (Frost and Zhou, 2005). As a result, organizations that fully utilize their collective knowledge are likely to be more innovative, efficient, and effective in the marketplace (Argote, 1999). Most importantly, co-production lowers the transaction cost of knowledge exchange, thus enhancing knowledge effectiveness. Similarly, through co-production, a mutually satisfactory outcome may be reached (Claro *et al.*, 2003). Thus:

H3. Knowledge sharing will have an indirect effect on knowledge effectiveness through co-production.

2.5 Tacit knowledge

Knowledge has two dimensions, i.e. explicit and tacit. Explicit knowledge can be articulated or expressed in words and documents, and can be shared easily. By contrast, tacit knowledge, which is held implicitly in the minds of individuals, is difficult to articulate, and requires observation, demonstration, and experience to be understood (Nonaka and Takeuchi, 1995). The concept of tacit knowledge is central to knowledge stickiness because this knowledge dimension is difficult to understand, and the concept cannot be codified or easily communicated (Szulanski, 1996). Tacit knowledge exists because of knowledge recipients and their limited ability to understand the experiences of others based solely on language. In other words, the lower the level the absorptive capacity of the recipients, the more difficulty the recipients will have in acquiring tacit and complex knowledge (Szulanski, 1996). In this case, sharing tacit knowledge requires several social exchanges (Nonaka, 1994). For example, tacit knowledge can be shared via learning, collaborative experiences, and activities (Nonaka and Takeuchi, 1995).

According to Nonaka (1994), formal exchange mechanisms, such as the procedure, formal language, and exchange of handbooks, ensure the exchange of explicit knowledge among individuals. Explicit knowledge can be based on the information structure of an organization, and this knowledge dimension underpins its repetitive and unexceptional activities. However, Nonaka and Takeuchi (1995) maintain that tacit knowledge, which is usually embedded in the cognitive processes of individuals, is more difficult to share. Consequently, this difficulty causes several problems in expression and complexity of the application of such knowledge in other contexts (Stenmark, 2000). Given knowledge differs in the degrees of articulability and codifiability, and tacit knowledge transfers effortlessly compared with explicit knowledge. Hence, tacit knowledge can be viewed as a moderating variable. For example, Szulanski (1996) observes that the success of knowledge sharing is affected by the explicitness of the knowledge to be shared. By contrast, Hansen (1999) proposes that tacit knowledge negatively moderates the impact of tie strength on project outcomes. Zander and Kogut (1995) argue that a higher degree of tacit knowledge decreases the speed of knowledge sharing because it is more difficult to express directly or to articulate with formal language. Thus, tacit knowledge reduces the effect of knowledge sharing on knowledge effectiveness. Thus:

H4. Knowledge sharing has a direct positive effect on knowledge effectiveness that will decrease as tacit knowledge increases.

Haldin-Herrgard (2000) argues that tacit knowledge could be transferred, but it must be converted first into explicit knowledge through codification. By sharing tacit knowledge within a collaborative and learning environment, the issues concerning its depreciation could possibly be overcome. Moreover, the creation of explicit knowledge within networks can be encouraged (Harris, 2009). Tacit knowledge is generally part of a long-term and accumulated learning process. Knowledge sharing through learning can facilitate the delivery of solutions for evaluation problems created by uncertainties and complexities (Selnes and Sallis, 2003). Most importantly, organizations must keep up with changing

technological innovations through constant learning to survive in environments with high technological turbulence (Hanvanich *et al.*, 2006). A strong learning orientation signifies the strategic intention of organizations to succeed. The ability and motivation of knowledge recipients to absorb and to share knowledge are keys to successful knowledge transfer (Gupta and Govindarajan, 2000; Zahra and George, 2002). Therefore, organizations should be motivated to engage in learning orientation to gain some control over complexity (Hanvanich *et al.*, 2006; Jap, 1999). In such case, interactive activities serve as the platform of knowledge sharing that facilitates inter-organizational learning in the relationship. Furthermore, these activities can be employed to facilitate the receipt of useful knowledge across organizations (Huang and Chu, 2010). In other words, through learning orientation, tacit knowledge in one firm can be effectively converted into shared terms and concepts, and can be likely transferred into the knowledge base of another firm. In summary, increase in tacit knowledge necessitates special procedures for knowledge sharing. Moreover, as tacit knowledge increases, learning orientation seems to play a more important role in the sharing of such knowledge. Thus:

H5. Knowledge sharing has an indirect positive effect on knowledge effectiveness through learning orientation that will increases as tacit knowledge increases.

