Explaining knowledge sharing with social capital theory in information systems development projects

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Abstract

Purpose – Owing to their complex and knowledge-intensive nature, information systems development (ISD) projects require effective collaboration between business and technology experts. In this regard, social capital theory may provide a valuable framework and insight into explaining knowledge sharing behavior in an ISD context. The purpose of this paper is to expand the theory of knowledge sharing as developed thus far in the ISD project context using the full-blown team social capital theory.

Design/methodology/approach – The expertise and communication effectiveness of business and technology professionals were posited as antecedents of team social capital and knowledge sharing. The research model for this study integrates expertise, communication, knowledge sharing, social capital, and team performance into a structural equation modeling. The research model was empirically tested with a data set from business and technology professional pairs collected from 115 ISD project teams.

Findings – The results indicated that team social capital and knowledge sharing have significant influences on team performance. Team social capital appears to have a stronger influence on knowledge sharing than business and technology expertise. Communication effectiveness and technology expertise are important antecedents to raise team social capital.

Originality/value – In this study, the social capital theory is applied toward enhancing the theory of knowledge sharing in ISD project teams. General social capital construct and measures are adopted and modified into the team social capital measures and validated empirically.

Keywords Expertise, Knowledge sharing, Communication effectiveness,
Information systems development projects, Project performance, Team social capital

Paper type Research paper

1. Introduction

Information systems development (ISD) project teams often take up various and difficult challenges, as ISD projects tend to be complex and require the intensive coordination of different levels of expertise, resources, and work efforts. Due to their complex and knowledge-intensive nature (Greenwood *et al.*, 2010; Tesch *et al.*, 2009), the coordinated presence of expertise is necessary for ISD projects (Faraj and Sproull, 2000). Integrating and sharing explicit and tacit knowledge allow ISD team members to learn and access experiential knowledge and methods from their teammates (Tiwana and McLean, 2005). Moreover, social relations between members facilitate collaborative activities such as the transferring and sharing of knowledge.

In maintaining and effectuating social relations among ISD team members, team social capital may need to be incubated and increased from different disciplines. In this

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regard, social capital theory may provide a valuable framework and insight into explaining knowledge sharing behavior in an ISD context. Although social capital has been investigated as an important research issue in various fields, there have been limited numbers of studies conducted with respect to ISD project teams thus far (Ghosh and Scott, 2009; van den Hooff and de Winter, 2011). This study intends to expand the theory of the knowledge sharing developed thus far in the ISD project context with the full-blown team social capital theory.

In knowledge sharing, the expertise of knowledge workers and communication effectiveness are known to precede effective knowledge sharing and subsequently lead to good team performance. In ISD context, this model is posited as applicable, and moreover, team social capital is, theoretically, posited as critical mediator in this relationship. As technology and business together play critical roles in ISD, expertise and communication effectiveness have been measured in both technology and business aspects, respectively.

As effective collaboration between business and technology experts is important issue for ISD projects (Pee *et al.*, 2010), it is important to understand how differently these distinct professionals act in forming team social capital, sharing knowledge, and ultimately contributing to team performance and thus ensuring the success of an ISD project.

In sum, this study integrates social capital theory with the theory of knowledge sharing. The expertise and communication effectiveness of business and technology professionals are posited as antecedents of team social capital and knowledge sharing. A detailed theoretical background is given in the next section, and the research model and hypotheses follow.

2. Theoretical background

2.1 Antecedents of the theory of knowledge sharing

Knowledge sharing is defined as revealing the presence of pertinent knowledge without necessarily transmitting it in its entirety (Tiwana and McLean, 2005). One key concept behind knowledge sharing in the system development process is the activity of knowledge exchanges between the participants in a project. Participants (i.e. internal business professionals and external technology professionals) engage in two-way interactions and shift between the roles of knowledge source and recipient in knowledge sharing (Pee *et al.*, 2010). Knowledge sharing in a project involves bi-directional exchanges and is different from other concepts such as knowledge transfer, which refers to the flow of knowledge in one direction from a source to the recipient (Joshi *et al.*, 2007). Therefore, the relationships between participants in a project are critical to the sharing of knowledge.

