

Exploiting Group Social Capital in Systems Development Projects*

Jun-Gi Park** · Seyoon Lee*** · Gyoo Gun Lim**** · Jungwoo Lee*****

■ Abstract ■

Group social capital can be defined as an intangible asset that promotes knowledge sharing and social interaction. It is posited here that the group social capital raised and nurtured among group members positively influences on team performance in IS (Information Systems) development projects. And communication effectiveness is selected as a critical antecedent and its detailed relationships with the dimensions of group social capital are analyzed. Effective communication plays important role in ISD project teams by integrating knowledge from different areas. Moderating effects of project phase between the sub-dimensions of social capital and project performance are investigated. Hypotheses are tested using data from 131 project teams of 85 manufacturing firms. The results indicated that Communication effectiveness positively impacted sub-dimensions of social capital (social ties, trust, and shared vision). Moreover, the team performance is influenced by shared vision and trust, leaving social ties as a leading subcontract, as theoretically proposed in prior research. The project phase moderates the impact of shared vision on team performance.

Keyword : Group Social Capital, Communication Effectiveness, Team Performance, Knowledge Sharing, Project Phase, Information System Project

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** Senior Researcher in the Institute of East West Studies, Yonsei University

*** Associate researcher of the Center for Work Science, Yonsei University

**** Profess of MIS at School of Business Hanyang University

***** Director of the Center for Work Science, Yonsei University, Corresponding Author

1. Introduction

Not many IS (Information Systems) projects succeed while satisfying all project targets, such as the required goals, budget limit, and due date. According to IBM, the success rate is about 41%, and 44% of all projects fail to meet either their budget or duration goals. The remaining 15% fail in all project targets and eventually stop (IBM, 2008). Such failures are due to technological issues and management mistakes, but they occur also due to social factors such as the social relationships between team members and issues related to social complexity (Brabander and Thiers, 1984; Greenwood et al., 2010; Tesch et al., 2009).

The reason social factors have a high level of importance in IS projects can be found in their distinctive characteristics. These types of projects are generally executed by both IT system experts and business professionals. In particular, adequate knowledge and continuous communication among them are required to complete an IT system in a limited amount of time. In other words, when considering its complexity and knowledge-intensive characteristics (Greenwood et al., 2010; Tesch et al., 2009), the social aspects are considered to be among the most important factors that determine the successful completion of an IS project. Thus, many studies have been performed to identify how knowledge sharing and social interaction influence performance during IS projects (Pee et al., 2010).

However, little research has deeply investigated the social network structure of a project team that fosters the internal social capital and is influenced by communication effectiveness

among team members. Prior social capital research has largely limited the analysis of internal relationship in team levels, otherwise neglecting the external impact on the structure of social capital.

While many studies of social capital have been done in various fields, the antecedents that form social capital have not been studied as much. Even in the IS field, previous studies mainly viewed social capital as a factor that affects knowledge sharing and performance (Ghosh and Scott, 2009; van den Hooff and de Winter, 2011). However, there are few studies on antecedents such as leadership competence (Lee et al., 2011) or similarity (van Emmerik and Brenninkmeijer, 2009) that can impact the formation of social capital. Although social capital impact on formation of relationship is important, disregarding the other factors influence on social capital may lead to an under-estimation of the impacts of the social capital as a whole, while simultaneously overemphasizing the effects of group social capital.

Under the assumption that such social factors become a type of asset that serves as a basis for IS project teams to execute their projects, this study focused on the concept of social capital of a development project team. Social capital is an intangible asset that evolves from the social structure and relationships, and it cannot easily be replaced or obtained in a short period of time, unlike traditional capital such as labor, land, facilities, technologies or transportation (Bourdieu, 1986). The way it is formed and accumulated and how it functions must differ from other types of tangible capital. Therefore, if social capital serves in an important role for the success of an IS project, studies of its antecedents and/or roles must be of significance

from a theoretical and a practical standpoint.

This study also focuses on communication effectiveness as an antecedent of social capital, because social capital can be explained in terms of the social structure and the interaction between team members (Kostova and Roth, 2003; Mäkelä and Brewster, 2009) and communication is one of the most general forms of social interaction. In this study, communication effectiveness refers to the formal as well as informal sharing of meaningful and timely information between members in an empathetic manner. (Sharma and Patterson, 1999)

To prove whether communication effectiveness is a proper antecedent of social capital, this study segmented social capital into sub-dimensions and analyzed the relationships between the effectiveness of communication and the sub-dimensions of social capital. Through a literature review, this study established hypotheses on communication, social capital, and the performance of projects, after which the study formulated them into a structural equation model. To verify the research model, we collected data from IS project teams by means of structured questionnaires and analyzed the findings.