By nature, tacit knowledge is not readily accessible, and is difficult to share without significant personal interactions (D'Eredita and Barreto, 2006). Hansen (1999) suggests that strong social ties are better options in the sharing of complex and tacit knowledge in inter-organizational settings. The closeness and quality of the relationship of the two partners are key factors in sharing tacit knowledge (Cavusgil *et al.*, 2003; Simonin, 1999). In particular, co-production enables more interaction across organizations, thus, enhancing mutual understanding (Claro *et al.*, 2003). According to Jones *et al.* (1997), frequent communication facilitates the sharing of tacit knowledge across organizations, and establishes the foundation for the cooperative mechanism to adapt, coordinate, and safeguard exchanges effectively. Gençtürk and Aulakh (2007) indicate that highly uncertain situations increase the effects of cooperative norms on the performances of organizations. Thus, co-production widens the scope of exchanging tacit knowledge across organizations, which results in knowledge effectiveness. That is, cooperative relationships with partners can convert knowledge sharing into knowledge effectiveness, thus establishing a source of competitive advantage (Gerwin, 1993). In other words, tacit knowledge requires contextually co-production platforms to be communicated and shared. Taken together, knowledge sharing through co-production is associated more strongly with knowledge effectiveness under the condition of high tacit knowledge than of low tacit knowledge. Thus:

H6. Knowledge sharing has an indirect positive effect on knowledge effectiveness through co-production that will increases as tacit knowledge increases.

2.6 Control variables

Accordingly, we have included two control variables in this study. First, organization size (measured by the total number of employees) is used to control this effect, as larger firms can derive greater returns from knowledge effectiveness because of the greater resources they can expend. Second, relationship age (measured by the number of years from the founding date) can reduce the learning curve, hence helping organizations gain knowledge effectiveness. These effects were controlled when examining knowledge effectiveness.

3. Methodology

3.1 Data collection and sampling

The sample is randomly drawn from the top 5,000 Taiwanese firms listed in the yearbook published by the China Credit Information Service Ltd. It is also drawn from a list of firms that are manifested in their strategic alliance, joint venture, and research and development (R&D) cooperation. By participating in ODM networks, many Taiwanese firms have built strategic alliances and R&D cooperation with leading global firms (Chang and Gotcher, 2007). As such, Taiwanese firms make for a suitable sample for this study. Questionnaires were mailed to 500 companies, along with a cover page that explained the nature of the study. Questionnaires were completed by senior executives who were familiar with the topic of the study. They were project supervisors, supply chain management managers, manufacturing managers, R&D managers, or general managers. Follow-up letters were sent after two weeks. Among the 220 surveys returned, 212 were complete in all predictor and dependent variables, resulting in a usable response rate of 42.4 percent. Non-response bias was not a factor because no significant difference was found between early and late responses (Armstrong and Overton, 1977).

The sample characteristics are as follows:

- industry type – manufacturing sector, 35.7 percent; high-tech sector, 64.3 percent;
- firm age – ≤5 years, 7.5 percent; 5-10 years, 34.9 percent; 10-15 years, 23.1 percent; 15-20 years, 29.7 percent; ≥20 years, 4.8 percent;
- sales revenue – ≤200 million, 2.8 percent; 200 million-1 billion, 4.2 percent; 1 billion to 5 billion, 14.2 percent; 5 billion to 10 billion, 38.2 percent; ≥10 billion, 40.6 percent; and
- number of employees – ≤50 persons, 8.0 percent; 50-200 persons, 28.3 percent; 200-500 persons, 25.5 percent; 500-1,000 persons, 24.1 percent; ≥1,000 persons, 14.1 percent.

3.2 Measure development

All the measures used in this study were adapted from existing scales. Knowledge effectiveness, knowledge sharing, learning orientation, co-production, and tacit knowledge constructs used a five-point Likert-type scale, with the descriptive equivalents ranging from strongly disagree (1) to strongly agree (5). For the measurement of knowledge effectiveness, six items related to project efficiency and effectiveness were adapted from Levin and Cross (2004), while the measure of knowledge sharing used to evaluate the extent to which critical information and knowledge were shared between the two partners. Four items were adopted from Fang *et al.* (2008). We adapted the measures of learning orientation from Baker and Sinkula (1999) with six items, and we drew the measures of co-production from Auh *et al.* (2007) and Chan *et al.* (2010) with four items. The measure of tacit knowledge included two items taken from Simonin (1999).

3.3 Validation of measures

The questionnaire was pilot tested to establish face validity with one academic and one manager who were knowledgeable in this area. According to their suggestions, several items were adapted to better suit the airlines context. Finally, confirmatory factor analysis (CFA) was performed to test the measurement model using LISREL 8.52. In assessing reliability, the composite reliabilities and the Cronbach's α for each construct were also computed. The Cronbach's α values for knowledge effectiveness, knowledge sharing, learning orientation, co-production, and tacit knowledge were all greater than 0.80, supporting the reliability of the measurement. In addition, all composite reliability estimates were greater than 0.80, and all average variance extracted (AVE) estimates were greater than the recommended value of 0.50 (Fornell and Larcker, 1981).

