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# The mediating effect of knowledge management on social interaction and innovation performance

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## Abstract

**Purpose** – The purpose of this paper is to examine the mediating role of knowledge management in the relationship between social interaction and innovation performance.

**Design/methodology/approach** – The population in the study is the Taiwanese firms listed in the China Credit Information Service Incorporation. A stratified random sampling method was used to select 176 firms in Taiwan. The usable response rate was 23.47 per cent. The study employed LISREL to test the hypothesized relationships in the path-analytic framework.

**Findings** – The results indicate that social interaction is positively related to knowledge management. Knowledge management is, in turn, positively related to administrative and technical innovation performance. Further, the results provide evidence that knowledge management plays a mediating role between social interaction and innovation performance.

**Originality/value** – The study highlights the importance of social interaction and knowledge management in the process of innovation, and helps scholars and managers to better understand the mediator of knowledge management through which social interaction benefits innovation performance.

**Keywords** Social interaction, Knowledge management, Innovation, Performance management, Taiwan

**Paper type** Research paper

## Introduction

In dynamic and competitive environment, innovation is expected to become an increasingly critical component for firms to create value and sustain competitive advantage (Madhavan and Grover, 1998; Subramaniam and Youndt, 2005). Firms with greater innovative capacity are better at new product introduction and new market entry that enable firms to gain favorable innovation outcomes and enhance performance (Montes *et al.*, 2004; Subramaniam and Youndt, 2005). When firms develop innovation initiatives, they rely on the knowledge, skill, and commitment of organizational members in the value creation process (Youndt *et al.*, 1996). Innovation processes are increasingly interactive, involving multiple actors distributed within and across the organization. Such interactive processes need the development and growth of interaction networks to shape innovation activities and diffuse innovation outcomes (Dyer and Nobeoka, 2000; Singh, 2005). Prior research has revealed that social network or interactive relationship provide opportunities for mutual learning and cooperation

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that stimulate knowledge exchange and combination (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998; Bouty, 2000; Levin and Cross, 2004). Organizational members can access various knowledge required for their work to increase their innovation involvement through close contacts and interactions (McGrath, 2001; Tsai, 2001; Uzzi and Lancaster, 2003; Rodan and Galunic, 2004). Social interaction networks embedded in individuals and groups facilitate the firm to develop the unusual combination and transformation for innovation (Dyer and Nobeoka, 2000; Lechler, 2001; Singh, 2005).

The knowledge-based view of the firm highlights that heterogeneous and inimitable knowledge generates more durable competitive advantages and performance differences (Szulanski, 1996; Grant, 1996). However, knowledge is possessed by individuals, and it cannot easily be transferred across different members in a firm (Hansen, 1999; Grant, 1996; Tsai, 2002). Although social interaction allows employees to access knowledge developed by many other members, knowledge management enables a firm to successfully apply or replicate knowledge dispersed by interactions among individuals and their networks of interrelationships (Ruggles, 1998; Scarbrough, 2003). Knowledge management can improve the stock of knowledge available to the firm and enhance the potential for variety generation and engagement in innovation activities (Nonaka and Takeuchi, 1995; Coombs and Hull, 1998; Scarbrough, 2003). Organizations that effectively manage and develop knowledge are better at translating their intellectual capital into innovative products and services (Sarin and McDermott, 2003; Scarbrough, 2003). Through managing knowledge effectively, firms can foster the generation, acceptance, and implementation of new ideas to fuel innovative activities (Argote *et al.*, 2003; Spencer, 2003; Lin and Lee, 2005). Thus, knowledge management plays an important role in transforming knowledge embedded in interaction networks among organizational members to achieve favorable innovation results. As noted previously, knowledge management may mediate the relationship between social interaction and innovation performance. In this study, we attempt to examine whether social interaction will affect innovation performance through the mediating variable of knowledge management.

Accordingly, the purpose of this paper is to refine and extend the understanding of how social interaction influences innovation performance and to examine the mediating effect of knowledge management on the relationship between social interaction and innovation performance. The remainder of the paper proceeds as follows. The next section considers the relevant literature and sets out the hypotheses of this study. Following is the methodology for the study. Then, the paper presents the results of the empirical study in achieving the goals as those set out previously. Discussion and conclusions are provided in the last section.

