HOW BOUNDARIES SPANNING ENHANCES ISD PROJECT TEAM PERFORMANCE

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Abstract

Boundaries between project team and other units emerge when information system development project team is formed. Difficulties, during project execution, introduced by such boundaries highlight the importance of boundaries spanning for project team. On the other hand, previous studies have highlighted the critical role of social capital on performance, through enhancing acquisition, exchange, and integration of intellectual resources. While the impact of social capital on teamwork performance has been illustrated by past studies, in this study, we move further and argue that social capital contributes to project performance through promoting boundaries spanning. We first identify three critical boundaries between information system development (ISD) project team and user group, and then validate the mediating role of boundaries spanning, between social capital and project performance. Data collected from 184 practitioners confirmed the proposed concept.

Keywords: Social Capital Theory, Team Boundary Spanning, Project Performance.

1 INTRODUCTION

Software project team is considered as a temporary combination of diversified resources that aims at accomplishing specific goal within predefined budget and schedule (Archibald 2003). Software project team is conceptually viewed and treated as an individual unit to perform tasks, once the team is formed and the project is kicked off. It implies that there is an invisible faultline or boundary blocks project team from its environment. Given that resources are limited within one organization, projects and departments may compete with each other for those limited resources to achieve their own goals (Archer & Ghasemzadeh 1999). Each unit therefore needs to protect resources available and acquire those not available but needed resources from external. Specifically, the project team need to assure needed software, hardware, and expertise resources are available. The uncertainty of acquiring and maintaining resources challenges the planning and control of software project.

On the other hand, in order to assure the developed outcome can meet users' needs, the project teams need to interact with various stakeholders, such as users, to assure that correct requirements are elicited and the final designs are acceptable for other stakeholders. However, the invisible fautline might block the project team to communicate with different stakeholders (including users) effectively (Tesch et al. 2009). As an outcome, incorrect requirement elicited is often considered as one major risk that significantly undermines the performance of project team. The developed system can be viewed as a result of integrating business and technical knowledge possessed by different parties (van den Hooff & de Winter 2011). Since the project team is a temporary unit and mainly formed by technical individuals, it is reasonable to expect that the way those technical members perform assigned task (operational) is significantly different from other business units. This operational faultline further increases the difficulty of producing high quality system. For achieving high performance, it is critical for ISD project team to cross faultline or to span the boundary to other departments or units. Even though few studies emphasize the importance of other faullines and boundaries but did not investigate into the faultlines crossing or boundaries spanning issue with large quantitative opinions collected from practitioners (Sawyer et al. 2010). Therefore, the research question of this study is: how ISD project teams can effectively cross boundaries to achieve better performance?

Since an ISD project team have to interact with external stakeholders for crossing boundaries, it is critical to consider social aspects of ISD project teams. By viewing ISD project team as an actor, we adopt social capital theory and argue that the extent to which a project team can effectively span the boundaries is associated with the amount of social capital that it possesses. Social capital is classified into three dimensions: structural, relational, and cognitive. Structural social capital represents the physical ties to connect the ISD project team and critical stakeholders for accessing required resources. Relational social capital refers to the emotional and affective status between the ISD project team and other units that have impact on the willingness of resources exchange. Cognitive social capital represents the shared language and vision that can access resources effectively (Hsu & Hung 2013). Recently studies have demonstrated the importance of social capital in information system development area. While some studies have demonstrated its direct effect on project performance (Hsu & Hung 2013), other researchers have shown that social capital can facilitate information searching (Brion et al. 2012), knowledge integration (Robert Jr et al. 2008), knowledge sharing (Chang & Chuang 2011), knowledge acquisition (Yli- Renko et al. 2001) coordination, the obtaining of resources, and the exchange and combination of resources (Tsai & Ghoshal 1998). Hence, we further propose that the effect of social capital on through boundaries spanning.

In this study, we first identify important boundaries and then explore the critical role of boundaries spanning in ISD context. In particular, we propose the mediating role of boundaries spanning between social capital and project performance. This indicates that social capital improves project performance through allowing project team to cross the invisible inherited faultlines and boundaries. This study contributes to both academia and practice in the following ways. First, this study demonstrates why social capital can enhance project performance – through facilitating boundary. Second, different

from past studies that largely focused on a single boundary or faultline, this study includes several boundaries and according spanning effects simultaneously in the ISD project team context.

This paper is organized as follows. In the following section, we first review social capital theory, boundary spanning, and project performance studies. In the third section, hypotheses and research model are proposed. The fourth section, we describe the method used to collect data and examine the proposed model. The fifth section presents the discussion. Last, conclusion, implication and limitation are provided.

2 LITERATURE REVIEW

2.1 Boundaries and Boundaries Spanning

According to the Oxford English Dictionary, a boundary is "a real or imagined line that marks the limits or edges of something and separates it from other things or places". Initially, boundaries include physical creatures, such as river, ocean, and mountain. With the rapid acceleration of globalization and innovative technology over the last couple of decades, traditional boundaries based on geographical regions and time zones can be crossed with less effort. In addition to physical gaps, the term "boundary" also refers to other intangible barriers such as asymmetric resources, gaps caused by inadequate knowledge, and the inability to cooperate and gain support. Those intangible boundaries play a critical role in contemporary organization because cross-functional alignment is desired in a highly interdependent organization design (Ancona & Caldwell 1992). Boundary spanning refers to the communication that links units to external sources of information (Tushman & Scanlan 1981). Team boundary spanning is defined as the team's actions to establish linkages and manage interactions with parties in the external environment (Ancona & Caldwell 1992; Marrone et al. 2007).