As evidence of convergent validity, all the items had significant loadings on their respective constructs (Anderson and Gerbing, 1988). Discriminant validity was assessed for two constructs by constraining the estimated correlation parameter between two constructs to a value of 1.0, and then performing a χ^2 difference test on the values for the constrained and unconstrained models (Anderson and Gerbing, 1988). A significantly lower χ^2 value for the unconstrained model was found, thus indicating that discriminant validity was achieved. Discriminant validity was also tested between all constructs according to Fornell and Larcker's (1981) recommendations and confirmed for all pairs of constructs. Specifically, the AVE estimate for each construct was greater than the squared correlation of all construct pairs. Table I shows the means, standard deviations, and correlations matrix for the constructs. The Appendix summarizes the results of the item description, AVE, and reliability tests.

Due to the self-reported nature of the data, there was a potential for common method variance, and so the Harman one-factor test was conducted to determine the extent of this. The unrotated factor analysis showed that the first factor accounted for only 39.95 percent of the variance, and thus the common method bias was not a serious threat in the study (Podsakoff *et al.*, 2003).

4. Analysis and results

The proposed model was tested through a structural equation model using LISREL 8.52 to explore the direct effect of knowledge sharing on knowledge effectiveness, the indirect effects of knowledge sharing on knowledge effectiveness through learning orientation and co-production, and the moderating effects of tacit knowledge.

4.1 Hypothesis testing

The results of the structural model are reported in Table II and Figure 2. *H1*, *H2*, and *H3* were tested by Model 1. The fit of Model 1 was acceptable ($\chi^2(201) = 503.52$, $p = 0.00$, GFI = 0.83, NFI = 0.95, NNFI = 0.96, CFI = 0.96, PNFI = 0.82, RMSEA = 0.08). *H1* proposes that knowledge sharing has a direct positive effect on knowledge effectiveness. As shown in Model 1, knowledge sharing had a direct effect on knowledge effectiveness ($\gamma = 0.34$, $t = 5.83$). Therefore, *H1* was supported.

H2 proposes that knowledge sharing has an indirect positive effect on knowledge effectiveness through learning orientation. As shown in Model 1, knowledge sharing had a positive effect on learning orientation ($\gamma = 0.31$, $t = 6.17$). However, learning orientation had no positive effect on knowledge effectiveness ($\beta = 0.10$, $t = 1.56$). Therefore, *H2* was not supported.

H3 proposes that knowledge sharing has an indirect positive effect on knowledge effectiveness through co-production. As shown in Model 1, knowledge sharing had a positive effect on co-production ($\gamma = 0.47$, $t = 7.51$), and co-production had a positive effect on knowledge effectiveness ($\beta = 0.12$, $t = 2.41$). Therefore, *H3* was supported.

A multiple group was examined to test the moderating effects of tacit knowledge and make statistical comparisons of the coefficients between the two subgroups. If the coefficients are significantly different from each other, then the higher the coefficients are, the greater the effect on learning orientation, co-production, and knowledge effectiveness. The procedure adopted involved dividing the total sample into two subgroups based on high/low tacit knowledge. The sample size was $n = 119$ for the low tacit knowledge subgroup and $n = 93$ for the high tacit knowledge subgroup. Chi-square difference tests were performed to test the equality of the coefficients and to ascertain whether the two coefficients were significantly different. If the χ^2 difference test is significant, then a difference between two paths exists. In this study, two subgroups that were different with respect to the direct effect of knowledge sharing and indirect effects through learning orientation and co-production on knowledge effectiveness were compared. *H4*, *H5*, and *H6* were tested by Model 2.

H4 proposes that knowledge sharing has a direct positive effect on knowledge effectiveness, which decreases as tacit knowledge increases. As shown in Model 2 and Figure 2, in the low tacit knowledge sample, knowledge sharing had a direct effect on knowledge effectiveness ($\gamma = 0.32$, $t = 5.65$). In contrast, knowledge sharing had no significantly positive effect on knowledge effectiveness in the high tacit knowledge sample ($\gamma = 0.02$, $t = 0.15$). In addition, the χ^2 difference was significant ($\Delta\chi^2 = 4.92$, df = 1, $p < 0.05$), Therefore, *H4* was supported.

Table I Means, standard deviations, and correlations

Variables	Mean	SD	1	2	3	4	5
1. Knowledge sharing	2.99	1.15	1	0.41**	0.45**	0.61**	−0.13
2. Learning orientation	3.16	0.93		1	0.55**	0.45**	0.39**
3. Co-production	3.07	1.03			1	0.47**	0.42**
4. Perceived knowledge effectiveness	3.49	0.81				1	−0.04
5. Tacit knowledge	2.86	1.08					1

Note: $^{**}p < 0.01$

Table II LISREL results

Proposed path	Model 1 Total sample (212) Coefficient	*t*	Model 2 Low tacit knowledge sample (119) Coefficient	*t*	Model 2 High tacit knowledge sample (93) Coefficient	*t*
Organization size → Knowledge effectiveness	0.22*	4.39	0.18*	3.25	0.09	1.29
Firm age → Knowledge effectiveness	0.12*	2.74	0.17*	3.59	0.02	0.34
Knowledge sharing → Knowledge effectiveness	0.34*	5.83	0.32*	5.65	0.02	0.15
Knowledge sharing → Learning orientation	0.31*	6.17	0.02	0.32	0.63*	8.51
Knowledge sharing → Co-production	0.47*	7.51	0.14*	2.11	0.71*	8.79
Learning orientation → Knowledge effectiveness	0.10	1.56	0.04	0.35	0.48*	3.55
Co-production → Knowledge effectiveness	0.12*	2.41	0.14	1.68	0.49*	4.79