Regarding the effects of social capital, several case studies found that the roles of social capital vary depending on the project phase. Accordingly, additional empirical verifications on how its roles change are significant. In addition, the study analyzed the moderation effect of the project phase on project performance. In the conclusion, we discuss the roles of communication and social capital and their changing effects according to the project phase as well as theoretical and practical implications.

2. Theoretical Background

2.1 Social Capital

As social capital has been studied in different fields, its concept tends to be applied differently. The French sociologist Bourdieu (1986) identified social capital as an integrated concept of actual or potential resources that an individual or a group obtains through a social system or a network. On the other hand, Coleman (1988) claimed that social capital exists in the relationships of people from the social structure and that it facilitates human actions. Social capital within an organization is a necessary factor to maintain a competitive edge (Nahapiet and Ghoshal, 1998). Group social capital is a special type of social capital which refers to the social capital that exists in the relationships between group members from the group social structure (Oh et al., 2004). Generally, social capital is perceived as having a positive influence on group performance, Oh et al. (2004) argued that there is the most optimal combination of internal and external factors with which group social capital can have a positive effect on group performance. This implies that social capital can have complex influences based on internal and external factors rather than social capital and project performance having a linear relationship.

Many researchers have studied collaboration between business and IT, knowledge sharing, customer participation, and related areas in an effort to develop a successful information system (Hartwick and Barki, 1994; Pee et al., 2010; Tait and Vessey, 1988). Hatzakis et al. (2005) approached the issue of change management as a means of improving collaboration between busi-

ness experts and IT professionals from the perspective of social capital. Many issues arising from IS projects can be explained in terms of an absence of social capital, as the conceptualization of a project between business experts and IT professionals can differ (van den Hooff and de Winter, 2011). In the context of IS outsourcing, the knowledge gap between customers and an IS vendor interrupts the effective alignment between the two entities. However, as social capital increases, knowledge sharing becomes more active which, in turn, improves the IS development performance (Ghosh and Scott, 2009). Even in group research involving interaction and knowledge sharing, social capital's cognitive aspect becomes an avenue for sharing knowledge and contexts, supporting the relationship between social capital and IS performance (Mäkelä and Brewster, 2009). Concerning social capital within project groups and teams, many studies focused on leadership skills or the performance of managers, as well as organizational innovations. Social capital is considered to be an important factor in strengthening the internal leadership of a group (McCallum and O'Connell, 2009). In IS projects, a manager's levels of intellectual and social competence have an effect on forming group social capital while also providing positive reinforcement on the performance of the group (Lee et al., 2011). Group social capital is related to the effectiveness of the group, appropriate levels of performance, and to their level of satisfaction as well (van Emmerik and Brenninkmeijer, 2009). Tansley and Newell (2007) claimed that in order for a team to increase their performance, trust is essential and social capital is a necessary antecedent.

Social capital can serve different roles in vari-

ous environments such as phase of project, complexity of tasks, strategy behind relationships, etc. (Riemer, 2004). The analyzing phase of an IS project-specifying demands and checking technical validity-demands a higher level of knowledge sharing than the latter phases (Tiwana and Mclean, 2003). In other words, the level of required knowledge sharing can differ according to the project phase. The impact and role of social capital can also vary because social capital is associated with knowledge sharing. The changing role of social capital based on various IS project phases was studied by Brabander and Thiers (1984). As their case study, the roles of social capital in motivating during an initial phase, integrating during the design and development phase, and facilitating during the implementing phase were assessed. Pan et al. (2007) argued that the required knowledge and type of social capital can vary according to the ERP project phases in terms of knowledge management. They explained that as a project moves through idea formation, design, development and usage phases, social capital transforms from team formation, network formation, community formation, and then to knowledge-based network formation (Pan et al., 2007). Similarly, the role of group social capital can be different by the project duration or term. Lee et al. (2013) found that the significant effect of cognitive dimension of leader's intelligence competency on project performance is partially mediated by group social capital in short term project. But, in case of long term project, group social capital fully mediates the influence of cognitive intelligence competency on performance and the effect of group social capital is stronger than in shorter term project. Therefore, it can be considered that

project phase or term can moderate the effect of group social capital on project performance.

Granovetter (1973) found that social capital has both structural and relational aspects. Nahapiet and Ghoshal (1998) expanded this concept and categorized its features further into structural, relational and cognitive aspects. The structural aspect refers to a network's characteristics or its configuration based on the relationships among members. Nahapiet and Ghoshal (1998) viewed the structural dimension as network ties, the network configuration and the appropriable organization. Tsai and Ghoshal (1998) used social interaction ties as a variable of the structural dimension. Social ties become a channel through which members' information and resources flow. More social ties lead to more channels, which can lead to a broader range for information sharing.

