2008

Understanding The Role Of Social Capital In Expertise Coordination In Information Systems Development (isd) Teams

Shih-Chieh Hsu
University of Central Florida

UNDERSTANDING THE ROLE OF SOCIAL CAPITAL IN EXPERTISE COORDINATION IN INFORMATION SYSTEMS DEVELOPMENT (ISD) TEAMS

by

SHIH-CHIEH HSU

B.S. Feng-Chia University, 1997
M.S. National Chung-Cheng University, 2002

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Management Information Systems
in the College of Business
at the University of Central Florida
Orlando, Florida

Summer Term
2008

Major Professor: James J. Jiang

ABSTRACT

Information system development (ISD) project is a knowledge-intensive teamwork process which requires members to coordinate their expertise to generate the final outcome. Breakdown or coordination and insufficient knowledge integration have been reported as critical factors which lead to ISD project failure. Most existing coordination literature focus on the effect of administrative coordination mechanisms toward project performance which hints that more efforts are needed to understand expertise coordination and explore ways to improve it. Addressing the above issues, two studies in this dissertation attempt to understand expertise coordination within the IS development team based on social capital perspective.

The first study, based on intention-behavior literature, knowledge management research, and Gerwin's (2004) coordination model, investigates relationships among willingness, competence, and actual expertise coordination. The relationships between expertise coordination and teamwork outcomes are also examined. The second study incorporates social capital theory and examines (1) dependencies among three dimensions of social capital and (2) linkage between social capital and expertise coordination. Data collected from more than five hundred information systems project team members was used to test the proposed hypotheses. The analysis results confirmed most of the hypotheses. This dissertation contributes to coordination, project management, and team mental model research through many perspectives. In each study, directions for management practice and future research are discussed.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GENERAL INTRODUCTION

High failure rate of information system development (ISD) project is observed by academic researchers and practical managers (Glaser, 2004; Guinan, Cooprider, & Faraj, 1998). Several major risks factors that might case project failed have been identified, such as environmental uncertainty, low user commitment, unclear requirement, high project complexity, difficult to planning and controlling development process, and uneasy team management (Wallace, Keil, & Rai, 2004b). Different approaches include development methodologies (e.g. prototyping and RAD) and management approaches (e.g. user participation and team management) have been proposed to counter possible risks and to increase the chance of success (Guinan et al., 1998). However, research results indicate that even after the presenting of CASE tools or structural methodologies, ongoing high failure rates imply the importance of human factors. Among these human factors, team management receives substantial attention.

The large scale and high complexity nature of contemporary information system architecture and limited capability of the human brain generate the need for teamwork. Most software development projects are accomplished by teams because those projects are too complicated for one person to finish or even understand. In an ISD team, heterogeneous knowledge, skills, and ability, e.g. communication skills, programming ability, business domain knowledge, project managing competency, and the ability to combine the above capability, are needed to accomplish the development task. People with different knowledge backgrounds are gathered together to form a team. Individual members contribute effort and knowledge to determine the requirement, design and develop the software, and implement it in the organization. For example, users and

stakeholders provide system requirement, system analysts transfer those requirements into system design, programmers code mapping functions, and then the developed system can be implemented for the users. These non-independent works require members to join their efforts and expertise to carry out the final product.

Forming an effective team is more than simply putting diversified people together. Research has pointed out that coordinating members to generate high quality teamwork is critical under high interdependence context. Members need to coordinate their expertise in a high quality manner to reduce potential risks and uncertainties during the teamwork process (Krackhardt, 1992). The final teamwork performance is largely determined by how well members can communicate and coordinate effectively (Akgun & Lynn, 2002; Hoegl & Gemuenden, 2001; Nidumolu, 1995, 1996). In fact, ISD team performance might be eroded when coordination breaks down or knowledge integration is insufficient (Walz, Elam, & Curtis, 1993a). In addition to administrative coordination which focuses on managing schedule and resources, several recent studies also highlight the importance of expertise coordination in ISD teams (Faraj & Sproull, 2000; Kanawattanachai & Yoo, 2007; Tiwana & McLean, 2005).

Gerwin (2004) proposed a model to understand coordination gap and performance. In this model, coordination gap is determined by needs to coordinate and actual coordination. Actual coordination is the function of willingness and competence. However, most empirical studies used actual behavior to represent coordination effectiveness and mixed willingness and competence with actual behavior. The power of explanation is limited under this condition. Without separating willingness and competence from actual behavior, real antecedents of actual behavior cannot be

determined. For example, what lead to willingness and what lead to competence? There is a need to empirically test Gerwin's (2004) model and study how those three constructs relate with each other. Furthermore, after the importance of expertise coordination has been emphasized, approaches to improve expertise coordination become salient.

Therefore, the purpose of this dissertation, with two separated but correlated studies, is to extend the coordination theory by examining the willingness and competence of coordination. Meanwhile several antecedents of expertise coordination based on social capital perspective are proposed and examined.

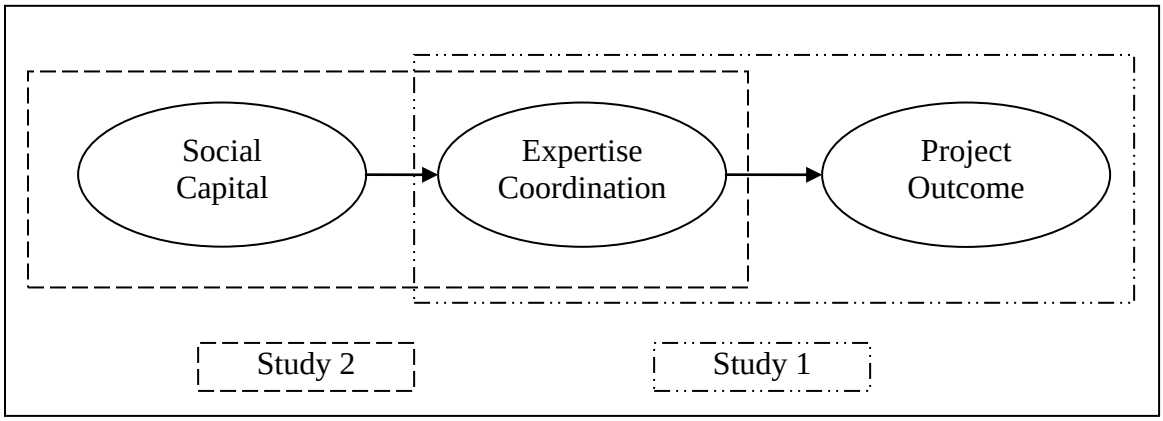


Figure 0.1 Conceptual Research Model

Study one:
Expertise Coordination in Information System Development team: The Willingness, Competence and Actual coordination

Administrative coordination received attention from many researches. Previous research focused on the effect of coordination mechanisms and its interaction with other variables, e.g. conflict and task interdependence (Andres & Zmud, 2002; Krishnan, Kriebel, Kekre, & Mukhopadhaya, 2000). In a knowledge intensive teamwork environment, expertise coordination is as important as administrative coordination (Faraj et al., 2000). Coordination is required among units of organization as well as among

team members for a large-scale and complex system. How well team members can coordinate diversified knowledge possessed by individuals determines the project performance.

Although prior research provides a foundation for understanding coordination in teamwork, there are some limitations. For example, ambiguous measurement weakens the power of research and need to be clarified before moving ahead. Based on the model proposed by Gerwin (2004), knowledge management literature, and the theory of planned behavior (TPB), this study attempts to understand the composition of expertise coordination and examine the relationships among those components. More specific, I study the effects of the willingness to coordinate, competence to coordinate, and their interaction on actual coordination behavior. In addition, the relationship between expertise coordination and teamwork outcome (both group and individual level) is also hypothesized.

By separating expertise coordination into three components and examining their relationships, more understanding has been developed for the correlation between the willingness and competence of coordination and its effects on the actual coordination behavior. Meanwhile, practitioners can also understand how project performance can be enhanced and how individual team members learn from the coordination of special expertise.

Study Two:
Understanding the role of social capital on expertise coordination in Information System Development Team

Past research has specified the relationship between expertise coordination and knowledge integration and project performance (Tiwana, 2004). However, methods to improve expertise coordination are not clear. There is a need to understand what can be done to enhance expertise coordination and, in turn, improve the teamwork outcome.

By viewing an ISD team as a knowledge system, social capital theory is adopted to understand possible antecedents of expertise coordination. I follow and advance Tsai et al.'s (2001) study to understand the relationship between different dimensions of social capital proposed by Nahapiet and Ghoshal (1998). Meanwhile, variables related to expertise coordination were added into each dimension.

In this study, social network density is used to represent the structural dimension of social capital. Cognitive dimension contains transactive memory system (TMS) and team mental model (TMM). Relational dimension includes team identity and trust. Network density is viewed as an antecedent of both cognitive and relational dimension. Intensive instrumental interaction among members improves team mental model and transactive memory system. Expressive interaction density is positively related to trust building. The emergence of TMS improves trust and identity. Finally, cognitive dimension social capital leads to the competence to coordinate and relational dimension social capital leads to willingness to coordinate.

Overall Contribution

Taking these two studies together, this dissertation contributes to coordination and project management research from several perspectives. First, we advance the coordination literature by separating expertise coordination into three constructs and

correlating them together based on intention-behavior perspective. The driving forces of actual coordination behavior include willingness and competence.

Research results highlight the importance of promoting willingness and competence for high quality teamwork. Some empirical implications toward member selection and member building within an ISD project team are also provided. In addition, project management research can also benefit through understanding the impact of expertise coordination on project and individual outcomes.

Second, based on Social Capital Theory, I discover some antecedents for expertise coordination. More specifically, group identity leads to willingness and both transactive memory systems and team mental model improve the competence to coordinate. Methods to enhance willingness and competence are also proposed.

Third, I also contribute to team mental model research by confirming previous research through data collected from the IS industry. Measuring complexity and huge data collection effort limit the development of TMM research in lab experiment or military sample. Subjective measuring approach and data from real industry provide a solid support for this TMM research.

General Introduction List of Reference

Akgun, A. E., & Lynn, G. S. 2002. Antecedents and consequences of team stability on new product development performance. ***Journal of Engineering & Technology Management***, 19(3/4): 263.

Andres, H. P., & Zmud, R. W. 2002. A contingency approach to software project coordination. ***Journal of Management Information Systems***, 18(3): 41-70.

Faraj, S., & Sproull, L. 2000. Coordinating expertise in software development teams. ***Management Science***, 46(12): 1554-1568.

Gerwin, D. 2004. Coordinating new product development in strategic alliances. ***Academy of Management Review***, 29((2)): 241-257.

Glaser, J. 2004. Back to basics managing IT projects. ***Healthcare Financial Management***, 58(7): 34-38.

Guinan, P. J., Cooprider, J. G., & Faraj, S. 1998. Enabling software development team performance during requirements definition: A behavioral versus technical approach. ***Information Systems Research***, 9(2): 101-125.

Hoegl, M., & Gemuenden, H. G. 2001. Teamwork quality and the success of innovative projects: A theoretical concept and empirical evidence. ***Organization Science***, 12(4): 435-449.

Kanawattanachai, P., & Yoo, Y. 2007. The impact of knowledge coordination on virtual team performance over time. ***MIS Quarterly***, 31(4): 783-808.

Krackhardt, D. 1992. The strength of strong ties: The importance of philos in organizations. ***Networks and Organizations: Structure, Form, and Action***: 216-239.

Krishnan, M. S., Kriebel, C. H., Kekre, S., & Mukhopadhaya, T. 2000. An empirical analysis of productivity and quality in software products. ***Management Science***, 46(6): 745-759.

Nahapiet, J., & Ghoshal, S. 1998. Social capital, intellectual capital, and the organizational advantage. ***The Academy of Management Review***, 23(2): 242-266.

Nidumolu, S. 1995. The effect of coordination and uncertainty on software project performance: Residual performance risk as an intervening variable. ***Information Systems Research***, 6(3): 191-219.

Nidumolu, S. 1996. A comparison of the structural contingency and risk-based perspectives on coordination in software-development projects. ***Journal of Management Information Systems***, 13(2): 77-113.

Santhanam, R., Guimaraes, T., & George, J. F. 2000. An empirical investigation of ODSS impact on individuals and organizations. ***Decision Supprot Systems***, 30(1): 51-72.

Tiwana, A. 2004. An empirical study of the effect of knowledge integration of software development performance. ***Information and Software Technology***, 46(13): 899-906.

Tiwana, A., & McLean, E. R. 2005. Expertise integration and creativity in information systems development. ***Journal of Management Information Systems***, 22(1): 13-43.

Tsai, W. 2001. Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. ***The Academy of Management Journal***, 44(5): 996-1004.

Wallace, L., Keil, M., & Rai, A. 2004. How Software Project Risk Affects Project Performance: An Investigation of the Dimensions of Risk and an Exploratory Model*. ***Decision Sciences***, 35(2): 289-321.

Walz, D. B., Elam, J. J., & Curtis, B. 1993. Inside a software design team: Knowledge acquisition, sharing, and integration. ***Communications of the ACM***, 36(10): 62-87.

STUY ONE: EXPERTISE COORDINATION IN INFORMATION SYSTEM DEVELOPMENT TEAM: THE WILLINGNESS, COMPETENCE, AND ACTUAL COORDINATION

1. Introduction

After decades of knowledge accumulation, the success rate of ISD project still keep challenging project managers. Approaches based on behavioral and technical perspectives were proposed to counter high failure rate and low team performance (Guinan et al., 1998). While technical perspective focuses on methodologies and development automation tools, behavior perspective emphasize the importance of experience, skills, and expertise. Behavioral issues become salient since failure rate remains high after the presenting of CASE tool, system reuse, and other communication technologies. Identified risks factors, including team management and user involvement, also highlight the importance of project management.

Complexity and growing scale of contemporary system also increase the need for team management. As the system complexity increases under high environmental uncertainty, people with heterogeneous expertise form a team and work together interdependently to accomplish project tasks (Krackhardt, 1992). Within ISD team, members exchange requirement, design, coding, implementation, and other special information to cope with uncertainty. However, forming an effective team is more than simply putting diversified people together. High quality teamwork is required to accomplish tasks and reduce potential risks during teamwork process (Hoegl et al., 2001).

High quality teamwork through coordinating members is critical under high interdependence since team performance is largely determined by communication and coordination effectiveness (Akgun et al., 2002; Hoegl et al., 2001; Nidumolu, 1995,

1996). ISD literature pointed out that project performance is eroded by coordination breakdown and insufficient knowledge integration (Walz, Elam, & Curtis, 1993b). Previous coordination studies in IS area focus on the effect of coordination mechanisms and its interaction with other variables, such as conflict and task interdependence (Andres et al., 2002; Kirsch, 2000). Following the coordination research stream, Faraj et al. (2000) distinguish expertise coordination from administrative coordination and emphasize its importance in ISD project. They view expertise coordination as the management of special skill or knowledge possess by individual in the team to fulfill knowledge and skill dependency.

Although these studies provide a foundation for followers to understand the teamwork process within ISD project team, their studies are not without limitations. For example, process, intention, competence, and effectiveness of coordination are mixed in one construct while measuring team coordination (Collins & Smith, 2006; Kraut, Fussell, Lerch, & Espinosa, 2004). Marks, Mathieu, and Zaccaro (2001) urged that some variables which describe cognitive, motivational, and affective states as team should be distinguished from actual interaction process (e.g. coordination). Those emergent states characterize *properties of the team that are typically dynamic in nature and vary as a function of team context, input, processes, and outcomes*. They represent the inputs or products of teamwork process but the interaction process. Constructs are contaminated while mixing the processes and emergent states together. Inconsequence, the ambiguous measurement weakens the power of research modeling the relationship between coordination and its antecedents and consequences. There is a need to reinvestigate the construction of coordination. For example, should willingness and competence be

separated from coordination behavior and, if so, how do these different constructs correlated with each other?

Gerwin (2004) proposed a model to understand the gap of coordination. In this model, performance is determined by the gap of coordination which refers to the difference between needs for coordination and actual coordination. The needs for coordination are determined by the uncertainty of external environments and the actual coordination is a function of willingness and ability to coordinate. By separating coordination into willingness, competence, and actual behavior, this model allows researchers to advance the understanding toward coordination. In addition, knowledge management literature also indicates that actual knowledge transfer behavior is affected by both cognitive (ability to transfer) and affective (willing to transfer) factors. Therefore, drawing on Gerwin's (2004) model and knowledge integration perspective, this study attempts to study how intention and competence affect actual expertise coordination behavior. We also hypothesize the relationship between willingness and competence, as well as how their interaction affects actual coordination. Furthermore, the relationship between coordination and teamwork outcomes are also examined.

After collecting data from 104 ISD teams with 525 members, we confirmed the hypothesized relationship. Including the introduction section, this paper is organized into six sections. In the second section, we reviewed the expertise coordination literature and developed hypotheses of this study. The third section describes the data collection methods. The fourth section provides data analysis result and discussion. Conclusion, limitations, and future search directions are provided in the fifth section.

2. Theory Background and Hypotheses

Coordination is defined as "*the integration of different parts of an organization to accomplish a collective set of tasks*" (Van de Ven, Delbecq, & R. Koenig, 1976). Coordination serves as an important factor for the success of system development. It affects project performance directly and indirectly through reducing residual risks (Nidumolu, 1995). Members in one team coordinate with each other trough communication and configuration management. For example, IS staffs and users coordinate with each other horizontally to resolve unclear requirements or project and function managers set the priority, schedule, and cost for each subsystem. With adequate coordination, project performance can be improved (Bensaou & Venkatraman, 1995; Clark & Fujimoto, 1991).

Recently, Faraj et al. (2000) pointed out that in addition to administrative coordination, expertise is one important resource in ISD teamwork and required to be well managed to achieve high project performance. Information system development is a knowledge-intensive work and knowledge is one of the core resources within ISD teams. Each ISD projects is an innovative work and it is difficult to fully apply accumulated experience to the new project. This innovative work environment requires members to exchange diverse knowledge to counter many never-faced problems. In addition, complexity and large-scale nature of contemporary information systems requires people with diversified and complementary expertise to form a team to accomplish the task (Kraut & Streeter, 1995). ISD process can be viewed as a teamwork process involves people who join their efforts and combine unique knowledge and expertise into final product. Since special expertise possessed by individuals are complementary and not

independent, expertise coordination is required to manage the dependencies of expertise resources (Faraj et al., 2000).

Expertise coordination can also be viewed as the process of knowledge integration and the outcome of knowledge sharing and combination through interaction among members (Okhuysen, 2001; Reich & Benbasat, 1996). Knowledge integration refers to "*the synthesis of individuals' specialized knowledge into situation-specific systemic knowledge*" (Alavi & Tiwana, 2002). It is a process of absorbing and blending knowledge from different sources (Tiwana, 2003). To be called integrated, at least two different pieces of special knowledge (or expertise) from different members should be put together to form new knowledge to accomplish a project task or solve a problem.

To carry out the final system, team need to solve a series of never-faced problems through the utilizing of knowledge and expertise. The integration of specialist expertise possessed by individuals to perform tasks is the essence of team capability (Grant, 1996). Knowledge integration capability can be viewed as how well individuals in one team can share their knowledge and then combine existing knowledge to form new knowledge. Teamwork outcome is largely determined by the team's knowledge integration capability.

In the study of coordination gap, Gerwin (2004) proposed that performance is determined by the gap of coordination which equals to the difference between coordination needs and actual coordination. Actual coordination is the function of willingness and competence to coordinate. Similar to Gerwin's model, factors that affect the effectiveness of knowledge transfer can be categorized into competent and motivational two major dimensions. In addition, intention-behavior theories also indicate

that intention, efficacy, and other variables determine the take place of actual behavior. We developed our research model based on the above three research streams. Figure 1 shows our research model.

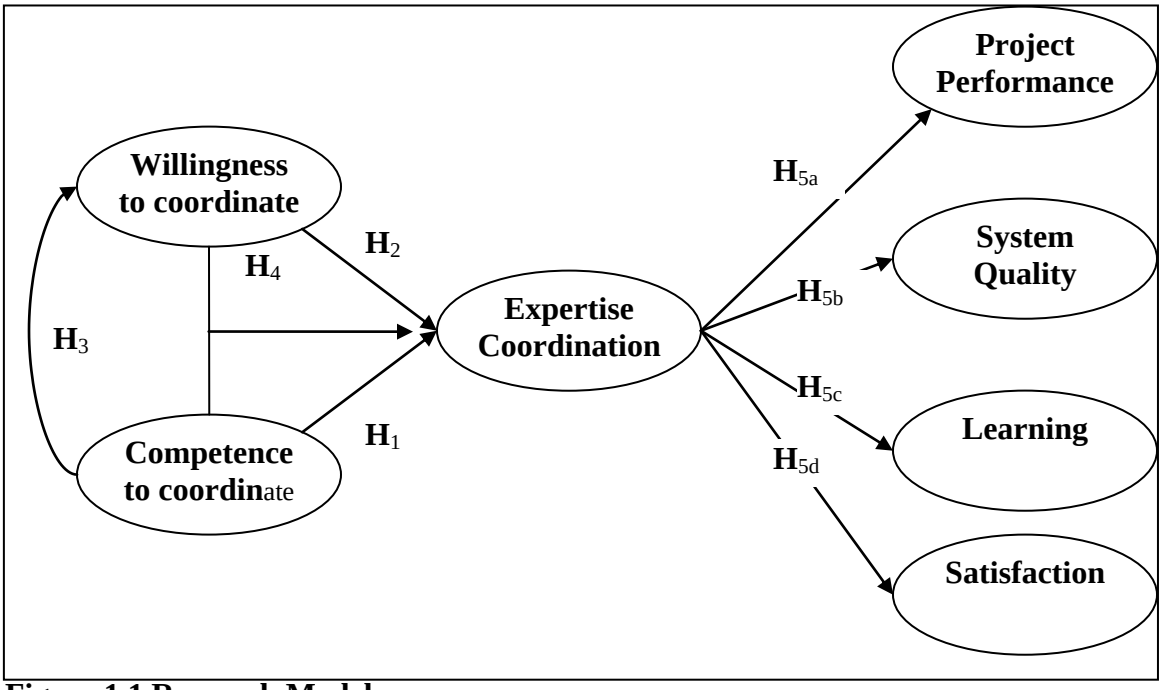


Figure 1.1 Research Model

2.1. Ability to coordinate

The first category, competence to coordinate, also refers to individual capability or knowledge barriers (Szulanski, 1996). Knowledge barriers mean the inability of senders and recipients to exchange knowledge. Transferring effectiveness is limited when senders are unable to express knowledge and receivers are unable to absorb knowledge (Hinds & Pfeffer, 2003; Ko, Kirsch, & King, 2005).

Before integrating knowledge, the knowledge requestor should be aware of and be able to access knowledge (Yli-Renko, Autio, & Sapienza, 2001). Transferring knowledge is impossible when one is unable to detect the location of knowledge. After detecting the

location of knowledge, it can be transferred from one to another through relating, encoding, communicating, decoding, and absorbing stages. In the relating stage, the knowledge owner attempts to relate the requestor's question to his or her existing knowledge. In the encoding stage, the knowledge owner uses his/her language to code the knowledge and then transfer it to the receiver. In the decoding and absorbing stage, receivers attempt to decode messages and make sense of the received knowledge according to existing knowledge in their minds. A lack in any of the above capabilities reduces the effectiveness of knowledge exchange.

The competence of expertise coordination can be represented by the ability to process information though exchange, integration, and utilization processes. The effectiveness of knowledge sharing and integration is constrained by the difference of sender and receiver's mental representation. Expertise can not be integrated from one to another party when the sender cannot express it, receiver cannot understand the received information, or confusion occurs when there is no common understanding (Szulanski, 1996).