In an information system development (ISD) context, teamwork style is often adopted to develop needed information system. The complex nature of contemporary information system needs more than one individual to contribute their expertise to carry out the project. However, there is an inherited and intangible line between project team and other units within organization when the project team is formed. During the development process, in order to carry out the task effectively, project team need to cross the intangible line, which separates the team from its environment. There are several boundaries undermines the effectiveness of project team. It is critical to clarify those lines or boundaries and identify possible ways to cross the lines and span the boundaries.

While attempting to understand the role of boundaries, knowledge gaps among different stakeholders associated with the project attract researchers' attention initially. For example, in new product development area, Carlile (2002, 2004) identify three types of knowledge boundaries and proposed that knowledge boundaries among participants in the same team reduce the effectiveness of new product development project. Racheva (2009) also propose knowledge boundaries may take place within project team and between project team and its environment. Knowledge boundaries within project team is named project action boundary, which represents the situation that members of a project team possess diversified knowledge and cannot effectively integrate those diversified knowledge. Knowledge boundaries also take place between project team and other stakeholders. Project knowledge boundary can be observed when members cannot apply knowledge to interpret and understand the project requirements in the designated context. Project team members must increase contextual knowledge and combine it with occupational knowledge in order to minimize the gap between the requirements and the solution so that the system performs according to the specific needs of the business. In addition to knowledge boundaries, Racheva (2009) also identify project social boundary, which means that project team must invariably acquire resources and assistance from outside experts to deal with complexity and uncertainty embedded in project or caused by environment. Interpersonal ties, relationships and connections are means for team members to access critical resources to strengthen their ability. In the study of offshore ISD project, Krishnan and Ranganathan (2009) further proposed that the concept of operational boundary, social boundary, and knowledge boundary. Knowledge boundary spanning refers to the activities that facilitate the search

and acquisition required information, and enhance knowledge sharing and integration with related external experts. Social boundary spanning refers to the activities that monitor the outer environment, acquire management support, and identify trends. Operational boundary spanning refers to activities that coordinate with stakeholders and allocate resources.

Although several past studies in ISD project management have taken effect of boundary spanning into consideration, these studies largely focus on either knowledge boundary (Levina & Vaast 2005; Patnayakuni et al. 2007) or general boundary spanning (Gopal & Gosain 2010). In line with Krishnan and Ranganathan (2009), this study classifies boundary spanning into three dimensions: social boundary spanning, operational boundary spanning, and knowledge boundary spanning. Social boundary spanning comprises managing external dependence of team and obtaining critical resources to gain better performance (Ancona 1990). Knowledge boundary spanning refers to the extent that facilitates knowledge exchange to solve problems (Okhuysen & Eisenhardt 2002). Operational boundary spanning is defined as the extent of routine interactions with stakeholders outside the teams to coordinate task assignment (Faraj & Sproull 2000).

2.2 Social Capital Theory

Social capital 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, p. 248). Social capital can be viewed as a set of accessible resources which are accumulated by the entities within a relational social network and can trigger beneficial actions (Baker 1990; Coleman 1988). For example, it is "the number of people who can be expected to provide support and the resources those people have at their disposal" (Boxman et al. 1991, p. 52). Nahapiet and Ghoshal (1998) further classify social capital into three dimensions: structural, relational, and cognitive.

Structural capital reflects the interaction pattern of one social actor with others in the social network (Tsai & Ghoshal 1998). Structural dimension of social capital can be viewed as the network ties which serve as channels to access resources. The term also refers to the configuration of those ties (i.e., density, connectivity, and hierarchy), which can affect the flexibility and ease with which resources can be exchanged (Burt 2000; Inkpen & Tsang 2005). Relational dimension of social capital refers to the nature and quality of the above relationships. It is generally measured via trust, obligation, identification, and norms of members within the network. Theorists argue that when relational capital is high, people are willing and able to rely on each other, and can acquire resources from each other. Cognitive dimension of social capital refers to the language and mental model shared among actors in the social network. Such sharing can strengthen the team’s ability to communicate and exchange resources efficiently.