Factors of knowledge sharing in organizations can be categorized according to the nature of the knowledge and the opportunities and motivation to share (Ipe, 2003). Among these factors, this study focusses on two factors: the nature of the knowledge and opportunities for knowledge sharing. This study does not consider the motivation to share knowledge, as motivational aspects are more relevant to an individual context than they are to a team context. Within the nature of the knowledge category, project members' capabilities and levels of expertise form the basis of their knowledge sharing activities (Chang *et al.*, 2013; Tiwana and McLean, 2005). From sharing opportunities, knowledge sharing consists of social interactions between project participants, and such interactions are influenced by the relationships between individuals (Bartsch *et al.*, 2013; Di Vincenzo and Mascia, 2012). Some studies have argued that social capital

plays a major role in enhancing knowledge sharing (Ghosh and Scott, 2009; Hau *et al.*, 2013; van den Hooff and de Winter, 2011; Yang and Farn, 2009).

Expertise. IS expertise can be divided into two sub-dimensions: business expertise (for the business domain) and technology expertise (for the technology domain). Business expertise refers to clients' accumulated in-house knowledge concerning business processes, and it plays an important role in decision making during ISD projects (Pee *et al.*, 2010). On the other hand, technology expertise refers to the specific technology knowledge of IS experts. IS experts provide various skills and services, such as analyzing system requirements, offering specific knowledge on using a system or package, training users, aligning business processes with the system functions, supporting system configurations, and proposing appropriate solutions to clients (Chow and Chan, 2008).

Integrating both business and technology expertise is crucial to achieving project goals. During an ISD project, participants must possess expertise or knowledge and share expertise in both directions (Hartnett *et al.*, 2012). The members of the ISD team need to work together as an equal partnership and communicate so as to recognize group specialties and expertise (Coughlan *et al.*, 2005). If a service partner has more expertise, customers' willingness to maintain their relationships may be stronger (Bendapudi and Berry, 1997). Thus, the expertise level of ISD team members would be important for building and maintaining social relationships, such as social ties, trust, and shared vision.

Communication effectiveness. The definition of communication varies. This study aims to examine communication between business professionals and technology professionals during ISD projects. From this point of view, communication can be defined as a process that involves the creation and sharing of information in order to enhance the level of mutual understanding between project team members (Rogers, 1981). Communication can reduce misunderstandings and provide the information necessary for making decisions and solving emerging issues (Chen *et al.*, 2013). Therefore, communication can have a positive impact on knowledge sharing and technical performance within a team.

We cannot conclude, however, that communication behavior is always positively related to social relationships or team performance. When communication is not frequent, team members lack sufficient chances to interact or share their knowledge. However, too much communication can interfere with members' concentration or result in information overflow. Therefore, both high and low communication frequencies can have a negative effect on team performance or social relationships (Leenders *et al.*, 2003).

To overcome this ambiguous aspect of communication, one must additionally consider communication effectiveness. Effective communication occurs when useful, reliable, understandable, and appropriate information is communicated between members (Massey and Kyriazis, 2007). It can lead to the desired results of communication – sharing information and fostering good relationships. Communication effectiveness positively influences relational commitment (Postmes *et al.*, 2001; Sharma and Patterson, 1999; Park *et al.*, 2012) and group effectiveness (Tzafrir *et al.*, 2004). Also, a high level of communication effectiveness is associated with the level of intimacy and with relationship satisfaction (Emmers-Sommer, 2004). Therefore, effective communication helps to form and maintain good relationships, suggesting that social capital is strongly related to communication effectiveness.

Intrinsically, communication does not occur in a one-way manner. Communication can be defined as a set of formal or informal activities of exchanging project-related facts, needs, opinions, visions, and considerations among users and between users and interested parties (Hartwick and Barki, 2001). In this sense, communication in an organization is not a one-way delivery of information but rather a two-way interaction, as it is a process of exchanging and sharing information that is of common interest. Thus, to ensure effective communication, both business professionals and technology professionals should be considered when investigating the influence of communication effectiveness on an ISD project.

2.2 Team social capital theory

An organization needs social capital to build a competitive edge (Nahapiet and Ghoshal, 1998). Social capital can be defined as an integrated concept of actual or potential resources gained by an individual or group from a social system or network (Bourdieu, 1986). However, it is difficult to define social capital with only one concept, as the literature on social capital spans various fields and offers different meanings.

Research on social capital and its effects has been conducted at the individual (Burt, 1997), team (Bartsch *et al.*, 2013; Lee *et al.*, 2013), and organizational (Chow and Chan, 2008) levels. Yu *et al.* (2013) divided social capital into the individual and team levels to study its impact on individual knowledge sharing behavior within teams. Their study showed that both levels of social capital have combined effects on individuals' tacit and explicit knowledge sharing (Yu *et al.*, 2013).