The intention-behavior theories also have similar assertions. According to the theory of planned behavior, one's actual behavior is determined by his/her intention and perceived behavior control (Ajzen, 1991). Initially, perceived resource control refers to one's perceived difficulty in conducting certain behaviors. Later, Manstead & Eekelen (1998) distinguished internal control (from within the individual, such as ability) from external control (from outside of individual, such as task difficulty) and refer to internal control as "self-efficacy." Self-efficacy is defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types

of performances" (Bandura, 1986 p. 391). Self-efficacy is strongly correlated to intention and actual behavior (Armitage & Conner, 2001). The chance for actual behavior to take place is reduced when efficacy is low. Based on the knowledge management and theory of planned behavior, we hypothesize that

H_1: Actual coordination is positively associated with the competence to coordinate.

2.2. Willingness to coordinate

While cognitive limitation inhibits the ability to transfer knowledge, the motivational limitation suppresses the willingness to integrate knowledge (Hinds et al., 2003; Szulanski, 1996; Yli-Renko et al., 2001). A lack of willingness to share knowledge has been cited as one critical factor which erodes the effectiveness of knowledge exchange (Hislop, 2003; Stenmark, 2000). Willingness refers to the extent to which team members intend to share or exchange knowledge with other team members as well as to combine and utilize existing knowledge to solve problems. However, expertise is a competitive resource and, without strong motivation, people do not share it. Several reasons contribute to low willingness, e.g. afraid of losing power, interpersonal relationships, lack of incentives, lack of confidence, or unit climate, low reciprocity, conflict avoidance, uncertain reward of sharing, or insufficient trust (Disterer, 2001; Ipe, 2003).

Some empirical studies attempted to understand how to increase willingness (e.g. Bock, Zmud, & Kim, 2005; Ko et al., 2005; Lin et al., 2007). They categorized the antecedents of willingness into intrinsic and extrinsic dimensions. Intrinsic motivation

refers to needs that can be directly satisfied or to satisfaction that lies in the content of the activity itself, e.g. self-defined goals. On the other hand, extrinsic motivation refers to satisfaction that does not lie in the content of the activity itself. There are three types of extrinsic drivers, including economic, social-psychological, and sociological factors (Bock, Zmud, & Kim, 2005). The most salient example is monetary incentive. Empirical results show that intrinsic motivation is more effective toward knowledge transfer behavior as well as intention (Ko et al., 2005; Lin, 2007b).

The intention-behavior theories also indicate that actual behavior is determined by one's intention. The possibility that one conducts certain behavior is increased if the intention is high. Therefore, in addition to the ability to coordinate, willingness to integrate knowledge is a necessary condition for expertise integration to take place (Inkpen & Tsang, 2005; Tiwana & McLean, 2002; Tiwana et al., 2005).

H_2*: Actual coordination is positively associated with the willingness to coordinate.*

2.3. Willingness, competence, and actual coordination

While taking actual coordination as behavior, willingness to coordinate can be viewed as behavioral intention. TPB indicates that willingness is a function of efficacy or perceived behavior control (Ajzen, 1991). People are more willing to conduct certain behaviors when they can control resources or have high self-confidence. Lack of ability is one of possible causes of low motivation to share knowledge. The willingness to coordinate expertise with others decreases when one is unable to either capture or transfer knowledge or expertise to others. Individuals' perceived competence in coordinating with others determines their intention. Therefore, we hypothesize that

H_3: The willingness to coordination is positively associated with the competence to coordinate.

Knowing the location of knowledge and the way to access it forms the basis of sharing and transferring. Without this, a long information searching process inhibits knowledge integration and solution forming. However, having the competence to share and integrate is not necessarily linked to effectiveness. Effectiveness is also determined by team members' willingness to exchange and combine them. Many knowledge management systems have failed because organization members are not willing to share their tacit knowledge (Hislop, 2003). When people are not willing to share, exchange, or coordinate knowledge, only a few coordination activities can be observed.

On the other hand, coordination is difficult to be found when members intend but are unable to do so. To solve problems, team members first need to know what expertise is required, who possess those expertise and how to exchange and combine those expertise. A team with low competence, much time is wasted on understanding the problem, determining required expertise, and searching for those expertise. In addition, combination is impossible or in low efficiency when there is no common understanding or common language among members. Therefore, to have effective coordination, both competency and willingness should be at a certain level.

H_4: Coordination effectiveness is high when both competence and willingness to coordination are high.

2.4. Actual coordination and teamwork outcomes

Team effectiveness includes three major components: team performance, behavioral intention, and attitudinal perception (Cohen & Bailey, 1997). This study focuses on performance and attitudinal perception. First, team performance often

indicates how efficiently and effectively the team carries out the final outcome. Since project escalation, canceled before finished, and unusable system are quoted as top system development issues, a high performance ISD team should be able finish predefined tasks within budget and schedule.

Teamwork outcomes can be improved through effective expertise coordination (Faraj et al., 2000; Kraut et al., 1995). By sharing the detail information and specific design information, teams can develop the system effectively and efficiency. In a project team, performance is not just a function of having the "right" expertise on the team. Rather, expertise must be coordinated among team members (Faraj et al., 2000). With high level expertise coordination, people are able to explore the causes of problem, understand and evaluate assumptions, and develop new solutions to improve current practices (Lubit, 2001). The literature already pointed out the highly correlated relationship between expertise integration and new product performance, includes better development effectiveness, fewer defects, increased development efficiency, and innovated products (Tiwana et al., 2005; Tsai & Ghoshal, 1998; Yang, 2005). Therefore, the relationship between coordination effectiveness and team performance is hypothesized.

H_{5a}: Coordination effectiveness is positively related to team performance

System quality was used by many researchers to evaluate team performance. An ISD project requires all team members to contribute to the development and implementation process. Especially, they need to integrate their knowledge and expertise to discover problems, diagnosis causes, and generate solutions for problems. Teams are more creative when diversified knowledge and viewpoints are integrated. Moreover,

teams can have sufficient expertise resources to conduct experiments or try to improve the development process(Tiwana et al., 2005). In addition, the construction of a comprehensive view can be done by incorporate each individual's view point. Having a comprehensive understanding toward potential problems is an important antecedent of improving system quality. With this, user requirement can be satisfied and the system can be more reliable. Therefore, the relationship between expertise coordination and system quality is hypothesized.

H_{5b}: Coordination effectiveness is positively related to system quality.

Attitudinal perception, the second teamwork outcome, refers to the extent that members are satisfied with the teamwork process (Hackman & Morris, 1975). Teamwork process includes interpersonal interaction and task performing. Both positive and negative consequences may emerge. Conflicts and disagreement may lead to negative affective consequences. On the other hand, learning happens when ISD team members gain experience which can be used for future tasks from the development process.

Administrative or explicit coordination process increases team performance and members' satisfaction toward the development process (Andrea, 2001; Faraj et al., 2000; Kraut et al., 1995). By viewing expertise coordination as a knowledge exchange and an integration process, several impacts on individuals can be expected. *First*, people share, exchange, and integrate expertise when trust and identity are high. Cohesive working climate is an important antecedent of satisfaction. *Second*, members can obtain other people's expertise and learn from the integration process by observing how different expertise are gathered to generate solutions to solve problems. Empirical studies show

that high cooperation and teamwork quality lead to members' satisfaction and individual learning (Hoegl et al., 2001; Janz & Prasarnphanich, 2003).

H_{5c}: Coordination effectiveness is positively related to individual satisfaction.
H_{5d}: Coordination effectiveness is positively related to individual learning.

3. Method and Analysis

3.1.Data collection

The target respondents of this study are members of information system development project teams in Taiwan. As indicated above, coordination is one behavior performed by two or more people, data from all team members are required to satisfy the above condition. In this study, teams with 5 to 10 members were included only to avoid possible variances caused by team size. Those teams were solicited through author's personal social network. The following procedures were adopted for the collection.

We first contacted the key person in each team to introduce the purpose of this study and to obtain the permission of access. For those who are willing to participate in this study, an appointment was made for an advanced visit.

Second, packages with a big cover envelope and various numbers of small envelopes and instruments, according the number of team members, were delivered physically by the researcher or through the post system. The purpose of this study and the instructions for filling out the survey were provided. Each respondent received one envelope and one survey instrument and he/she kept the filled instrument in the given envelope to assure confidentiality. The contact person then collected those filled survey and returned it to researchers with the cover envelope.

Third, teams who still did not return the survey after four to six weeks were contacted to remind them to complete the survey. Fourth, a thank you letter was sent to those teams who finally returned the completed survey package.

Table 1.1 Demographic Analysis

Variables	Categories	#	%	Variables	Categories	%
Gender	Male	353	67.2%	**# of IS employee**	< = 10	22.5
	Female	169	32.2%		11-50	35.1
	Missing	3	0.6%		51-100	18.0
					101-500	18.9
					> 500	2.7
					Missing	2.7
Job position	Dept. Manager	27	5.14 %	**Avg. Team Size**	< = 7	70.3
	Project Leader	63	12 %		8-15	19.8
	Programmer	253	48.2%		16-25	2.7
	SA	84	15.7 %		> = 26	5.4
	NA/DBA	26	4.9%		Missing	1.8%
	Others	72	13.7 %			
Experience	Work	7.95	5.47	**Avg. Duration**	< 1 year	64.9
	Software	5.96	4.76		1~2 years	26.1
	Current company				2~3 years	5.4
		4.49	3.90		3~5 years	.9
					> 6 years	1.8
					Missing	.9
Industry	Manufacturer	55	52.88%			
	Finance	13	12.50%			
	Education	5	4.81%			
	Healthcare	12	11.54%			
	Others	19	18.27%			

Total sample size: 104 teams; 525 people

A total of 140 teams from the sampling pool showed their willingness to participate in this study. After two months, there were 110 teams that returned the survey package. Except for 6 teams that returned incomplete data which cannot be used for the following analysis, data from the rest of the 104 teams with 525 members were entered into Excel for advanced analysis. Among those respondents, more than two-thirds of them were male and around half of them were programmers. Their average work experience is 8 years, software development experience is 6 years, and have been at the current company for 4.5 years. For those companies, more than half of them have less

than 50 IS employee, the average team sizes are quiet small, and 65% of them have a short term project (less than 1 year).

3.2.Measures

All constructs were obtained from past research and were measured by multi-item scales. Because all respondents are located in Taiwan, a Chinese translated version was provided. The translation work was done by the researcher and validated by another Ph.D. candidate not involved in this study and fluent in both English and Chinese. In addition, the Chinese version was validated by one researcher and a couple of project managers with industrial experience. Some minor revisions were done before printing. The following describes the operational definition, measurement items, and sources of each construct.

Project team performance refers to how efficiently and effectively a team can complete the task. Efficiency means to accomplish the work within a schedule and a budget and effectiveness represents the quality of work. The measurement of performance includes a total of 7 items adopted from (Guinan et al., 1998; Jones & Harrison, 1996). Likert scales, with anchors ranging from 1 (strongly disagree) to 5 (strongly agree) were used for questions.

Individual success includes two major parts: work satisfaction and learning. Work satisfaction refers to team members' perception toward teamwork process. Learning refers to how well they learn from the team interaction process. A total of 8 items adopted from (Hoegl et al., 2001) will be used to measure individual success (4 for

learning and 4 for satisfaction). Likert scales, with anchors ranging from 1 (strongly disagree) to 5 (strongly agree) were used for questions.

System Quality refers to the extent that the system is stable and its ease of use. A total of 4 items adopted from (Wu & Wang, 2006) will be used to measure system quality. Likert scales, with anchors ranging from 1 (strongly disagree) to 5 (strongly agree) were used for questions.

Expertise coordination (coordination effectiveness) refers to the coordinated application of individually held specialist expertise in the accomplishment of tasks at the project level (Tiwana et al., 2005). Likert scales, with anchors ranging from 1 (strongly disagree) to 5 (strongly agree) were used for questions.

Willingness to coordinate expertise refers to the extent that members in one team are willing to exchange and integrate their unique expertise or knowledge to solve a faced problem. On the other hand, competence to coordinate refers to the extent that members in one team are able to exchange and integrate knowledge or expertise to form a solution to solve problems. A total of 7 items obtained from (Collins et al., 2006) were used to measure the willingness and competence of coordination. For each item, each subjective has to give two different answers, one for willingness and one for competence. Likert scales, with anchors ranging from 1 (strongly disagree) to 5 (strongly agree) were used for questions.

3.3.Measure validation

In this study, PLS-Graph Version 3.01 (Chin, 1994) was used to verify the measurement and test hypotheses. Using Ordinary Least Squares as its estimation

technique, PLS performs an iterative set of factor analysis and applies a bootstrap approach to estimate the significance (t-values) of the paths. A two steps approach includes measurement validation and path analysis was used for analysis.

Item reliability, convergent validity, and discriminant validity test are often used to test the measurement model in PLS. Individual item reliability can be examined by observing the factor loading of each item. A high loading implies that the shared variance between constructs and its measurement is higher than error variance (Hulland, 1999). Factor loading higher than 0.7 can be viewed as high reliability and factor loading less than 0.5 should be dropped.

Convergent validity should be assured when multiple indicators are used to measure one construct. It can be examined by item-total correlation (ITC), composite reliability, and variance extracted by constructs (AVE) (Fornell & Larcker, 1981; Kerlinger, 1986). To obtain the required convergent validity, ITC should not be lower than 0.3 and composite should be higher than 0.7. Moreover, if the AVE is less than 0.5, it means that the variance captured by the construct is less than the measurement error. Therefore, the validity of a single indicator and construct is questionable.

Table 1.2 Factor loadings and item-total correlation

Constructs	Items	Loadings	t-statistics	ITC
Willingness to Coordinate	WILL1	0.71	21.11	0.58
	WILL2	0.74	34.26	0.61
	WILL3	0.80	47.06	0.69
	WILL4	0.83	54.63	0.72
	WILL5	0.74	27.05	0.67
	WILL6	0.77	32.81	0.71
	WILL7	0.71	23.13	0.64
Ability to coordinate	ABT1	0.81	46.81	0.73
	ABT2	0.82	45.15	0.73
	ABT3	0.83	45.91	0.77
	ABT4	0.82	46.11	0.75
	ABT5	0.82	48.59	0.76
	ABT6	0.81	50.89	0.75

	ABT7	0.71	20.94	0.62
Actual coordinate	COOR1	0.67	24.52	0.56
	COOR2	0.71	24.39	0.59
	COOR3	0.75	27.44	0.63
	COOR4	0.79	38.97	0.67
	COOR5	0.70	23.92	0.58
	COOR6	0.74	38.86	0.63
	COOR7	0.62	17.66	0.50
Project Performance	PP1	0.75	30.90	0.66
	PP2	0.82	53.87	0.74
	PP3	0.82	54.70	0.74
	PP4	0.82	42.60	0.74
	PP5	0.72	27.93	0.63
	PP6	0.85	63.86	0.79
	PP7	0.75	31.66	0.65
Learning	Learn1	0.83	47.78	0.60
	Learn2	0.62	5.07	0.40
	Learn3	0.83	44.21	0.60
	Learn4	0.78	29.80	0.49
Satisfaction	Sat1	0.75	34.23	0.47
	Sat2	0.80	37.78	0.53
	Sat3	0.83	48.22	0.58

Discriminant validity focuses on testing whether the measures of constructs are different from each other (Messick, 1980). To have the required validity, the correlation between pairs of constructs should be lower than 0.90 and the square root of AVE should be higher than the correlation coefficients (Bagozzi, Yi, & Philips, 1991; Chin, 1988).

In this study, all indicators have loadings higher than 0.5, the AVE of all constructs are higher than 0.5, the minimum composite reliability is 0.8 for knowledge interdependence, and the item-total correlation are all higher than 0.3. Therefore, the reliability and validity of the measurement is assured.

Table 1.3 Composite Reliability and AVE

Constructs	Composite reliability	Average Variance extracted
Willingness to coordinate	0.91	0.58
Ability to coordinate	0.93	0.65
Actual coordinate	0.88	0.51
Project Performance	0.92	0.63
Knowledge interdependence	0.80	0.57
Satisfaction	0.84	0.63

Learning	0.85	0.56

3.4.Inter-rater reliability

Since data was collected from individual members in each team, before aggregating into a group level, there is a need to evaluate whether the data is appropriate to be aggregated. We use R_{wg} index to evaluate the appropriation of aggregating data in an individual level into group level. R_{wg}, proposed by James, Demaree, & Wolf (1984) was adopted to test the consensus or variation within group unit. R_{wg} compared the variability of a given variable with the expected variance. R_{wg} value, in general, ranges from 0 to 1. However, negative value may exist and the absolute value may exceed 1. High R_{wg} means high internal consistency for individuals in one group. The cut-off point for general practices is 0.7. A group that has a R_{wg} value less than 0.7 should be removed from the following analysis or should be replaced by measures in group level. In our data, although values of some variables in some group are less than 0.7, those groups are still retained for the following analysis because those values are close enough to 0.7 enough.

4. Result and Discussion

The following table shows the descriptive statistics and correlation matrix of aggregated data. For each variable, the minimum and maximum values, skewness (M3), and kurtosis (M4) are provided. Mean and standard deviation are used to represent the central and diversified dependency. The correlation matrix shows medium (0.23 to 0.44) correlations coefficient among variables.

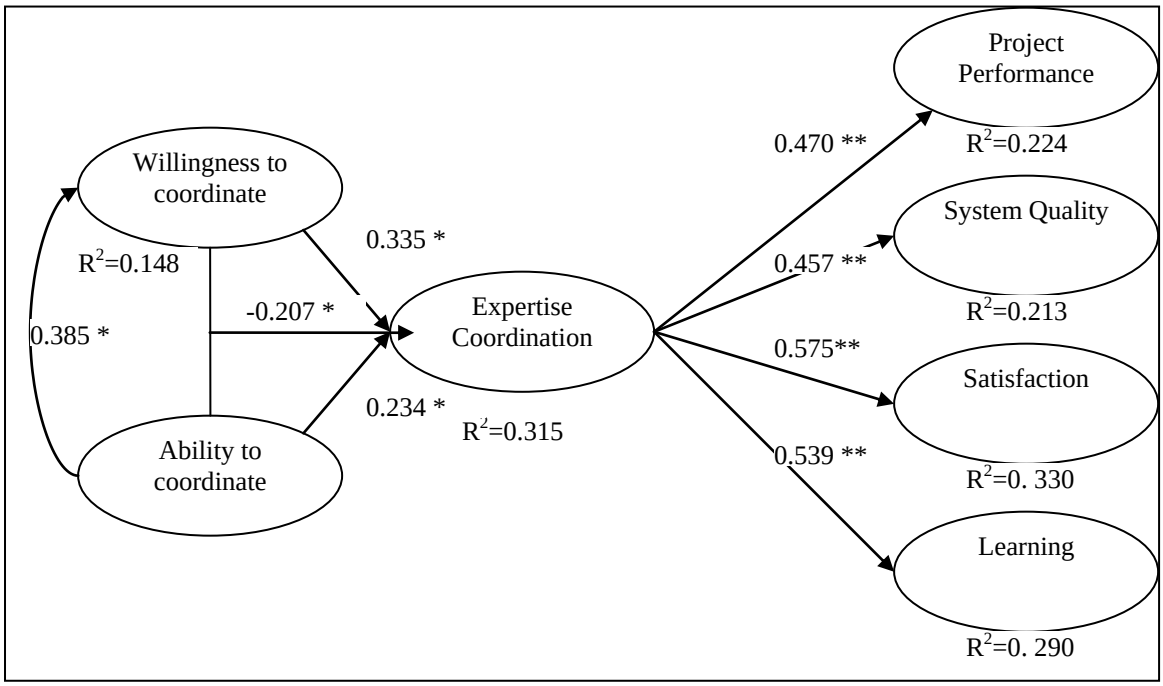
Table 1.4 Descriptive Statistics and Correlation Matrix

Variables	Mean	Std. Dev.	M3	M4		Correlation Matrix						
						W	C	P	A	K	L	S
Willingness	4.43	0.28	-0.43	-0.06		**0.76**						

Competence	3.56	0.42	-0.16	-0.10		0.27	**0.81**					
Actual Coordination	3.72	0.32	-0.40	0.17		0.33	0.33	**0.71**				
Project Performance	3.95	0.38	-0.33	0.20		0.15	0.35	0.45	**0.79**			
System Quality	3.65	0.39	-0.17	0.18		0.01	0.24	0.41	0.65	**0.75**		
Learning	3.32	0.31	-0.26	0.01		0.22	0.26	0.37	0.43	0.41	**0.79**	
Satisfaction	4.03	0.35	-0.34	-0.13		0.18	0.24	0.60	0.38	0.39	0.56	**0.75**

Note:
M3: Skewness; M4: Kurtosis
the diagonal line of correlation matrix represents the square root of AVE

Figure 2 shows the analysis result for hypotheses testing.[1] As hypothesized, actual coordination improves project and individual level outcomes. Actual coordination is a function of willingness, competence, and the interaction of these two. Meanwhile ability to coordinate has a positive effect on willingness to coordinate. The result also confirmed past studies showing that the willingness to coordinate knowledge is more important than the capability in determining the extent of knowledge coordination (Roper & Crone, 2003).



[1] The analysis result by using project performance and system quality answered by project managers is showed in appendix.

Figure 1.2 Path Analysis

Although the interaction effect is significant, the negative coefficient deviates from expected. To explore the implied meaning of the negative coefficient, we divided our sample into high and low levels according to willingness and ability. Within each block, the mean and standard deviation of actual coordination are provided (see Table 5). Actual coordination is higher when both willingness and ability are high, and vice versa. When one is low and the other is high, middle level coordination is observed. The tests of main effects are significant at 0.01 levels but the interaction effect is only significant at 0.1 levels.

We then combined high ability – low willingness and low ability – high willingness, and compared the combined result with high-high and low-low conditions. Table 6 shows the one-way AVNOA result of these three groups. Null hypothesis is rejected which means the mean of these three groups are not all the same. Furthermore, the post hoc tests indicate that both (2) and (3) are significantly higher than (1) but there is no significant difference between (2) and (3). This indicates that, when both willingness and competence are low, the actual coordination is difficult to take place. However, different from what we expected that members coordinate only when willingness and ability are high, members start to coordinate when either willingness or ability is high, members start to coordinate. A plausible explanation is that we measured actual behavior instead of coordination effectiveness. When willingness is high, people start to coordinate even it may not in a high quality manner. On the other hand, when competence is high, problem solving pressure forces people to coordinate even in a low willingness condition.

Table 1.5 ANOVA Test – 4 Blocks

	Low willingness (n=52)	High willingness (n=52)	(Low – High) willingness
High ability (n=53)	3.77 (0.31)	**3.86 (0.27)**	***P=0.006 *****
Low ability (n=51)	3.51 (0.31)	3.79 (0.25)	
(Low – High) ability	***P=0.004 *****		Interaction effect **P = 0.092**$^{+}$

Table 1.6 ANOVA Test – 3 Blocks

	(1) Low-Low (n=34)	(2) Low-High & High-Low (n=37)	(3) High-High (n=33)	Difference
ANOVA	3.51 (0.31)	3.79 (0.28)	3.86 (0.27)	p < 0.001 **
Post Hoc	(1) – (2) **	(2) – (3)	(1) – (3) **	

4.1 Implication for researchers

This study contributes to teamwork research from several perspectives. First, for behavior research, we applied TPB in team level analysis. Past TPB research focused on individual intention and actual behavior. In this research, data collected from individuals were aggregated into the team level. Coordination is required to obtain better team performance. It cannot be done by one only and requires two or more people to unify their efforts. This team level study confirmed the impact of willingness (intention) and competence (efficacy) on actual coordination behavior. This indicates that by viewing the team as the unit of action, the intention-behavior concept can be used to explain how the aggregation of individual intention and efficacy can affect group level behavior. Future research can advance this concept by including the group-level constraints and facilitators. For example, complex tasks requires members to exchange or combine expertise which may serves as facilitator of expertise coordination. Perceived other members' willingness may also affect individual's attitude toward knowledge exchange.