Nahapiet and Ghoshal’s social capital model has been extended and applied to various empirical studies to explore the impact of social capital on entrepreneurial growth (Liao & Welsch 2003), knowledge integration (Robert Jr et al. 2008), knowledge transfer (Inkpen & Tsang 2005), knowledge sharing (van den Hooff & de Winter 2011), project productivity (Reagans & Zuckerman 2001), coordination (Di Vincenzo & Mascia 2012), value creation, and the exchange and combination of resources (Tsai & Ghoshal 1998). However, it is noticeable that, even though social capital is viewed as one critical resources benefiting performance through allowing actors to across the given boundaries between them and others to acquire resources for action, whether the impact of social capital really goes through social capital has not been widely examined. Few of them address this issue from limited perspective only. For example, Yli-Renko et al. (2001) illustrate how social capital can benefit final performance through enhancing knowledge acquisition. Through identifying three types of boundaries between ISD project team and other stakeholders, we also attempt to examine whether social capital can enhance ISD project team through promoting the spanning of different boundaries. Adler and Kwon (2002) reviewed social capital research and categorized according studies into three streams, focusing on external relation, internal relation, or both. The summation of three research streams indicates that social capital is the shard mental model allows internal members to cooperate with each other, is the sum of capabilities which allow people to identify and have

opportunities to contact important stakeholders to request support and resources. For example, A common consensus, shared expectations and a shared mental model allow people to feel a sense of oneness with the group, and a willingness to facilitate cooperation. In the third research stream, both external and internal relations are considered in a neutral perspective of social capital. Davidsson and Honig (2003) argued that the bridging and bonding forms of social capital are complementary. As a result, neither external nor internal linkages are dispensable. In the ISD project team context, our study asserts that internal bonding and external bridging are both essential to the team. Therefore, we adopt Nahapiet and Ghoshal's definition of social capital which addresses both bonding and bridging (Newell et al. 2004).

Hooff and Winter (2011) combine social capital theories to reveal how to deal with the relationship between IT teams and business operation teams which can be problematic because of gaps in each team's background, knowledge and expectations. The results show that structural, cognitive and relational capital can effectively narrow these problematic gaps. Based on Hooff and Winter's pioneering research, we have also reviewed relevant social capital research regarding project-based organizations, digitally-enabled teams, and project-based R&D and ISD teams (Chiu et al. 2006; Di Vincenzo & Mascia 2012; Krishnan & Ranganathan 2009; Reagans & Zuckerman 2001; Robert Jr et al. 2008) to define social capital and its sub constructs in our study.

The main concept is that social capital allows actor to acquire resources needed to facilitate action. As an outcome, project performance can be improved. Social capital is also shown can benefit the creation of other capitals, such as intellectual capital (Nahapiet & Ghoshal 1998; van den Hooff & de Winter 2011). Even though past studies have shown that social capital can enhance performance, whether such an effect goes through boundaries spanning activities haven't been explicitly tested. Therefore, based on the literature review, this study proposes a research model as shown in Figure 1. We especially argue that social capital allows actors, ISD project teams, to cross boundaries between them and other parties. Furthermore, we also proposed that boundaries spanning mediate the effect of social capital.

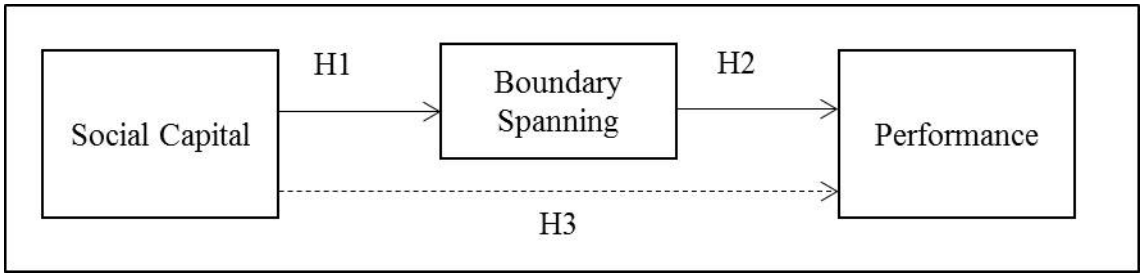

Figure 1. Research Model

3 HYPOTHESIS DEVELOPMENT

3.1 From ISD Team Social Capital to Boundary Spanning

As discussed above, social capital is asset that allows a team to facilitate knowledge integration, knowledge sharing, coordination, the exchange and combination of resources, and the obtaining of support (Brion et al. 2012; Chang & Chuang 2011; Chiu et al. 2006; Di Vincenzo & Mascia 2012; Robert Jr et al. 2008). Social capital can accelerate boundary spanning, defined as activities which allow the team to bridge the knowledge gap, enhance coordination, and gain external resources and support. In the followings, we provide specific argument to describe the effect of social capital on boundaries spanning.

In an ISD project context, the project team is distinguished from other when it is formed. Structural capital is the network ties that link the ISD project team and relevant stakeholders. Ties serve as bridges between separate organizational areas or functions. It will be difficult for project team to

interact, communicate, or perform any required activities when the ties between project team and other units are absent. For operational, structural social capital is critical for operational boundary spanning because network ties are critical for task coordination and integration (Di Vincenzo & Mascia 2012; Robert Jr et al. 2008). From knowledge perspective, when ties are strong, project team can better know who possesses specific knowledge and expertise that can be exchanged and integrated (Robert Jr et al. 2008; Yli- Renko et al. 2001). Furthermore, solid network ties also serve as a mean that allows project team to identify the location of resources and clarify sources of potential disturbances (Brion et al. 2012). Hence, we argue that structural capital has a positive impact on knowledge boundary spanning, operational boundary spanning, and social boundary spanning.