Note: $^{*}p < 0.05$

H5 proposes that knowledge sharing has an indirect positive effect on knowledge effectiveness through learning orientation, which increases as tacit knowledge increases. As shown in Model 2 and Figure 2, knowledge sharing had no positive effect on learning orientation in the low tacit knowledge sample ($\gamma = 0.02$, $t = 0.32$), but knowledge sharing had a positive effect on learning orientation in the high tacit knowledge sample ($\gamma = 0.63$, $t = 8.51$). The chi-square difference was significant ($\Delta\chi^2 = 48.06$, df = 1, $p < 0.05$). Learning orientation had no effect on knowledge effectiveness in the low tacit knowledge sample ($\beta = 0.04$, $t = 0.35$) but had an effect on knowledge effectiveness in the high tacit knowledge sample ($\beta = 0.48$, $t = 3.55$). The χ^2 difference was significant ($\Delta\chi^2 = 4.11$, df = 1, $p < 0.05$). Therefore, *H5* was supported.

H6 proposes that knowledge sharing has an indirect positive effect on knowledge effectiveness through co-production, which increases as tacit knowledge increases. As shown in Model 2 and Figure 2, knowledge sharing had a positive effect on co-production in the low tacit knowledge sample ($\gamma = 0.14$, $t = 2.11$) and in the high tacit knowledge sample ($\gamma = 0.71$, $t = 8.79$). The χ^2 difference was significant ($\Delta\chi^2 = 28.42$, df = 1, $p < 0.05$). Co-production had no positive effect on knowledge effectiveness in the low tacit knowledge sample ($\beta = 0.14$, $t = 1.68$) but had a positive effect on knowledge effectiveness in the high tacit knowledge sample ($\beta = 0.49$, t = 4.79). The χ^2 difference was significant ($\Delta\chi^2 = 4.15$, df = 1, $p < 0.05$). Therefore, *H6* was supported.

4.2 Additional analysis

The mediating effects on the hypotheses (i.e. *H2*, *H3*, *H5*, and *H6*) were additionally assessed using regression analysis. The analysis of mediating effects requires the testing of three equations devised by Baron and Kenny (1986) based on the following:

- the effect of knowledge sharing on knowledge effectiveness;
- the effect of knowledge sharing on learning orientation and co-production; and
- the combined effects of learning orientation, co-production, and knowledge sharing on knowledge effectiveness.

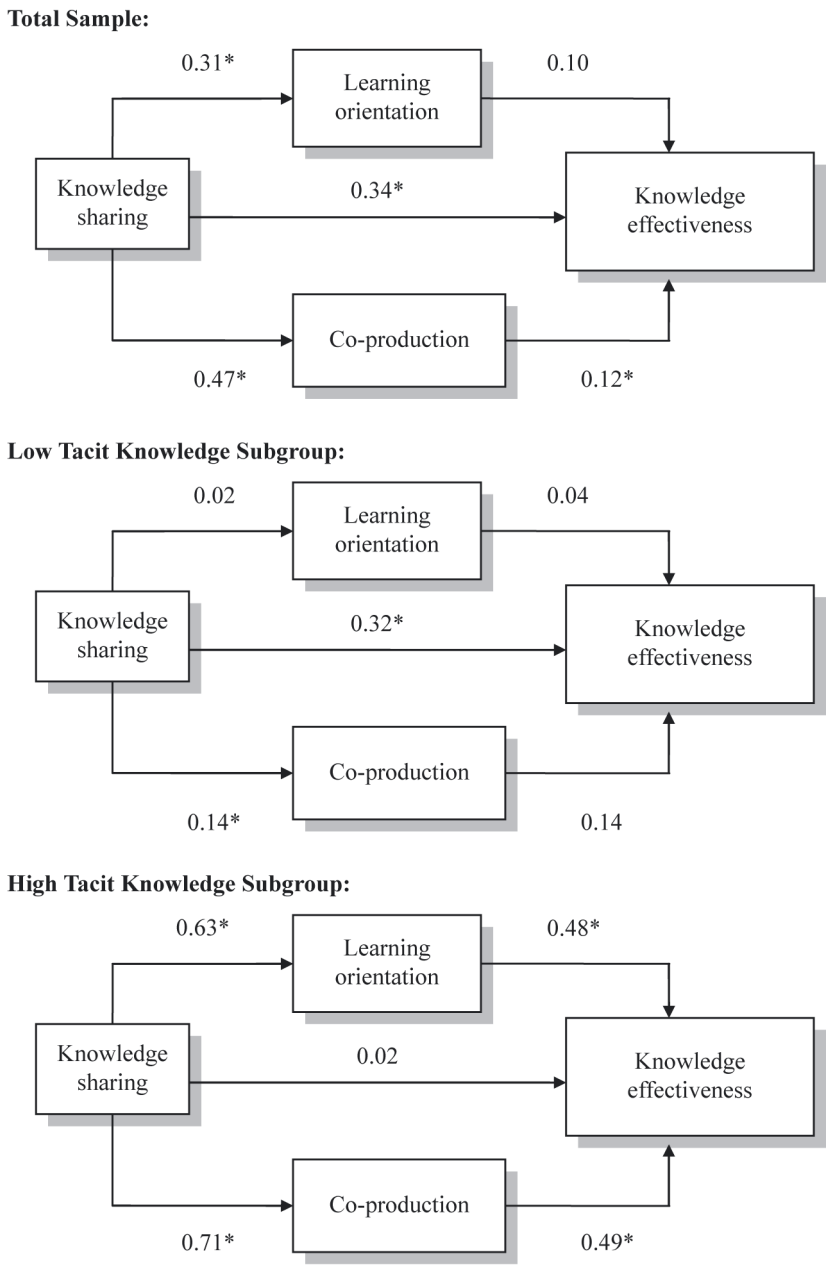
Each of the three aforementioned effects must be significant for a mediating effect to occur, but the significance of the relationships between knowledge sharing and knowledge effectiveness must be reduced by adding learning orientation and co-production to the model.