Second, part of Gerwin's (2004) model has been confirmed by collecting data from ISD teams. In this study, we show that, theoretically, the measurement of expertise (or knowledge) coordination or integration should be separated into three different sections: named willingness, competence, and actual coordination. By linking these three constructs together, the importance of willingness and competence on actual coordination has been demonstrated. In addition, willingness is more important than competence since willingness has a higher coefficient. It is critical for the project leader to motivate member to engage in knowledge intensive teamwork processes, e.g. contribute and integrate their expertise and knowledge during IS development.

On the other hand, having competence is important for taking action as well as promoting motivation to take action. Although the direct impact of competence is lower than the impact of willingness on actual behavior, building competence can enhance expertise coordination both directly and indirectly through willingness. Higher competence results in stronger willingness and strong willingness promotes actual behavior.

Third, separating coordination into three parts helps researchers to identify the actual antecedents of each dimension. With the identification of different antecedents, both researchers and practitioners know what can be done to encourage the willingness to coordinate and the competence to coordinate. Academic researchers may comprehend the picture by exploring potential antecedents for willingness and competence based on various organizational, behavioral, psychological, or small group-based theories. For example, willingness to coordinate expertise can be promoted through reducing interpersonal uncertainty, providing extrinsic motivations to encourage action taking,

enhancing intrinsic motivations to direct members, and exercising transformational leadership to improve team cohesiveness. On the other hand, expertise coordination competence can be enhanced through information work communication, building standardized procedures for coordination, socialization, or providing adequate training to improve task skills and competence to coordinate expertise (Gerwin, 2004). Having shared understanding toward faced tasks and knowing the location of expertise is also required for efficient expertise coordination (Nonaka, 1994; Mitchell, 2006).

Finally, we confirmed past research and showed that expertise coordination leads to better teamwork outcome. Project performance and system quality are increased when expertise coordination increases. In addition, by exchanging and combining expertise and knowledge, learning takes place and satisfaction increases.

4.2 Implication for practitioners

There are two major implications for practitioners from this study. First, past research indicated that, in addition to technical factors, human factors play an important role in ISD teamwork. Project performance is largely affected by member composition and selecting appropriate members is a critical job for project managers (Gorla & Lam, 2004). Managers should include members with high motivation to coordinate their expertise. A personality testing tool, e.g. MBTI, can be used to understand whether people are suitable for teamwork.

Many project managers select team members based on their technical competence only. Although technical competence is critical for individual performance, teamwork performance depends on how well members can put their efforts together to carry out the

final product. In a knowledge intensive teamwork context, a preferred member should have certain capability to work with others as well as a willingness to work with others. Project managers should take this into consider while selecting project members.

Second, if given members do not possess the required capability or lack willingness to work with others, managers should take certain interventions to enhance their capability and willingness. Although willingness is relative important, capability should also be emphasized because willingness tends to be higher when competence is high. For example, team building serves as a useful tool in building a shared mental model and facilitating information processing within the team. Project leaders can also concentrate on improving the teamwork climate so that people are willing to contribute their expertise to teamwork when motivation is low. When insufficient capability is found, leaders should find methods to enhance it, e.g. providing adequate training, so that expertise and knowledge can be transferred, absorbed, and integrated.

5. Conclusions, limitations and future research

An ISD project is a set of knowledge intensive activities which required individuals with diversified knowledge background to contribute their unique knowledge to solve problems and carry out the final product. This study highlighted the importance of expertise coordination by showing its impact on group- and individual-level outcome. We also demonstrated that actual coordination behavior is a function of willingness and competence to coordinate.

This study is not without limitations. First, the data was collected from one Asian country only. Implications generated from this study should be carefully interpreted and more studies should be conducted before applying the results to other contexts or settings.

Second, to control possible effect caused by sample size, teams with only 5 to 10 members were included. Project performance or coordination activities may be different in larger teams (more than 10 people). For example, project complexity increased as the team size increased. Meanwhile, the need and difficult to coordinate are increased as well. Compared with simple projects, performance is difficult to maintain for a complicated project.

Third, this is a cross-sectional study. The actual coordination may also have impact on the willingness and ability to coordinate in the future. For example, when members integrate their knowledge to solve problem successfully, members may generate more confidence and efficacy toward conducting similar activities in the future. If conflicts or difficulties emerged during coordinating process, negative emotional consequences may be generated and inhibit the willingness to coordinate in the future.

Finally, in this study, the need to separate expertise coordination has been shown. However, to advance understanding of these issues within ISD team, several critical points must be clarified. First, a longitudinal study should be conducted to understand how the actual coordination activities can reversely affect the willingness and competence to coordinate. Second, to understand what can be done or what should have been done to improve the willingness and competence to coordinate, future research should, based on different theories, explore potential antecedents. For example, certain managerial interventions, e.g. empowerment or rewards, should be able to improve the

willingness to coordinate expertise or integrate knowledge within the team. Team building or similar activities can be adopted to enhance members' abilities to integrate or coordinate expertise by promoting members' understandings toward each other.

Study 1List of Questionnaire

Willingness/ Competence to coordinate

Will1/Abt1 Exchange and combine information, knowledge, and skills with others
Will2/Abt2 Freely share hard-to-find knowledge or expertise with other members
Will3/Abt3 Exchange and combine ideas with others to solve problems or create opportunities
Will4/Abt4 Share my expertise with others to bring new projects of initiative to fruition
Will5/Abt5 Give other people performance feedback on our team
Will6/Abt6 Continually assess our product in order to get the feedback we need to improve it
Will7/Abt7 Acknowledge it when a member does extra work

Expertise Coordination

Coor1 Members of this team synthesize and integrate their individual expertise at the project level
Coor2 Members of this team span several areas of expertise to develop shared project concepts
Coor3 Members of this team can clearly see how different pieces of this project fit together
Coor4 Members of this team competently blend new project-related knowledge with what they already know
Coor5 Members provide feedback to each other
Coor6 Members keep reviewing progress to obtain the way to improve the performance
Coor7 Other people tell me how good my performance is

Project Performance

PP1 Ability to meet project goals
PP2 Expected amount of work completed
PP3 High quality of work completed
PP4 Adherence to schedule
PP5 Adherence to budget
PP6 Efficient task operations
PP7 Maintain high work morale

System Quality

SQ1 Easy to use
SQ2 User friendly
SQ3 Stable
SQ4 Response time

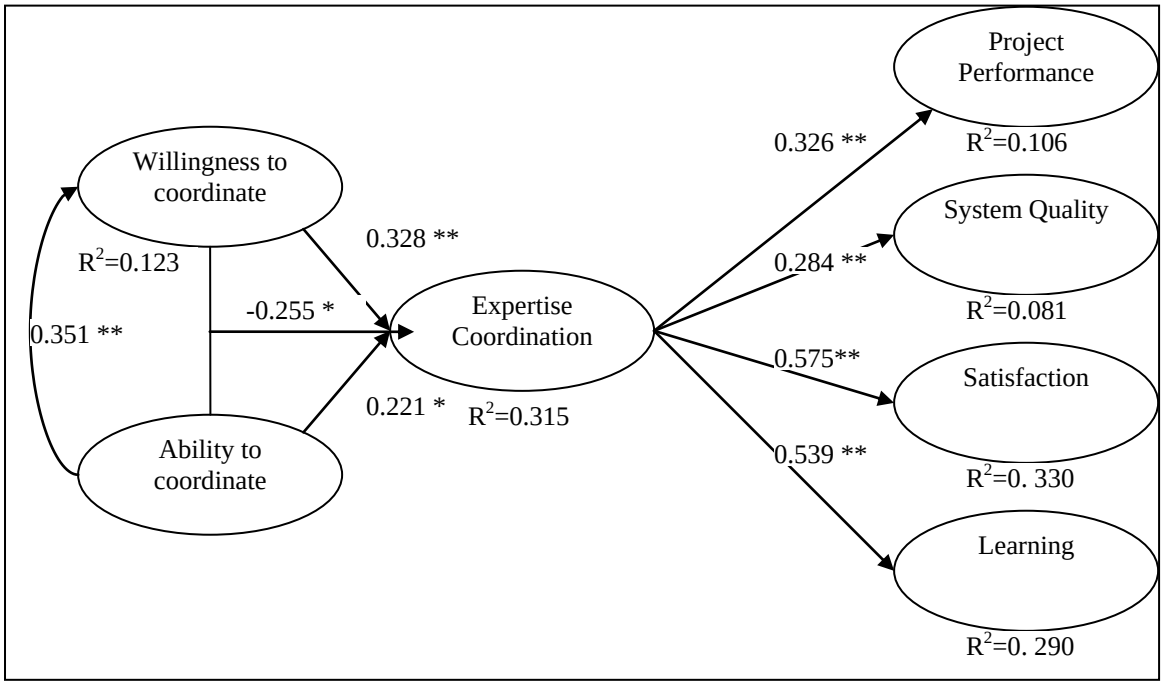
Satisfaction

Sat1 I could draw a positive balance for myself overall
Sat2 I would like to do this type of collaborative work again
Sat3 Teamwork promotes me professionally

Learning

Learn1 I have gained from the collaborative project
Learn2 I am able to acquire important know-how through this project
Learn3 Teamwork promotes me personally
Learn4 I learned important lessons from this project

Study 1 Another analysis result



Study 1 List of Reference

Ajzen, I. 1991. The theory of planned behavior. ***Organizational Behavior and Human Decision Processes***, 50(2): 179-211.

Akgun, A. E., & Lynn, G. S. 2002. Antecedents and consequences of team stability on new product development performance. ***Journal of Engineering & Technology Management***, 19(3/4): 263.

Alavi, M., & Tiwana, A. 2002. Knowledge integration in virtual teams: The potential role of KMS. ***Journal of the American Society for Information Science & Technology***, 53(12): 1029.

Andrea, B. H. 2001. Cognitive interdependence and convergent expectations in transactive memory. ***Journal of Personality and Social Psychology***, 81(6): 1080.

Andres, H. P., & Zmud, R. W. 2002. A contingency approach to software project coordination. ***Journal of Management Information Systems***, 18(3): 41-70.

Armitage, C. J., & Conner, M. 2001. Efficacy of the theory of planned behaviour: A meta-analytic review. ***British Journal of Social Psychology***, 40(4): 471-499.

Bagozzi, R. P., Yi, Y., & Philips, L. 1991. Assessing construct validity in organizational research. ***Administrative Science Quarterly***, 36: 421-436.

Bandura, A. 1986. ***Social Foundations of Thought and Action***.

Bock, G.-W., Zmud, R. W., & Kim, Y.-G. 2005. Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. ***MIS Quarterly***, 29(1): 87-111.

Chin, W. W. 1988. Issues and opinion on structural equation modeling. ***MIS Quarterly***, 22(1): vii-xvi.

Chin, W. W. 1994. ***PLS-Graph Manual Version 2.7***. Calgary, AB.: University of Calgary.

Cohen, S. G., & Bailey, D. E. 1997. What Makes Teams Work: Group Effectiveness Research from the Shop Floor to the Executive Suite. ***Journal of Management***, 23(3): 239-290.

Collins, C. J., & Smith, K. 2006. Knowledge exchange and combination: The role of human resource practices in the performance of high-technology firms. ***The Academy of Management Journal***, 49(3): 544-560.

Disterer, G. 2001. Individual and Social Barriers to Knowledge Transfer. ***Proceedings of the 34th Annual Hawaii International Conference on System Sciences (HICSS-34)-Volume 8-Volume 8***.

Faraj, S., & Sproull, L. 2000. Coordinating expertise in software development teams. ***Management Science***, 46(12): 1554-1568.

Fornell, C., & Larcker, D. 1981. Evaluating structural equation models with unobservable variables and measurement error. ***Journal of Marketing Research***, 18(3): 39-50.

Gerwin, D. 2004. Coordinating new product development in strategic alliances. ***Academy of Management Review***, 29((2)): 241-257.

Gorla, N., & Lam, Y. W. 2004. Who should work with whom? building effective software project teams. ***Communications of the ACM***, 47(6): 79-82.

Grant, R. M. 1996. Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. ***Organization Science***, 7(4): 375-387.

Guinan, P. J., Cooprider, J. G., & Faraj, S. 1998. Enabling software development team performance during requirements definition: A behavioral versus technical approach. ***Information Systems Research***, 9(2): 101-125.

Hackman, J. R., & Morris, C. G. 1975. Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. ***Advances in experimental social psychology***, 8: 45-99.

Hinds, P. J., & Pfeffer, J. 2003. Why organizations don't" know what they Know": Cognitive and motivational factors affecting the transfer of expertise. In M. S. Ackerman, V. Pipek, & V. Wulf (Eds.), ***Sharing Expertise : Beyond Knowledge Management*** 3-26. Cambridge, Mass.: MIT Press.

Hislop, D. 2003. Linking human resource management and knowledge management via commitment. ***Employee Relations***, 25(2): 182-202.

Hoegl, M., & Gemuenden, H. G. 2001. Teamwork quality and the success of innovative projects: A theoretical concept and empirical evidence. ***Organization Science***, 12(4): 435-449.

Hulland, J. 1999. Use of partial lest squares (PLS) in strategic management research: A review of four recent studies. ***Strategic Management Journal***, 20(2): 195-204.

Inkpen, A. C., & Tsang, E. W. K. 2005. Social Capital, Networks, and Knowledge Transfer. ***The Academy of Management Review***, 30(1): 146-165.

Ipe, M. 2003. Knowledge sharing in organizations: A conceptual framework. ***Human Resource Development Review***, 2(4): 337.

James, L. R., Demaree, R. G., & Wolf, G. 1984. Estimating within-group interrater reliability with and without rater bias. ***Journal of Applied Psychology***, 69: 85-98.

Janz, B. D., & Prasarnphanich, P. 2003. Understanding the antecedents of effective knowledge management: The importance of a knowledge-centered culture. ***Decision Sciences***, 34(2): 351-384.

Jones, M. C., & Harrison, A. W. 1996. IS project team performance: An empirical assessment. ***Information & Management***, 31(2): 57-65.

Kerlinger, F. N. 1986. ***Foundations of behavioral research***: Wadsworth Publishing Co Inc.

Kirsch, L. J. 2000. Software project management: An integrated perspective for an emerging paradigm. In R. W. Zmud (Ed.), ***Framing the domains of IT management: Projecting the Future Through the Past***: 285-304. Cincinnati, OH: Pinnaflex.

Ko, D. G., Kirsch, L. J., & King, W. R. 2005. Antecedents of knowledge transfer from consultants to clients in enterprise system implementations. ***MIS Quarterly***, 29(1): 59-85.

Krackhardt, D. 1992. The strength of strong ties: The importance of philos in organizations. ***Networks and Organizations: Structure, Form, and Action***: 216-239.

Kraut, R. E., Fussell, S. R., Lerch, F. J., & Espinosa, A. 2004. Coordination in teams: evidence from a simulated management game. ***Working Paper***.

Kraut, R. E., & Streeter, L. A. 1995. Coordination in software development. ***Communications of the ACM***, 38(3): 69-81.

Lin, H. F. 2007. Effects of extrinsic and intrinsic motivation on employee knowledge sharing intentions. ***Journal of Information Science***, 33(2): 135.

Lubit, R. 2001. The keys to sustainable competitive advantage Tacit knowledge and knowledge management. ***Organizational Dynamics***, 29(3): 164-178.

Manstead, A. S. R., & Eekelen, S. A. M. 1998. Distinguishing between perceived behavioral control and self-efficacy in the domain of academic achievement intentions and behaviors. ***Journal of Applied Social Psychology***, 28(15): 1375-1392.

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. 2001. A temporally based framework and taxonomy of team processes. ***Academy of Management Review***, 26(3): 356-376.

Messick, S. 1980. Test validity and the ethics of assessment. ***American Psychologist***, 35(11): 1012–1027.

Nidumolu, S. 1995. The effect of coordination and uncertainty on software project performance: Residual performance risk as an intervening variable. ***Information Systems Research***, 6(3): 191-219.

Nidumolu, S. 1996. A comparison of the structural contingency and risk-based perspectives on coordination in software-development projects. ***Journal of Management Information Systems***, 13(2): 77-113.

Okhuysen, G. A. 2001. Structuring change: Familiarity and formal interventions in problem-solving groups. ***Academy of Management Journal***, 44(4): 794.

Reich, B. H., & Benbasat, I. 1996. Measuring the linkage between business and information technology objectives. ***MIS Quarterly***, 20(1): 55-81.

Roper, S., & Crone, M. 2003. Knowledge complementarity and coordination in the local supply chain: Some empirical evidence. ***British Journal of Management***, 14(4): 339-355.

Santhanam, R., Guimaraes, T., & George, J. F. 2000. An empirical investigation of ODSS impact on individuals and organizations. ***Decision Supprot Systems***, 30(1): 51-72.

Stenmark, D. 2000. Leveraging tacit organizational knowledge. ***Journal of Management Information Systems***, 17(3): 9-24.

Szulanski, G. 1996. Exploring internal stickiness: Impediments to the transfer of best practice within the firm. ***Strategic Management Journal***, 17(1): 27-43.

Tiwana, A., & McLean, E. 2002. Knowledge integration and individual expertise development in e-business project teams: prom the pod to the peas. ***Proceedings of the 2002 ACM SIGCPR conference on Computer personnel research***: 120-123.

Tiwana, A., & McLean, E. R. 2005. Expertise Integration and Creativity in Information Systems Development. ***Journal of Management Information Systems***, 22(1): 13-43.

Tsai, W., & Ghoshal, S. 1998. Social Capital and Value Creation: The Role of Intrafirm Networks. ***The Academy of Management Journal***, 41(4): 464-476.

Van de Ven, A. H., Delbecq, A. L., & R. Koenig, J. 1976. Determinants of coordination modes within organizations. ***American Sociological Review***, 41(2): 322-338.

Walz, D. B., Elam, J. J., & Curtis, B. 1993. Inside a software design team: knowledge acquisition, sharing, and integration. ***Communications of the ACM***, 36(10): 63-77.

Wu, J. H., & Wang, Y. M. 2006. Measuring KMS success: A respecification of the DeLone and McLean's model. ***Information & Management***, 43: 728-739.

Yang, J. 2005. Knowledge integration and innovation: Securing new product advantage in high technology industry. ***Journal of High Technology Management Research***, 16(1): 121?135.

Yli-Renko, H., Autio, E., & Sapienza, H. J. 2001. Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. ***Strategic Management Journal***, 22(6-7): 587-613.

STUDY TWO: UNDERSTANDING THE ROLE OF SOCIAL CAPITAL ON EXPERTISE COORDINATION IN INFORMATION SYSTEM DEVELOPMENT TEAM

1. Introduction

Expertise coordination and knowledge integration explain a certain level of information system development (ISD) project performance and team creativity. How to enhance expertise coordination within the project team is a critical issue for project leaders. Prior study has shown that expertise coordination can be better understood by separating willingness and competence from actual behavior. To have a clear map of expertise coordination, a step that needs to be taken is to understand what should be done first to enhance expertise coordination within a team and, in turn, promote the final performance.

By viewing an ISD team as a knowledge system, social capital theory can be used to explain how unique knowledge and skills are structured, coordinated, and exchanged through daily interpersonal interaction. Social capital theorists view interpersonal relationship as one kind of capital. They attempt to explain how well one can access resources possessed by other people through the interpersonal relationship. Social capital has been shown to have an effect on building other forms of capital, e.g. human capital and intellectual capital (Coleman, 1988; Nahapiet et al., 1998).

Theoretically, social capital can be categorized into three dimensions: structural dimension represents the real interaction among team members, cognitive dimension represents the resources that provide shared meaning and understanding among members, and relational dimension represents the relational outcome, such as trust and identity

(Nahapiet et al., 1998). Different dimensions of social capital have specific effects on different dimensions (access, expectancy, motivation, and capability) of intellectual capital creation. Although empirical study have attempted to link those three dimensions to resource exchange and combination directly, not all direct effects were found (Tsai et al., 1998). Their study raised two important questions. First, what variables should be included in each dimension? Second, should all dimensions link to exchange or coordination effectiveness directly or though other variables?

In this study, we propose that, in addition to shared goal and vision, transactive memory systems (TMS) and team mental model (TMM) should be included in the cognitive dimension while conducting group level analysis. We also attempt to answer, based on the first purpose, what dimensions and how those dimensions of social capital lead to the willingness and competence of knowledge or expertise coordination. Hence, ***the purpose of this study is to understand the relationship between social capital and intra-team coordination; more specifically, what dimensions of social capital lead to the willingness of coordination and what dimensions of social capital lead to the competence of coordination.***

The result benefits coordination research by verifying the above relationship through explaining what can be done to promote the actual coordination through enhancing the willingness and competence to coordinate with each other. This study also contributes to team mental model literature by understanding the relationship between social network and team mental model forming since most empirical team mental model studies use lab experiments. This will be one of the few field studies to collect data from non-student or military teams.

This paper is organized into five sections. Following this introduction section, we first review the social capital theory and each dimension of social capital. We then developed hypotheses based on the literature. Data collection methods and analysis results are showed in the third and fourth section. Finally, discussions are provided and conclusion is made.

2. Background and Hypotheses Development

Social capital concept originates from sociology and political science. Before this concept was proposed, researchers viewed human life as the consequence of capital in different forms, e.g. economical and cultural capital. Social capital provides a new idea that the interpersonal relationship generated from social interaction is one kind of capital which has benefit toward individuals and community.

Originally, it is defined as "*the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition*" (Bourdieu, 1986). Unlike other forms of capital which based on what one has, social capital inheres in the structure of relations between actors and among actors (Coleman, 1988). Researchers assert that the owned social capital allows one to access resources, which he or she doesn't have, through the connection with other people. There are two elements in social capital: social relationship and the amount (and quality) of resources. The first one serves as the basis for individuals to access resources possessed by their associates. The second one represents how much resource one can obtain through the social relationship.

Coleman (1988) defined social capital as "*a variety of entities with two elements in common: they all consist of some aspect of social structures, and they facilitate certain action of actors- whether person or corporate actors-within the structure*". Social capital is productive, making possible the achievement of certain ends that in its absence would not be possible. Social capital theory is adopted by organizational researchers to explain behaviors of individuals, outcome of group work, and competition among organizations or countries.

While studying the relationship between social capital and intellectual capital, Nahapiet et al. (1998) viewed social capital as "*the sum of actual and potential resources embedded with, available through, and derived from the network of relationship possessed by an individual*" (p.243). They also categorized social capital into three dimensions, based on Granovetter (1992)'s study, and each dimension contains a number of variables. The three dimensions are: structure dimension refers to the structure of social network, cognitive dimension refers to the representation of team members, and relational dimension refers to the emotional and affective part.

Nahapiet et al.'s definition and classification was adopted by researchers who are interested in understanding the relationship between social capital and various concepts, e.g. knowledge management system usage (Kankanhalli et al., 2005, Bock et al., 2006) , knowledge acquisition and knowledge exploitation (Yli-Renko et al., 2001), knowledge integration in ERP implementation team (Newell et al., 2004, 2001), knowledge integration in cross-fuctional project team (Huang and Newell, 2003), knowledge sharing (Swat and Kinnie, 2003), and resource exchange (Tsai, 2001). Most of them viewed those three dimensions as parallel. The only exception, Tsai (2001), studied the dependencies

of these three dimensions and their impact on resource exchange behavior. Following this research stream and Tsai's mindset, we advance this research stream by modifying the content, exploring their dependencies, and linking them with expertise coordination. In the following section, hypotheses are developed based on the concept of each dimension.

2.1. Structural dimension - Social Network Analysis

Structural dimension of social capital depicts the properties of the structure of a social network and the relation between actors (Granovetter, 1992). Social network analysis is very useful to understand the structure of a social network and how it affects individual or network's performance. This approach allows the researcher to explore the linkages between actors, including who is linking to whom and how to reach one from another by which path (Burt, 1992). Through drawing the connecting map in the group, researcher can study impacts of the structure of a social network, e.g. density, centralization, or connectivity, and individual's position in the network, e.g. strength of ties and centrality. In this study, density was selected to represent network structure and the following provides more discussion about density.