Relational capital refers to the project team's relationship with the social network, in terms of trust, reliance, and interactions. Different from structural social capital mainly focus on the structure of network, relational capital focuses on how valuable relationships can be built on the given structure (Tsai & Ghoshal 1998; van den Hooff & de Winter 2011). With strong relational capital, members of an ISD project team can better identify the location of knowledge resources and acquire that resource or gain support from external (Brion et al. 2012; Newell et al. 2004; Robert Jr et al. 2008). Once the linkages are well established (i.e., structural capital), interactions, communication, and exchanges of resources and expertise can flow easily. Individuals in project teams and other units are willing and able to rely on each other to cooperate and coordinate as they work together (Tsai & Ghoshal 1998). In the ISD project context, if the team and relevant stakeholders have a great working relationship, they can better share and integrate knowledge, achieve a higher level of performance on the accompanying tasks, and gain management support. Thus, we argue that relational capital has a positive impact on the spanning of knowledge boundaries, operational boundaries, and social boundaries.

Cognitive capital refers to the language shared between the project team and relevant stakeholders, which allows for congruence in the understanding and interpretation of project related issues. With shared language and experiences, individuals involved in the project are able to communicate with each other and find needed helps and directions easier. Coordination and negotiation are easier in this condition. In addition, strong cognitive social capital allows project team and relevant stakeholders to communicate with each other by using consistent business and technical language, which is critical in system analysis and design stage. Cognitive capital is also affected by structural social capital, so we can infer that the same network ties that are the foundation of social capital allow the building of a shared vision and common consensus (Tsai & Ghoshal 1998; van den Hooff & de Winter 2011). which allows them to better share information, understand and define the system requirements, and integrate the outcome (Stout et al. 1999). Also, using this shared language, they can promote the spirit and the core concept of the project to others in order to request resources. In addition to connected together, effective knowledge sharing and integration also need shared both parties to have shared understanding toward each other (Newell et al. 2004). Hence, we argue that cognitive capital has a positive impact on the spanning of knowledge boundaries, operational boundaries, and social boundaries. We therefore propose the following.

Hypothesis 1: Team social capital is positively associated with team boundary spanning.

3.2 From ISD Team Boundary Spanning to Project Performance

Past studies have shown that boundary spanning is positively associated with team performance (Ancona & Caldwell 1992; Brion et al. 2012; Krishnan & Ranganathan 2009; Marrone et al. 2007). Effectively acquiring resources (e,g., money, new members, equipment) for the system development of the team help the project proceed smoothly. It prevents outsiders from "overloading" the team with too much information or too many requests that might lower project performance (Ancona & Caldwell 1992). With effective social boundary spanning, the ISD project team can obtain superior or user supports. If a project leader can persuade other individuals that the this project is important, it will increase the chances of being successful (Sarin & McDermott 2003).

In order to respond to constantly changing requirement of users, teams must effectively coordinate with members or related stakeholders (Faraj & Sproull 2000). Through communication with users or related stakeholders, it increases user participation and helps tailor the system's attributes to the users' needs (Nidumolu 1995), and then reduces the delay of project.

When users and developers have a shared interpretation regarding the IS development, the users can smoothly deliver their knowledge to help IS developers identify the actual requirements (He & King 2008). If users and IS developers can identify actual requirements in the earlier stage, the project would be accomplished on time and within budget (Patnayakuni et al. 2007). Therefore, we propose the following.

Hypothesis 2: Team boundary spanning is positively associated with project performance.

3.3 The Mediating Role of Team Boundary Spanning

Hypotheses 1 and 2 suggest that, for the ISD project team, social capital is positively associated with boundary spanning, and boundary spanning is also positively associated with project performance. In this section, we further argue that the effect of social capital on project performance mainly goes through boundaries spanning. That is, social capital can enhance boundary spanning, which, in turn, facilitates the achievement of better project performance. Many studies in this area pointed out that social capital is positively associated with performance (Oh et al. 2004; Yang & Tang 2004). More and more studies attempt to explore the impact of social capital on enhancing knowledge integration and sharing, coordination, promoting productivity and creativity, resources exchange and combination, and even support obtaining (Brion et al. 2012; Chang & Chuang 2011; Chen et al. 2008; Chiu et al. 2006; Reagans & Zuckerman 2001; Robert Jr et al. 2008; Tsai & Ghoshal 1998; Yli- Renko et al. 2001). Since those activities have been shown as parts of teamwork process, which is critical for team performance, we therefore further argue that the relationship between social capital and project performance is mediated by boundary spanning. Hence, we propose the following.

Hypothesis 3: The impact of social capital on project performance is mediated by team boundary spanning.

4 RESEARCH METHOD

4.1 Data Collection

We conducted a questionnaire survey to examine the proposed model and hypotheses. The target sample of this study is members of the ISD team. We asked respondents to consider their most recent or most impressive ISD project as the scenario for their responses. Questionnaires were sent via letter form to 150 part-time MBA students, and via a web-based form. A total of 205 surveys were returned and 21 of them were dropped because of invalid response and missing value. The demographic information is shown in Table 1.