The present study focusses on team social capital, which is specific type of social capital that exists in the relationships between team members (Oh *et al.*, 2004). These relationships arise from the formal as well as the informal structure within the team.

In general, team social capital can be considered a key factor to improve team performance, but it does not operate in a simple manner. Oh *et al.* (2004) insisted that team social capital contributes to enhancing team performance when it has the optimal combination of internal and external factors. This suggests that there is a complex rather than a linear relationship between team social capital and team performance.

To investigate these complex characteristics of social capital, some researchers have considered social capital as a multi-dimensional construct. Granovetter (1973) proposed that social capital has both structural and relational aspects. Nahapiet and Ghoshal (1998) expanded this concept by suggesting structural, relational, and cognitive aspects.

Social capital's structural dimension refers to the level of interconnections between members and the intensity of their connections (Nahapiet and Ghoshal, 1998). Mehra *et al.* (2006) applied social network ties as one variable of the structural dimension. The relational aspect refers to the shared values created through the characteristics and levels of members' relationships (Nahapiet and Ghoshal, 1998). It contains ideas such as trust, norms, duties, and a sense of identity between members. In particular, trust is the central concept of the relational aspect of social capital (Tsai and Ghoshal, 1998). The cognitive dimension can be defined as shared codes, languages, and vision. Nahapiet and Ghoshal (1998) stated that a shared vision is an important antecedent of knowledge sharing because it forms a common context for the team.

These sub-dimensions of social capital, i.e., structural, relational, and cognitive dimension, have been empirically tested and validated (Chiu *et al.*, 2006; Chow and Chan, 2008). This study adopted these three sub-dimensions to measure the level of social capital.

3. Research model and hypotheses

The research model for this study integrates expertise, communication, knowledge sharing, social capital, and team performance. The model indicates that, as antecedents of team performance, knowledge sharing and social capital can be influential. In addition, expertise and communication effectiveness become antecedents of knowledge sharing and team social capital. As Nahapiet and Ghoshal (1998) proposed, we considered team social capital as a second-order construct with shared vision, trust, and social ties. Team size, project type, and duration were selected as control variables.

3.1 Expertise on knowledge sharing and team social capital

Participants' expertise or knowledge of a project is critical to solving issues and sharing information. Chen *et al.* (2013) suggest that a developer's knowledge credibility, confidence, and trust in a partner's knowledge, has an effect on knowledge sharing in open-source software project teams because software development requires participants with various areas of expertise. According to Tiwana and McLean (2005), on project teams with diverse areas of expertise, effective working relationships are important for cooperation. Park and Lee (2014) also reported that a partner's expertise plays an essential role in sharing knowledge via dependence and trust in project environments.

The level of knowledge on an ISD project team would be related to the building of team social capital as well as knowledge sharing. This study operationalizes knowledge as expertise (i.e. business expertise and technology expertise). Due to the interdependent nature of ISD project teams, any deficiency of other members' expertise can have a negative influence on teamwork or members' relationships. Expertise can be seen as a contact resource which is accessible through a social network (Cornwell and Cornwell, 2008). If one perceives that his/her partner has expertise which is beneficial for his/her work, one will make an effort to form stronger ties with his/her partner in order to obtain more useful contact resources. Thus, the perceived partner's expertise can strengthen social ties, which is one of sub-dimensions of social capital.

In terms of trust, another sub-dimension of social capital, expertise, has been studied as its antecedent (Moorman *et al.*, 1993), including highly knowledge-based services (Ifinedo, 2011). Crosby *et al.* (1990) find a positive relationship between the perceived expertise of an insurance salesperson and customers' levels of trust. Spake and Megehee (2010) also showed that the perceived level of expertise in partners is a significant predictor of the level of trust in partners. Therefore, the hypotheses can be derived:

H1. Business expertise has a positive impact on knowledge sharing.

H2. Technology expertise has a positive impact on knowledge sharing.

H3. Business expertise has a positive impact on social capital.

H4. Technology expertise has a positive impact on social capital.

3.2 Communication effectiveness on team social capital

Researchers have argued that the formation of social capital is affected by social interaction (Kostova and Roth, 2003; Mäkelä and Brewster, 2009). In particular, social ties, the structural element of social capital, have a significant association with

social interaction (Chen *et al.*, 2008). Because communication can be regarded as a type of social interaction, communication can contribute to forming social capital.