## Background and hypotheses

### *Social interaction and innovation performance*

Knowledge is embedded within and utilized by interactions among individuals and their networks of interrelationships (Hansen, 1999; Tsai, 2002). Social relations and ties constitute information channels that reduce the amount of time and investment required to gather information (Nahapiet and Ghoshal, 1998; Chua, 2002). The role of network of social relationships has been recognized as a critical mechanism for knowledge combination and exchange to further achieve favorable innovation (Ibarra, 1993; Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998). Social network scholars

have suggested that structural properties of networks, such as the centrality of network position, endow the occupants of those positions with differential advantages relative to other position in the network (Ibarra, 1993; Tsai, 2001). A more central network position helps individuals and organizations to access desired strategic resources and increase their social interaction to involve in innovation activities (Ibarra, 1993; Tsai, 2001; Sparrowe *et al.*, 2001; Bell, 2005). Given that innovative activities usually take place in organizational units, Tsai (2001) suggested that organizational units could produce more innovations and enjoy better performance if they occupy central network positions that provide opportunities for shared learning and knowledge transfer and exchange. Bell (2005) also found that locating in the industry cluster and centrality in the managerial tie network enhances the firm's innovativeness. Beyond network configuration, the closeness or connectivity of social relationship between two parties allows firms to benefit from knowledge distributed and accumulated by close contacts and interactions (Hansen, 1999; Dyer and Nobeoka, 2000; Uzzi and Lancaster, 2003; Levin and Cross, 2004). For instance, Dyer and Nobeoka (2000) demonstrated that the relative productivity advantages enjoyed by Toyota and its suppliers come from the ability to effectively manage knowledge-sharing networks. Toyota's highly interconnected networks which create a strong identity and coordinating rules motivate members to openly share valuable knowledge and engage in multidirectional knowledge flows and innovation.

Social interaction, such as mutual trust, effective communication, and coordination, may ensure the motivation and capability of organizational members for innovation (Ibarra, 1993; Sivadas and Dwyer, 2000; Levin and Cross, 2004). Innovation activities are characterized by unpredictability, multidiscipline, and variability in the process, and firms can take advantage of multiple viewpoints through the development of interaction networks among members (Tsai and Ghoshal, 1998; Tsai, 2001). Moreover, ties and interactions that encourage the sharing of knowledge and know-how are key attributes of social capital (Adler and Kwon, 2002). Such attributes facilitate firms to orchestrate innovation activities and further attain innovation performance (Lechler, 2001; Rodan and Galunic, 2004; Singh, 2005). The empirical study from Lechler (2001) showed that social interaction within entrepreneurial teams facilitates new product development and leads to innovation success. Rodan and Galunic (2004) built on social network theory to assess how the network structure influences performance and innovativeness. They found that social networks of managers enable them to gain greater status and prestige and pursue novel and relatively unsanctioned entrepreneurial activities. A manager's social interaction networks are positively associated with innovation performance. Similarly, Singh (2005) examined whether interpersonal networks help to explain knowledge diffusion patterns. The evidence is consistent with a view that interpersonal networks are important in determining patterns of knowledge flow and technical innovation diffusion.

The preceding arguments suggest that social interaction can add greater value to develop innovation. Through effective social interaction in terms of trust, communication, and coordination, firms would enhance the innovative capability in introducing new and improved product, service, and process to foster and achieve innovation performance. Accordingly, the following hypothesis is proposed.

*H1.* Social interaction will be positively related to innovation performance.

*Social interaction and knowledge management*

Knowledge, especially tacit knowledge such as expertise and know-how, is held in the individuals' minds (Grant, 1996; Spender, 1996). From knowledge-based view, knowledge is difficult to spread across different members inside the firm because of stickiness and tacitness (Szulanski, 1996; Grant, 1996; Tsai, 2002). Knowledge sharing and exchange involves a complex social process, and several studies have highlighted the importance of social interaction within organizations (Nahapiet and Ghoshal, 1998; Tsai, 2002; Hoegl *et al.*, 2003; Chen and Huang, 2007). Such behaviors of linkages and interaction among intellectual members nurture a willingness to connect socially (Adler and Kwon, 2002; Chua, 2002), blur the boundaries of organizations, and stimulate the formation of common interests (Szulanski, 1996; Tsai and Ghoshal, 1998). Members can utilize valuable resources and knowledge through interacting with one another (Kogut and Zander, 1992; Ibarra, 1993; Hansen, 1999; Tsai, 2002). The density of the interaction relations among members benefits organizations in terms of greater reciprocity, trust, and a stronger sense of accountability (Sparrowe *et al.*, 2001), and it provides a foundation for organizations to create value (Nahapiet and Ghoshal, 1998; Levin and Cross, 2004). Trust is derived from a positive perception that there is equity and truth between exchange partners (Bouty, 2000). Mutual understanding and trust among work members allow companies to relinquish information and integrate its distributed expertise more efficiently (Nahapiet and Ghoshal, 1998; Bartol and Srivastava, 2002; Chen and Huang, 2007). Tsai and Ghoshal (1998) found trust and perceived trustworthiness lead to the exchange of more knowledge and resource between departments. Levin and Cross (2004) further identified benevolence-based and competence-based trust, and they suggested that benevolence-based trust improves the usefulness of both tacit and explicit knowledge exchange, while competence-based trust is especially important for tacit knowledge exchange. Thus, individual members can enhance their willingness to exchange and absorb knowledge with trusty and capable colleagues, leading to greater knowledge sharing and exchange (Tsai and Ghoshal, 1998; Bouty, 2000; Levin and Cross, 2004).