Measure	Categories	#	%	Measure	Categories	#	%
Gender	Male	127	69.0	Education	College and below	102	55.7
	Female	57	31.0		Master	79	43.2
Age	Less than 25	40	21.7		Doctoral	0	0.0
	26~30	44	23.9		Missing	2	1.1
	31~35	53	28.8	Position	Programmer	97	52.7
	36~40	28	15.2		System Analyst	15	8.2
	Above 41	19	10.3		Team Leader	10	5.4
Tenure	Less than 1	31	16.8		Department Manager	2	1.1
	Less than 6	60	32.6		Network Administrator	13	7.1
	7~15	79	42.9		Database	6	3.3

					Administrator		
	16~30	13	7.1		Testing Member	4	2.2
	Missing	1	0.5		Maintaining Member	3	1.6
Industry	Manufacturing	53	28.8		Other specialties	33	17.9
	Service	28	15.2		Missing	1	0.5
	Information Technology	64	34.8	Project Size	Less than 5 people	97	55.7
	Public	34	18.5		6~10 people	56	32.2
	Othersb	4	2.2		11~20 people	12	6.9
	Missing	1	0.5		More than 21	6	3.4
IT Department Size	1~10	56	30.4		Missing	3	1.7
	11~20	47	25.5	Project Duration (Month)	Less than 3	32	17.4
	21~40	0	0.0		3~6	60	32.6
	More than 40	80	43.5		7~12	44	23.9
	Missing	1	0.5		13~18	22	12.0
					More than 18	21	11.4
					Missing	5	2.7

Table 1. Sample Demographics (N=184)

4.2 Constructs and Measurements

All constructs were measured with items adopted or adapted from past studies. All items are in Likert scale style, ranging from 1 (strongly agree) to 7 (strongly disagree).

Social capital includes structural, relational and cognitive three components. For structural capital, 3 items adopted from Hoff and Winter (2011) and Faraj and Sproull (2000) were used to the extent to which network linkages, that allow ISD project team to reach or access specific knowledge and resources from relevant stakeholders, are available. For relational capital, 3 items adopted from Hoff and Winter (2011) and Roberts et al. (2008) were used to measure the extent to which project team and other stakeholders are willing and able to rely on each other for offering knowing resources to each other. For cognitive capital, 2 items adopted from Hooff and Winter (2011) and Chiu et al. (2006) were used to measure the extent to which ISD project team and relevant stakeholders have shared language, experience and background that allow them to communicate effectively.

Boundaries spanning is a second-order formative construct with three reflective first-order components, including knowledge, social, operational boundaries spanning. For knowledge boundary spanning, 4 items were used to measure knowledge boundary spanning, including if project team and relevant stakeholders are able to do knowledge sharing, exchange, and integration. For social boundary spanning, 3 items were used to measure the extent to which project team can acquire and protect resources of the team effectively. For operational boundaries spanning, 5 items were used to measure whether project team and relevant stakeholders can coordinate the work, integrate the outcome, and plan the project schedule collaboratively. These items were adopted from Brion et al. (2012), Faraj & Yan (2000), Krishnan & Ranganathan (2009), and Ancona & Caldwell (1992)

Project performance were measured with 6 items, adopted from Markus & Mao (2004) and Jones & Harrison (1996), focus on capturing the extent to which the project was accomplished within planned schedule and budget and the level of system quality, system reliability, and user satisfaction.

4.3 Common Method Variance

Common method variance (CMV) might be a concern in this study, because both independent and dependent variables are collected simultaneously from the same respondent. The Marker-Variable Technique was implemented to estimate the extent of CMV in our causal model (Malhotra et al. 2006). First, we chose the value of second-smallest positive correlation (0.053, the coefficient correlation of operational boundary spanning and project size) as the marker variable and used this value to conduct

the CMV-adjusted correlations calculation. No significant difference was found between the original and adjusted correlation matrix. Therefore, CMV might not be problematic in this study.

4.4 Reliability and Validity

In this study, we have examined the reliability, convergent validity and discriminate validity of measurement model. The reliability was ensured through composite reliability, Cronbach's alpha and factor loading. Convergent validity should be examined by item-to-total correlation (ITC), composite reliability, and average variance extracted (AVE) by constructs (Fornell & Larcker 1981). For discriminant validity, the correlation between construct pairs should be lower than 0.90 and the square root of AVE should be higher than the inter-construct correlation coefficients (Fornell & Larcker 1981). All validity requirements are met, as shown in Tables 2 and 3.

As discussed in this study, both social capital and boundary spanning have sub dimensions. Therefore, we treated social capital and boundary spanning as second order formative constructs. We examined the co-linearity of the three constructs of social capital and the three constructs of boundary spanning by the variance inflation faction value (VIF). The testing results indicate that all VIF values are less than 3.33 (range from 1.2 to 1.9); therefore, we conclude that there is no co-linearity within the second order constructs. In summary, this formative model is demonstrated to be appropriate.