Effective communication increases the intimacy of, and satisfaction with, relationships. Therefore, communication effectiveness helps to maintain relations and reduce conflicts (Dawes and Massey, 2005; Emmers-Sommer, 2004; Park *et al.*, 2012). Social relations are made or broken depending on the effectiveness of communication.

Effective communication is also related to the cognitive aspects of social capital, especially shared vision, as it affects how well information such as the team's vision is transmitted to members. If a partner communicates a new vision effectively, there is a greater chance that the other members will agree with the vision (Farmer *et al.*, 1998). In short, the visions and goals of a team can be shared through effective communication.

In summary, communication effectiveness allows team members to share information, exchange social contexts, strengthen their trust, and finally raise performance (Sharma and Patterson, 1999; Tzafrir *et al.*, 2004). Information sharing, the exchange of social contexts, and the building of trust are the major elements of social capital (Nahapiet and Ghoshal, 1998). Thus, effective communication has a positive impact on social capital formation.

From this perspective, this study derives the following hypotheses:

H5. Business professionals' communication effectiveness has a positive impact on team social capital.

H6. Technology professionals' communication effectiveness has a positive impact on team social capital.

3.3 Team social capital, knowledge sharing, and performance

Social capital is related to how closely and densely interconnected team members are, how good their relationships are, and how shared cognition between team members is achieved. If members are interconnected closely and densely, their frequency of interaction will increase and the possibility of knowledge sharing will rise. The level of trust – the relational aspect of team social capital – is positively related to the level of knowledge sharing (Nelson and Cooprider, 1996). Based on trust, members can expect other members to reciprocate by sharing resources. Therefore, trust can enhance the intention to share knowledge (Yang and Farn, 2009). Furthermore, shared cognition, including shared vision, is related to social norms that promote knowledge sharing among members (Li, 2005; Mäkelä and Brewster, 2009). From the integrated effects of social capital's sub-elements, social capital is expected to contribute significantly to enhancing knowledge sharing on a team (Hau *et al.*, 2013; Yu *et al.*, 2013; Ghosh and Scott, 2009). Therefore, the following hypothesis can be derived:

H7. Team social capital has a positive impact on knowledge sharing.

On an ISD project team, there are various business and technology professionals who frequently interact to accomplish shared goals. Given this characteristic, sharing language and knowledge is important for good project performance (Nelson and Cooprider, 1996). Similarly, Blumenberg *et al.* (2009) stated that high levels of shared knowledge positively influence outsourcing team performance. From these results, the following hypothesis can be proposed:

H8. Knowledge sharing has a positive impact on team performance.

Social capital is positively related to team effectiveness, performance, and satisfaction (van Emmerik and Brenninkmeijer, 2009). In the context of an ISD project, social capital also influences project performance significantly (Lee *et al.*, 2011). Regarding the structural aspects of social capital, vigorous interaction between team members, combined with their internal communication network, contributes to team performance (Janhonen and Johanson, 2011). Likewise, the relational aspect of trust is related to IS project team performance, as it is important for maintaining a relational commitment in an interdependent context (Chakrabarty *et al.*, 2007). In IT-based transactions or processes, building trust with partners can reduce the ambiguity and risk in relationships and thereby increase performance (Lee and Kim, 1999). Shared vision – a cognitive aspect – is also positively related to IT service projects (Pee *et al.*, 2010). Leadership research has shown that team performance improves when a leader shares a vision with members (Dionne *et al.*, 2004). Therefore, it can be suggested that social capital has a positive influence on ISD project team performance:

H9. Team social capital has a positive impact on the performance of a project team.

4. Research method

Data were collected by an on-line survey method with a structured questionnaire from 145 ISD project teams in March of 2003. For the team-level analysis, business and technology pairwise data were collected from each team. This study asked respondents to evaluate their counterparts for every construct except team performance (i.e. for business professionals to respond while referring to their technology partners, and for technology professionals to do this in reverse). Compartmented data were used for expertise and communication effectiveness by business and technology. On the other hand, the mean values of business and technology were used for knowledge sharing, team social capital, and team performance.