While much knowledge may be written down or stored formally, other knowledge is stored informally through the collective memories of individuals. Social interaction generates a shared language, which enhances the capability of sharing and combining knowledge and provides apparatus for evaluating the benefits of the created knowledge (Nahapiet and Ghoshal, 1998; Chua, 2002). Organizations increasingly utilize inter-connectivity among members, such as cross-functional team designs for accomplishing knowledge work (Gibson, 2001). Team activities require members to learn to communicate and contact each other frequently. Firms can establish a highly interactive social process and direct interaction in the promotive communication environment to increase connectivity (Nonaka and Takeuchi, 1995; Chua, 2002; Hoegl *et al.*, 2003). When organizational members involve in exchanging resources such as information, assistance, and guidance with coworkers and engaging in mutual problem solving, they are able to accumulate knowledge about task-related problems and workable solutions (Sparrowe *et al.*, 2001; Hoegl *et al.*, 2003). Thus, richer communication interactions may be necessary for the transferability of critical information and knowledge in intra-organizational settings (Nonaka and Takeuchi, 1995; Bartol and Srivastava, 2002; Chen and Huang, 2007). In addition, coordination is needed to deal with the uncertainty and complexity in knowledge activities (Janz *et al.*,

1997). Coordination helps to generate cohesiveness and synergy that enable organizational members to implement tasks and assignments more effectively (Janz *et al.*, 1997; Sarin and McDermott, 2003). Under a coordination circumstance, members can increase interactive behaviors to expand considerable resources on attempting to acquire, share, and utilize the needed knowledge (Janz *et al.*, 1997; Lechler, 2001; Tsai, 2002; Chen and Huang, 2007).

According to the previous, building the networks of social interaction can timely integrate knowledge and foster the knowledge variety required for the work (Szulanski, 1996; McGrath, 2001; Uzzi and Lancaster, 2003). Through interpersonal interaction socially, knowledge acquisition, sharing, and application to the organizational context can be facilitated (Bartol and Srivastava, 2002; Chua, 2002; Levin and Cross, 2004; Singh, 2005). Hence, we propose the following hypothesis.

*H2.* Social interaction will be positively related to knowledge management.

*Knowledge management and innovation performance*

The knowledge-based view concerns knowledge as a valuable resource of the firm (Grant, 1996; Spender, 1996; Hansen, 1999). The roles of knowledge and its management have emerged as an important area of inquiry in the understanding of innovation and value creation in the firm (Grant, 1996; Nonaka and Takeuchi, 1995; Argote *et al.*, 2003). Knowledge management is an approach of more actively collectivizing knowledge, which is dispersed across the organization (Gold *et al.*, 2001; Ruggles, 1998; Scarbrough, 2003). Knowledge management provides individuals and groups with the opportunity to create, retain, and share knowledge (Argote *et al.*, 2003). When knowledge is used, learning takes place, which, in turn, improves the stock of knowledge available to the firm (Nonaka and Takeuchi, 1995). Access and exposure to diverse knowledge may help employees improve opportunity recognition, enlighten new ways to solve problems, and further nurture innovation activities (Gold *et al.*, 2001; Scarbrough, 2003; Rodan and Galunic, 2004). Managing knowledge effectively is an essential driver of knowledge communication and exchange required in the innovation process (Nonaka and Takeuchi, 1995; Madhavan and Grover, 1998; Spencer, 2003). Previous research has indicated that knowledge management is pivotal for supporting and promoting favorable innovation outcomes (Coombs and Hull, 1998; Johannessen *et al.*, 1999; Scarbrough, 2003; Lin and Lee, 2005; Argote *et al.*, 2003). For example, Coombs and Hull (1998) proposed the processing characteristics of knowledge management and drew from case studies to suggest that knowledge management practices have advantages that firms can modify the potential for variety generation and engage in innovation activities. Scarbrough (2003) focused on the global approach to knowledge management and its particular application in e-bank. The findings highlighted the potential role of knowledge management in the key task of integrating different forms of knowledge elicited from a variety of sources. The emergence of knowledge management concepts and tools can be seen as a response to the changes in the process of innovation.

The value of knowledge depends on tapping the highly tacit and subjective insights and making those insights available for sharing and applying by the company (Nonaka and Takeuchi, 1995; Alavi and Leidner, 2001). Knowledge sharing implies that organizationally relevant information, knowledge, and expertise are spread and exchanged among individual members or units within an organization (Moorman and

Miner, 1998; Bartol and Srivastava, 2002). Knowledge sharing increases the possibility for new combinations of existing and new knowledge that would result in process improvements or novel products (Kogut and Zander, 1992; Tsai and Ghoshal, 1998; Tsai, 2001; Spencer, 2003). Spencer (2003) examined the relationship between knowledge sharing and innovative performance, and found that firms that design strategies to share technological knowledge with competitors earned higher innovative performance than firms that did not share knowledge.