As shown in Table III, learning orientation and co-production partially mediated the relationship between knowledge sharing and knowledge effectiveness in the total sample. In the low tacit knowledge sample, learning orientation and co-production neither partially nor fully mediated the relationship between knowledge sharing and knowledge effectiveness. In the high tacit knowledge sample, learning orientation and co-production fully mediated the relationship between knowledge sharing and knowledge effectiveness. The regression results are consistent with the SEM model, with the exception of *H2*. Given that the effect of knowledge sharing on knowledge effectiveness is attenuated substantially with the inclusion of learning orientation and co-production in the model in the high tacit knowledge sample, we conclude that there is sufficient evidence for learning orientation and co-production to become critical mediators as tacit knowledge increases.

5. Discussion

This study aims to understand the process of receiving useful knowledge across organizations. However, knowledge sharing across organizations is a dynamic process in which knowledge senders identify the specific knowledge that can be shared until it is eventually applied by the knowledge recipients (Minbaeva *et al.*, 2003). Knowledge effectiveness is clearly influenced by several factors such as structure, processes, information technology, social networks, and organizational learning. Therefore, a better understanding of the dynamism of the knowledge sharing process is required. Other questions relate to how organizations effectively share both explicit and tacit knowledge and what key factors enhance the sharing process. Table II and Figure 2 show that all hypotheses were supported except *H2*. Specifically, *H2* indicated that knowledge sharing had an indirect positive effect on knowledge effectiveness through learning orientation. However, the results indicated that this mediating effect was not significant. Although *H2* was rejected by the SEM model, *H5* was supported. *H5* indicated that knowledge sharing had an indirect positive effect on knowledge effectiveness through learning orientation, which increased as tacit knowledge increased. Interestingly, the same mediating effect became significant when we included the contingency factor of tacit knowledge into our model. Thus, any failure to incorporate tacit knowledge may lead to a misunderstanding of the roles of knowledge sharing, co-production, and learning

Figure 2 Path diagram



Note: *$p < 0.05$

orientation. Sharing high tacit knowledge requires a richer context that goes beyond mere codification, documents, and blueprints (Daft and Lengel, 1986). Thus, we emphasize co-production and learning orientation, and shift the focus from the direct effect of knowledge sharing on knowledge effectiveness to the indirect effects of knowledge sharing via co-production and learning orientation on knowledge effectiveness under the context of tacit knowledge.

5.1 Theoretical discussion: the direct effect of knowledge sharing

Knowledge effectiveness is better when both knowledge senders and recipients have a dialogue to facilitate knowledge sharing. In agreement with Schroeder *et al.* (2002) and Smith *et al.* (2005), knowledge sharing results in the enrichment of knowledge effectiveness. However, if knowledge senders are very protective of their expertise and restrict the sharing of relevant knowledge, knowledge effectiveness becomes more or less negatively influenced.