4.1 Operational definitions and measurement items

In this study, expertise is defined as the evaluation of the relevant competencies associated with the exchange partner (Crosby *et al.*, 1990). The scale for expertise was a modified form of the Spake and Megehee (2010) knowledge scale used to assess the expertise of a service provider. Communication can be defined as a process that involves the sharing and creating of information for mutual understanding between project team members (Rogers, 1981). Effective communication refers to whether useful, reliable, understandable, and appropriate information is communicated between members (Massey and Kyriazis, 2007). Based on studies by Chiu *et al.* (2006) and Chow and Chan (2008), social capital consists of measured variables that are sub-dimensions of a structural dimension (social ties), a relational dimension (trust), and a cognitive dimension (shared vision). Knowledge sharing was adapted from six items proposed by Bock and Kim (2005). In accordance with Henderson and Lee (1992), project performance was conceptualized as the fulfillment of technical and business demands, the expected resources, and the project schedule. The measurement items are based on a seven-point Likert scale, with a score of 1 indicating "strongly disagree" and a score of 7 indicating "strongly agree." For pre-verification, this study selected five project managers and performed a pilot test. From feedback on the pilot test, this study corrected a few terms and expressions for some items, but no major corrections were undertaken.

4.2 Sample characteristics

Completed survey instruments from matched pairs of business and technology professionals were collected. A total of 290 solicitation e-mails were sent to business and technology leaders of 145 ISD projects in a large electronic parts manufacturing firm. A total of 249 questionnaires were returned (response rate 85.9 percent), but after excluding questionnaires with any missing or inappropriate data and matching pairs for project teams, 230 responses from 115 project teams were found to be complete and matched. After merging responses from both business and technology professionals on each team using a mean value, 115 data points were used for the final data analysis. Table I shows the demographics of the respondents.

5. Data analysis and results

For the analysis of the study model, the partial least squares (PLS) approach was used. Because this method relies on an element-based approach, it tends to be more generous in terms of sample sizes or distributions (Lohmoller, 1989). At the same time, this method has an advantage in that the measurement model and structural model can be analyzed simultaneously (Chin, 1998). It is also appropriate for analyzing relatively small samples and for exploratory research (Gefen *et al.*, 2000). In this study, we chose to use PLS because the conceptual framework of the relationships between the main variables was based on theories, whereas the relationships between the sub-dimensions were studied using an exploratory approach.

The PLS analysis was conducted in two phases. The first of these involved a measurement model analysis to test the reliability and validity of the measurement items and variables. The second phase was a structural model analysis to verify the

Characteristics	Categories	Sample	%
Project type	Enterprise resource planning	40	34.8
	Business intelligence and analysis	35	30.4
	Web/mobile application development	17	14.8
	Supply chain management	8	7.0
	Knowledge management	4	3.5
	Customer relationship management	4	3.5
	Human resource management	3	2.6
	Accounting and financing system	3	2.6
	Manufacturing execution system	1	0.9
Project duration	Less than 6 months	38	33.0
	7-12 months	24	20.9
	13-24 months	47	40.9
	More than 25 months	6	5.2
Project phase	Requirement analysis	32	27.8
	System analysis/design	35	30.4
	Developing/testing	33	28.7
	Roll-out/stabilization	15	13.0
Team size	Fewer than 10 members	47	40.9
	11-20 members	24	20.9
	21-30 members	17	14.8
	31-40 members	8	7.0
	More than 41 members	19	16.4
Total		115	100

Table I. Sample characteristics

research model and hypotheses. To analyze the measuring model and structural model, this study used "SmartPLS 2.0" software and applied a bootstrap method and the PLS algorithm.

5.1 Measurement model analysis

First, for the analysis of the measurement model, an exploratory factor analysis of the variables was done, and the measurement items were verified. This study conducted a confirmatory factor analysis for reliability and validity (convergent and discriminant). The reliability analysis was done using Cronbach's α and with composite reliability (CR), with the levels of statistical significance of the factor loadings. As shown in Table II, the score of each variable's Cronbach's α and CR exceeded 0.80 (Anderson *et al.*, 2006; Chin, 1998). In accordance with Hair *et al.* (1995), the measurement indicators were evaluated for convergent and discriminant validity. Generally, if the factor loading of each measurement item on its construct is more than 0.7, the measurement item is considered valid (Chin *et al.*, 2003). The factor loadings of all measurements were more than 0.7, indicating good convergent validity.