Social network density represents the frequency and intensity of interaction within a social network. It refers to the extent that the members are connected with each other. The calculation of density is done by calculating the ratio of the detected number of links to the maximum possible number of links. For example, the density of a community with 5 nodes in the network and 5 relationships is 0.5. The maximum possible relationships with 5 nodes are 5*(5-1)/2=10.

Network density is used to represent team cohesiveness by social network researchers. As cohesive teams have higher performance, high density is expected to have a positive effect on team performance. Two perspectives can be used to explain the relationship between network density and team performance. First, *social influence perspective* indicates that in human life, individuals are influenced by those who they contact directly. The density of interaction reflects directly on the frequency, intensity, and proximity (Burt, 1987). The influence from others increased as the level of interaction increased. Interpersonal influence leads to perception convergence for people within a social network (Burkhardt, 1994; Galaskiewicz & Burt, 1991; Rice & Aydin, 1991a). The network effects model shows that views and behaviors of individuals in a social network will converge if they are exposured to others in the networks (Friedkin & Marsden, 1994). People in a highly cohesive group interact with each other and affect, and are affected, by whom they interact with (Burt, 1987).

Second, *resource exchange perspective* indicates that various knowledge (as a resource) should be exchanged and the density of advice network increased as the need for knowledge exchange increased (Athanassiou & Nigh, 1999). The more group members engage in information sharing, the more nonredundant information is likely to be shared. Building connections with other team members increases one's visibility and reduces social loafing which erodes team performance (Wagner, 1995). A sense of accountability is built when people interact with each other frequently to share teamwork information. In sum, through the reciprocal information exchange process, the team should benefit from greater information sharing, a stronger sense of accountability, greater agreement of expectation, and less tendency to engage in social loafing. Within

the ISD team, information exchange helps members understand each other's role. Taskwork information sharing facilitates the forming of common understanding and reduces individual-group goal conflict.

Social network researchers view social network density as group cohesion. A team with high density social network means a cohesive team. Group researchers identified two types of group cohesion: task cohesion and social cohesion (Mullen & Copper, 1994). Task cohesion refers to the extent to which the team is united and committed to achieving the work task. Social cohesion refers to the degree to which team members like socializing together (Carless & De Paola, 2000). These two cohesion types map to two network ties in social network research: expressive and instrumental ties. Expressive tie refers to the affective level of relationships, such as friendship network or enemy network. Instrumental tie refers to people obtain task-related information, advices, and resources necessary to accomplish task from others.

2.2. Cognitive dimension

Cognitive dimension in social capital refers to resources that provide shared meaning or representation among actors within the same social network. Nahapiet et al. (1998) proposed that shared language and code and shared narratives are important for the emergence of intelligent capital. Shared language and code refers to the symbol used in communication. However, using the same symbol does not guarantee that two parties have the same understanding and shared narrative, refers to the same way of thinking developed through common experiences or background, is needed. In here, to depict a more completed picture, team mental models (TMM), knowledge structure held in

common, and transactive memory systems (TMS), knowledge of information distribution within a team, are included to show how common understanding affects knowledge coordination within the project team.

2.2.1 Team Mental model

A TMM "*refers to an organized understanding of relevant knowledge that is shared by team members*" (Klimosi & Mohammed, 1994). With shared understandings, team members have similar ways of thinking while facing problems. Having TMMs means that team members have compatible, but not identical, mental models (Cannon-Bowers, Salas, & Converse, 1993). Team mental models include three major components: the form, content, and function (Klimoski & Mohammed, 1994). The form of mental model refers to the structure of knowledge in mind. The content of team mental model includes taskwork and teamwork (Cannon-Bowers et al., 1993). The function of team mental modes includes description, explanation, and prediction. Description is describing the current status and the content of each concept; explanation is giving reasons why different concepts are linked together; prediction is expecting the future status according to current status. Researchers treat the content of team mental models as major dimension of team mental models.

It is believed that team members have shared understanding, explanation, and expectation impact teamwork positively. The major consequences of TMM include task performance, team process, and emotional outcomes. For the task performance, Blickensderfer, Cannon-Bowers, and Salas (1997) concluded that shared knowledge is a necessary condition for team performance. Team mental model can enhance team performance through improving team process (Mathieu, Goodwin, Heffner, Salas, &

Cannon-Bowers, 2000; Mathieu, Heffner, Goodwin, Cannon-Bowers, & Salas, 2005). With TMM, team process can be improved through better information processing, communication, more accurate expectations, and predictions, consensus, similar interpretations and, better coordination (Cannon-Bowers & Salas, 2001; Orasanu & Salas, 1993). A TMM also leads to motivational outcomes, such as cohesion, trust, morale, collective efficacy, and satisfaction with the team.

Socialization is the basis for forming common language, symbol, and understanding. The purpose of social interaction is to exchange information. People seek information or advice from others and provide information or advice to those who come to them. This reciprocated dyadic interaction and communication process allows people to exchange their individual goals, opinions toward certain issues, and perceptions with specific person in the group (Pastor, Meindl, & Mayo, 2002). People adjust their thinking by comparing the coming and existing information. A shared vision about the task is consequently formed with frequently exchanging knowledge and opinions (Krackhardt, 1992). Empirical study shows that people have similar attitudes or make similar decisions with those who they interact with or communicate with frequently (Burkhardt, 1994; Krackhardt, 1992; Rice & Aydin, 1991b; Umphress, Labianca, Brass, Kass, & Scholten, 2003). Moreover, reducing the interaction among team members leads to low shared mental model (Levesque & Wilson, 2001). Therefore, we hypothesize that

H_{1a}: Instrumental social network density is positively associated with TMM development.

2.2.2 Transactive memory systems

Although TMM literature claims that having common knowledge structure is critical for team performance, it doesn't mean that all team members should have an

identical knowledge structure. Instead, in addition to the shared knowledge, members should possess some unique information (Banks & Millward, 2000; Kozlowski, Gully, Salas, & Cannon-Bowers, 1996). Transactive memory systems support this idea by asserting that each team member possesses unique knowledge required for performing task as well as the information about who knows what in the team. When team members need knowledge or expertise that they don't have, they know where to access it through utilizing TMS. By viewing other team members' knowledge as one's external memory system, team performance can be improved.

Wegner, Giuliano, & Hertel (1985) first proposed the concept of transactive memory systems to described the fostering of common memory through a closed relationship. They used the husband-wife relationship to illustrate how a couple can cooperate to accomplish one task by having complementary knowledge and knowing each other's expertise. Wegner extended this concept to the group level and indicated that, in a team, a TMS is a collective system for encoding, storing, and retrieving information that is distributed across members (Wegner, 1995; Wegner et al., 1985). Two empirical studies show that face-to-face communication, common experience, or training may be useful for developing a TMS (Liang, Moreland, & Argote, 1995; Moreland, 1999). All those interventions have a common feature: interaction. TMS grows from repeated interaction among team members (Liang et al., 1995; Moreland, 1999).

In a group, people answer questions that they are familiar with and, when they do not possess related knowledge, direct questions to other people who know how to answer them. Through the information seeking process, people learn the strength and weakness of members. After performing several tasks together, TMS increased as members

acknowledge each other's competence. In ISD projects, if one person shows strong ability on one network programming, then other people may start relying on him when they face network programming problem. If other people receive useful advice from that person, they may stop developing their capability on network programming.

The development of TMS includes communication and keeps updating of information one has about knowledge others have. The interaction process within the team allows individuals to reveal their own knowledge to other members. High quality teamwork allows members to keep tracking other team members' expertise, compare it with TMS in their mind, and update it if difference is found (Mohammed & Dumville, 2001). Therefore, the following relationship is hypothesized.

H_{1b}: Instrumental social network density is positively associated with TMS development.

2.3. Relational dimension

Relational dimension of social capital theory describes interpersonal relationships developed during the interaction process and how those ongoing relationships affect an individual's attitude and behavior (Granovetter, 1992). An individual's attitude and behavior can be predicted by internalization, compliance, and identification (Kelman, 1961). Internalization refers to having the same value as another person or group, compliance refers to driven by reward or punishment, and identification refers to the desire to be associated. Internalization belongs to the cognitive dimension and has been discussed in the previous section. Compliance can be viewed as part of trust and accompany with identification should be included in relational dimension.

2.3.1 Trust

Trust is a concept in which one expects others will not perform opportunistic behaviors. Mayer, Davis, and Schoorman (1995) defined trust as *" the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustier, irrespective of the ability to monitor or control that other party*" (p 712). It can also be defined as the expectation shared by team members that they will meet their commitments to each other (Dasgupta, 1988). From social exchange perspective, the emergence of trust is based on the exchange behavior and the exchange behavior is contingent on reactions from exchange partners (Blau, 1986). In a social network, relationship is built through the exchange of material goods and non-material goods. Actors modify their attitude toward each other based on the results of exchange.

Trust has received attention in many social science research areas (e.g. (Barney & Hansen, 1994; North, 1990; Sabel, 1993; Wilson, 2000). Worchel (1979) categorized trust into three groups. *First*, trust is defined as a belief, expectancy, or feeling. Personality theorists tried to understand people's trust proposition under different contexts. *Second*, sociologists and economists view trust as an institutional phenomenon which exists within and between institutions. They also study how individuals put trust toward institutions. *Third*, trust can be viewed as the expectation of the other party in a transaction. Individual and group level studies tried to explain the emergence and disappearing of trust in interpersonal relationship. Consistent with past team research (Akgun et al., 2002; Kanawattanachai et al., 2007), the third approach – trust in interpersonal relationship – is adopted in this study.

Shapiro, Sheppard, and Cheraskin (1992) identified three kinds of trust in work relationships. *Deterrence-based trust* exists when people do what they say they will do. If one fails to maintain what they say, losing the relationship happens as punishment. The second type of trust is *knowledge-based trust* which refers to the sufficient knowing of others so that their behaviors become predictable. Information obtained and exchanged through regular communication and interaction increases the predictability. The third type of trust refers to the *mutual understanding and appreciation* of each other's needs and wants. Based on this type of trust, one member can be confident that other members in the same group will act in the way fitting to his interest.

Trust is built through social interaction and trust emerged as the frequency of interaction increased (Gabarro, 1978; Granovetter, 1985; Gulati, 1995; Krackhardt, 1992; Nelson, 1989). People tend to distrust strangers or those who they are not familiar with. Familiarity comes from intensive interaction and leads to trust in co-workers or other parties (Anderson & Narus, 1990; Kramer, Brewer, & Hanna, 1996a; Lin, 2007a). There are two types of interaction within the team: direct and indirect interaction. The first approach provides immediate understanding toward other people through direct information exchange. The indirect information can be obtained from the interaction with people who have contacting history with the actor. Reputation spreads out faster through more intensive social interaction. Both of them help the development of trust. Therefore, the following is hypothesized.

H_{2a}: Expressive social network density of one project team is positively associated with team trust development.

2.3.2 Identity

Two major theories were used in social identity research. First, developed by Tajfel and Turner (1979), social identity theory is developed to understand how individuals identify themselves as members of certain social groups. By considering both psychological and sociological aspects, this theory serves as a basis for understanding why and when individuals identify themselves as members of certain groups and, then, adapt their behavior to fit into those groups and adopt shared attitudes with people in other groups. On the other hand, self-categorization theory explains how individuals categorize themselves into one group from a cognitive perspective (Turner, 1987). Based on this theory, researchers deal with leadership, social influence, group polarization, social attraction, and group cohesiveness.

Social identity theory is adopted to explain the effect of group identity on group performance. This is done by attempting to understand conditions that prompt conflicts, cooperation, social exchange, and social status (Hogg & Reid, 2006a). Empirical results show that group identity is directly and positively related to group performance. For example, Cunningham and Chelladurai (2004) found a positive relationship between group identity formation and affective oriented group performance indicators (e.g. satisfaction and viability). Group identity also leads to better group performance by mitigating some negative group processes. For example, diversified background increases interpersonal conflict and, in turn, undermines team performance (Jehn, 1995). Team identity can mitigate the negative effect resulting from diversity by reducing task and affective conflict among team members (Cunningham et al., 2004; Mortensen & Hinds, 2001). Forming group identity also reduces self-interest behavior of individuals when

personal and group goals are different (Eckel & Grossman, 2005b; Zdaniuk & Levine, 2001).

High density social networks represent frequent interaction among team members. Team cohesiveness is one source of group identification (Henry, Arrow, & Carini, 1999). Team members, with intensive interaction and high affective bonded, generate high identification toward the team (Kerr & Kaufman-Gilliland, 1994). For example, providing information to others helps building the sense of belonging to one unit (Wenger, 2000), p14). Voight and Callaghan (2001) pointed out that to form a high identity team, some management interventions are recommended. For example, team building, which increases interaction among team members, is critical for building team identity for sport team. (Moore, Kurtzberg, Thompson, & Morris., 1999) found that building rapport, the expressive ties, among individuals is critical for group performance and lacking of group identification is associated with low found rapport. Peteraf & Shanley (1997) proposed that the greater the density of a network the greater the likelihood that a strong group identity will develop in a strategy group.

Different from Tsai et al. (1998) who hypothesized that unit centrality leads to trust and trustworthiness, this study focuses on the group level and tries to build the relationship between the group structure dimension and the group relational dimension. Therefore, we hypothesize that

H_{2b}: Expressive social network density of one project team is positively associated with team identity development.

2.4. The linkage between cognitive and relational

Trust emerges when two parties have compatible goals or objectives (Sitkin & Roth, 1993). However, this relationship between trust and shared goal is not supported by some empirical studies (Tsai et al., 1998). In this study, we argue that a shared goal is not strong enough to form mutual trust. Although people who share the same goal will not take action to harm the mutual benefit, a clear or shared understanding toward the task and team members is required. People within a unit work together more effectively when they have common values and beliefs, because common values and beliefs provide the harmony of interests that reduce or erase the possibility of opportunistic behavior (Morgan & Hunt, 1994; Ouchi, 1980). More specifically, people need to know others' attitude of the target task, how others perceive the importance of each task and the sequence to accomplish each task. Therefore, we hypothesize that

H_{3a}: Team mental model is positively associated with trust development.

Trust is the basis for coordination or cooperation since people need to trust each other's knowledge, skills, and ability so that they can really coordinate and integrate knowledge to solve the problem (Jarvenpaa, Knoll, & Leidner, 1998). This means that people need to know the strength and weakness of each other and whether the other member is reliable (Shapiro et al., 1992). The reliability of source is critical for exchanging and integrating knowledge and expertise. Trust is formed when two know each other better. Therefore, TMS leads to better trust.

H_{3c}: Transactive memory system is positively associated with trust development.

Social identity related theories indicate that people tend to categorize themselves to the group with similar features. Physical features include race, age, and gender. Psychological features include staying in the same organization, living in the same location, or even having the same thinking. For example, people within one practical community pursue a shared expertise and they develop a common identity through finding meaning together (Wenger, 1999). A "shared mental state" is the prime components for forming group identity (Rosenman & Handelsman, 1990). When one find he/she has similar understanding with others toward the goal, the way to achieve this goal, and how to interact with each other to achieve this goal, team identification increases. In addition to common understanding, people view themselves the same as those who they are familiar with. Familiarity comes from two sources: knowing others and knowing others know you. High TMM refers to having similar knowledge structure and having TMS refers to knowing each other's knowledge content. Therefore, the following statements are hypothesized.

H_{3b}: Team mental model is positively associated with team identity development.

H_{3d}: Transactive memory system is positively associated with team identity development.

2.5. From social capital to expertise coordination

Trust is a key aspect of relational capital and facilitator of collective action (Coleman, 1990). People are more willing to engage in exchange and cooperation activities when trust level is high (Kramer & Tyler, 1996b; Ring & van de Ven, 1994; Ring & Ven, 1992). With collective trust, team members can rely on each other and, therefore, trust facilitates cooperation and coordination (Kramer et al., 1996a).

The knowledge management literature also indicates that trust facilitates knowledge sharing or affects the willingness of tacit knowledge sharing (Coleman, 1988; Gee-Woo, Zmud, Young-Gul, & Jae-Nam, 2005; Koskinen, Pihlanto, & Vanharanta, 2003; Wasko & Faraj, 2005). Trust serves as a bidirectional facilitator between sender and receiver of knowledge transfer. When senders have trust on receivers, they tend to be more open to the receiver. Therefore, team members are expected to share highly sensitive information with others when trust is in place (Nahapiet et al., 1998; Ouchi, 1980). On the other hand, when receivers have trust on senders, they tend to accept and utilize knowledge from senders. Trust also affects receivers' perception of incoming knowledge. When knowledge is received from trustworthy senders, receivers shorten the verification process. This speeds the knowledge transfer within the team and makes knowledge integration easier. In contrast, without trust, receivers tend to spend more time and effort in verification or even abandon the knowledge and search for it from other sources. In addition, source credibility also affects receiver's perceived importance of knowledge. When knowledge comes from a credible source, people tend to believe the knowledge is relevant and important.

H_{4a}: The willingness to coordinate expertise is positively associated with trust

Social identity theory serves as the basis for explaining how group identity can affect group performance through better cooperation and social exchange (Hogg & Reid, 2006b). According to this theory, simply categorizing one into a group is enough to increase his or her willingness to cooperate with others in the same group (Tajfel, 1981). Identity can also increase psychological commitment toward the group and promote organizational citizenship behavior, e.g. helping other group members and willingness to

participate (Haslam, Bastian, Bain, & Kashima, 2006; Haslam, Powell, & Turner, 2000; Tyler, 1999). Above evidence shows that group identity promotes a psychological state which encourages team members to perform positive behaviors, such as cooperative behavior or engagement in group activities (Tyler & Blader, 2003).

Social dilemma research also points out that, in a team, people may behave in a way to maximize joint outcomes (social orientation), to maximize the partner's outcome (altruism), or to maximize their own outcome without any concern for partners (individualism). A collective social identity increases the altruism of the members and altruism promotes the willingness to cooperate with others (Kollock, 1998). Brewer & Kramer (1986; 1984) demonstrated that when people have been identified as members of a team, they are more willing to exhibit personal restraint in a commons dilemma. In contrast, individuals are more likely to behave selfishly (e.g. free-riding and shirking) if identity is unknown or unstable and if there is no recollection or record of past interaction (Axelrod, 1984; Eckel & Grossman, 2005a; Zdaniuk et al., 2001). Therefore, its impact on the willingness to coordinate is hypothesized.

H_{4b}: The willingness to coordinate expertise is positively associated with group identity

Lack of overlap in understanding for people who possess extremely different knowledge may harm the knowledge integration capability (Tiwana et al., 2005). Integration capability is determined by socialization capability which refers to "*the ability of the team to produce a shared ideology that offers members an attractive identity as well as convincing interpretations of reality*" (Boer, Van den Bosch and Volberda, 1999). To enhance this ability, a coherent set of beliefs, highly shared values, a common language, and a strongly agreed-upon kind of appropriate behavior are needed. The

shared language, code, and mental model reduce the cost for communication and coordination and enhance the capability to combine knowledge (Nahapiet et al., 1998). To be capable of effective information exchange, team members must hold common understanding toward key elements of task. Several research streams confirmed the importance of common understanding. For example, knowledge management literature indicates that effective knowledge exchange requires certain levels of overlap (Nonaka & Takeuchi, 1995). Group support systems literature points out that common information serves as the basis for exchanging unique information. Team mental model literature also shows that TMM leads to better performance through better teamwork process, e.g. communication and coordination efficiency (Marks, Zaccaro, & Mathieu, 2000; Mathieu et al., 2000; Mathieu et al., 2005). Team members must share a common view on what should be done to construct the system, how those activities should be organized, and how this system can fit into the context (Kraut et al., 1995).

H5a: Competence to coordinate is positively associated with TMM

In addition to mutual shared understanding, expertise is difficult to be integrated without transactive memory (Alavi et al., 2002). Although shared language and understanding play an important role in having efficient communication and reduce the cost of coordination, integration is impossible without knowing the location of required knowledge and the way to access it. Transactive memory system (TMS) theory indicates that effective knowledge exchange and combination requires team members to know who possesses what knowledge first (Austin, 2003; Liang et al., 1995; Wegner, 1987). With TMS, organization can match task, knowledge, and people (Brandon & Hollingshead, 2004). IPO-model based research also concludes that group TMS enhances group process

and performance. A better solution can be generated easily by identify the location and use of required knowledge (Hollingshead, 1998; Moreland, 1999). Therefore, we hypothesize that

H5b: Competent to coordination is positively associated with TMS

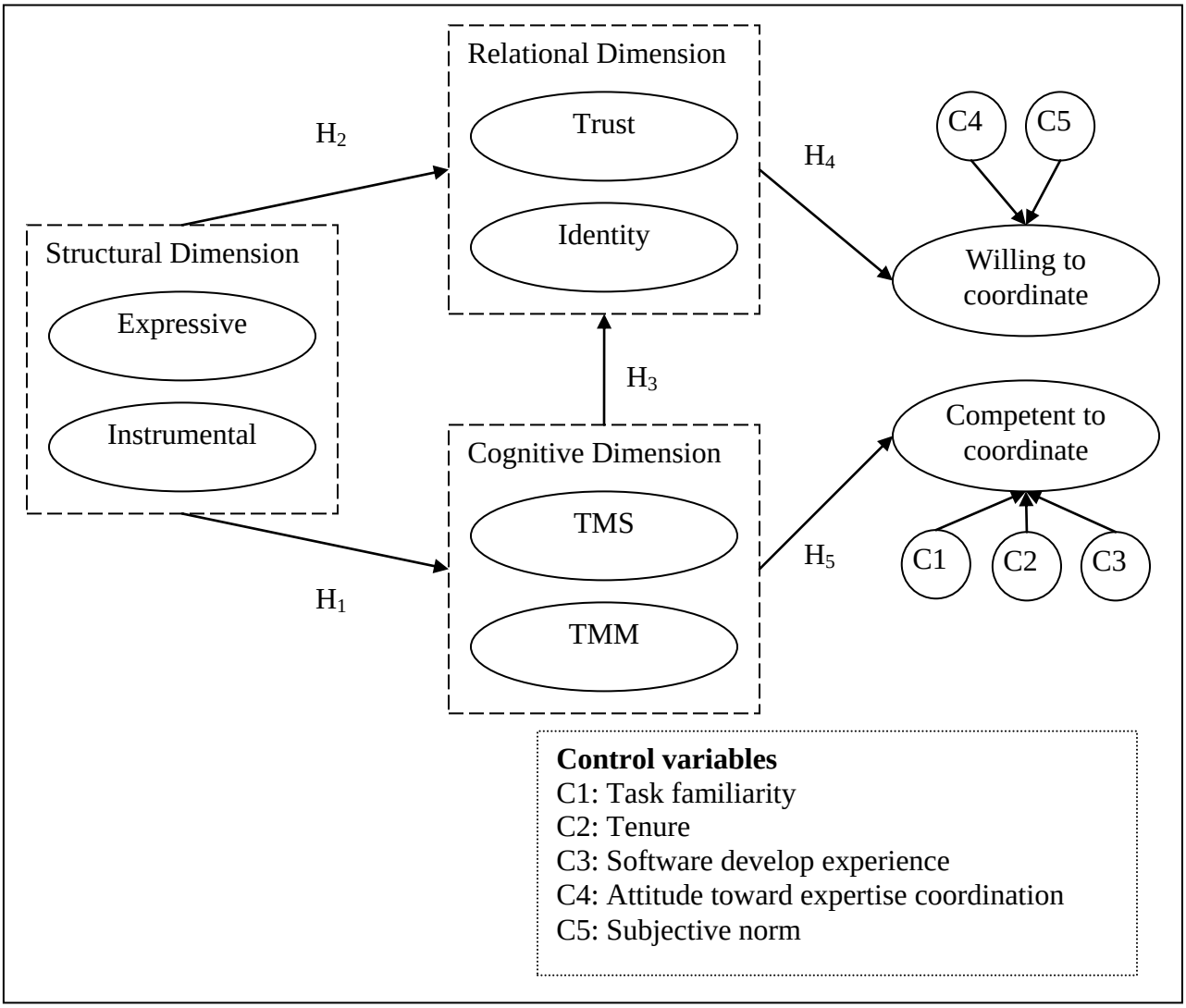


Figure 2.1 Research Model

3. Research Method

3.1. Data collection

To test the hypotheses, we collected both social network analysis and Likert scale format data on ISD teams in Taiwan. ISD teams with 5 to 10 members are the research target of this study to avoid possible deviations caused by team size. To fulfill the requirement of social network analysis, data from all members within one team was needed to understand the interpersonal interaction.