5.2 Theoretical discussion: the mediating effects of learning orientation and co-production

Consistent with our expectations, knowledge sharing was found to have an indirect positive effect on knowledge effectiveness through co-production in both the SEM and regression model. However, contrary to expectations,

Table III Regression results

Proposed path	Model 1 Coefficient	*t*	Model 2 Coefficient	*t*	Model 3 Coefficient	*t*
Total sample						
Knowledge sharing → Knowledge effectiveness	0.36*	9.38			0.28*	7.07
Knowledge sharing → Learning orientation			0.33*	6.49		
Knowledge sharing → Co-production			0.41*	7.37		
Learning orientation → Knowledge effectiveness					0.11*	2.01
Co-production → Knowledge effectiveness					0.12*	2.36
Low tacit knowledge sample						
Knowledge sharing → Knowledge effectiveness	0.30*	5.56			0.28*	6.782
Knowledge sharing → Learning orientation			0.04	0.65		
Knowledge sharing → Co-production			0.11	1.93		
Learning orientation → Knowledge effectiveness					0.10	1.33
Co-production → Knowledge effectiveness					0.04	0.49
High tacit knowledge sample						
Knowledge sharing → Knowledge effectiveness	0.48*	8.14			0.04	0.82
Knowledge sharing → Learning orientation			0.69*	10.56		
Knowledge sharing → Co-production			0.64*	9.79		
Learning orientation → Knowledge effectiveness					0.37*	4.55
Co-production → Knowledge effectiveness					0.45*	5.37

Note: $^{*}p < 0.05$

knowledge sharing did not have an indirect positive effect on knowledge effectiveness through learning orientation in the SEM model. A potential explanation for this finding is that, as tacit knowledge increases beyond a certain point, this mediating relationship begins to emerge. In such case, the effect of knowledge sharing on knowledge effectiveness is not straightforward. It requires organizations to modify some of their existing work while engaging in the tacit knowledge sharing processes.

5.3 Theoretical discussion: the moderating effect of tacit knowledge

This study offers insight into the processes through which knowledge effectiveness occurs and indicates that learning orientation and co-production fully mediate the effect of tacit knowledge sharing on knowledge effectiveness. Knowledge sharing does not exert much direct influence on knowledge effectiveness under conditions of high tacit knowledge. Rather, the mediating roles of learning orientation and co-production in the process of tacit knowledge sharing become apparent because both roles are more likely to expend the effort. This condition ensures that knowledge recipients can sufficiently understand and utilize their newly acquired tacit knowledge.

Gulati *et al.* (2000) attribute knowledge sharing and organizational learning to the networks of relationships in which organizations are embedded and that provide organizations access to knowledge. Thus, increasing knowledge sharing across organizations can help reduce conflict resulting from misunderstanding and therefore increase learning orientation to overcome difficulties in sharing tacit knowledge (Simonin, 1999). In addition, tacit knowledge sharing requires social interactions. By sharing tacit knowledge within a co-productive environment, knowledge stickiness can be overcome, and knowledge sharing can be encouraged within networks. Co-production diverts the focus from a separate organization toward the value-creating systems of complementary links (Ulhøi, 2009). As such, organizations have come to consider networks as processes of co-created value (Vargo and Lusch, 2004). In summary, the findings from this study support the need for a clear and focused approach to learning orientation and co-production that facilitates social interaction and learning to harness the value of shared tacit knowledge. Through learning orientation and co-production, knowledge sharing can be converted into common language and memory. Thereafter, organizations become more inclined to utilize tacit knowledge to improve knowledge effectiveness.

5.4 Theoretical contributions

Several theories have made valuable contributions to the analysis of knowledge transfer. Among these, absorptive capacity is a major determinant of the knowledge transfer (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998). However, aside from the role of absorptive capacity, only a few studies have empirically approached the process of knowledge transfer by recognizing the central role of mechanisms. Inter-organizational knowledge flows do not occur automatically, and knowledge recipients have to develop mechanisms to tap into external knowledge. Our proposed model is an attempt to address this theoretical gap. Thus, our study contributes to the theory of business and industrial marketing by providing the analysis of knowledge transfer a complete view of the three elements:

1 the knowledge senders (knowledge sharing);
2 the knowledge recipients (knowledge effectiveness); and
3 the knowledge transfer mechanism between the knowledge senders and the recipients (learning orientation and co-production).

In fact, these two mechanisms entail implementing a set of inter-organizational processes. Such mechanisms help knowledge recipients recognize and assimilate new knowledge (Lane *et al.*, 2001). In summary, learning orientation and co-production enable the absorption of external knowledge and in this respect act as important mediating mechanisms between knowledge sharing and knowledge effectiveness across organizations.

6. Managerial implications

This study has several practical implications for management. Managers need to develop mechanisms that support and foster effective external knowledge sharing and co-production as well as learning orientation in which knowledge effectiveness will be highly enhanced. Evidently, the receipt of useful knowledge is a complex process. The findings of this study reinforce the notion that knowledge effectiveness is highly dependent on the willingness of the senders to share knowledge. In fact, the decision not to share is usually rational and well justified from the perspective of the knowledge sender (Minbaeva, 2007). However, when knowledge senders have a high perception that the knowledge recipient will reciprocate their knowledge sharing, the positive effect of motivations tends to intensify. In addition, higher-level managers should design incentive schemes that can induce a high level of effort from knowledge senders and can mitigate their protection and hidden behavior (Nan, 2008). Finally, knowledge sharing requires information systems that support sharing processes. For example, a knowledge platform should encourage information sharing and should reduce barriers to information flow between knowledge senders and recipients.