Constructs	Items		Factors Loading
Structural Capital CR=0.869 Alpha=0.774 AVE= 0.688	1	During the system development, when encountering problems, team members all know that they can ask for help from which other related department personnel (including users).	0.80
	2	Team members all know that what kinds of occupational knowledge and skill other related department personnel (including users) have.	0.87
	3	Other related department personnel (including users) all know that what kinds of occupational knowledge and skill our team members have.	0.82
Relational Capital CR=0.922 Alpha= 0.873 AVE= 0.799	1	During the system development, our team members are able to trust the occupational skills of other related department personnel (including users).	0.89
	2	When we need support, our team members all believe that they can rely on other related department personnel (including users)'s assistance.	0.93
	3	Our team members have close interactive relationship with other related department personnel (including users).	0.86
Cognitive Capital CR=0.828 Alpha=0.585 AVE= 0.707	1	During the system development, members of our team and people in other related department personnel (including users) can communicate through shared operational and technical languages.	0.85
	2	During the system development, members of our team and people in other related department personnel (including users) usually communicate through concise word and sentence when discussing.	0.83
Knowledge Boundary Spanning CR=0.925 Alpha=0.891 AVE= 0.755	1	Members of our team and people in other related department (including users) can integrate different knowledge to solve problems effectively.	0.83
	2	Members of our team and people in other related department (including users) can share ideas with each other to propose innovative system functions.	0.90
	3	Members of our team and people in other related department (including users) can collaboratively apply new knowledge and ideas into system design.	0.90
	4	Members of our team and people in other related department	0.85

		(including users) can exchange knowledge with each other.	
Social Boundary Spanning CR=0.895 Alpha= 0.824 AVE= 0.740	1	Our team members can effectively acquire project needed resources.	0.88
	2	Our team members can effectively promote this project to other departments.	0.83
	3	Our team members can effectively protect the project resources and protect the team from outer disturbance.	0.87
Operational Boundary Spanning CR=0.935 Alpha= 0.913 AVE= 0.743	1	Members in our team and people in other related department (including users) can coordinate the timeline of the project delivery and accomplishment.	0.84
	2	Members in our team and people in other related department (including users) can review the documents of system requirement and system design collaboratively.	0.85
	3	Members in our team and people in other related department (including users) can integrate the project outcomes among each other effectively.	0.89
	4	Members in our team and people in other related department (including users) can monitor and check the progress and time schedule of the project collaboratively.	0.86
	5	Members in our team and people in other related department (including users) can share related information with each other.	0.87
Performance CR=0.906 Alpha=0.876 AVE= 0.618	1	The developed system is stable and reliable.	0.80
	2	The quality of the developed system is high.	0.84
	3	Users perceive that the developed system can meet their functional requirement.	0.82
	4	The project objectives are realized.	0.81
	5	The project is delivered within the budget (cost).	0.70
	6	The project is delivered on schedule.	0.73

Table 2. The Result of Factor Analysis

Variables	**Mean**	**Std. Dev.**	**[a] M3**	**[b] M4**	**[c]Correlation Matrix**						
					SC	**RC**	**CC**	**KB**	**SB**	**OB**	**PP**
Structural Capital	5.19	0.93	-0.42	0.00	**0.83**						
Relational Capital	5.08	1.04	-0.77	0.67	0.54	**0.89**					
Cognitive Capital	4.33	1.18	-0.45	-0.36	0.35	0.39	**0.84**				
Knowledge BS [d]	4.89	1.07	-0.53	0.24	0.45	0.58	0.46	**0.87**			
Social BS [d]	4.66	1.09	-0.73	1.12	0.32	0.45	0.42	0.56	**0.86**		
Operational BS [d]	4.86	1.07	-0.50	0.43	0.56	0.61	0.47	0.64	0.60	**0.86**	
Project Performance	4.87	0.94	-0.21	-0.34	0.42	0.46	0.31	0.58	0.62	0.61	**0.78**
Note. [a] M3: Skewness; [b] M4: Kurtosis [c]Correlation Matrix: The diagonal line represents the square root of AVE; [d] BS: boundaries spanning											

Table 3. Descriptive Statistics and Correlation Matrix

4.5 Hypothesis Testing: The Structural Model

Partial least squares regression (PLS) analysis was used to test proposed hypotheses. As indicated in Figure 2, team social capital (β=0.73, $p<0.001$) has a positive effect on team boundary spanning, and team boundary spanning (β=0.69, $p<0.001$) has a positive effect on project performance. The results support both Hypothesis 1 and Hypothesis 2.

By following the steps proposed by Barron and Kenny (1986), we further validated the mediated effect of team boundaries spanning. First, the relationship between social capital and performance was positive and significant (β=0.532, $p<0.001$). Second, we added boundary spanning as a mediator into the model (Figure 2). The result of our test indicated no impact of social capital on project performance (β=0.024, $p > 0.1$). Moreover, we found that the explanatory power of the model

increases from 27.5% to 49.7% if boundary spanning was modelled as a mediator and included in the regression simultaneously. Hence, we conclude that boundary spanning fully mediate the relationship between social capital and project performance. This conclusion supports Hypothesis 3.