We first contacted the key person in each team to introduce the purpose of this study and to obtain the permission of access. For those who are willing to participate in this study, an appointment was made for an advanced visit. For those companies which cannot be accessed physically, the mailing address of the contact person is recorded.

Second, packages with a big cover envelope and various numbers of small envelopes and instruments, according the number of team members, were delivered physically by researcher or through the post system. The purpose of this study and the instruction in filling the survey are provided. Each respondent receives one envelope and one survey instrument and he/she keeps the filled instrument in the given small envelope to assure the confidentiality. The contact person then collected those filled survey and returned it to researchers with the cover envelope.

Third, teams who are still not returning the survey four to six weeks later were contacted to remind them to complete the survey. Fourth, a thank you letter was sent to those teams who finally return the complete survey package.

Table 2.1 Demographic Analysis

Variables	Categories	#	%	Variables	Categories	%
Gender	Male	278	65.4%	**# of IS employee**	< = 10	21.6
	Female	145	34.1%		11-50	41.4
	Missing	2	0.5%		51-100	13.4
					101-500	17.2
					> 500	3.8
					Missing	2.6
Job position	Dept. Leader	22	5.18 %	**Avg. Team Size**	< = 7	67.3
	Proj. Leader	50	12.76 %		8-15	20.9
	Programmer	205	48.24%		16-25	2.1
	SA	49	11.53 %		> = 26	6.8
	NA/DBA	21	4.94%		Missing	2.8%
	Others	78	18.35 %			
Experience	Work	7.89	5.63	**Avg. Duration**	< 1 year	58.9
	Software	6.01	4.87		1~2 years	25.9
	Current company	4.53	3.95		2~3 years	6.1
					3~5 years	2.9
					> 6 years	3.8
					Missing	2.4

Total sample size: 83 teams; 425 people

A total of 83 teams with 425 members returned the questionnaire. Compared with past group-based social network research, this sample size is reasonable (Collins & Clark, 2003; Leenders, van Engelen, & Kratzer, 2007; Marshall, Reday, Woonbong, & Agrawal, 2007; Mehra, Smith, Dixon, & Robertson, 2006; Reagans & Zuckerman, 2001; Yang & Tang, 2004).[2] The demographic information of those 425 people is shown in table 1. Around two thirds of them are male. For their job title, almost half these respondents are programmers, 18% are leaders, 15% are system analysts or database administrators, and 18% are other special experts. Respondents have, in average, 7.89 years work experience, 7 years software development experience, and have worked in their current company for 4.53 years. More than 63% of companies have less than 50 IS employees. More than two-thirds of companies have small project teams with less than 7 people. Almost 60% of projects have less than 1 year duration and the number become 85 for less than 2 years.

[2] The number of teams range from 13 to 224. The number of members in each team range from 2 to 22.

3.2. Measures

Willingness and Competence to coordinate

The willingness to coordinate refers to the extent that members in one team are willing to exchange and integrate their expertise with others to form the integrated knowledge for problem solving. The competence to coordinate refers to the extent that members in one team have the required ability to exchange and integrate their expertise with others to form the integrated knowledge for problem solving. Each construct was measured through seven items adopted from Collins et al., (2006) and Edmonson (1999). Likert scales, with anchors ranging from 1 to 5 were used for questions.

Social capital variables were measured with two formats: some with social network and some with Likert scales format. For social network measurement, the contact person of each team was asked to fill the list with name of each team member first. Individual members then answered questions based on the name list.

Structural dimension was measured with social network approach. *Network density* refers to the extent to which all actors in a social network are connected by direct relations. Two variables were used to represent within-team network density: instrumental and expressive. Two items for *instrumental ties* were used to measure the task-related information flow. Three items for *expressive ties* were used to measure non-task related information flow and friendship within the team. After coding the data into a matrix format, we calculated the network density of each group by using the following equation (Wasserman & Faust, 1994).

Network density = existing links / maximum possible links

Cognitive Dimension

TMS refers to a combination of the knowledge possessed by each individual and a collective awareness of who knows what. A social network approach created by Borgatti and Cross (2003) was used to measure TMS. Each team member was asked to answer three items which specifying whether he or she understands and is able to access each team member's knowledge, skills, and ability.

TMM refers to an organized understanding of relevant knowledge that is shared by team members (Klimoski et al., 1994). The most common methodologies to measure team mental model includes similarity ratings (Mathieu et al., 2005), Likert-scale questionnaires (Blickensderfer et al., 1997), pathfinder (Stout & Cannon-Bowers, 1999), UCINET (Mathieu et al., 2000), and concept mapping (Marks et al., 2000). These existing TMM measures have three major common problems: confusing instruments, time-consuming questionnaires, and cumbersome administration procedures (Webber, Chen, Payne, Marsh, & Zaccaro, 2000). Since different methods are available, researcher should determine the measurement based on the research question and research method used (Mohammed, Klimoski, & Rentsch, 2000). We followed the approach proposed by Gurtner, Tschan, Semmer, and Nagele (2007) to measure TMM. This method is chosen because it is easy to implement.

In the measuring stage, a total of 32 items adapted from Tarnoff (1999) were used. This context-free instrument was selected because most previous instruments were developed to fit the military training oriented context. We asked respondents to evaluate the importance of each items (from 1: not at all, to 9: very important) for obtaining high performance teamwork. Since a Likert-scale format questionnaire was used, the collected

data should be transformed before testing. A two step approach was then adopted to calculate TMM similarity. Fist, Pathfinder algorithm was used to calculate individual mental model. Based on graph theory, this algorithm can calculate the similarity (proximity) of two concepts in one's mind. We calculated the absolute distance between the pairs of items and transformed the result into a matrix format. With this format, the Pathfinder software can calculate the concept network (mental model) for each person. The second step is to calculate the similarity of individuals in the team. The Pathfinder correlation was used to represent the mental model similarity between two members. Team's mental model similarity is the average score of the all possible paired Pathfinder correlations in the team.

Relational Dimension

Team identity refers to the result of a categorization of the in-group and the out-group into a one-group cognitive representation (Gaertner, Rust, Dovidio, Bachman, & Anastasio, 1994). A total of 4 questions adopted from Vegt and Bunderson (2005) will be used to measure team identity. Likert scales with anchors ranging from 1 to 5 were used for questions.

Trust refers to confidence (a) that the behavior of another will conform to one's expectations, and (b) in the goodwill of another (Ring et al., 1994). A total of 3 items obtained from Tasi et al. (1998) were used to measure trust toward each team member. This construct is also measured through social network approach and the calculation of trust network density is the same as structural density.

Control Variables

Several factors which might affect the forming of willingness and building of competence are controlled to purify real effect caused by different social capital dimensions.

Experience is a basis for performing activities. As the experience one increases, one's ability to perform such activity increased. For the competence to coordinate expertise with others, three major variables can be used to represent experiences: task familiarity, tenure, and software experience. Task familiarity refers to whether respondents are familiar with the technical and business background of the target project. Two items related to development technique and business environment are used to measure task familiarity. Tenure refers to the exact time that one stay in the current company. People are more familiar with the organizational context as they stay in the company longer. According to their understanding of organizational culture, people know what can or cannot be done and under what condition. They also know the way to conduct certain behavior without violating organization rules or culture. One item is used to measure the exact time period that the member has spent in current company. The third control variable for competence is software development experience. Experiences accumulated in the past allow one to know how to coordinate with each other. One item is used to measure each respondent's exact software development experience.

For the willingness to coordinate, another two variables were controlled according to intention-behavior researches (Ajzen, 1985). Intention of conducting certain behavior is constrained by forces coming from both internal and external. Internal force refers to one's attitude toward the consequence of performing that behavior and external force refers to other important people's expectation. Three items adopted from Wasko et al.

(2005) were used to measure each respondent's attitude toward coordinating expertise with others. Two items were used to measure the subjective norm, to the extent that respondents' colleague and supervisor expect them to coordinate expertise with other members in the same team.

4. Analysis and discussion

In this study, PLS-Graph Version 3.01 (Chin, 1988) was used to verify the measurement and test hypotheses. PLS is selected since it is not contingent upon data having multivariate normal distributions nor does it require the large sample sizes of other methods. Using ordinary least squares as its estimation technique PLS performs an iterative set of factor analysis and PLS applies a bootstrap approach to estimate the significance (t-values) of the paths.

4.1. Measurement Model

PLS estimation involves two steps: measurement model and structural model. First, item reliability, convergent validity, and discriminant validity test are often used to test the measurement model in PLS. Individual item reliability can be examined by observing the factor loading of each item. A high loading implies that the shared variance between construct and its measurement is higher than error variance (Hulland, 1999). Factor loading higher than 0.7 can be viewed as high reliability and factor loading less than 0.5 should be dropped.

Convergent validity should be assured when multiple indicators were used to measure one construct. It can be examined by item-total correlation (ITC), composite reliability of constructs, and variance extracted by constructs (AVE) (Fornell et al., 1981;

Kerlinger, 1986). ITC should not be lower than 0.3 and composite reliability should be higher than 0.8. If the AVE is less than 0.5, it means that the variance captured by the construct is less than the measurement error and the validity of a single indicator and construct is questionable.

Discriminant validity focuses on testing whether the measures of constructs are different from each other (Messick, 1980). It can be assessed by testing whether the correlation between pairs of construct are below the threshold value of 0.90 (Bagozzi et al., 1991) and whether the square root of AVE is larger than correlation coefficients (Fornell et al., 1981).

Table 2.2 Factor Loading and Item-Total Correlation

Constructs	Items	Loadings	t-value	ITC
Willingness to Coordination *CR=0.91; AVE=0.58*	WILL1	0.72	20.24	0.57
	WILL2	0.73	25.46	0.58
	WILL3	0.81	41.14	0.69
	WILL4	0.82	44.11	0.71
	WILL5	0.74	26.03	0.67
	WILL6	0.78	31.71	0.72
	WILL7	0.71	23.12	0.64
Ability to coordinate *CR=0.93; AVE=0.64*	ABT1	0.81	46.73	0.73
	ABT2	0.81	51.08	0.71
	ABT3	0.84	46.96	0.77
	ABT4	0.82	42.43	0.73
	ABT5	0.82	37.96	0.75
	ABT6	0.81	41.23	0.74
	ABT7	0.69	16.58	0.59
Team Identity *CR=0.92; AVE=0.79*	IDENTITY1	0.90	76.18	0.77
	IDENTITY2	0.92	71.24	0.81
	IDENTITY3	0.84	36.40	0.67
Task Familiarity *CR=0.90; AVE=0.82*	FAMILITY1	0.91	117.38	0.64
	FAMILITY2	0.90	118.29	0.64
Subjective Norm *CR=0.88; AVE=0.79*	SNORM1	0.89	81.99	0.58
	SNORM2	0.89	81.99	0.58
Attitude Toward Coordination *CR=0.95; AVE=0.86*	Attitude1	0.93	76.11	0.83
	Attitude2	0.93	79.81	0.85
	Attitude3	0.92	57.82	0.83

Data shown in Table 2.2 indicates that validity and reliability are assured in this study. Except for one indicator that has factor loading less than 0.7 (0.69), all loadings are high and significant. The composite reliability of all constructs is very high and AVE are all acceptable. Finally, the item-total correlations are all higher than 0.3.

Table 2.3 Descriptive Analysis and Correlation Matrix

	Mean	Std. Dev.	M3	M4		Correlation Matrix							
						1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. Instrumental	0.59	0.15	0.27	-0.25		1.00							
2. Expressive	0.46	0.16	0.42	-0.06		0.57	1.00						
3. TMS	0.60	0.12	0.07	-0.80		0.70	0.60	1.00					
4. TMM	0.56	0.10	0.01	-0.95		0.29	0.10	0.26	1.00				
5. Trust	0.46	0.11	-0.12	-0.21		0.45	0.56	0.55	0.06	1.00			
6. Identity	3.89	0.36	-0.39	1.74		0.27	0.25	0.50	0.25	0.28	**0.89**		
7. Ability	3.57	0.39	-0.24	-0.25		0.28	0.17	0.41	0.35	0.14	0.53	**0.80**	
8. Willingness	4.42	0.30	-1.23	3.89		0.11	0.23	0.42	0.13	0.29	0.56	0.39	**0.76**

Note: M3: Skewness; M4: Kurtosis

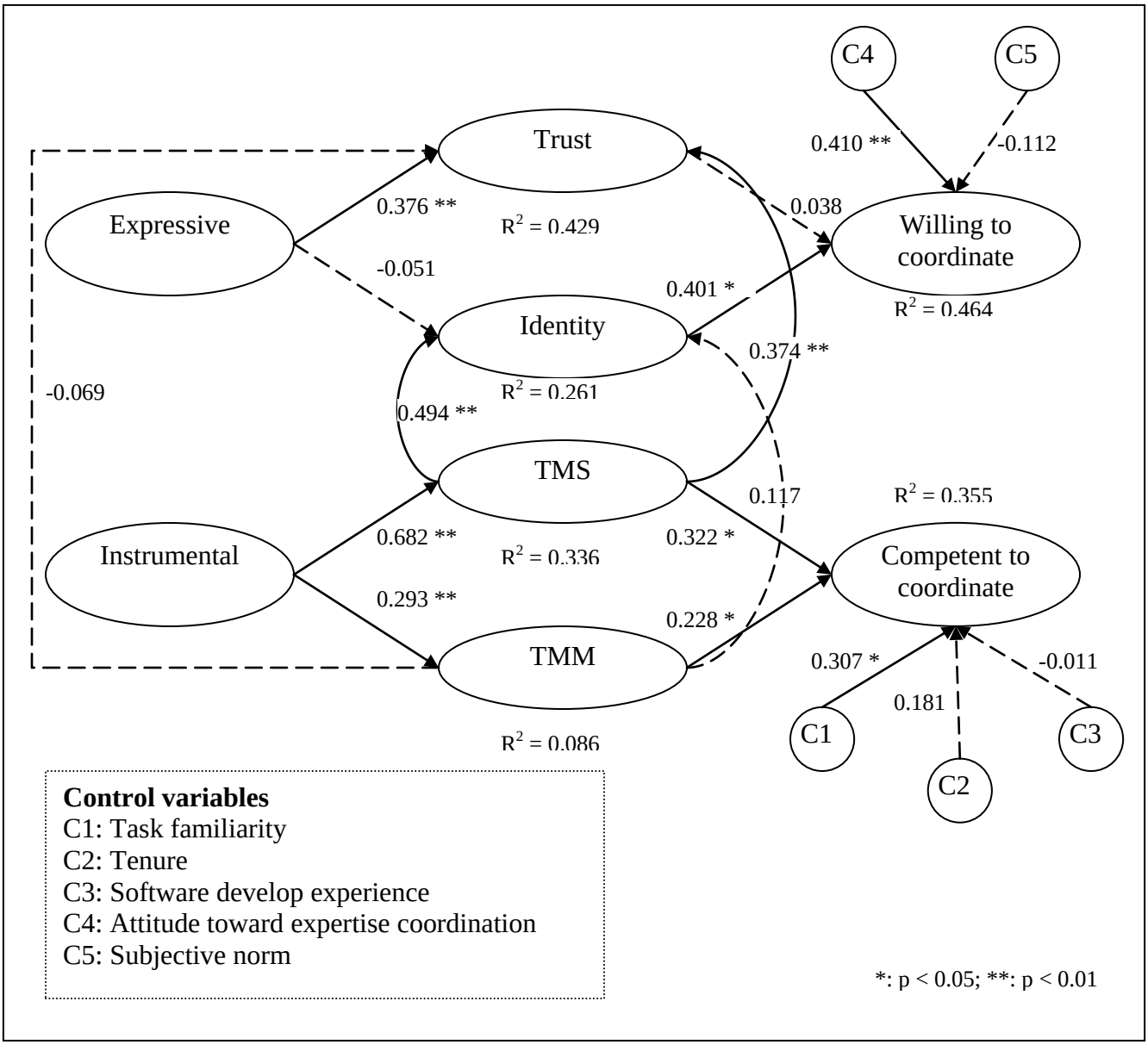


Figure 2.2 Path Analysis

4.2. Analysis results

After examining the validity and reliability of measurement, obtained individual data was transformed into group level before entering into PLS. As indicated in the previous section, network density was generated from social network matrix, mental model similarity was calculated by using Pathfinder algorithm, and Likert scales data was

aggregated based on group. Table 3 lists the descriptive analysis for variables, as well as their correlation coefficients, included in this study.

Figure 2.2 shows the analysis results, include coefficients, significance level, and R-square. Social network density measures have positive and significant impact on the other two dimensions of social capital, except for the link between the density of expressive ties and team identity. From the cognitive dimension to relational dimension, only TMS has effect. The relationship between identity and willingness to coordinate is significant. Both TMS and TMM have significant effect on coordinating ability.

Among control variables, task familiarity has strong effect on competence but the other two do not. Attitude toward expertise coordination has effect on the willingness but subjective norm does not.

However, contrary to our expectation, four relationships are not supported by our data. First, trust does not have effect on promoting willingness. This originates from two facets: measurement and context issues. For the measurement issue, social network approach with binary network data - "YES or NO" type questions - were used to measure trust density within the group. Over-simplified measurement can only reflect part of real intention and increase uncertainty. For example, one might have strong trust (10 out of 10) in member A and have middle level (5 out of 10) of trust in member B. The average score for this case is 7.5 out of 10. In our measurement, the respondent is only allowed to specify whether member A and B are trustworthy (0 or 1). Respondent may rate member A with 1 and B with 0 or 1. The average score under this situation may be 1 or 0.5 out of 1 based on respondents' answer. Uncertainty generated from oversimplified answers lowers the magnitude of correlation also limits the explaining power. For the context

issue, samples were drawn from ISD teams in Taiwan, a country with typical Asian culture. For people in Asia, showing willingness to coordinate with others is highly encouraged by collectivism-based culture. The fact that average score of trust is extremely high and centralized reflects the culture impact. Therefore the variation of willingness is not related to trust.

Second, expressive network density leads to trust but not identity. As shown in the demographic data, many peop0le in our sample came from small IS department in small to middle size companies. Project members come from the same department and they are familiar with each other. In that situation, respondents may refer team identity to department identity. Therefore the relationship between identity and interaction is not significant. Third, similar explanation from the above can be applied to the relationship between TMM and identity building. People refer team identity to department identity while rating team identity.

Finally, TMM was found to have no effect on trust. It is reasonable that TMS, instead of TMM, leads to trust. Trust is more sensitive. Having a similar mental model doesn't mean another party is trustworthy. Trust should have a more concrete basis, e.g. knowing what others know and what others can or cannot do. Trust is built through frequent interaction.

4.3. Contribution to theories

For coordination research, this study identified possible antecedents of the willingness and competence to coordinate from a social capital perspective. We also

examined relationships among three dimensions of social capital before linking them to expertise coordination.

In the original proposed model, these three dimensions are parallel. (Tsai et al., 1998) hypothesized and partially confirmed the dependency of these three dimensions as well as the relationship between social capital and resource exchange. We extended the previous study with following new insights.

Different from past research (Tsai, 2001), the direct effect between social capital and actual behavior is not hypothesized. Instead, social capital is hypothesized to be correlated with willingness and competence, the antecedents of actual behavior. For the cognitive dimension, instead of shared vision, we introduce another two new concepts: team (or shared) mental models and transactive memory system. Although the theoretical model proposed that shared vision provides a basis for building commitment toward group goal and, then, facilitates the exchange of resource and communication between members, the proposed effect was not found in the prior study. In our model, we built the indirect relationship between cognitive dimension and actual behavior, through competence. More specific, TMM and TMS increase the ability to coordinate. Ability serves as one of many antecedents of real behavior and the real behavior is also determined by other constraints. The significant and positive relationship between the cognitive dimension of social capital and intellectual capital indicates that common understanding toward key elements of teamwork facilitates expertise coordination. At the same time, knowing each other's expertise and being able to access it with low cost is also important for members to exchange and integrate knowledge resources to form new knowledge.

For the relationship dimension, identity is found as an important antecedent of willingness. As we hypothesized, team identity, whether one perceives he/she is part of the team, encourages team member to perform altruistic behavior. Some management interventions can be taken to form a high identity team. For example, team building can help building team identity for sports teams (Voight et al., 2001).

In addition to social capital theory, this study provides empirical support for TMM research. Empirical TMM study is largely behind conceptual research because of measurement and sample issues (Mohammed et al., 2000). Obtaining group-level mental model is uneasy and complex and, similar to this study, many research generates it from the individual level. On the other hand, collecting required samples from industry doubles the difficulty and, therefore, most empirical team mental model research uses lab experiments or military samples (e.g. Gurtner et al., 2007). Although we found few exceptions, they were either done in individual level or with subjective measuring (Kang, Yang, & Rowley, 2006). We collected individual level mental models and, based on this, formed the team level mental model from real ISD teams. Data from industrial rather than military also confirms the importance and the basis of forming TMM.

4.4. Contribution to the practitioners

For team managers, this study provides a hint in understanding how to enhance trust, identity, TMM, and TMS. Two types of interaction are included in this study: task related and non-task related interaction and, as hypothesized, both types of interaction are the basis for forming better working climates. It is difficult for members to coordinate their expertise when team members are unable to find the required knowledge or when

members are not able to communicate with each other. For task related interactions, it can be done by encouraging consulting from coworkers instead of searching for solutions by oneself. Leaders can also provide informal workshops or training sessions to increase the instrumental interaction among team members. Those activities help members by building a team mental model and transactive memory which can facilitate expertise coordination.

Team leaders can take possible actions to enhance non-task related interactions, e.g. having lunch, dinner, or even partying together. People might share personal habits, interests, and preferences during those occurrences. Sharing expressive information and building friendship is the basis of forming trust. With trust, positive attitude toward knowledge sharing and integration are formed. On the other hand, the importance of team identity is also highlighted in this study. Although expressive ties show no effect on building team identity, leaders should still consider taking other actions to build team identity. For example, using visual symbols, putting members in the same location, or having parties together may allow members to build identity toward the team (Jurison, 1999). When members believe they are part of the team, their intentions to take altruistic behaviors are increased.

5. Conclusion

After collecting data from 83 ISD teams in Taiwan, the proposed model has been examined. As hypothesized, expressive social network density has a positive impact on forming trust among team members. People are more willing to exchange and integrate their expertise to solve problem when there is a higher level of team identity. Higher

instrumental social network density results in a higher level transactive memory systems and team mental models which, in turn, increase the ability to coordinate expertise. Finally, building transactive memory systems facilitates the forming of trust and identity within the team. As shown in table 4, four hypotheses are found which are not-supported by the data: those are relationships between expressive density and identity, between trust and willingness, between TMM and trust, and between TMM and identity.

Within an ISD team, interaction is the basis of forming a better work climate. In this study, we measured both instrumental and expressive ties within the team. Frequently seeking and providing task-related information from each other facilitates the exchange of not only information, but also of the mental model. Members build a shared mental model through the exchange of individual mental models such as "why this should be done first" or "why this should be done in this way." By exchanging knowledge, each member in the team can build a complete knowledge map which indicates who knows what. Similar to Tsai et al.'s (1998) study, we found that the density of expressive ties is highly correlated with the forming of trust. Trust is the belief that others will not take opportunistic behavior if they have chance. It will never exist automatically, but will emerge only after knowing each other deeply.