Another important insight from this study is that tacit knowledge moderates the relationships between mechanisms and knowledge effectiveness in different ways. Most importantly, each mechanism is suited for a particular level of tacit knowledge. Therefore, project managers must be willing to understand the differences in tacit knowledge. Tacit knowledge is found in individual skills, and the receipt of tacit knowledge becomes highly ineffective in knowledge sharing (Jasimuddin, 2008). Furthermore, tacit knowledge is not easily codified and is not effectively transferred by using conventional instruments, such as documents, blueprints, and procedures. Moreover, knowledge sharing alone may be insufficient to influence the innovation in a high tacit knowledge context. However, for tacit knowledge to become an effective source of sustainable competitive advantage, organizations should intensify their search for ways to achieve effective knowledge sharing and to prevent the loss of knowledge during the sharing process. Hence, we strongly suggest that participating in learning orientation and co-production aids in overcoming the limitations inherent in tacit knowledge sharing. Extra learning skills and social arrangements should be designed for existing work activities. In other words, effective integration of external and internal sources of known and new knowledge is still necessary. For example, learning orientation plays a mechanism that affects the ability of a firm to challenge old assumptions and to facilitate new techniques and methodologies (Baker and Sinkula, 1999). Similarly, Bessant *et al.* (2003) show that learning orientation created through knowledge sharing is an important means of knowledge practice. Learning orientation affects the capabilities of knowledge recipients to utilize effectively tacit knowledge. Through learning orientation, knowledge recipients should be able to learn the experiences of knowledge senders, to try new approaches, and to solve problems systematically, thus reducing the learning curve in acquiring tacit knowledge. Moreover, the process of establishing learning orientation requires commitment and managerial processes. For example, high-level managers must place great value on learning and sharpening a culture that is amenable to learning across organizations (Baker and Sinkula, 1999).

Aside from learning orientation, the sharing of tacit knowledge relies on interactive dialogues among project members. Thus, project managers should encourage and motivate team members involved in the co-production activities in a high tacit knowledge context. Both sides should interact as active partners in the collaboration process to produce enhanced levels of valued outcomes (Vargo and Lusch, 2004). In addition, project managers may use co-production as a mechanism to increase knowledge effectiveness. Knowledge recipients need to play a co-productive role as part of the tacit knowledge sharing process because their contribution is integral to knowledge effectiveness. Co-production should be developed through mutual work practices, which encourage and enable members to work together for the implementation of projects. To summarize, we suggest that both parties should develop platforms and procedures that invoke dialogue concerning the objectives of co-production.

7. Research limitations and directions for future research

This study should be interpreted with caution, given its several limitations. First, this study took place in a specific geographic area. Knowledge sharing in Taiwan may be handled in a different cultural context than that in European or North American countries. As a result, the findings of this study may not be generalized for other countries. For cross-validation, additional exploration of the relationships should be extended beyond the sample reported here.

Second, the sample sizes are low. A small sample size may imply that our model may be over-fitted. Accordingly, a large sample size is desirable to overcome this limitation and can improve the accuracy in relation to the estimate of the true relationships. Thus, future research should obtain larger sample sizes to have greater confidence in the generalizability of the research findings.

Third, we collected data from the knowledge recipient side of the dyad relationship. Future research may explore co-production from both sides to confirm the findings of this study as well as to generate additional insight into the dynamic interactions between knowledge senders and recipients.

Finally, when individuals or team project members have wider communication channels, knowledge sharing in inter-organizational settings may be facilitated. Thus, future research may conduct cross-level analysis (i.e. individual, team, and organizational levels) to explore this issue further.

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Appendix. Descriptions of the measurement items and confirmatory factor analysis

Table AI

Item	Coefficient α	Composite reliability	Average variance extracted
Knowledge sharing	0.92	0.89	0.67
1. Both partners expect that significant knowledge will be shared in the relationship in this project			
2. Exchange of information and knowledge between partners takes place frequently in this project			
3. Both partners are expected to keep the other partner informed about changes that could affect that partner in this project			
4. It is expected that both partners will share proprietary, information, and knowledge in this project			
Learning orientation	0.91	0.91	0.63
1. We believe that our ability to learn is the key to our competitive advantage			
2. Our basic values include learning as the key to improvement			
3. Both partners have a well-defined vision in this project			
4. We are committed to our partner relationship in this project			
5. We place a high value on open-mindedness			
6. We encourage our project members to think outside of box			
Co-production	0.93	0.93	0.79
1. We try to work cooperatively with our partners in this project			
2. We openly discuss our needs with our partners to help them deliver the best knowledge and know-how in this project			
3. We always provide suggestions to our partners for improving the outcome in this project			
4. We are very much involved in the transfer process			
Tacit knowledge	0.91	0.91	0.83
1. This project's technology know-how is easily codifiable (R).			
2. This project's technology know-how is more explicit than tacit (R).			
Knowledge transfer effectiveness	0.91	0.92	0.65
The knowledge received from our partners made the following contribution to:			
1. Satisfaction with this project			
2. This project's overall performance			
3. This project's value to our firm			
4. This project's quality			
5. This project's budget control			
6. Shortening the time this project took			