To determine discriminant validity, this study compared the square root of AVE and the correlation coefficient. Table II summarizes the factors' descriptive statistics and the correlation coefficients, with the square root of AVE displayed diagonally (italicised). Each factor's square root of AVE was higher than the correlation coefficient with the other variables. Because the measurement item of each variable was thought to have a higher correlation than the other variables, it can be concluded that the measurement items have good discriminant validity (Fornell and Larcker, 1981).

The only exception is that the AVE values were unavailable for project type and team size (control variables), as they were constructed as one item for the purpose of the analysis, as summarized in Table II.

5.2 Structural model analysis

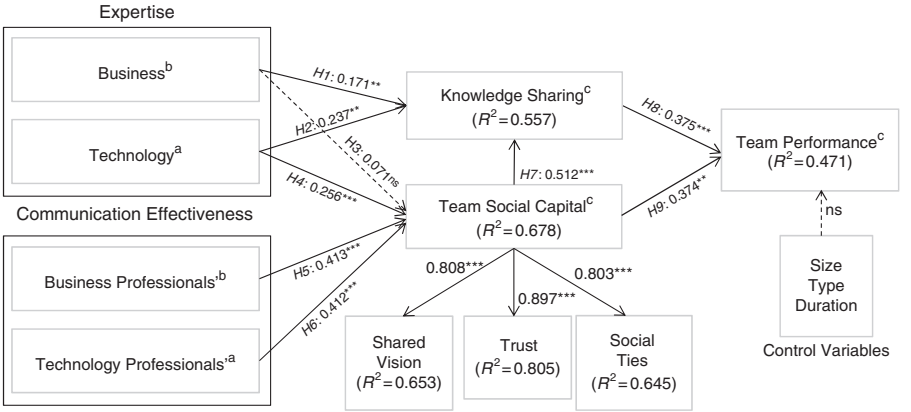
Once the reliability and validity of the measurement model were confirmed, the research model and hypotheses were tested. Figure 1 shows the results of the structural model analysis. Path coefficients were the standardized β coefficients from the PLS analysis.

As expected, business expertise ($\beta = 0.171$, $t = 2.704$) and technology expertise ($\beta = 0.237$, $t = 2.767$) were positively associated with knowledge sharing. Therefore, *H1* and *H2* were accepted. In addition, business expertise ($\beta = 0.071$, $t = 1.133$) did not affect team social capital, indicating that *H3* was rejected, whereas technology expertise ($\beta = 0.256$, $t = 4.674$) showed a significant association with team social capital, with *H4* therefore accepted. Regarding the analysis model, communication effectiveness by business professionals was found to be positively related to team social capital ($\beta = 0.413$, $t = 8.097$), and communication effectiveness by technology professionals was found to have a significant and positive relationship with social capital ($\beta = 0.412$, $t = 7.513$). Therefore, *H5* and *H6* were supported. Regarding the relationship between knowledge sharing and team social capital, social capital had a positive relationship with knowledge sharing ($\beta = 0.512$, $t = 6.460$). Therefore *H7* was accepted. Regarding the association between knowledge sharing and project team performance, the coefficient of *H8* provided support ($\beta = 0.375$, $t = 3.614$). Likewise, team social capital had a significant positive relationship with project team performance ($\beta = 0.374$, $t = 3.337$). Therefore, *H9* was supported as well.

Table II.
Results of the measurement model analysis[a]

Variables	*AVE*	CR	Cr α	BEX	TEX	BCE	TCE	SC	SHV	SOT	TRU	KSR	PER	term	size	type
Business expertise	0.68	0.89	0.84	*0.82*												
Technology expertise	0.66	0.88	0.83	0.29	*0.81*											
Business communication effectiveness	0.79	0.94	0.91	0.22	0.36	*0.89*										
Technology communication effectiveness	0.78	0.93	0.91	0.31	0.20	0.33	*0.88*									
Social capital	0.56	0.95	0.94	0.50	0.37	0.63	0.64	*0.75*								
Shared vision	0.73	0.93	0.91	0.49	0.32	0.52	0.52	0.81	*0.86*							
Social ties	0.77	0.94	0.93	0.36	0.18	0.37	0.55	0.80	0.51	*0.88*						
Trust	0.83	0.96	0.95	0.42	0.39	0.63	0.56	0.90	0.60	0.56	*0.91*					
Knowledge sharing	0.77	0.95	0.94	0.54	0.43	0.48	0.41	0.69	0.60	0.45	0.67	*0.88*				
Performance	0.81	0.96	0.94	0.39	0.24	0.52	0.40	0.63	0.49	0.37	0.67	0.63	*0.90*			
Project term				0.15	0.15	0.11	0.12	0.09	0.15	−0.07	0.11	0.19	0.06	na[b]		
Project size				0.13	0.02	−0.12	−0.05	0.05	0.05	0.08	0.03	0.02	−0.05	0.12	na[b]	
Project type				−0.05	0.10	0.00	0.06	0.07	0.07	0.02	0.07	−0.01	0.01	−0.01	0.01	na[b]