Although teams cannot achieve high levels of productivity without interaction and adequate resource exchange among team members, the relationship between interaction density and group effectiveness is not linear (Oh, Chung, & Labianca, 2004).Team effectiveness is increased as interaction is increased and will reach a peak when they have a moderate level interaction. However, if people interact excessively, they might spend

too much time on interacting and not enough time on working. In addition, group thinking may emerge in high density work groups (White & Harary, 2001).

Table 2.4 Hypotheses test results

#	Hypotheses	Support Not support
H_{1a}	Instrumental social network density is positively associated with TMS development.	Supported
H_{1b}	Instrumental social network density is positively associated with TMM development.	Supported
H_{2a}	Expressive social network density of one project team is positively associated with team trust development.	Supported
H_{2b}	Expressive social network density of one project team is positively associated with team identity development.	Not supported
H_{3a}	Team mental model is positively associated with trust development.	Not supported
H_{3b}	Team mental model is positively associated with team identity development.	Not supported
H_{3c}	Transactive memory system is positively associated with trust development.	Supported
H_{3d}	Transactive memory system is positively associated with team identity development	Supported
H_{4a}	Willingness to coordinate expertise is positively associated with trust	Not supported
H_{4b}	Willingness to coordinate expertise is positively associated with group identity	Supported
$H5_{a}$	Competent to coordination is positively associated with TMM	Supported
$H5_{b}$	Competent to coordination is positively associated with TMS	Supported

5.1 Limitation and future research

A couple of features of this study limit the expansion of the results. First, cross-sectional data is collected from ISD team members only. As we hypothesized, structural dimension leads to cognitive and relational dimensions and cognitive dimension affects relational dimensions of social capital. One might argue that from a long-term perspective, the relationship among those three dimensions may be reversed. For example, higher trust and identity may increase the ensuing interaction. In addition, people may interact with others who have shared mental models and transactive memory systems with them. These assertions may be true and cannot be answered by one wave

data collection effort. Future research with a qualitative approach or multi-waves data collection should be done to understand the interaction between these three dimensions.

Second, the data is collected from ISD teams in Taiwan. Applying results to other social contexts (e.g. different countries or cultures) should be done very carefully. For example, while collecting the data, we found that while asking about people's willingness to coordinate with others, most of them have a very positive answer. A cross-cultural comparison is preferred. This may be a result of social desirability, desire to please the researcher, and may or may not relate to reality. Assuming that it is based on reality, the expressed willingness to coordinate with others may be related to a cultural bias to social behavior that may not be found in a more individualistic society.

Third, the measure of project performance is based on each team member's perception. Different perspectives may be required to understand performance from different stakeholders. Future research may collect performance data from users, higher level supervisors, or others to really understand the project outcome.

Fourth, we used binary format questions to measure the social network within the team. This approach reduces cognitive efforts and saves responding time. However, the precision is sacrificed and this may cause an unexpected result (e.g. trust to coordination willingness in our study) Future research should avoid possible harms by using another approach.

Study 2 List of Questionnaire

Willingness/ Competence to coordinate

Will1/Abt1 Exchange and combine information, knowledge, and skills with others
Will2/Abt2 Freely share hard-to-find knowledge or expertise with other members
Will3/Abt3 Exchange and combine ideas with others to solve problems or create opportunities
Will4/Abt4 Share my expertise with others to bring new projects of initiative to fruition
Will5/Abt5 Give other people performance feedback on our team
Will6/Abt6 Continually assess our product in order to get the feedback we need to improve it
Will7/Abt7 Acknowledge it when a member does extra work

Team mental model

TMM1. Knowing what my team's task(s) is/are
TMM2. Knowing the requirements and procedures for performing my team's task(s)
TMM3. Understanding the situations that are likely to arise as my team performs its task(s)
TMM4. Understanding of the strategies for performing my team's task(s)
TMM5. Knowing limitations the situation puts on my team's ability to perform its task(s)
TMM6. Knowing how severe and urgent problems might be that may occur as my team performs its task(s)
TMM7. Understanding new problems that may occur as my team performs its task(s)
TMM8. Knowing when my teammate's need help
TMM9. Knowing how long it takes to complete a task
TMM10. Knowing when I need help to complete a task
TMM11. Understanding how my team's equipment works
TMM12. Understanding the procedures for running my team's equipment
TMM13. Knowing what my team's equipment can't do or its limitations
TMM14. Understanding the problems that are likely to occur with my team's equipment
TMM15. Understanding the equipment failures that are likely to occur
TMM16. Knowing how much my teammate's know about my team's task(s)
TMM17. Knowing how skilled my teammate's are in performing my team's task(s)
TMM18. Knowing the abilities of my teammate's to perform my team's task(s)
TMM19. Knowing my teammate's preferences when performing my team's task(s)
TMM20. Knowing my teammate's limitations
TMM21. Knowing my teammate's faults
TMM22. Realizing how much I know or don't know about my team's task(s)
TMM23. Knowing my level of skill in performing my team's task(s)
TMM24. Knowing my level of ability in performing my team's task(s)
TMM25. Realizing my preferences when performing my team's task(s)
TMM26. Realizing my tendencies when performing my team's task(s)
TMM27. Realizing my limitations when performing my team's task(s)
TMM28. Understanding my teammate's roles
TMM29. Understanding my teammate's responsibilities
TMM30. Understanding how my team gets information
TMM31. Understanding of the way my team's members interact with each other
TMM32. Understanding where my team gets information

Transactive memory systems

TMS1. I understand what skills this person has and domains they are knowledgeable in

TMS2. This person has expertise in areas that are important in kind of work I do
TMS3. Your over all ability to access this person's thinking and knowledge

Team identity

Identity1 I feel emotionally attached to this team
Identity2 I feel a strong sense of belonging to this team
Identity3 I feel as if the team's problems are my own

Trust

Trust1. Please specify people who will always keep the promises they make to you
Trust2. Please specify people who you believe you can rely on without any fear that they will take advantage of you even if the opportunity arises
Trust3. If this person provides you information, you will adopt without any concern
Trust4. I can tell this person my personal feelings, concerns, and needs

Instrumental interaction

Inst1. Have you turned to this person for work-related information or knowledge?
Inst2. Has this person turned to your for work-related information or knowledge

Expressive interaction

Express1. Has this person turned to your for non-work-related information or knowledge (e.g. entertainment)?
Express2. Have you turned to this person for non-work-related information (e.g. entertainment)?

Attitude

Attitude1. I see the benefits of knowledge or expertise exchange and combination
Attitude2. I see the values of knowledge or expertise exchange and combination
Attitude3. Knowledge or expertise exchange and combination can improve project performance

Subjective norm

Snorm1. My colleagues expect me to exchange or combine knowledge or expertise with each other
Snorm2. My supervisor expect me to exchange or combine knowledge or expertise with other people

Task familiarity

Familiarity1. I am familiar with the software and hardware used in this project
Familiarity2. I am familiar with the business domain of the project

Tenure

How long have you joined this company?

Software experience

How many year software development experiences do you have?

Study 2 List of Refernce

Ajzen, I. 1985. From intentions to actions: A theory of planned behavior. ***Action control: From cognition to behavior***, 2: 11-39.

Akgun, A. E., & Lynn, G. S. 2002. Antecedents and consequences of team stability on new product development performance. ***Journal of Engineering & Technology Management***, 19(3/4): 263.

Alavi, M., & Tiwana, A. 2002. Knowledge integration in virtual teams: The potential role of KMS. ***Journal of the American Society for Information Science & Technology***, 53(12): 1029.

Anderson, J. C., & Narus, J. A. 1990. A model of distributor firm and manufacturer firm working partnerships. ***Journal of Marketing***, 54(1): 42-58.

Athanassiou, N., & Nigh, D. 1999. The impact of U. S. company internationalization on top management team advice networks: a tacit knowledge perspective. ***Strategic Management Journal***, 20(1): 83-92.

Austin, J. R. 2003. Transactive memory in organizational groups: The effects of content, consensus, specialization, and accuracy on group performance. ***Journal of Applied Psychology***, 88(5): 866-878.

Axelrod, R. M. 1984. ***The Evolution of Cooperation***. New York: Basic Books.

Bagozzi, R. P., Yi, Y., & Philips, L. 1991. Assessing construct validity in organizational research. ***Administrative Science Quarterly***, 36: 421-436.

Banks, A. P., & Millward, L. J. 2000. Running shared mental models as a distributed cognitive process. ***British Journal of Psychology***, 91(4): 513.

Barney, J. B., & Hansen, M. H. 1994. Trustworthiness as a source of competitive advantage. ***Strategic Management Journal***, 15: 175-190.

Blau, P. M. 1986. ***Exchange and Power in Social Life***: Transaction Publishers.

Blickensderfer, E., Cannon-Bowers, J. A., & Salas, E. 1997. Theoretical bases for team self-correction: Fostering shared mental models. ***Advances in Interdisciplinary Studies of Work Teams***, 4: 249-279.

Borgatti, S. P., & Cross, R. 2003. A relational view of information seeking and learning in social networks. ***Management Science***, 49(4): 432.

Bourdieu, P. 1986. The form of capital. ***Handbook of Theory and Research for the Sociology of Education***: 241-258.

Brandon, D. P., & Hollingshead, A. B. 2004. Transactive Memory Systems in Organizations: Matching Tasks, Expertise, and People. ***Organization Science***, 15(6): 633-644.

Brewer, M. B., & Kramer, R. M. 1986. Choice behavior in social dilemmas: Effects of social identity, group size, and decision framing. ***Journal of Personality and Social Psychology***, 50(3): 543-549.

Burkhardt, M. E. 1994. Social Interaction Effects following a Technological Change: A Longitudinal Investigation. ***The Academy of Management Journal***, 37(4): 869-898.

Burt, R. S. 1987. Social contagion and innovation: Cohesion versus structural equivalence. ***The American Journal of Sociology***, 92(6): 1287-1335.

Burt, R. S. 1992. ***Structural Holes: The Social Structure of Competition***: Harvard University Press.

Cannon-Bowers, J. A., & Salas, E. 2001. Reflections on shared cognition. ***Journal of Organizational Behavior***, 22(2): 195-202.

Cannon-Bowers, J. A., Salas, E., & Converse, S. 1993. Shared mental models in expert team decision making. ***Current issues in individual and group decision making***: 221-246.

Carless, S. A., & De Paola, C. 2000. The Measurement of Cohesion in Work Teams. ***Small Group Research***, 31(1): 71.

Chin, W. W. 1988. Issues and opinion on structural equation modeling. ***MIS Quarterly***, 22(1): vii-xvi.

Coleman, J. S. 1988. Social Capital in the Creation of Human Capital. ***The American Journal of Sociology***, 94: 95-120.

Coleman, J. S. 1990. ***Foundations of Social Theory***: Belknap Pr.

Collins, C. J., & Clark, K. D. 2003. Strategic human resource practices, top management team social networks, and firm performance: The role of human resource practices in creating organizational competitive advantage. ***Academy of Management Journal***, 46(6): 740-751.

Collins, C. J., & Smith, K. 2006. Knowledge exchange and combination: The role of human resource practices in the performance of high-technology firms. ***The Academy of Management Journal***, 49(3): 544-560.

Cunningham, G. B., & Chelladurai, P. 2004. Affective reactions to cross-functional teams: The impact of size, relative performance, and common in-group identity. ***Group Dynamics: Theory, Research, and Practice***, 8(2): 112-125.

Dasgupta, P. 1988. Trust as a commodity. ***Trust: Making and Breaking Cooperative Relations***: 49-72.

Eckel, C., & Grossman, P. 2005a. Managing diversity by creating team identity. ***Journal of Economic Behavior and Organization***, 58: 371?392.

Eckel, C. C., & Grossman, P. J. 2005b. Managing diversity by creating team identity. ***Journal of Economic Behavior and Organization***, 58: 371-392.

Edmonson, A. 1999. Psychological Safety and Learning Behavior in Work Teams. ***Administrative Science Quarterly***, 44(2): 350-353.

Fornell, C., & Larcker, D. 1981. Evaluating structural equation models with unobservable variables and measurement error. ***Journal of Marketing Research***, 18(3): 39-50.

Friedkin, N. E., & Marsden, P. 1994. Network studies of social influence. ***Advances in Social Network Analysis***: 1-25.

Gabarro, J. J. 1978. The development of trust, influence, and expectations. ***Interpersonal behavior: Communication and understanding in relationships***: 290-303.

Gaertner, S. L., Rust, M. C., Dovidio, J. F., Bachman, B. A., & Anastasio, P. A. 1994. The Contact Hypothesis: The Role of a Common Ingroup Identity on Reducing Intergroup Bias. ***Small Group Research***, 25(2): 224-249.

Galaskiewicz, J., & Burt, R. S. 1991. Interorganization contagion in corporate philanthropy. ***Administrative Science Quarterly***, 36(1): 88-105.

Gee-Woo, B., Zmud, R. W., Young-Gul, K., & Jae-Nam, L. 2005. Behavioral Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces, and Organizational Climate. ***MIS Quarterly***, 29(1): 87-111.

Granovetter, M. 1985. Economic Action and Social Structure: The Problem of Embeddedness. ***The American Journal of Sociology***, 91(3): 481-510.

Granovetter, M. 1992. Economic institutions as social constructions: A framework for analysis. ***Acta Sociologica***, 35(1): 3.

Gulati, R. 1995. Does Familiarity Breed Trust? The Implications of Repeated Ties for Contractual Choice in Alliances. ***The Academy of Management Journal***, 38(1): 85-112.

Gurtner, A., Tschan, F., Semmer, N. K., & Nagele, C. 2007. Getting groups to develop good strategies: Effects of reflexivity interventions on team process, team performance, and shared mental models.' ***Organizational Behavior and Human Decision Processes***, 102(1): 127-142.

Haslam, N., Bastian, B., Bain, P., & Kashima, Y. 2006. Psychological essentialism, implicit theories, and intergroup relations. ***Group Processes & Intergroup Relations***, 9(1): 63-76.

Haslam, S. A., Powell, C., & Turner, J. C. 2000. Social identity, self-categorization and work motivation: Rethinking the contribution of the group to positive and sustainable organizational outcomes. ***Applied Psychology: An International Review***, 49(3): 319-339.

Henry, K. B., Arrow, H., & Carini, B. 1999. A Tripartite Model of Group Identification: Theory and Measurement. ***Small Group Research***, 30(5): 558-581.

Hogg, M. A., & Reid, S. A. 2006a. Social Identity, Self-Categorization, and the Communication of Group Norms. ***COMMUNICATION THEORY***, 16(1): 7.

Hogg, M. A., & Reid, S. A. 2006b. Social identity, self-categorization, and the communication of group norms. ***Communication Theory***, 16(1): 7-30.

Hollingshead, A. B. 1998. Communication, Learning, and Retrieval in Transactive Memory Systems. ***Journal of Experimental Social Psychology***, 34(5): 423-442.

Hulland, J. 1999. Use of partial lest squares (PLS) in strategic management research: A review of four recent studies. ***Strategic Management Journal***, 20(2): 195-204.

Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. 1998. Is anybody out there? Antecedents of trust in global virtual teams. ***Journal of Management Information Systems***, 14(4): 29-64.

Jehn, K. A. 1995. A multimethod examination of the benefits and detriments of intragroup conflict. ***Administrative Science Quarterly***, 40(2): 256-282.

Jurison, J. 1999. Software project management: the manager's view. ***Communications of the AIS***, 2(17).

Kanawattanachai, P., & Yoo, Y. 2007. The impact of knowledge coordination on virtual team performance over time. ***MIS Quarterly***, 31(4): 783-808.

Kang, H. R., Yang, H. D., & Rowley, C. 2006. Factors in team effectiveness: Cognitive and demographic similarities of software development team members. ***Human Relations***, 59(12): 1681.

Kelman, H. C. 1961. Processes of opinion change. ***The Public Opinion Quarterly***, 25(1): 57-78.

Kerlinger, F. N. 1986. ***Foundations of behavioral research***: Wadsworth Publishing Co Inc.

Kerr, N. L., & Kaufman-Gilliland, C. M. 1994. Communication, commitment, and cooperation in social dilemmas. ***Journal of Personality and Social Psychology***, 66(3): 513?529.

Klimosi, R., & Mohammed, S. 1994. Team Mental Model: Construct or Metaphor? ***Journal of Management***, 20(2): 403.

Klimoski, R., & Mohammed, S. 1994. Team mental model: Construct or metaphor? ***Journal of Management***, 20(2): 403.

Kollock, P. 1998. Social dilemmas: The anatomy of cooperation. ***Annual Review of Sociology***, 24(1): 183-214.

Koskinen, K. U., Pihlanto, P., & Vanharanta, H. 2003. Tacit knowledge acquisition and sharing in a project work context. ***International Journal of Project Management***, 21(4): 281-290.

Kozlowski, S. W. J., Gully, S. M., Salas, E., & Cannon-Bowers, J. A. 1996. Team leadership and development: Theory, principles, and guidelines for training leaders and teams. ***Advances in interdisciplinary studies of work teams: Team leadership***, 3: 251-289.

Krackhardt, D. 1992. The strength of strong ties: The importance of philos in organizations. ***Networks and Organizations: Structure, Form, and Action***: 216-239.

Kramer, R. M., & Brewer, M. B. 1984. Effects of group identity on resource use in a simulated commons dilemma. ***J Pers Soc Psychol***, 46(5): 1044-1057.

Kramer, R. M., Brewer, M. B., & Hanna, B. A. 1996a. Collective trust and collective action: The decision to trust as a social decision. ***Trust in organizations: Frontiers of theory and research***: 357-389.

Kramer, R. M., & Tyler, T. R. 1996b. ***Trust in Organizations: Frontiers of Theory and Research***: Sage.

Kraut, R. E., & Streeter, L. A. 1995. Coordination in software development. ***Communications of the ACM***, 38(3): 69-81.

Leenders, R. T. A. J., van Engelen, J. M. L., & Kratzer, J. 2007. Systematic design methods and the creative performance of new product teams: Do they contradict or complement each other? ***Journal of Product Innovation Management***, 24(2): 166-179.

Levesque, L. L., & Wilson, J. M. 2001. Cognitive divergence and shared mental models in software development project teams. ***Journal of Organizational Behavior***, 22(2): 135.

Liang, D. W., Moreland, R., & Argote, L. 1995. Group Versus Individual Training and Group Performance: The Mediating Role of Transactive Memory. ***Personality and Social Psychology Bulletin***, 21(4): 384-393.

Lin, C. P. 2007. To Share or Not to Share: Modeling Tacit Knowledge Sharing, Its Mediators and Antecedents. ***Journal of Business Ethics***, 70(4): 411-428.

Marks, M. A., Zaccaro, S. J., & Mathieu, J. E. 2000. Performance implications of leader briefings and team-interaction training for team adaptation to novel environments. ***Journal of Applied Psychology***, 85(6): 971.

Marshall, R., Reday, P. A., Woonbong, N., & Agrawal, S. S. 2007. Response-time measurement of group purchasing-decision power structures. ***Journal of Business Research*** 60(7): 711-719.

Mathieu, J. E., Goodwin, G. F., Heffner, T. S., Salas, E., & Cannon-Bowers, J. A. 2000. The Influence of Shared Mental Models on Team Process and Performance. ***Journal of Applied Psychology***, 85(2): 273.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Cannon-Bowers, J. A., & Salas, E. 2005. Scaling the quality of teammates' mental models: equifinality and normative comparisons. ***Journal of Organizational Behavior***, 26(1): 37.

Mayer, R. C., Davis, J. H., & Schoorman, F. D. 1995. An integrative model of organizational trust. ***The Academy of Management Review***, 20(3): 709-734.

Mehra, A., Smith, B. R., Dixon, A. L., & Robertson, B. 2006. Distributed leadership in teams: The network of leadership perceptions and team performance. ***Leadership Quarterly***, 17(3): 232-245.

Messick, S. 1980. Test validity and the ethics of assessment. ***American Psychologist***, 35(11): 1012–1027.

Mohammed, S., & Dumville, B. C. 2001. Team mental models in a team knowledge framework: Expanding theory and measurement across disciplinary boundaries. ***Journal of Organizational Behavior***, 22: 89.

Mohammed, S., Klimoski, R., & Rentsch, J. R. 2000. The Measurement of Team Mental Models: We Have No Shared Schema. ***Organizational Research Methods***, 3(2): 123.

Moore, D. A., Kurtzberg, T. R., Thompson, L. L., & Morris., M. W. 1999. Long and Short Routes to Success in Electronically-Mediated Negotiations: Group Affiliations and Good Vibrations. ***Organizational Behavior and Human Decision Processes***, 77: 22-43.

Moreland, R. L. 1999. Transactive memory: Learning who knows what in work groups and organizations. In L. Thompson, D. Messick, & J. Levine (Eds.), ***Shared cognition in organizations: The management of knowledge***: 3-31. New York: Lawrence

Erlbaum.

Morgan, R. M., & Hunt, S. D. 1994. The Commitment-Trust Theory of Relationship Marketing. ***Journal of Marketing***, 58(3): 20-38.

Mortensen, M., & Hinds, P. J. 2001. Conflict and shared identity in geographically distributed teams. ***International Journal of Conflict Management***, 12(3): 212-238.

Mullen, B., & Copper, C. 1994. The relation between group cohesiveness and performance: An integration. ***Psychological Bulletin***, 115(2): 210-227.

Nahapiet, J., & Ghoshal, S. 1998. Social capital, intellectual capital, and the organizational advantage. ***The Academy of Management Review***, 23(2): 242-266.

Nelson, R. E. 1989. The Strength of Strong Ties: Social Networks and Intergroup Conflict in Organizations. ***The Academy of Management Journal***, 32(2): 377-401.

Nonaka, I., & Takeuchi, H. 1995. ***The Knowledge-Creating Company: How Japanese companies create the dynamics of innovation***: Oxford University Press US.

North, D. C. 1990. ***Institutions, Institutional Change and Economic Performance***: Cambridge University Press.

Oh, H., Chung, M. H., & Labianca, G. 2004. Group social capital and group effectiveness: The role of informal socializing ties. ***Academy of Management Journal***, 47(6): 860-875.

Orasanu, J., & Salas, E. 1993. Team decision making in complex environments. ***Decision making in action: Models and methods***: 327-345.

Ouchi, W. G. 1980. Markets, Bureaucracies, and Clans. ***Administrative Science Quarterly***, 25(1): 129-141.

Pastor, J. C., Meindl, J. R., & Mayo, M. C. 2002. A network effects model of charisma attributions. ***Academy of Management Journal***, 45(2): 410-420.

Peteraf, M., & Shanley, M. 1997. Getting to know you: A theory of strategic gropu identity. ***Strategic Management Journal***, 18(s 1): 165-186.

Reagans, R., & Zuckerman, E. W. 2001. Networks, diversity, and productivity: The social capital of corporate R&D teams. ***Organization Science***, 12(4): 502.

Rice, R. E., & Aydin, C. 1991a. Attitudes toward New Organizational Technology: Network Proximity as a Mechanism for Social Information Processing. ***Administrative Science Quarterly***, 36(2).

Rice, R. E., & Aydin, C. 1991b. Attitudes toward new organizational technology: Network proximity as a mechanism for social information processing. ***Administrative Science Quarterly***, 36(2): 219-244.

Ring, P. S., & van de Ven, A. H. 1994. Developmental Processes of Cooperative Interorganizational Relationships. ***The Academy of Management Review***, 19(1): 90-118.

Ring, P. S., & Ven, A. 1992. Structuring Cooperative Relationships between Organizations. ***Strategic Management Journal***, 13(7): 483-498.

Rosenman, S., & Handelsman, I. 1990. The collective past, group psychology and personal narrative: Shaping Jewish identity by memoirs of the Holocaust. ***The American Journal of Psychoanalysis (Historical Archive)***, 50(2): 151-170.