Corresponding author

Li-Wei Wu can be contacted at: lwwu@thu.edu.tw

Executive summary and implications for managers and executives

This summary has been provided to allow managers and executives a rapid appreciation of the content of the article. Those with a particular interest in the topic covered may then read the article in toto *to take advantage of the more comprehensive description of the research undertaken and its results to get the full benefit of the material present.*

As every classroom teacher knows, sharing knowledge with others is a two-way process. For the knowledge being imparted to be of any use, it has to go to receptive ears – preferably ears connected to a brain that will find ways of processing that information and, who knows, using it in the future to do or make something amazing. In other words, the availability of knowledge should not be equated with knowledge effectiveness. The inability of knowledge recipients to absorb new knowledge is one of the impediments to knowledge transfer.

Businesses have long recognized that, if they are to do or make amazing things, knowledge is a resource to be prioritized – and the good thing about knowledge is that sharing it with others doesn't dilute it. On the contrary, transferred knowledge potentially becomes an important source of synergy. That's the message from Li-Wei Wu and Jwu-Rong Lin, who, in "Knowledge sharing and knowledge

effectiveness: learning orientation and co-production in the contingency model of tacit knowledge", explore how knowledge is shared and received effectively across organizations.

Furthermore, the study addresses the question "How does tacit knowledge moderate the knowledge sharing processes?". This study seeks to identify whether learning orientation and co-production play an increasingly important role as mediators in times of rising instances of sharing of tacit knowledge. The study is also an attempt to integrate simultaneously relationship marketing, organizational learning, and knowledge management in a single model. It finds that any failure to incorporate tacit knowledge may lead to a misunderstanding of the roles of knowledge sharing, co-production, and learning orientation.

Tacit knowledge moderates the relationships between mechanisms and knowledge effectiveness in different ways. Most importantly, each mechanism is suited for a particular level of tacit knowledge. Therefore, project managers must be willing to understand the differences in tacit knowledge. Tacit knowledge is found in individual skills, and the receipt of tacit knowledge becomes highly ineffective in knowledge sharing. Furthermore, tacit knowledge is not easily codified and is not effectively transferred by using conventional instruments, such as documents, blueprints, and procedures. Moreover, knowledge sharing alone may be insufficient to influence the innovation in a high tacit knowledge context.

However, for tacit knowledge to become an effective source of sustainable competitive advantage, organizations should intensify their search for ways to achieve effective knowledge sharing and to prevent the loss of knowledge during the sharing process. Hence, participating in learning orientation and co-production aids in overcoming the limitations inherent in tacit knowledge sharing is strongly recommended.

Extra learning skills and social arrangements should be designed for existing work activities. In other words, effective integration of external and internal sources of known and new knowledge is necessary. For example, learning orientation plays a mechanism that affects the ability of a firm to challenge old assumptions and to facilitate new techniques and methodologies. Similarly, learning orientation created through knowledge sharing is an important means of knowledge practice. Learning orientation affects the capabilities of knowledge recipients to utilize effectively tacit knowledge. Through learning orientation, knowledge recipients should be able to learn the experiences of knowledge senders, to try new approaches, and to solve problems systematically, thus reducing the learning curve in acquiring tacit knowledge.

Aside from learning orientation, the sharing of tacit knowledge relies on interactive dialogues among project members. Consequently, project managers should encourage and motivate team members involved in the co-production activities in a high tacit knowledge context. Both sides should interact as active partners in the collaboration process to produce enhanced levels of valued outcomes. In addition, project managers may use co-production as a mechanism to increase knowledge effectiveness. Knowledge recipients need to play a co-productive role as part of the tacit knowledge sharing process because their contribution is integral to knowledge effectiveness.

Managers need to develop mechanisms that support and foster effective external knowledge sharing and co-production as well as learning orientation in which knowledge effectiveness will be highly enhanced. The receipt of useful knowledge is a complex process. The findings of this study reinforce the notion that knowledge effectiveness is highly dependent on the willingness of the senders to share knowledge. In fact, the decision not to share is usually rational and well justified from the perspective of the knowledge sender. However, when knowledge senders have a high perception that the knowledge recipient will reciprocate their knowledge sharing, the positive effect of motivations tends to intensify.

In addition, higher-level managers should design incentive schemes that can induce a high level of effort from knowledge senders and can mitigate their protection and hidden behavior. Knowledge sharing requires information systems that support sharing processes. For example, a knowledge platform should encourage information sharing and should reduce barriers to information flow between knowledge senders and recipients.

(A précis of the article "Knowledge sharing and knowledge effectiveness: learning orientation and co-production in the contingency model of tacit knowledge". Supplied by Marketing Consultants for Emerald.)