Notes: [a]Square root of AVE on the diagonal (italicised); [b]AVE values are unavailable because these items are constructed as one item



Notes: ns, Insignificant at the 0.05 level. [a]Responses from business professionals; [b]responses from technology professionals; [c]responses from both.**$p < 0.01$; ***$p < 0.001$

Figure 1.
Results of the structural model analysis

The squared multiple correlations (R^2) for the endogenous constructs are presented in Figure 1. R^2 measures the percent of the variance explained by the independent constructs in the model. Independent constructs were found to explain a substantial portion of the variance in the dependent construct of project team performance ($R^2 = 47.1$ percent). It was also found that business and technology expertise and team social capital explained 55.7 percent of the variance in knowledge sharing. Team social capital explained 67.8 percent of the variance in technology expertise and communication effectiveness by business professionals and technology professionals. The changes in the variance explained in the model with the control variables were statistically insignificant.

To assess overall statistical fitness of the model, we adopted goodness-of-fit (*GoF*) index ($0 < GoF < 1$) which was proposed by Tenenhaus *et al.* (2004). *GoF* is the statistical index which focusses on the difference between the observed (or approximated) and predicted value by the model (Henseler and Sarstedt, 2013). *GoF* is derived from the geometric mean of the average communality and the average R^2 (Henseler and Sarstedt, 2013). Because communality is same as AVE in the PLS path modeling, *GoF* can be calculated by the equation $\left(GoF = \sqrt{\overline{AVE} \times \overline{R^2}}\right)$ (Wetzels *et al.*, 2009). Also, Wetzels *et al.* (2009) proposed the cut-off values of *GoF* as $GoF_{small} = 0.1$, $GoF_{medium} = 0.25$, and $GoF_{large} = 0.36$ depending on the effect size of R^2 (small: 0.02; medium: 0.13; large: 0.26).

From Table II and Figure 1, the average AVE (0.74) and the average R^2 (0.63) can be computed and, following the above *GoF* equation, the *GoF* of our model is obtained as a value of 0.68. This value of *GoF* exceeds 0.36, the cut-off value for large effect size of R^2, thus supporting our research model. But validating model based on the *GoF* should be careful, because the *GoF* is effective for group comparison or validating reflective indicators but limited for structural model comparison (Henseler and Sarstedt, 2013).

6. Conclusions and implications

The main objective of this study was to clarify how expertise and communication effectiveness operate as antecedents of social capital and knowledge sharing on ISD

project teams. In particular, this study investigated both business and technology professionals simultaneously. The research model and all of the hypotheses were confirmed, except for the effect of business expertise on team social capital. Conclusions and implications of the findings are discussed below.

6.1 Results and discussion

First, we empirically validated the effects of business and technology expertise on knowledge sharing. We found that both forms of expertise can significantly increase knowledge sharing within a project team. Second, regarding the effects of expertise on team social capital, the technology side showed a significant effect, but the business side did not. This suggests that business professionals (clients) consider their partners' (technology professionals') expertise for enhancing team social capital, but technology professionals do not consider their partner's expertise with regard to team social capital. Third, the hypotheses regarding the influence of communication effectiveness on team social capital were confirmed. Effective communication by both business professionals and technology professionals has a significant, positive effect on team social capital. Therefore, knowledge sharing and social capital are affected by both sides of the project team: business as well as technology professionals. This result empirically showed that the integrated effect of both sides of the project team corresponds to the characteristics of ISD project teams, where various business and technology professionals closely and frequently cooperate. However, the how expertise influences knowledge sharing differed. Technology expertise has not only a direct effect on knowledge sharing but an indirect effect by way of team social capital, while business expertise showed only a direct effect.

A fourth interesting finding is that team social capital significantly impacts knowledge sharing. In this study, knowledge sharing was affected by business and technology expertise and by team social capital. In particular, team social capital had a stronger influence on knowledge sharing than did expertise. Team social capital arises from effective communication among business and technology professionals. Therefore, building team social capital is important to enhance knowledge sharing between members, and to do so, effective communication and technology expertise are helpful.