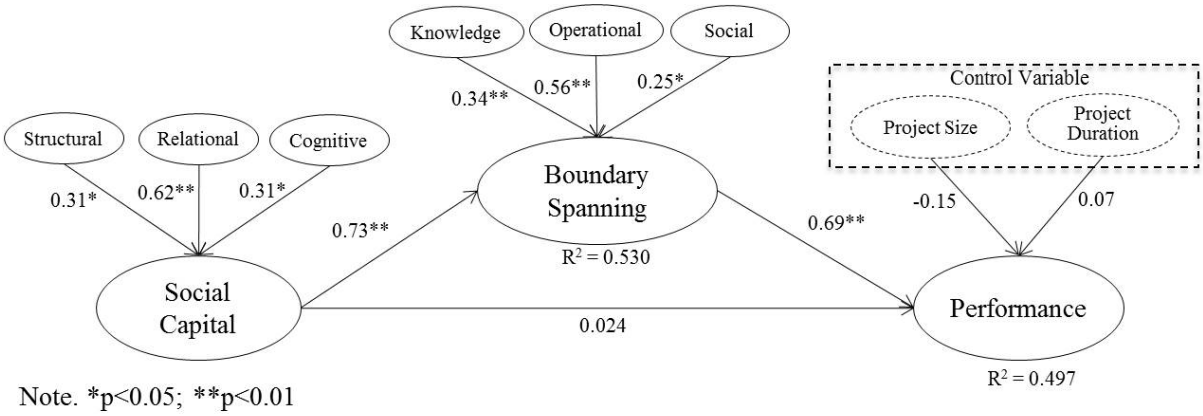

Figure 2. Path analysis – 2nd order model

In addition, we also conducted path analysis by using first order constructs directly. While the second order analysis can demonstrate the mediating effect of boundaries spanning, the first order model allow us to further understand the paired relationships between social capitals and the spanning of different boundaries. As shown in Figure 3, all paths were found significant, except for the path from structural social capital to knowledge boundary spanning and operational boundary spanning. Three social capitals can explain 41.4% of variance of knowledge boundary spanning, 48.7% of variance of operational boundary spanning and 27.3% of variance of social boundary spanning. Three constructs of boundary spanning totally explain 51.5% of variance of project performance.