It is noted that knowledge generation and sharing is part of the learning process. Without knowledge application, organizations would not be capable of fully taking advantage of the collective knowledge to achieve superior performance (Alavi and Leidner, 2001). The knowledge-based view suggests that firms need to engage not only in knowledge creation and codification but more importantly in knowledge application (Grant, 1996; Spender, 1996; Alavi and Leidner, 2001). As argued by Grant (1996), firms exist because they can better integrate and apply specialized knowledge and protect knowledge from expropriation and imitation by competitors. The application of knowledge makes knowledge more active and relevant for the firm in creating values, such as new product development, redundancy reduction, and performance improvement (Grant, 1996; Johannessen *et al.*, 1999; Lin and Lee, 2005; Sarin and McDermott, 2003). The results of Johannessen *et al.* (1999) revealed that knowledge application could promote organizational innovation. Lin and Lee (2005) examined the impact of organizational learning factors and knowledge management processes on e-business system adoption level. The results suggested that knowledge acquisition and application positively related to e-business system adoption. Knowledge management can be viewed as the facilitator of successful technological innovation.

The previous discussion suggests that firms can develop knowledge management to encourage the sharing, application, and deployment of knowledge to facilitate innovation. Knowledge management provides a positive contribution to transform tacit knowledge into innovative products, services, and processes, and thus lead to better technical and administrative innovation performance. Accordingly, the following hypothesis is formulated.

*H3.* Knowledge management will be positively related to innovation performance.

*Mediating effect of knowledge management*

As discussed previously, *H2* and *H3* link social interaction with knowledge management, and knowledge management with innovation performance. Implicitly, the discussion suggests that social interaction affects innovation performance via its effects on knowledge management. Innovation and new product development require the linkage and cooperation of individuals and groups in a firm (Dyer and Nobeoka, 2000; Levin and Cross, 2004; Singh, 2005). Social relationship and interaction provide organizational members the opportunity to access to others' knowledge and learn from each other (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998; Tsai, 2001). Collective learning and knowledge exchange among members allow them to solve problems and avoid mistakes (Nonaka and Takeuchi, 1995; Uzzi and Lancaster, 2003). Knowledge is characterized by stickiness and tacitness, and it is difficult to spread across different members (Grant, 1996; Hansen, 1999; Tsai, 2002). To fully leverage the knowledge, know-how, and experience resided in individual minds, the firm needs to develop knowledge management to facilitate knowledge sharing and application (Ruggles,

1998; Gold *et al.*, 2001; Scarbrough, 2003). Through knowledge management, knowledge accumulated by close contacts and interactions can be diffused throughout the firm and be converted into common language and memory shared by organizational members (Szulanski, 1996; Nahapiet and Ghoshal, 1998; Adler and Kwon, 2002; Chua, 2002). When knowledge can be disseminated effectively, organization members are more inclined to transfer and utilize knowledge to develop new product, improve efficiency and further achieve favorable innovation results and performance (Gold *et al.*, 2001; Sarin and McDermott, 2003; Argote *et al.*, 2003). Accordingly, we argue that knowledge management plays a mediating role in the relationship between independent variable of social interaction and dependent variable of innovation performance. The direct effect of social interaction on innovation performance may be diminished when considering the indirect effect of social interaction on knowledge management. Thus, the following hypothesis is developed.

*H4.* Knowledge management will mediate the relationship between social interaction and innovation performance.

## Research methods

### *Procedures and sample*

The empirical study employed a questionnaire approach designed to collect data for testing the validity of the model and research hypotheses. Variables in the questionnaire included background information, social interaction, knowledge management, and innovation performance. All of the independent and dependent variables were based on a seven-point Likert-type scale ranging from 1 = "strongly disagree", through 4 = "neutral", to 7 = "strongly agree". The population in this study was the top 5,000 Taiwanese firms listed in the yearbook published by the China Credit Information Service Incorporation. Drawing from the dataset, we used the stratified random sampling method to select 150 firms in each of the five 1,000 levels. A total of 750 surveys were distributed, and the questionnaires were requested to be completed by senior executives such as presidents, directors, or general managers who are familiar with the topic of this study. Follow-up letters, emails, and phone calls were done two weeks later to appeal for participation. Of the returned surveys, 185 were returned, 176 were complete in all predictor and dependent variables, giving us a 23.47 percent usable response rate. Table I presents some characteristics of respondents. The possibility of non-response bias was checked by using a two-tailed *t*-test to compare the characteristics of respondent firms with those of the original population sample. Respondent firms did not significantly differ from non-respondents in terms of firm age, annual sales revenues, and number of employees ($p$-values were greater than 0.10). The results indicated that nonresponse bias was not a significant problem in the current data.