Sabel, C. F. 1993. Studied trust: building bew forms of cooperation in a volatile economy. ***Human Relations***, 46(9): 1133-1170.

Santhanam, R., Guimaraes, T., & George, J. F. 2000. An empirical investigation of ODSS impact on individuals and organizations. ***Decision Supprot Systems***, 30(1): 51-72.

Shapiro, D. L., Sheppard, B. H., & Cheraskin, L. 1992. In Theory: Business on a handshake. ***Negotiation Journal***, 8(4): 365-377.

Sitkin, S. B., & Roth, N. L. 1993. Explaining the Limited Effectiveness of Legalistic" Remedies" for Trust/Distrust. ***Organization Science***, 4(3): 367-392.

Stout, R. J., & Cannon-Bowers, J. A. 1999. Planning, shared mental models, and coordinated performance: An empirical link is established. ***Human Factors***, 41(1): 61.

Tajfel, H. 1981. ***Human groups and social categories***. Cambridge, England: Cambridge University Press

Tajfel, H., & Turner, J. C. 1979. An integrative theory of intergroup conflict. ***The social psychology of intergroup relations***: 33-37.

Tarnoff, K. A. 1999. ***An Exploratory Study of the Determinants and Outcomes of Shared Mental Models of Skill Use in Autonomous Work Teams***. Unpublished Dissertation, Virginia Polytechnic Institute and State University.

Tiwana, A., & McLean, E. R. 2005. Expertise integration and creativity in information systems development. ***Journal of Management Information Systems***, 22(1): 13-43.

Tsai, W. 2001. Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. ***The Academy of Management Journal***, 44(5): 996-1004.

Tsai, W., & Ghoshal, S. 1998. Social Capital and Value Creation: The Role of Intrafirm Networks. ***The Academy of Management Journal***, 41(4): 464-476.

Turner, J. C. 1987. A self-categorization theory. ***Rediscovering the social group: A self-categorization theory***: 42-47.

Tyler, T. R. 1999. Why people cooperate with organizations: An identity-based perspective. ***Research in Organizational Behavior***, 21: 201?246.

Tyler, T. R., & Blader, S. L. 2003. The group engagement model: Procedural justice, social identity, and cooperative behavior. ***Personality and Social Psychology Review***, 7(4): 349-361.

Umphress, E. E., Labianca, G. J., Brass, D. J., Kass, E. E., & Scholten, L. 2003. The role of instrumental and expressive social ties in employees' perceptions of organizational justice. ***Organization Science***, 14(6): 738-753.

Vegt, G., & Bunderson, J. S. 2005. Learning and performance in multidisciplinary teams: The importance of collective team identification. ***The Academy of Management Journal***, 48(3): 532-547.

Voight, M., & Callaghan, J. 2001. A Team Building Intervention Program: Application and Evaluation with Two University Soccer Teams. ***Journal of Sport Behavior***, 24(4): 420-432.

Wagner, J. A. 1995. Studies of individualism-collectivism: Effects on cooperation in groups. ***Academy of Management Journal***, 38(1): 152-172.

Wasko, M. M., & Faraj, S. 2005. Why should I share? Examining social capital and knowledge contribution in electronic communities of practice. ***MIS Quarterly***, 29(1): 35-57.

Wasserman, S., & Faust, K. 1994. ***Social Network Analysis: Methods and Applications***: Cambridge University Press.

Webber, S. S., Chen, G., Payne, S. C., Marsh, S. M., & Zaccaro, S. J. 2000. Enhancing team mental model measurement with performance appraisal practices. ***Organizational Research Methods***, 3(4): 307.

Wegner, D. M. 1987. Transactive memory: A contemporary analysis of the group mind. ***Theories of group behavior***: 185-208.

Wegner, D. M. 1995. A computer network model of human transactive memory. ***Social cognition***, 13(3): 319-339.

Wegner, D. M., Giuliano, T., & Hertel, P. T. 1985. Cognitive interdependence in close relationships. ***Compatible and incompatible relationships***, 253-276.

Wenger, E. 1999. ***Communities of Practice: Learning, Meaning, and Identity***: Cambridge University Press.

Wenger, E. 2000. Communities of practice: the key to knowledge strategy. ***Knowledge and Communities***: 3-20.

White, D. R., & Harary, F. 2001. The Cohesiveness of blocks In social networks: Node connectivity and conditional density. ***Sociological Methodology***, 31(1): 305-359.

Wilson, P. N. 2000. Social capital, trust, and the agribusiness of economics. ***Journal of Agricultural Economics***, 25(1): 1-13.

Worchel, P. 1979. Trust and distrust. ***The social psychology of intergroup relations***: 174-187.

Yang, H. L., & Tang, J. H. 2004. Team structure and team performance in IS development: a social network perspective. ***Information & Management***, 41(3): 335-349.

Zdaniuk, B., & Levine, J. M. 2001. Group loyalty: Impact of members?identification and contributions. ***Journal of Experimental Social Psychology***, 37(6): 502-509.

GENERAL CONCLUSION

Information system development is a knowledge intensive working process. Project team members may increase uncertainty of project outcome while lacking of motivation or capability to work as a team (Wallace, Keil, & Rai, 2004a, b). How to effectively manage software development process from a team management perspective is critical. People with different knowledge and skills are gathered together to work on the same task. From teamwork perspective, performance is determined by the organization and unifying of individual's effort through communication and coordination. From knowledge management perspective, project teamwork process can be viewed as knowledge exchange, integration, and creation process. Team performance is determined by the effectiveness of solving problems through utilizing individual knowledge as well as exchange and combing individuals' knowledge. This dissertation focuses on how to enhance team and individual level performance through improving ISD teamwork process. More specific, the purpose is to understand the antecedents and consequence of knowledge or expertise coordination within the ISD team. More specifically, two studies explained that how ISD team knowledge coordination process can be improved and, in turn, leads to better teamwork performance.

In the review of teamwork process, (Cohen & Bailey, 1997) separated psychological traits (e.g. shared mental model, norm, affect) from teamwork process. Marks et al. (2001), refined the classification by viewing team process as the actual team interaction process and emergent states as factors which are dynamic in nature and vary as a function of team context, process, input, and outcome. Emergent states include

motivational, affective, and cognitive states of teamwork and should be considered as the inputs or products of team process. They also highlight that constructs are contaminated and casual relationships are ambiguous when process and emergent states of teamwork are mixed. In this dissertation, two separated but correlated studies were conducted to understand how team process affects and is affected by emergent states.

The first study focused on the coordination dimension of teamwork process and studied the relationship between expertise coordination and team effectiveness. Furthermore, based on Gerwin's (2004) model and knowledge integration literature, we separated expertise coordination into willingness, competence, and actual coordination and studied relationships among these three dimensions. The willingness and competence to coordinate represent the emergent states of teamwork and the actual coordination is the team interaction process. In this model team process is viewed as the outcome of emergent states. Data collected from 104 ISD teams with 525 members in Taiwan confirmed our hypotheses that (1) actual coordination is affected by willingness, competence, and their interaction; (2) competence leads to willingness; (3) expertise coordination helps improving group and individual level outcomes. For the interaction effect, actual coordination is low when both willingness and competence are low. Once any one of them starts to increase, actual coordination increases also. Actual coordination reaches the peak when both willingness and competence are high.

The second study extended the first one and aimed on discovering possible antecedents of the willingness and competence to coordinate expertise. Based on social capital concept, we hypothesized that relational dimension of social leads to willingness, cognitive social capital leads to competence, and both cognitive and relational

dimensions are affected by intra-team interacting process. Structural dimension represent the team interaction process and the other two dimensions of social capital refer to the emergent states of team process. In this mode, emergent states are viewed as the outcome of team process. Analysis results from 83 teams with 425 members indicate that (1) instrumental network density has positive effect on the building of TMS and TMM, (2) expressive network density has positive effect on trust but not on identity, (3) TMM and TMS can improve coordination competence, (4) TMS leads to trust and identity, and (4) team identity has an effect on coordination willingness.

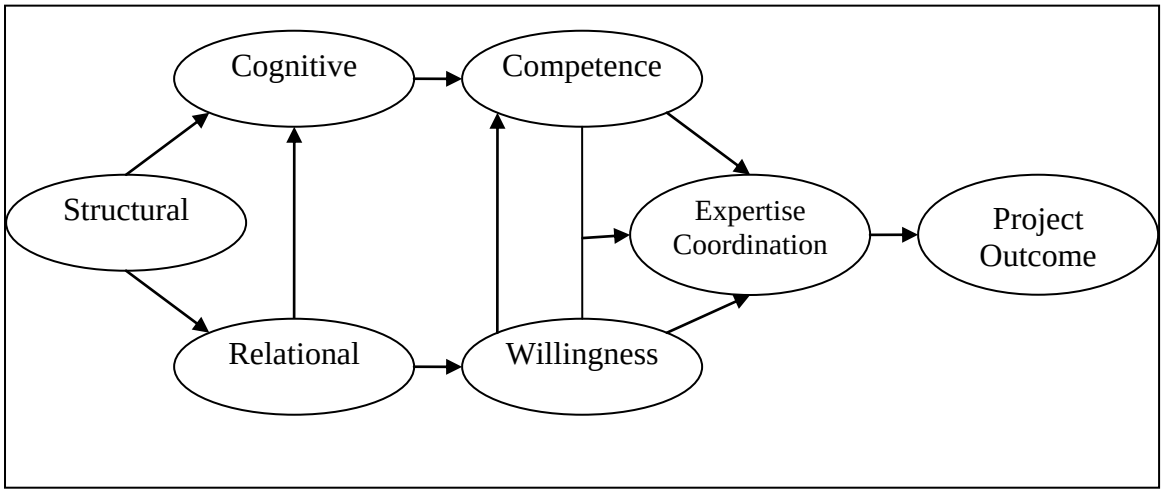


Figure 3.1 The Combined Research Model

Some implications on ISD teamwork process can be reached by putting results of these two studies together. First, understanding the effects of expertise coordination helps answering the question "why it is so important." As study one shows, ISD project outcomes are improved through intra-team expertise coordination or integration process. Expertise coordination, the exchange and combination of individual expertise during teamwork process, improves the efficiency and effectiveness of teamwork. Problems can be solved by utilizing the new created knowledge and project can adhere to predefined

schedule and cost, reach predefined goal, and complete higher quality work. Through the expertise exchange and combination process, complementary perspectives from individuals comprehend the overall view and improve the system quality. For individual team members, the exchange, combination, and utilizing created knowledge to solve problems is a learning process. Learning takes place when members exchange expertise and integrate expertise together. They can see how different expertise been put together and how the combined result can be applied to solve problems. The learned knowledge and coordinating approach can also be applied to future projects. Team members tend to be more satisfied when above activities take place. Hence, teamwork outcome is improved through better teamwork process.

Second, the results show that willingness and competence are keys for actual behavior. Expertise coordination is low when members are not willing or not competent to coordinate. Our model indicates that willingness to coordinate is strongly affected by group identity. Whether people identify themselves as part of the team is highly correlated their willingness to contribute knowledge. This confirmed the social dilemma research concept which indicates that identity encourage altruistic behavior. Therefore, forming group identity is critical for team knowledge process.

In addition to team identity, several factors not included in our model may also generate effects on willingness, e.g. afraid of losing power, insufficient trust among members, or lack of identification toward the team, etc. It is important for managers or leaders to create a working climate which makes members feel that interpersonal risk taking is safe within the team (Edmonson, 1999). A “psychological safe” work climate motivates members to contribute their expertise without considering of being harmed. In

addition, both intrinsic motivation, such as empowerment, and extrinsic motivation, such as reward systems, can also be built to encourage individual to contribute their expertise (Bartol & Srivastava, 2002). Forming a teamwork climate which facilitates teamwork process is important for team leader.

From competence perspective, expertise coordination is nothing but the process of finding, communicating, exchanging, and combining expertise. Low competence represents insufficient expertise, cannot find adequate expertise, or unable to communicate expertise with others. Our model indicates that having TMM and TMS is important for building competence. With TMM members can communicate efficiency and effective based on common understandings toward key elements of project tasks. There is no need to clarify or unify concepts before or during communication. Maximum effect can be obtained through minimum efforts. Having TMS allow members know who possess what expertise and, therefore, reduce expertise searching time and cost. Furthermore, TMM and TMS can be enhanced through instrumental interaction. Frequent exchange task related information enhances the understanding toward each other and knowing the location of expertise. It is critical for leaders or managers to enhance members' abilities in working together.

In addition to interaction, out model also indicates that task familiarity is another important antecedent of competence. Project managers can build a team with sufficient competence to coordinate expertise through selecting people who have strong technical and domain business knowledge. If experienced personnel are not available, on-the-job training may also create certain ability to coordinate expertise. Furthermore, other studies also suggest that coordination ability can be enhanced through additional methods, such

as participative decision making, standardized rule or procedures, socialization, or informational communication (Gerwin, 2004; Patnayakuni, Rai, & Tiwana, 2007).

Finally, based on prior theoretical and empirical organizational research, as well as project management literatures, these two studies advance project management research by incorporating theories from multiple areas and using data collected from various industries. This dissertation also generates important academic and practical implications on software project management.

General Conclusion List of Reference

Bartol, K. M., & Srivastava, A. 2002. Encouraging knowledge sharing: The role of organizational reward systems. ***Journal of Leadership & Organizational Studies***, 9(1): 64.

Cohen, S. G., & Bailey, D. E. 1997. What Makes Teams Work: Group Effectiveness Research from the Shop Floor to the Executive Suite. ***Journal of Management***, 23(3): 239-290.

Edmonson, A. 1999. Psychological safety and learning behavior in work teams. ***Administrative Science Quarterly***, 44(2): 350-353.

Gerwin, D. 2004. Coordinating new product development in strategic alliances. ***Academy of Management Review***, 29((2)): 241-257.

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. 2001. A temporally based framework and taxonomy of team processes. ***Academy of Management Review***, 26(3): 356-376.

Patnayakuni, R., Rai, A., & Tiwana, A. 2007. Systems development process improvement: A knowledge integration perspective. ***Engineering Management, IEEE Transactions on***, 54(2): 286-300.

Santhanam, R., Guimaraes, T., & George, J. F. 2000. An empirical investigation of ODSS impact on individuals and organizations. ***Decision Supprot Systems***, 30(1): 51-72.

Wallace, L., Keil, M., & Rai, A. 2004a. How software project risk affects project performance: An investigation of the dimensions of risk and an exploratory model. ***Decision Sciences***, 35(2): 289-321.

Wallace, L., Keil, M., & Rai, A. 2004b. Understanding software project risk: A cluster analysis. ***Information & Management***, 42(1): 115-125.

APPENDIX A IRB APPROVAL FORM

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Exempt Review Status

From: **UCF Institutional Review Board**
FWA00000351, Exp. 5/07/10, IRB00001138

To: **Shih-Chieh Hsu**

Date: **December 20, 2007**

IRB Number: **SBE-07-05359**

Study Title: **Understanding the role of social capital on expertise coordination in information system project team**

Dear Researcher:

Your research protocol was reviewed by the IRB Chair on 12/20/2007. Per federal regulations, 45 CFR 46.101, your study has been determined to be **minimal risk for human subjects and exempt** from 45 CFR 46 federal regulations and further IRB review or renewal unless you later wish to add the use of identifiers or change the protocol procedures in a way that might increase risk to participants. Before making any changes to your study, call the IRB office to discuss the changes. **A change which incorporates the use of identifiers may mean the study is no longer exempt, thus requiring the submission of a new application to change the classification to expedited if the risk is still minimal.** Please submit the Termination/Final Report form when the study has been completed. All forms may be completed and submitted online at https://iris.research.ucf.edu.

The category for which exempt status has been determined for this protocol is as follows:

2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures, or the observation of public behavior, so long as confidentiality is maintained.

(i) Information obtained is recorded in such a manner that the subject cannot be identified, directly or through identifiers linked to the subject, **and/or**

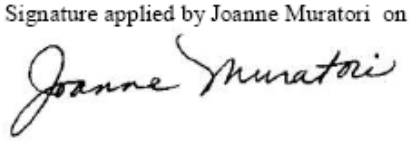
(ii) Subject's responses, if known outside the research would not reasonably place the subject at risk of criminal or civil liability or be damaging to the subject's financial standing or employability or reputation.

The IRB has approved a **consent procedure which requires participants to sign consent forms**. Use of the approved, stamped consent document(s) is required. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Subjects or their representatives must receive a copy of the consent form(s).

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 12/20/2007 01:47:47 PM EST



IRB Coordinator

APPENDIX B SURVEY QUESTIONNAIRES – ENGLISH

Shih-Chieh Hsu
Ph.D. candidate
jhsu@bus.ucf.edu
407-823-1482 voice
407-823-2389 FAX

Informed Consent form for survey participants

Dear participant:

I am a Ph.D. candidate in MIS department at University of Central Florida. I am under Dr. James Jiang's supervision to conduct this research study. You are being asked to participate in a survey designed to gather the interaction pattern within information system development team and its impact on team coordination and team performance. This research project is designed for research purposes and your individual responses are intended solely for the research team. Except for anonymous quotations of comments from surveys, responses will be reported in aggregate statistical form and no individually-identifying information will be disclosed. Your responses will be kept confidential using a numerical coding system. Only the research team will have access to your responses.

Your participation is voluntary. You do not have to answer any question(s) that you do not wish to answer. Please be advised that you may choose not to participate in this research, and you may discontinue participation at any time without consequence. There are no other direct benefits or compensation for individual participation. A presentation about program management and best industry practices will be made to the participation firms based upon request. This survey will take approximately fifteen (15) minutes if done in a single attempt. There are minimal risks associated with participation.

If you have any questions or comments about this research, please contact:

Shih-Chieh Hsu (e-mail: yli@bus.ucf.edu, 1-407-823-1482) or
Dr. James Jiang (Professor, Supervisor, email: jjiang@bus.ucf.edu, 1-407-823-4864)
MIS Department
College of Business
Orlando FL 32816-1400
USA

This research has been reviewed and approved by the UCF Institutional Review Board. Questions or concerns about research participants' rights may be directed to the UCFIRB office, University of Central Florida Office of Research, Office of Research and Commercialization, 12201 Research Parkway, Suite 501, Orlando FL 32826. The phone number is 407-823-2901.

Sincerely,

Shih-Chieh Hsu

I am 18 years of age or older, have read the procedure described above and voluntarily agree to participate.

_____ / _____

Participant Date

Management Information Systems Department
College of Business Administration
P.O. Box 161400 • Orlando, FL 32816-1400 • 407-823-3174 • 407=823=2389 FAX

Instrument

Project title: _____

Team member:

#	Name
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	
O	
P	
Q	
R	
S	
T	
U	
V	
W	
X	
Y	
Z	

This part of questions focus on understanding your interaction with other team members. For example, during the project, you seek work-related information from Jack (A), Sue (B), and Edward (D), please put a mark on A, B, and D.		A	B	C	D	E	F	G	H…
Example	You seek work-related information from _____	ˇ	ˇ		ˇ				

	During the project	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1.	Have you turned to this person for work-related information or knowledge?															
2.	Have you turned to this person for non-work-related information (e.g. entertainment)?															
3.	Has this person turned to your for work-related information or knowledge															
4.	Has this person turned to your for non-work-related information or knowledge (e.g. entertainment)?															
5.	Who are important sources of professional advice, when you have work-related problems															
6.	Are you required to interact with this person to get your job done															
7.	Whom do you need to report your work result to?															
8.	This person is my good friends and we hang out together after work															
9.	I understand what skills this person has and domains they are knowledgeable in															
10.	This person has expertise in areas that are important in kind of work I do															
11.	Your over all ability to access this person's thinking and knowledge															
12.	In light of interpersonal risks and obligations, the extent to which you feel that seeking information or advice from this person is costly															
13.	Please specify people who will always keep the promises they make to you															
14.	Please specify people who you believe you can rely on without any fear that they will take advantage of you even if the opportunity arises															
15.	If this person provides you information, you will adopt without any concern															
16.	I can tell this person my personal feelings, concerns, and needs															
17.	There are some task-related frictions between this person and me															
18.	There are certain level of emotional tension between this person and me															

Team Mental Model

	Please read and check the importance level of each item toward having an outstanding team performance 1 (not important) to 9 (very important).	Not at all 1	2	3	4	5	6	7	8	Very important 9
1.	Knowing what my team's task(s) is/are	1	2	3	4	5	6	7	8	9
2.	Knowing the requirements and procedures for performing my team's task(s)	1	2	3	4	5	6	7	8	9
3.	Understanding the situations that are likely to arise as my team performs its task(s)	1	2	3	4	5	6	7	8	9
4.	Understanding of the strategies for performing my team's task(s)	1	2	3	4	5	6	7	8	9
5.	Knowing limitations the situation puts on my team's ability to perform its task(s)	1	2	3	4	5	6	7	8	9
6.	Knowing how severe and urgent problems might be that may occur as my team performs its task(s)	1	2	3	4	5	6	7	8	9
7.	Understanding new problems that may occur as my team performs its task(s)	1	2	3	4	5	6	7	8	9
8.	Knowing when my teammate's need help	1	2	3	4	5	6	7	8	9
9.	Knowing how long it takes to complete a task	1	2	3	4	5	6	7	8	9
10.	Knowing when I need help to complete a task	1	2	3	4	5	6	7	8	9
11.	Understanding how my team's equipment works	1	2	3	4	5	6	7	8	9
12.	Understanding the procedures for running my team's equipment	1	2	3	4	5	6	7	8	9
13.	Knowing what my team's equipment can't do or its limitations	1	2	3	4	5	6	7	8	9
14.	Understanding the problems that are likely to occur with my team's equipment	1	2	3	4	5	6	7	8	9
15.	Understanding the equipment failures that are likely to occur	1	2	3	4	5	6	7	8	9
16.	Knowing how much my teammate's know about my team's task(s)	1	2	3	4	5	6	7	8	9
17.	Knowing how skilled my teammate's are in performing my team's task(s)	1	2	3	4	5	6	7	8	9
18.	Knowing the abilities of my teammate's to perform my team's task(s)	1	2	3	4	5	6	7	8	9
19.	Knowing my teammate's preferences when performing my team's task(s)	1	2	3	4	5	6	7	8	9
20.	Knowing my teammate's limitations	1	2	3	4	5	6	7	8	9
21.	Knowing my teammate's faults	1	2	3	4	5	6	7	8	9
22.	Realizing how much I know or don't know about my team's task(s)	1	2	3	4	5	6	7	8	9
23.	Knowing my level of skill in performing my team's task(s)	1	2	3	4	5	6	7	8	9
24.	Knowing my level of ability in performing my team's task(s)	1	2	3	4	5	6	7	8	9
25.	Realizing my preferences when performing my team's task(s)	1	2	3	4	5	6	7	8	9
26.	Realizing my tendencies when performing my team's task(s)	1	2	3	4	5	6	7	8	9
27.	Realizing my limitations when performing my team's task(s)	1	2	3	4	5	6	7	8	9
28.	Understanding my teammate's roles	1	2	3	4	5	6	7	8	9
29.	Understanding my teammate's responsibilities	1	2	3	4	5	6	7	8	9
30.	Understanding how my team gets information	1	2	3	4	5	6	7	8	9
31.	Understanding of the way my team's members interact with each other	1	2	3	4	5	6	7	8	9
32.	Understanding where my team gets information	1	2	3	4	5	6	7	8	9