The relational dimension contains trust, norms, duties, and a sense of identity between members according to Nahapiet and Ghoshal (1998). It refers to the level of contribution to the creation of shared values by the characteristics and levels of members' relationships. Among the variables of the relational dimension, 'trust' is the representative form (Tsai and Ghoshal, 1998). If trust exists between members, more important information can be shared with confidence. Because the degree of information sharing can differ based on how much the members trust each other, it should be considered as an important aspect of social capital.

The cognitive dimension refers to specific codes, languages and stories that members share together. Nahapiet and Ghoshal (1998) claimed that because intellectual capital can be exchanged and accumulated in the context of the society, the cognitive aspect of social capital must be

considered. The cognitive aspect can be categorized into two areas, shared languages and codes, and shared stories (context). As a variable that represents the cognitive dimension, Tsai and Ghoshal (1998) selected the shared vision. They argued that we can predict how members will exchange their thoughts and resources if a shared vision exists.

2.2 Effectiveness of Communication and Social Relationships

Social capital occurs in the midst of relationships between members within a social structure. In forming a social relationship, the social interaction among members becomes one of important factors. While there have not been for many studies on the antecedents of social capital, some studies have considered the social interaction of members or groups as an antecedent of social capital (Kostova and Roth, 2003; Mäkelä and Brewster, 2009). Therefore, communication as an important form of social interaction can act as an antecedent that forms social capital. In some cases, social interaction or communication were included as a sub-element of social capital or as a measurement item (Chen et al., 2008; Merlo et al., 2006; Zheng, 2010).

There have also been many studies that noted the positive impacts of communication within an organization. Tzafrir et al. (2004) argued that communication has a positive impact on the effectiveness of a group by allowing its members to share and exchange information, improve their trust for each other, and raise the degree of understanding among members. Communication can also enhance relationships in group by resolving conflicts (Dawes, 2005). In addition,

Postmes et al. (2001) claimed that communication can be viewed as an antecedent that derives a relational commitment toward an organization. In conclusion, the effectiveness of communication and the expected result of communication have a positive effect on trust and the relational commitment between members of groups (Sharma and Patterson, 1999). Effective communication can also have a positive impact on performance during an IS development project (Brabander and Thiers, 1984).

Massey (2007) defined effective communication as communicating useful, reliable, understandable, and appropriate information between members. Effective communication enhances the relational commitment (Park et al., 2012; Postmes et al., 2001; Sharma and Patterson, 1999) and the level of intimacy and relationship satisfaction (Emmers-Sommer, 2004). Lee et al. (2015) empirically showed the positive effect of communication effectiveness on team performance by way of group social capital in the context of ISD project. Therefore, communication effectiveness is positively associated with forming and maintaining social relationships and social capital.

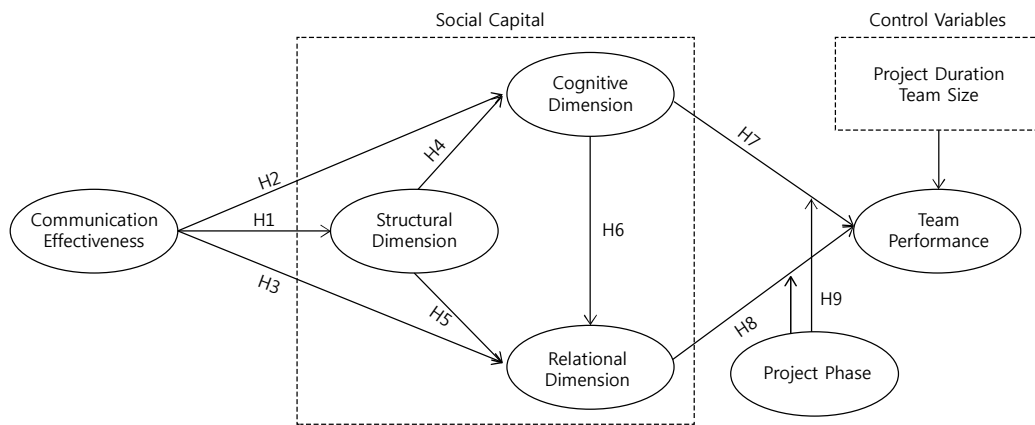
3. Research Model and Hypotheses

This study constructed the relationship model of communication effectiveness, the sub-dimensions of social capital, and team performance into a research model, as presented below in Fig. 1. The model indicates that as an antecedent of team performance, social capital can be influential and that communication effectiveness becomes an antecedent of social capital. This study es-

tablished the hypothesis that the effectiveness of communication impacts the sub-dimensions of social capital, i.e., social ties, trust and shared vision. We also added that each factor of social capital is related to the others. Trust and shared vision influence project performance. Moreover, this study forecasts that the sub-dimensions of social capital have different impacts on a project based on its phases while also including a moderating effect of the project phase in the research model and its hypotheses. Project duration and team size were considered as control variables that may impact project performance.