Using a single data-gathering method and/or a single indicator for a concept may result in common method bias. Common method bias is assessed by the correlations between different indicators using the same method. Since all measures were collected from one informant in each company, the Harman one-factor test was used to examine the potential problem of common method bias. Significant common method bias would result if one general factor accounts for the majority of covariance in the variables (Podsakoff and Organ, 1986). A principal factor analysis on the questionnaire measurement items of this study yielded five factors with eigenvalues greater than one

| | Respondents ($n = 176$) | | |
|---|---|---|---|
| | Frequency | Percentage (%) | Cumulative percentage (%) |
| *Firm age* | | | |
| Less than ten years | 42 | 23.9 | 23.9 |
| Ten to 20 years | 44 | 25.0 | 48.9 |
| 20 to 30 years | 38 | 21.6 | 70.5 |
| More than 30 years | 52 | 29.5 | 100.0 |
| *Sales revenue* | | | |
| Less than 100 million | 29 | 16.5 | 16.5 |
| 100 million-1 billion | 42 | 23.9 | 40.4 |
| 1 billion-5 billion | 60 | 34.1 | 74.5 |
| More than 5 billion | 45 | 25.5 | 100.0 |
| *Number of employees* | | | |
| Less than 100 | 47 | 26.7 | 26.7 |
| 101-500 | 60 | 34.1 | 60.8 |
| 501-1,000 | 22 | 12.5 | 73.3 |
| More than 1,001 | 47 | 26.7 | 100.0 |
| *Industry type* | | | |
| Manufacture sector | 70 | 39.8 | 39.8 |
| High-tech sector | 41 | 23.3 | 63.1 |
| Service sector | 65 | 36.9 | 100.0 |

**Notes**: $n$ = number of subjects

**Table I.**
Characteristics of the respondents

that account for 82.59 percent of the total variance, and the first factor accounts for 20.33 percent for the variance. Since a single factor does not emerge and one general factor does not account for most of the variance, common method bias is unlikely to be a serious problem in the data (Podsakoff and Organ, 1986).

*Measures*

*Social interaction*. Social interaction construct was based on seven items, adapted from Chen and Huang (2007), to reflect the degree of interactions among organizational members. Table II lists the items used in our study. The three factors of social interaction construct were trust, communication, and coordination (Sivadas and Dwyer, 2000; Chen and Huang, 2007). The trust factor was reflected by three items indicating how much employees have confidence on other organizational members on their abilities and skills to do the work, decision making, and action in company's best interests. The two indicators in the communication factor are frequency and intensity of discussion among organizational members. Two items, including task assignment plan and scheduled work procedures and activities were used to measure coordination.

*Knowledge management*. Knowledge management construct was assessed with eight items adapted from the concept of Lin and Lee (2005) and Gold *et al.* (2001). The items asked respondents to indicate the extent of knowledge management possessed by the firm. Drawing on previous studies (e.g. Gold *et al.*, 2001; Lin and Lee, 2005; Chen and Huang, 2007), we measured knowledge management construct as three

| Items | Cronbach alpha | Composite reliability |
|---|---|---|
| *Trust*<br>Employees have confidence in other organizational members for their abilities and skills to do the work<br>Employees have confidence in other organizational members for making decisions<br>Employees have confidence in other organizational members to act in company's best interests | 0.91 | 0.91 |
| *Communication*<br>Employees communicate and discuss with other members frequently<br>Employees have willingness to communicate and discuss with other members in depth | 0.85 | 0.86 |
| *Coordination*<br>The task assignments of the employees are well planned<br>The work procedures and activities are well scheduled | 0.85 | 0.85 |
| *Knowledge acquisition*<br>Knowledge is obtained from customers<br>Knowledge is obtained from partners<br>Knowledge is obtained from employees | 0.92 | 0.91 |
| *Knowledge sharing*<br>Knowledge is shared between supervisors and subordinates<br>Knowledge is shared among colleagues<br>Knowledge is shared across the units | 0.86 | 0.88 |
| *Knowledge application*<br>The firm effectively manages different sources and types of knowledge<br>The firm utilizes knowledge into practical use | 0.92 | 0.92 |
| *Administrative innovation*<br>The firm responds to environmental changes flexibly<br>The firm develops innovative administration in planning procedures<br>The firm develops innovative administration in process control systems<br>The firm develops innovative administration in integrated mechanisms | 0.93 | 0.93 |
| *Technical innovation*<br>The firm enhances the development of new technologies<br>The firm incorporates technologies into new products<br>The firm facilitates new processes to improve quality and lower cost | 0.91 | 0.91 |

**Note**: This study measured all items with seven-point Likert scale

**Table II.**
Measurement items and reliabilities

dimensions including knowledge acquisition, sharing, and application. The knowledge acquisition factor was reflected by three items, with respondents indicating the extent to which knowledge were obtained from customers, partners, and employees. The knowledge-sharing factor was measured with a three-item scale tapping the degree to which the knowledge was openly shared between supervisors and subordinates,

between colleagues, and between units. The two indicators in knowledge application factor were the effective management of different sources and types of knowledge and the utilization of knowledge into practical use.