	Based on the selected project, please respond to the questions by circling the most appropriate response according to the extent to which each team performance objective is achieved. 1: never; 5: always	1	2	3	4	5
Performance						
1.	Ability to meet project goals	1	2	3	4	5
2.	Expected amount of work completed	1	2	3	4	5
3.	High quality of work completed	1	2	3	4	5
4.	Adherence to schedule	1	2	3	4	5
5.	Adherence to budget	1	2	3	4	5
6.	Efficient task operations	1	2	3	4	5
7.	Maintain high work morale	1	2	3	4	5
System Quality						
1.	Easy to use	1	2	3	4	5
2.	User friendly	1	2	3	4	5
3.	Stable	1	2	3	4	5
4.	Response time	1	2	3	4	5
Individual Impacts						
1.	I could draw a positive balance for myself overall	1	2	3	4	5
2.	I have gained from the collaborative project	1	2	3	4	5
3.	I would like to do this type of collaborative work again	1	2	3	4	5
4.	I am able to acquire important know-how through this project	1	2	3	4	5
5.	Teamwork promotes me personally	1	2	3	4	5
6.	Teamwork promotes me professionally	1	2	3	4	5
7.	I see this project as a technical success	1	2	3	4	5
8.	I learned important lessons from this project	1	2	3	4	5
9.	I want to leave this team during the project	1	2	3	4	5
Expertise coordination						
1.	Members of this team synthesize and integrate their individual expertise at the project level	1	2	3	4	5
2.	Members of this team span several areas of expertise to develop shared project concepts	1	2	3	4	5
3.	Members of this team can clearly see how different pieces of this project fit together	1	2	3	4	5
4.	Members of this team competently blend new project-related knowledge with what they already know	1	2	3	4	5
5.	Members provide feedback to each other	1	2	3	4	5
6.	Members keep reviewing progress to obtain the way to improve the performance	1	2	3	4	5
7.	Other people tell me how good my performance is	1	2	3	4	5
8.	We acknowledge each others' extract effort	1	2	3	4	5
Collectivism						
1.	Even when I strongly disagree with group members, I avoid an argument.	1	2	3	4	5
2.	I will stay in a group if they need me, even when I'm not happy with the group	1	2	3	4	5
3.	It is important to me to respect decision made by the group	1	2	3	4	5
4.	I will sacrifice my self-interest for the benefit of the group I am in	1	2	3	4	5
5.	It is important for me to maintain harmony within my group	1	2	3	4	5

6.	I see the benefits of knowledge or expertise exchange and combination	1	2	3	4	5
7.	I see the values of knowledge or expertise exchange and combination	1	2	3	4	5
8.	Knowledge or expertise exchange and combination can improve project performance	1	2	3	4	5
9.	My colleagues expect me to exchange or combine knowledge or expertise with each other	1	2	3	4	5
10.	My supervisor expect me to exchange or combine knowledge or expertise with other people	1	2	3	4	5
Team Identity						
1.	I feel emotionally attached to this team	1	2	3	4	5
2.	I feel a strong sense of belonging to this team	1	2	3	4	5
3.	I feel as if the team's problems are my own	1	2	3	4	5
4.	I feel like part of the family in this team	1	2	3	4	5
Task Interdependence						
1.	Other members provide me some hard to find information	1	2	3	4	5
2.	I cannot complete most of my job without the help from others	1	2	3	4	5
3.	In order to complete our work, my colleague and I have to exchange information and knowledge with each other	1	2	3	4	5
4.	Feedback about how well I am doing my job comes primarily from information about how well the entire team is doing.	1	2	3	4	5
5.	My performance evaluation is strongly influenced by how well my team performs.	1	2	3	4	5
6.	My rewards from my job (e.g., pay, promotion, etc.) are determined in large part by my contributions as a team member.	1	2	3	4	5
7.	For the team task , some members doesn't have required expertise	1	2	3	4	5
8.	No matter how hard they work, some members cannot accomplish their work because of lacking required knowledge	1	2	3	4	5
9.	Some members doesn't have required expertise for their own task	1	2	3	4	5

Willingness & competence to coordinate

		Willing to					Able to				
		1	2	3	4	5	1	2	3	4	5
1.	Exchange and combine information, knowledge, and skills with others	1	2	3	4	5	1	2	3	4	5
2.	Freely share hard-to-find knowledge or expertise with other members										
3.	Exchange and combine ideas with others to solve problems or create opportunities	1	2	3	4	5	1	2	3	4	5
4.	Share my expertise with others to bring new projects of initiative to fruition	1	2	3	4	5	1	2	3	4	5
5.	Give other people performance feedback on our team	1	2	3	4	5	1	2	3	4	5
6.	Continually assess our product in order to get the feedback we need to improve it	1	2	3	4	5	1	2	3	4	5
7.	Acknowledge it when a member does extra work	1	2	3	4	5	1	2	3	4	5

Project information – based on the project you answered for the above questions

1. How long have you been in this team?
   Less than 3 month □; 4~6 months □; 7~12 months □; 1~2 years □; 2~3 years □; more than 3 years □
2. The duration of this project (or till now)?
   Less than 3 month □; 4~6 months □; 7~12 months □; 1~2 years □; 2~3 years □; more than 3 years □
3. This project is in which stage?
   Completed □; Implementation □; Final testing □; developing; System design □; System analyzing □
4. In addition to your team member, whom do you spend your time with (for entertainment)?
5. Members in other teams □; Leaders of other teams □; End user □; Function manager □; IS department head □; Top management □; external consultant □;
   In addition to your team member, whom do you contact with for task-related information?
   Members in other teams □; Leaders of other teams □; End user □; Function manager □; IS department head □; Top management □; external consultant □;
6. In addition to your team members, you conduct social activities (e.g. go out for lunch) with
   Members in other ISD team □; Leaders of other ISD Team □; End user □; Function manager □; CIO □; Top manager □; Consultant Company (external) □;
7. What developing tools are used to develop the system?
   □Java; □C/C++; □VB; □Delphi; □COBOL; □PHP; □ASP; □Others_____
8. What methodologies are adopted to develop the system?
   □SDLC; □RAD; □Prototyping; □Agile; □XP; □RUP; □MSF; □Others _____

Demographic information

1. Gender：Male □；Female □
2. Your job title：Programmer □；System annalist □；Project Leader □；IS department head □；Network administrator □；Database administrator □
3. IS department size：Less than 10 □；11 ~ 50 □；51~100 □； 101-500; more than 500 □
4. Average project team size：
   Less 7 people □；8~15 people □；16-25 people □；more than 26 people □
5. Average project duration：

Less than 1 year □ ; 1~2years □ ; 2~3 years □ ; 3~5 years □ ; 6years □

6. Your software development experience is in which industry?
   Finance □ ; Service □ ; Healthcare □ ; Entertainment □ ; Education □ ;
   Manufacturer □; Government□
7. Your total work experience：_____years (include non-IS experience)
8. Your experience in software development：_____years
9. How long have you joined this company：_____years

APPENDIX C SURVEY QUESTIONNAIRES – CHINESE

徐士傑
博士候選人
jhsu@bus.ucf.edu
電話 1-407-823-1482
傳真 1-407-823-2389

資訊系統開發團隊互動
研究問卷

貴 資訊工程師暨專案經理 惠鑒:

本人是美國中央佛羅里達大學商學院管理資訊學系的博士候選人，在 Dr. James J. Jiang 的指導下，進行本項研究。本研究的目的在於了解資訊系統開發或維護專案團隊的互動及合作，以及其對於專案績效的影響。希望透過了解團隊經營的方式，找出高失敗率的解決之道。這個問卷調查研究以學術研究為主要目的，您的個人回答僅限於研究小組內部知悉。您的個人資料以及回答的內容，不會以個人的型態呈現，最終報告會以統計分析的形式報告出來。您的回答過程，會以數字編號的方式維護您的個人機密，因此，請放心填答。

所有的問卷參與者必需年滿 18 歲以上，以自願的方式參加。您可以不回答問卷中任何您不想回答的問題。您亦可以不參加本次問卷調查，您可以在任何時間中止參與，並且沒有任何負面後果。如果您有任何問卷填答方面的問題，請與以下研究人員聯繫，謝謝！

研究單位	研究人員
美國中央佛羅大學	徐士傑 (博士候選人) 1-407-823-1482
奧蘭多，佛羅里達州，美國	jhsu@bus.ucf.edu
4000 Central Florida Blvd.	Dr. James. J. Jiang 1-407-823-4864
Orlando, FL, 32816	jjiang@bus.ucf.edu

中央佛羅里達大學(UCF)保護研究參與者權利委員會已經審查並同意本次調查研究。若您有任何與參與者權利相關的問題，可以直接與該委員會聯繫（the UCFIRB office, University of Central Florida Office of Research, Office of Research and Commercialization, 12201 Research Parkway, Suite 501, Orlando FL 32826），電話是 407-823-2901。

敬祝 鴻圖大展

我已年滿 18 歲，已詳讀以上資訊，自願參與本研究之進行，並了解我在研究中可主張的權利

_____ / _____
簽名 / 日期

Management Information Systems Department
College of Business Administration
P.O. Box 161400 • Orlando, FL 32816-1400 • 407-823-3174 • 407=823=2389 FAX

貴 資訊工程師、資訊主管您好！

本研究主要在於了解團隊成員之間的「互動程度」對「團隊合作」以及「團隊績效」的影響。首先，請你將專案的名稱以及團隊成員的姓名或暱稱填入下表。本表格主要是提供成員填答問卷的依據，讓他們清楚該針對「哪個專案或系統」，以及該專案的參與成員。

為確保貴公司機密，本表格毋須繳回，填案完畢，請立即銷毀，謝謝！！！

專案名稱：_____

團隊成員

編號	姓名(或暱稱)
A	
B	
C	
D	
E	
F	
G	
H	
I	
J	
K	
L	
M	
N	
O	

以下部份，請您就選定的專案進行回答，如果需要，您可在人員名單列表上找到該專案的名稱。									
	本部份問題在於了解你與團隊成員間的互動狀況。請針對每一題項，依據您與其它人的實際互動狀況，勾選適合的人選。為確保您的隱私，請參閱「人名←→字母對應表」，在人名所對應的英文字母下打勾即可。且問卷填答完成後，該份人名字母對應表無需繳回。 **範例**：在專案進行過程中，你向張三(編號 A)，李四(編號 B)，以及王五(編號 D)詢問與工作相關的建議，則請在該列的 A、B、D 處打勾	A	B	C	D	E	F	G	H…
例	你向【 】詢問**與工作相關**的建議	ˇ	ˇ		ˇ				

	正式題目：在專案進行過程中，(或從專案開始到現在)	A	B	C	D	E	F	G	H	I	J	K	L
1.	我曾向【 】詢問**與工作相關**的建議	A	B	C	D	E	F	G	H	I	J	K	L
2.	我曾向【 】詢問**非工作相關**(如生活、休閒)的建議	A	B	C	D	E	F	G	H	I	J	K	L
3.	【 】向我詢問與**工作相關**的建議	A	B	C	D	E	F	G	H	I	J	K	L
4.	哪些人向我詢問**非工作相關**(如生活、休閒)的建議	A	B	C	D	E	F	G	H	I	J	K	L
5.	當你有工作上的問題時，【 】會提供你專業上的建議	A	B	C	D	E	F	G	H	I	J	K	L
6.	我需要跟【 】互動來完成我的工作	A	B	C	D	E	F	G	H	I	J	K	L
7.	我需要向【 】報告我的工作成果	A	B	C	D	E	F	G	H	I	J	K	L
8.	在工作之餘，我常與【 】一起進行休閒活動	A	B	C	D	E	F	G	H	I	J	K	L
9.	我清楚地知道【 】擁有的技術或熟悉的領域	A	B	C	D	E	F	G	H	I	J	K	L
10.	【 】擁有的專業知識對於我的工作內容很重要	A	B	C	D	E	F	G	H	I	J	K	L
11.	我有辦法去取得(或使用)【 】的想法跟知識	A	B	C	D	E	F	G	H	I	J	K	L

12.	如果把人際關係的風險跟義務考慮進來，向【 】取得的成本較高	A	B	C	D	E	F	G	H	I	J	K	L
13.	【 】屬於「說到做到，讓人放心」型的？	A	B	C	D	E	F	G	H	I	J	K	L
14.	在工作上，你可以放心的依靠【 】？因為就算有機會，他也不會佔你便宜	A	B	C	D	E	F	G	H	I	J	K	L
15.	【 】提供給你資訊時，你會毫不考慮的採用？	A	B	C	D	E	F	G	H	I	J	K	L
16.	你可以很放心的告訴【 】你內心的想法與感受	A	B	C	D	E	F	G	H	I	J	K	L
17.	我跟【 】有一些因工作上意見不同引起的摩擦	A	B	C	D	E	F	G	H	I	J	K	L
18.	【 】跟我有一些個人情緒上的摩擦	A	B	C	D	E	F	G	H	I	J	K	L

首先，我們想知道您對「一般資訊團隊合作」的看法

就軟體開發或維護而言，請針對每一個題項對於團隊績效的影響，從非常不重要(1)到非常重要(9)，圈選最適合您想法的數字。 ****若要獲得良好的團隊工作績效，以下題目的重要性為何？**		**非常不重要**								**非常重要**
19.	知道團隊任務是什麼	1	2	3	4	5	6	7	8	9
20.	知道任務的需求跟執行的程序	1	2	3	4	5	6	7	8	9
21.	了解任務的執行過程中可能發生的狀況	1	2	3	4	5	6	7	8	9
22.	了解執行任務的策略	1	2	3	4	5	6	7	8	9
23.	知道團隊能力的極限	1	2	3	4	5	6	7	8	9
24.	知道某些潛在問題的嚴重性和急迫性	1	2	3	4	5	6	7	8	9
25.	了解專案進行中有可能發生的新問題	1	2	3	4	5	6	7	8	9
26.	知道其它成員何時需要協助	1	2	3	4	5	6	7	8	9
27.	知道完成任務所需時間	1	2	3	4	5	6	7	8	9
28.	知道自己何時需要協助	1	2	3	4	5	6	7	8	9
29.	知道工具(如：軟體或硬體)如何運作	1	2	3	4	5	6	7	8	9
30.	知道如何操作這些工具(軟硬體)	1	2	3	4	5	6	7	8	9
31.	知道工具(軟硬體)的極限(不能做些什麼)	1	2	3	4	5	6	7	8	9
32.	知道工具(軟硬體)可能產生什麼樣的問題	1	2	3	4	5	6	7	8	9
33.	知道工具(軟硬體)何時可能會產生問題	1	2	3	4	5	6	7	8	9
34.	知道其它成員對團隊任務的瞭解程度	1	2	3	4	5	6	7	8	9
35.	知道其它成員所擁有的技術	1	2	3	4	5	6	7	8	9
36.	知道其它成員執行任務的能力	1	2	3	4	5	6	7	8	9
37.	知道其它成員工作上的喜好	1	2	3	4	5	6	7	8	9
38.	知道其它成員的極限	1	2	3	4	5	6	7	8	9
39.	知道其它成員的缺點	1	2	3	4	5	6	7	8	9
40.	了解自己知道的多少，「不知道」的又有多少	1	2	3	4	5	6	7	8	9
41.	知道自己任務執行上的熟悉程度	1	2	3	4	5	6	7	8	9
42.	知道自己與任務相關的能力	1	2	3	4	5	6	7	8	9

43.	知道自己在工作上的喜好	1	2	3	4	5	6	7	8	9
44.	知道自己在任務執行上的傾向	1	2	3	4	5	6	7	8	9
45.	知道自己在任務執行上的極限	1	2	3	4	5	6	7	8	9
46.	了解其它成員的角色	1	2	3	4	5	6	7	8	9
47.	了解其它成員的責任	1	2	3	4	5	6	7	8	9
48.	了解團隊如何取得資訊	1	2	3	4	5	6	7	8	9
49.	知道團隊成員間如何互動	1	2	3	4	5	6	7	8	9
50.	了解成員從何處取得資訊	1	2	3	4	5	6	7	8	9

****以下部份，請就選定的專案回答，您可在名單列表上找到該專案的名稱。謝謝！**

	以下問題，請針對您個人的「意願」及「能力」兩個不同方面回答，並請在右側相對應處勾選適合的答案(1：沒有 ~ 5:有)。 **意願與能力兩者並不相同！例如：有意願幫助別人，並不代表就有能力幫助別人。	**意願**					**能力**				
		沒意願				**有意願**	沒能力				**有能力**
		1	2	3	4	5	1	2	3	4	5
1.	與其它成員交換或結合資訊、知識、或技術	1	2	3	4	5	1	2	3	4	5
2.	以開放的態度分享「很難取得」的知識技能										
3.	與其它成員交換或結合專業技術，以找出各種問題的解決之道，或創造新的機會	1	2	3	4	5	1	2	3	4	5
4.	與其它人分享或結合專業，以協助專案的進行	1	2	3	4	5	1	2	3	4	5
5.	針對不同成員的專業及績效給予建議	1	2	3	4	5	1	2	3	4	5
6.	持續檢視整體進度與成果，並提出改善之道	1	2	3	4	5	1	2	3	4	5
7.	知道別人是否做了額外的工作，並給予鼓勵	1	2	3	4	5	1	2	3	4	5

	本部份問卷在於了解您認知上的團隊合作結果，內容包括「團隊績效」，系統品質，以及對個人的影響等。請依據每個問題，由 1(不同意)，到 5(同意)，勾選最適合的答案。	不同意	↔			同意
*在**團隊的績效**方面，這個團隊...*						
1.	有能力達到專案目標	1	2	3	4	5
2.	完成預期的工作量	1	2	3	4	5
3.	完成高品質的工作	1	2	3	4	5
4.	符合預定工作時程	1	2	3	4	5
5.	保持在預算以內	1	2	3	4	5
6.	任務執行相當有效率	1	2	3	4	5
7.	維持高度工作動力	1	2	3	4	5
*在**系統品質**方面，目前開發中的系統...*						
1.	相當易於使用	1	2	3	4	5
2.	介面相當友善	1	2	3	4	5
3.	系統相當穩定	1	2	3	4	5

4.	反應速度很快	1	2	3	4	5
專案進行到現在(或已結束之後)，*我認為…*						
1.	我對自己的評價是正面的	1	2	3	4	5
2.	我從團隊專案執行中學到很多	1	2	3	4	5
3.	我會期望再進行類似的專案活動	1	2	3	4	5
4.	我從專案團隊過程中學到重要的技術資訊	1	2	3	4	5
5.	就技術上而言，這個專案是成功的	1	2	3	4	5
6.	這個專案團隊讓我學到重要的一課	1	2	3	4	5
7.	因為這次專案的成果，我的職務得以向上提昇	1	2	3	4	5
8.	團隊合作的過程，提昇了我的專業能力	1	2	3	4	5
9.	在專案進行中，我想要離開團隊的念頭很強烈	1	2	3	4	5
團隊合作方面*，在這個團隊中，我觀察到…*						
1.	團隊成員組合或整合個人的技能，形成專案層級的知識技能	1	2	3	4	5
2.	團隊成員跨越數個專業領域來發展共同的專案概念	1	2	3	4	5
3.	成員可以清楚地看到專案不同的部份是如何結合	1	2	3	4	5
4.	團隊成員總是能有效地將新的與現有的專案知識結合	1	2	3	4	5
5.	團隊成員相互給予工作上的建議	1	2	3	4	5
6.	我們持續檢視成果，並提出改善之道	1	2	3	4	5
7.	團隊成員會告之我是否表現良好	1	2	3	4	5
8.	團隊成員相互認可彼此(額外)的付出	1	2	3	4	5
個人想法方面*，在這個團隊任務中…*						
1.	即使心中強烈不同意其它人的意見，我仍會儘量避免發生衝突	1	2	3	4	5
2.	即使心中不滿，當需要的時候，我還是會留下來幫忙	1	2	3	4	5
3.	遵重大家所做的決定，對我來說很重要	1	2	3	4	5
4.	我會為了團隊的利益犧生個人的權益	1	2	3	4	5
5.	對我來說，維持團隊和諧很重要	1	2	3	4	5
6.	我認為與其它人交換或結合彼此的知識或技能是有益的	1	2	3	4	5
7.	我相信與其它人交換或結合彼此的知識或技能可促進專案進行	1	2	3	4	5
8.	我認為與其它人交換或結合彼此的知識或技能是有價值的	1	2	3	4	5
9.	我的同事希望我與他們分享或結合彼此的知識或專業技能	1	2	3	4	5

10.	我的上司希望我和同事們分享或結合彼此的知識專業技能	1	2	3	4	5
11.	我對這個專案所使用的軟體及硬體相當熟稔	1	2	3	4	5
12.	我對這個專案所處的商業領域相當熟悉	1	2	3	4	5
13.	我對這個專案所用的開發方法論很有經驗	1	2	3	4	5
*在**團隊的情感**方面，我的感覺是…*						
1.	對於目前這個團隊，我有深厚的情感	1	2	3	4	5
2.	我深深地認為自己屬於這個團隊	1	2	3	4	5
3.	我把團隊的問題當成自己的問題來面對	1	2	3	4	5
4.	我認為自己是這個團隊大家庭的一份子	1	2	3	4	5
***團隊任務的相互依賴性**方面，在這個團隊任務中…*						
1.	其它成員依賴我提供一些執行任務所需的資訊或資訊	1	2	3	4	5
2.	如果缺乏其它成員所提供的資訊跟資源，我很難完成我的工作	1	2	3	4	5
3.	為了完成整個任務，成員之間必需彼此交換資訊及知識	1	2	3	4	5
4.	別人依據整個團隊做得好不好來決定我做得好不好	1	2	3	4	5
5.	團隊績效對於我個人績效的評等有很大的影響	1	2	3	4	5
6.	我工作上的報酬(例如薪水，升遷等)有一大部份是取決於我對團隊的貢獻	1	2	3	4	5
7.	有些團隊成員缺乏任務所需的特殊技能	1	2	3	4	5
8.	不管多麼努力，有些成員缺乏足夠的知識或技能把事情做好	1	2	3	4	5
9.	有些團隊成員缺乏足夠的知識跟技能去完成他個人的任務	1	2	3	4	5

專案相關資訊 – 針對您回答的這個專案而言

9. 你加入這個專案團隊多久了？

□少於 3 個月; □4-6 個月; □7-12 個月; □1-2 年; □2-3 年; □多於 3 年

10. 這個專案從開始到現在多久了？

□少於 3 個月; □4-6 個月; □7-12 個月; □1-2 年; □2-3 年; □多於 3 年

11. 這個專案目前處於哪一個階段？

□已完成; □安裝建置階段; □最後測試階段; □系統開發階段; □系統設計階段; □系統分析階段

12. (多選) 除了所屬的專案成員之外，你還跟哪些人有社交活動 (如共進午餐)？

□其它專案團隊成員; □其它專案領導人; □終端使用者; □使用者部門經理; □資訊部門主管; □高階主管; □外部顧問人員;

13. (多選) 除了所屬的團隊之外，你還跟哪些人詢問或提供與本專案相關的資訊？

□其它專案團隊成員; □其它專案領導人; □終端使用者; □使用者部門經理; □資訊部門主管; □高階主管; □外部顧問人員;

14. 這個專案主要使用哪一種開發工具？

□Java; □C/C++; □VB; □Delphi; □COBOL; □PHP; □ASP; □其它_____

15. 該專案採用哪一種方法論？

□SDLC; □RAD; □Prototyping; □Agile; □XP; □RUP; □MSF; □其它 _____

16. 你在該專案中的主要任務(或是您在專案中的職稱)是？

□程試設計開發；□系統分析；□專案領導人；□網路管理；□資料庫管理; □使用者；□測試人員; □維護人員

個人相關資訊

10. 性別：□男；□女

11. 你的正式職稱：□程試設計師；□系統分析師；□專案領導人；□資訊部門主管；□網管人員；□資料庫管理人員; □其它_____

12. 資訊部門規模：□少於 10； □11~50； □51~100； □101-500; □超過 500 人

13. 平均專案規模：□少於 7 人； □8~15 人； □16-25 人； □超過 26 人

14. 平均專案期間：□少於 1 年； □1~2 年； □2~3 年；□3~5 年；□超過 6 年

15. 您的軟體發開經驗大多在於哪個產業？

□財金業；□一般服務業；□醫療業；□娛樂業；□教育業；□製造業；□政府單位

16. 您有_____年工作經驗(包含各種工作經歷)

17. 您有_____年軟體開發經驗

18. 您在目前公司已經服務_____年