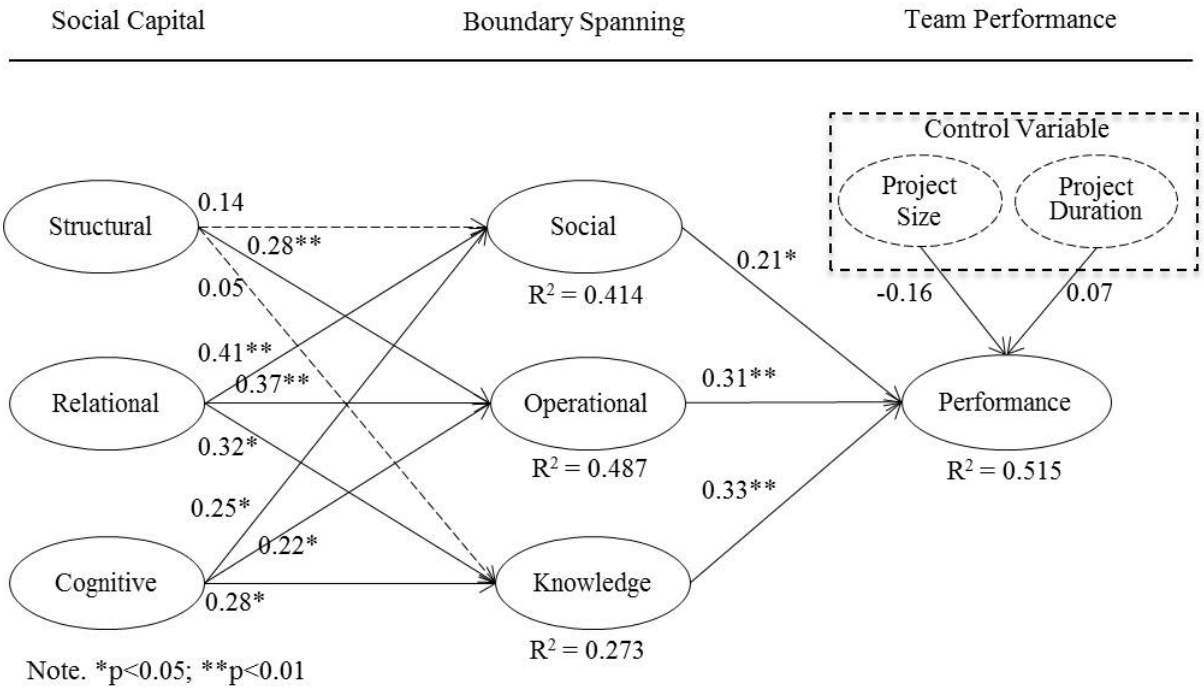

Figure 3. Path analysis – 1st Order Constructs

5 DISCUSSION

The findings are consistent with prior research that social capital allows actors to perform better through accelerating boundaries spanning, including knowledge integration, work coordination, and resource acquisition, among other things (Brion et al. 2012; Reagans & Zuckerman 2001; Robert Jr et al. 2008). In addition, effective boundary spanning can promote better project performance through obtaining critical resources and supports to help the project team to execute the work (Ancona & Caldwell 1992; Brion et al. 2012; Marrone et al. 2007). To gain better insights from such a result, we decompose social capital and boundaries spanning into first order constructs. The results show that, in terms of their impacts on boundaries spanning, relational capital is the most important factor, followed by cognitive capital. However, structural capital only has impact on operational, but not social and knowledge boundaries spanning. According to definition, structural capital mainly refers to network ties. Social boundary spanning activities include acquiring resources, protecting resources, and promoting the project. Actors need to possess strong relationships with different stakeholders in order to carry out those activities effectively. Having connection does facilitate team to communicate with network ties to coordinate with them, but is not sufficient for obtaining and protecting resources and sharing knowledge. On the other hand, knowledge boundaries spanning (knowledge integration) needs a deeper level of relationship (relational and cognitive capital) and shared language and experience to achieve. Therefore, having connection is a minimum requirement and may not sufficient to boost boundaries spanning, when other social capital dimensions are taken consideration simultaneously.

6 CONCLUSION AND IMPLICATIONS

This study has two purposes. First, we attempt to identify critical boundaries for ISD project teams. Second, we also attempt to demonstrate the effect of social capital on project performance goes through boundaries spanning effectiveness. A survey was conducted to collect opinions from practitioners to verify our hypotheses. Data collected from 184 IS professionals shows that social capital have a positive impact on boundary spanning, which, in turns, leads to better project performance. The results also confirm the mediating role of boundaries spanning effectiveness. In addition to testing the proposed hypotheses, we also illustrate the complicated relationships between the three dimensions of social capital and three dimensions of boundaries spanning effectiveness. The results of this study contribute to both academia and practitioners in the following ways.

6.1 Academic Implications

This study contributes to academic community in three ways. First, given that new product development and information system development are knowledge intensive tasks, most past studies examine the importance of knowledge boundaries or gaps between developers and other stakeholders (e.g. Hsu et al. 2014; Tesch et al. 2009). We advanced this research stream by highlighting the importance of social and operational boundaries, in addition to knowledge boundary. We also show the critical impacts of boundaries spanning effectiveness on project performance. Since project performance is determined by the effectiveness of boundaries spanning, future studies are encouraged to explore other types of boundaries and examine their impacts on project performance. Second, social capital has been shown to have impact on both unit capability (e.g. Tsai & Ghoshal 1998) and team performance (e.g. Hsu & Hung 2013). In this study, we demonstrate that the impact of social capital on team performance is fully mediated by boundaries spanning effectiveness. This result aligns with the original concept of social capital theory that social capital allows actors to improve their performance by accessing needed resources through social network. Social capital allows ISD project team members to cross boundaries surrounding the team to obtain needed resources. Third, many kinds of boundary spanning have been proposed with different definitions based on different theoretical background. However, the categories of team boundary spanning have not been widely researched or conceptualized. In this study, we define three dimensions of ISD project team boundary

spanning. We further illustrate that all three dimensions of boundary spanning are positively associated with ISD project team performance.

6.2 Practical Implications

Conflict between the ISD project team and other business units (including relevant users and management) is intensive because of different knowledge background, experience, and expectation toward the project. This not only increases risk but also leads to fail of projects. It is important to leverage IT and business operations by addressing participation, planning, and the sharing of domain knowledge, all of which can be regarded as boundary spanning (Karns & Sabherwal, 2007). Our study generates two mains implications for practitioners. First, project managers and team members can recognize the critical boundaries in the ISD project team, i.e., the knowledge, social and operational boundaries. They can better understand the possible intangible gaps between project team and other units. They also should be aware of the potential negative impact of ineffective boundary spanning on project performance. Therefore, they must take appropriate actions to cross boundaries to achieve better project performance. Given that operational and knowledge boundaries spanning are relative important, managers should pay attention on promoting coordination and knowledge sharing. Second, we also reveal that the social capital is one critical element for boundaries spanning. We also find that relational capital and cognitive capital are relative important than structural capital for ISD project teams. To obtain and maintain great relational and cognitive capitals, managers may obtain members who have strong relationship and experience in working with users. Otherwise, they may hold workshops, kick-off meetings and brainstorming activities regularly, when acquiring desired members are less likely.

6.3 Limitations and Suggestions for Future Study

The research limitations of this study are summarized below. First, we collected data from developer side only. While boundaries spanning involves two or more parties, collecting data from all related parties at the same time provides a more precise result. Therefore, future studies are encouraged to validate our results by obtaining opinions from all related parties. Second, boundaries spanning is not limited to parties within organization. Given that outsourcing is a popular way for contemporary information system development, there is a need to understand how project team can effective cross the line between different organizations. Therefore, future research may like to understand the drivers of boundaries spanning in both outsourced and in-house ISD projects. Lastly, after identifying critical boundaries, this study focuses on the spanning of those boundaries only. However, maintaining boundaries is also critical for project team to achieve high performance. Future researchers are encouraged to explore the effect of boundaries maintenance in the future.

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