*Innovation performance*. Following the distinction of previous researches (e.g., Damanpour, 1991; Ibarra, 1993), this study adopted two dimensions of innovation performance including administrative and technical innovation performance. A seven-item scale based on the work of Ibarra (1993) was developed to reflect the extent to which firms were satisfied with the achievements in their development and implementation of innovation activities. The administrative factor was assessed by four items aimed at measuring the extent of responsiveness to environmental changes and the degree of innovative administration in terms of planning procedures, process control systems, and integrated mechanisms. The technical factor was measured by asking the informants three questions about the extent to which the firm develops new technologies, incorporates technologies into new products, and facilitates new processes to improve quality and lower cost.

*Control variables*. We entered four control variables in our analysis including firm age, annual sales, number of employees, and industry type. Firm age was measured as the number of years from the founding date. Annual sales and number of employees were used to control for the possible firm-size effects. The amount of annual sales was measured in million NT dollars and the number of employees was calculated as the total number of employees in the firm. To assess the industry type, two dummy variables were included to indicate if the company was manufacturing industry, high-tech industry, or service industry. We used multivariate analysis of variance (MANOVA) to test whether social interaction, knowledge management, or innovation performance may vary depending on the age and size of the firm and the type of the industry. We found that the $F$ values are all less than 2.0 and the p values are all greater than 0.1. Thus, the four control variables have no significant difference on these research variables.

*Measures properties*

This study employed confirmatory factor analysis (CFA) to assess the quality of the measurement model prior to hypotheses testing. The CFA fit indexes for the proposed models ranged from adequate to excellent (social interaction: GFI = 0.98, AGFI = 0.96, CFI = 1.00, IFI = 1.00; knowledge management: GFI = 0.93, AGFI = 0.85, CFI = 0.98, IFI = 0.98; innovation performance: GFI = 0.93, AGFI = 0.84, CFI = 0.98, IFI = 0.98). Additionally, three models had chi-squares less than three times their degrees of freedom (social interaction, 29.59/11 = 2.69; knowledge management, 48.91/17 = 2.88; innovation performance, 34.80/12 = 2.90). Overall, the CFA results suggested that the models of social interaction, knowledge management, and innovation performance provided a good fit for the data. Moreover, the standardized loadings of all the measurement items on their posited underlying construct factor were statistically significant ($p < 0.05$) with the $t$-value exceeding 2.0 (Anderson and Gerbing, 1988) and none of the confidence intervals for each pairwise correlation estimate contained a value of one (Anderson and Gerbing, 1988). As shown in Table III, the percentage of extracted variance exceeds the construct's shared variance with every other construct (i.e. the square of the correlation) (Hult *et al.*, 2000). In addition, we constrained the correlation between each pair of constructs, one at a time, to be equal to 1 (Anderson and Gerbing, 1988; Hult *et al.*, 2000). The chi-square

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Mean | 5.33 | 5.76 | 5.19 | 5.39 | 5.47 | 5.18 | 5.33 | 5.11 |
| Standard deviation | 0.92 | 0.78 | 0.89 | 0.89 | 0.93 | 1.03 | 0.87 | 1.12 |
| Number of items | 3 | 2 | 2 | 3 | 3 | 2 | 4 | 3 |
| Extracted variance | 0.76 | 0.75 | 0.74 | 0.78 | 0.71 | 0.85 | 0.77 | 0.76 |
| Shared variances | 0.46 | 0.46 | 0.50 | 0.41 | 0.41 | 0.46 | 0.48 | 0.48 |
| | 0.50 | 0.31 | 0.31 | 0.46 | 0.41 | 0.41 | | |
| | Correlations[a] | | | | | | | |
| 1. Trust | 1.00 | | | | | | | |
| 2. Communication | 0.68 | 1.00 | | | | | | |
| 3. Coordination | 0.71 | 0.56 | 1.00 | | | | | |
| 4. Knowledge acquisition | 0.83 | 0.69 | 0.73 | 1.00 | | | | |
| 5. Knowledge sharing | 0.81 | 0.73 | 0.76 | 0.64 | 1.00 | | | |
| 6. Knowledge application | 0.80 | 0.67 | 0.72 | 0.68 | 0.64 | 1.00 | | |
| 7. Administrative innovation | 0.87 | 0.72 | 0.79 | 0.84 | 0.79 | 0.79 | 1.00 | |
| 8. Technical innovation | 0.84 | 0.75 | 0.76 | 0.77 | 0.84 | 0.76 | 0.69 | 1.00 |

**Notes**: [a]Correlations with absolute value greater than 0.15 are significant at $p < 0.05$, and those greater than 0.19 are significant at $p < 0.01$ (two-tailed test); $n = 176$

**Table III.**
Descriptive statistics, reliabilities, validities, and correlations

test comparing this model to the model freeing that correlation was significant ($p < 0.001$). These results indicated that the constructs exhibited convergent and discriminant validity (Anderson and Gerbing, 1988; Hult *et al.*, 2000).