Furthermore, in this research, team social capital was considered as a second-order construct with social ties (as a structural aspect), trust (as a relational aspect), and shared vision (as a cognitive aspect). These three aspects were found to be significant elements of team social capital. This is consistent with the model of social capital and its various aspects as proposed by Tsai and Ghoshal (1998).

Finally, both knowledge sharing and team social capital were found to have a positive influence on project performance. Team social capital has not only an indirect effect through knowledge sharing, but also a significant direct effect. This implies that social capital, as an intangible asset, can have various effects within a project team.

6.2 Theoretical and practical implications

This study investigated the effects of team members' expertise and communication effectiveness on team social capital, knowledge sharing, and team performance through structural equation modeling (SEM). Most notably, this study empirically proved that both business and technology professionals' expertise and effective communication are significant factors in ISD projects. To share knowledge, the level of technology

expertise as well as business expertise must be improved. In other words, business and technology professionals have to act as knowledge receivers as well as knowledge givers for their partners. Similarly, effective communication on both sides of the project team is important to build team social capital.

In general, technology professionals are regarded as important contributors to ISD projects, while business professionals are perceived to play a lesser role. The results of this study, however, suggest that business professionals, too, have important roles as participants in ISD projects. Therefore, business professionals' levels of expertise and effective communication have to be considered as important factors in IT service projects. These results reflect the complex nature of ISD project teams, where both business and technology professionals work toward common goals.

In particular, this study also showed a gap in the effects of expertise between business and technology professionals on team social capital. The expertise of technology professionals has a significant influence on team social capital, while the expertise of business professionals does not. Thus, it can be concluded that expertise from both sides of ISD project teams affect knowledge sharing but, in terms of social relationships, only expertise on the technical side influences the building of team social capital. It can be interpreted that there is an equal partnership for knowledge sharing, but distinctive roles as service providers and clients are exposed in terms of social aspects (i.e. team social capital).

Another major finding of this study is that both knowledge sharing and team social capital are necessary to improve project performance. Specifically, we need to focus more on team social capital, an intangible asset. The results show that team social capital improves ISD project team performance directly. At the same time, team social capital influences knowledge sharing and thereby indirectly contributes to improved project performance.

Based on these theoretical implications, several practical implications can be suggested. First, ISD project managers should consider the roles of business professionals and technology professionals. Managers have to let each side of the project team show its expertise to, and communication effectively with, the other side. Team members should perceive others' expertise and communication effectiveness on the basis of two-way relationships. The efforts of one party are not enough to reach the desired level of team performance.

Second, project managers should recognize the significance of team social capital and find ways to build it to enhance project team effectiveness. Team social capital plays direct and indirect roles in improving team performance and helps with the sharing of knowledge between team members. Based on each path coefficient of the SEM, the effect of team social capital is greater than the effect of knowledge sharing on team performance when considering both direct and indirect effects. Team social capital also has a stronger association with knowledge sharing than members' expertise. Therefore, for the sake of efficiency, managers and members of ISD project teams should concentrate more of their efforts on building team social capital than on knowledge sharing.

To build team social capital, effective communication and technology expertise deserve attention. To improve members' expertise, resources such as education and training are required, but communication is a social behavior that can be changed more easily than expertise. It is recommended that ISD project teams focus on effective communication to build team social capital and, ultimately, improve team performance. However, technology expertise should not be neglected for team social capital.

6.3 Limitations and future research

This study has several limitations. First, the unit of analysis was at the team level. Because responses were collected from two project leaders of each team, i.e., business and technology professionals, there is the possibility that project leaders were not always able to represent their own team. For instance, they may not have had enough information to provide answers regarding the levels of communication or social capital. Project members do not always share the same perceptions as their managers.

Consequently, it would be more appropriate if future studies involved additional members from each project team to enhance the reliability of the responses. Second, this study limited the scope of the team social capital concept to intra-team social capital; however, inter-team or inter-organization social capital may also be significant with regard to team performance and effectiveness. Therefore, it is necessary for future studies to consider external social relationships. In particular, as ISD projects are likely to involve various areas of expertise, it may be fruitful to investigate not only internal team knowledge sharing but also external factors involving the entire organization or business. Finally, future research should explore the constructs and relationships proposed in this research in more depth. For example, it may be beneficial to consider how the project phase influences team project performance.

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