This study assessed reliability of the multi-item scale for each dimension by calculating Cronbach alpha coefficients and composite reliabilities for all of the scales. As shown in Table II, both measures of reliability were above the recommended minimum standard of 0.70 (Hair *et al.*, 1998). Thus, we concluded that the measures utilized in the study demonstrate internal consistency.

## Results

This study attempts to understand the relationships among social interaction, knowledge management, and innovation performance. Table III displays the mean, standard deviation, number of items, and the correlation matrix of the research variables. This study employed LISREL to test the hypotheses in the path-analytic framework (Anderson and Gerbing, 1988; Jöreskog and Sörbom, 1986). LISREL provides a chi-square value and additional indices that assess the fit of path models. Calculating parameter estimates and standard errors that can be used to test statistical significance, LISREL also analyzes hypothesized relationships. Paths between constructs represent individual hypothesis, and this study assessed each for statistical significance of the path coefficient.

This study tested the model to examine the hypothesized relationships, and the LISREL analysis of this model produced a chi-square of 19.80 (df = 17). In addition to this chi-square value, the various goodness-of-fit indices also suggested a very good fit (GFI = 0.97, AGFI = 0.94, NFI = 0.99, CFI = 0.99, RMSR = 0.02). The analysis also provided support for the study's first three hypotheses. Table IV reports the results of standardized path estimates, and Figure 1 shows the path coefficients, *t*-values, and construct relationships.

As hypothesized, a positive relationship between social interaction and innovation performance is confirmed ($\gamma_{11} = 0.61, t = 13.30$). Therefore, *H1* is supported. The finding indicates that firms would achieve a higher level of innovation performance when organizational members have more social interaction such as trust, communication and coordination more frequently and effectively. A positive relationship between social interaction and knowledge management is established ($\gamma_{21} = 1.14, t = 18.47$). Therefore, *H2* is supported. As scholars have postulated, firms would enhance the degree of knowledge management if they seek to build trust, communication channels, and coordination mechanisms to encourage employees to contribute their knowledge and skills. As predicted, a significantly positive relationship between knowledge management and innovation performance is accepted ($\beta_{12} = 0.49, t = 10.81$). Therefore, *H3* is supported. This finding may add to the understanding that knowledge management is necessary for firms to achieve favorable innovation performance.

To test the mediating effects of knowledge management, we adopted the procedure outlined by Baron and Kenny (1986) and tested the three conditions using LISREL analysis. The first condition is to establish that the independent variable, social interaction, influences the mediator, knowledge management. Result shows that social

**Table IV.**
Standardized path estimates

| | | Hypothesized relationships | | |
|---|---|---|---|---|
| Hypothesis | Variables | Path coefficient | *t*-value | Result |
| *H1* | Social interaction and innovation performance | 0.61* | 13.30 | Supported |
| *H2* | Social interaction and knowledge management | 1.14* | 18.47 | Supported |
| *H3* | Knowledge management and innovation performance | 0.49* | 10.81 | Supported |

**Notes**: $n = 176$ (two-tailed test); $^{*}p < 0.001$

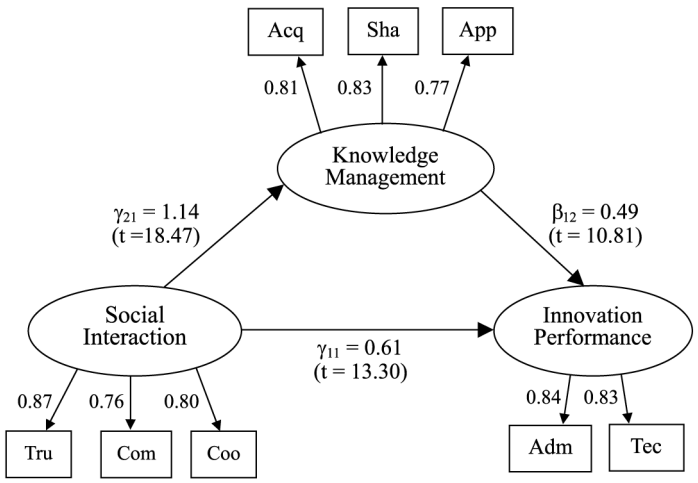


**Figure 1.**
The resulting model of this study

interaction has a significantly positive relationship with knowledge management ($\gamma_{21} = 1.07, t = 19.75$), which supports the first condition for mediating effect. Then, the relationship between the independent and the dependent variable shows that social interaction has a significantly positive relationship with innovation performance ($\gamma_{11} = 1.10, t = 23.06$), also supporting the second condition. Lastly, the mediator, knowledge management, was included in the models to examine whether it reduces the effects of the antecedents to non-significance. Mediation occurs if the effects of the antecedents on the performance of innovation are reduced in the presence of the mediator. Results show that social interaction has a significantly positive relationship with innovation performance ($\gamma_{11} = 0.61, t = 13.30$), and knowledge management has a significantly positive relationship with innovation performance ($\beta_{12} = 0.49, t = 10.81$). To test the third condition, this study examined the change in chi-square value for the social interaction variable between before and after entering the knowledge management variable. Results include a substantial change in the chi-square after entering the knowledge management variable ($\Delta\chi^2 = 58.87, \Delta\text{df} = 1, p < 0.001$). The significance of the direct effect of social interaction on innovation performance decreases when this study considers the indirect effect of social interaction through knowledge management in a total effect model. These results reveal that knowledge management plays a mediating role between social interaction and innovation performance (Baron and Kenny, 1986), supporting the mediation effect proposed in *H4*.

## Discussion and conclusions

We develop a conceptual model for examining the role of knowledge management in social interaction and innovation performance. Our results indicate that social interaction is positively related to knowledge management, which in turn is positively related to innovation performance. The present evidence implies social interaction leads to increased knowledge management and the indirect path through knowledge management resulted in a higher level of innovation performance. Thus, the findings show support for the mediating role of knowledge management in the relationship between social interaction and innovation performance. The key point is that social interaction works its beneficial effects on innovation performance through the level of knowledge acquisition, sharing, and application.

The findings of this study contribute to the social network literature, which emphasizes the importance of social relationships in gaining access to valuable knowledge and resources (Nahapiet and Ghoshal, 1998; Hansen, 1999; Tsai, 2002; Adler and Kwon, 2002). This study reveals that social interaction with mutual trust, communication, and coordination helps organizational members to accumulate social capital and increase interpersonal linkages for knowledge sharing and application. This study provides empirical support of the knowledge-based theory of value creation, and strengthens that knowledge management plays a critical role within a firm. Managing knowledge as a strategic resource is one of foundational weapons that enable a firm to sustain distinctive competencies and competitive advantages (Nonaka and Takeuchi, 1995; Grant, 1996; Spender, 1996; Sarin and McDermott, 2003; Argote *et al.*, 2003). We identify knowledge management as a mediating mechanism through which social interaction benefits innovation performance. When firms want to develop

interactive relationships among members to crate value and enhance innovation outcomes, they could take knowledge management into account.

From a practical point of view, the results of this study have some implications for organizations. The emergent model indicates that social interaction promotes the acquisition, sharing, and application of valuable knowledge and paves the way for enhancement of administrative and technical innovation performance. These findings highlight the critical role of social interaction and knowledge management in the process of innovation. Managers may be able to actively manage knowledge embedded in individuals through a variety of social interaction mechanisms to stimulate knowledge acquisition, sharing and application, and build competitive advantage. Furthermore, intense knowledge management activities in organizations can form the basis for creative and innovative thoughts that may eventually lead to greater innovation performance. More importantly, our results suggest the mediation effect of knowledge management. To enhance the link of social interaction and innovation performance, managers need to devote the necessary effort to conduct effective knowledge management and encourage employees to commit to acquire, share, and apply knowledge and experiences.

The findings of this study should be interpreted with caution in light of several limitations. First, the data employed in this study were cross-sectional research design. Although our results are consistent with theoretical reasoning, our cross-sectional design prevented us from drawing causality concerning the hypothesized relationships. Future research might address this issue by using longitudinal design in drawing causal inferences. Second, we have done the t-statistics to verify that the non-response bias is not a significant issue. However, the smaller sample size of the survey is still noted as a potential limitation in this study. In addition, this study was done by empirically investigating Taiwanese firms. Potential cultural limitation should be noted and future research is suggested, in different cultural contexts to generalize or modify the concepts. Third, this study is based on self-reported assessments that may have the possibility of common method bias. While the Harman one-factor test does not indicate it to be a significant problem, the issue may not be totally ruled out. Future research is suggested to benefit from using objective measures for innovation performance that can be independently verified. Finally, this study goes further than other studies in examining a potential mediator in the relationship between social interaction and innovation performance. However, this study does not consider the roles played by organizational routines, cultures, and other possible knowledge management processes such as knowledge accumulation and knowledge integration. Future studies might gain additional insights by exploring organizational factors or other knowledge management processes.

To conclude, our study highlights the crucial importance of the mediating role of knowledge management when examining the relationship between social interaction and innovation performance. The viewpoints proposed in this study have important implication for future research and organizations.

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