3.1 Relationships between Communication and Social Capital

Social interaction was studied as an antecedent to the formation of social capital (Kostova and Roth, 2003; Mäkelä and Brewster, 2009). Expanding the concept to include communication, it can also be regarded as an antecedent of social capital. Communication enables information sharing and exchanges of contexts, increasing the trust between members and improving the overall understanding of their roles and thus having a positive impact on the effectiveness of the organization (Sharma and Patterson, 1999). In other words, effective communication can influence an organization's performance by way of trust. Massey (2007) analyzed the relationship between the effectiveness of communication and the building of trust in a group. Earlier, Dawes (2005) found that communication relieves internal conflicts. This clarified the role of communication as it pertains to trust and conflict resolution between members. Therefore, this study predicts that communication effectiveness will



〈Figure 1〉 Research Model and Hypotheses

have an effect on social capital. The hypotheses below reflect this prediction.

The structural dimension of social capital includes whether members are interconnected and how intense the connections are (Nahapiet and Ghoshal, 1998). One of social capital's structural dimensions, social ties, signifies a connection with social interaction (Chen et al., 2008). Communication can be considered as a type of social interaction. Effective communication has a positive impact on relationships by way of trust (Sharma and Patterson, 1999). When communication is of a high quality, the closeness and satisfaction associated with relationships are heightened; therefore, members are more likely to maintain the relationship (Emmers-Sommer, 2004). On the other hand, if communication is of a low quality, members' levels of satisfaction with the relationship declines, causing the continuance of the relationship to be difficult. Because social relationships can be maintained or broken depending on the quality of communication, it impacts social ties. In the context in which communication has a positive effect on

relationships, effective communication can be regarded to have a significant relationship with social ties. Therefore, the following hypothesis is derived.

H1 : A team's communication effectiveness has a positive impact on social ties.

In the context of vision sharing, communication effectiveness is advantageous for team members. When a leader effectively communicates a new vision, more members tend to agree with the vision (Farmer et al., 1998). Because communication is an information-exchanging activity that members share, communication effectiveness is closely related to the appropriateness of the information content. A greater level of effectiveness of communication leads to a better information exchange. This can contribute to sharing visions. This study predicts that communication effectiveness has a positive impact on shared vision, which is a cognitive dimension of social capital. The hypothesis below was formulated based on this assumption.

H2 : A team's communication effectiveness has a positive impact on the team's shared vision.

Massey (2007) argued that the effectiveness of communication has a positive impact on the building of trust. Jarvenpaa and Leidner (1999) explained that the social communication creates trust and that substantial and timely communication helps maintain trust and the acknowledgement of the existence of others. This is so because one can trust another by gaining and sharing necessary information through communication. Morgan and Shelby (1994) also claimed that high-quality (appropriate, timely and reliable) communication builds even higher levels of trust. This leads to the conclusion that more effective communication builds more trust. Therefore, the hypothesis below becomes possible.

H3 : A team's communication effectiveness has a positive impact on trust between members.

3.2 Associations among the Sub-Dimensions of Social Capital

Social capital is convertible into various forms of economic capital, such as other forms of capital (Adler and Kwon, 2002; Bourdieu, 1986). This convertibility suggests that the sub-dimensions of social capital are not mutually exclusive but are instead interconnected (Liao and Welsch, 2005). Tsai and Ghoshal (1998) presented three sub-dimensions of social capital (structural, relational and cognitive dimension) and proposed relationships among them.

Social ties (structural dimension) refer to

whether members are interconnected via social interaction (Chen et al., 2008; Nahapiet and Ghoshal, 1998). More structural connections create more chances to interact between team members. With more social interaction, the organization's project targets and agendas are easily relayed to members, helping them to understand their roles better. For example, frequent interaction between the CEO and CIO helps with vision sharing in an IS project (Johnson and Lederer, 2006). Therefore, the following hypothesis was derived.

H4 : Social ties have a positive impact on shared vision.

Tsai and Ghoshal (1998) also proposed a link between the structural dimension and the relational dimension of social capital. Trust can be built by frequent interactions and socializing among members (Child, 2001). Morgan and Shelby (1994) also found that frequent contact with clients promotes trust in service providers. If members of an IS project team create close relations, they can frequently come into contact with each other and trust can be created.

H5 : Social ties have a positive impact on trust.

Tsai and Ghoshal (1998) proposed that if any team shares their goals and vision, then trusting relationships can be developed. Child (2001) also insisted that common understanding makes members bond and that trust can be built based on this bonding. Sharing vision among IS project team members can form the belief that team members will not harm each other and that they will exchange their thoughts and resources for

the common goals of the team. Hence, the following hypothesis was derived.

H6 : Shared vision has a positive impact on trust.

3.3 Relationships between a Team's Social Capital and Its Performance

In a group, social capital has a positive impacts on a team's effectiveness, performance and satisfaction (van Emmerik and Brenninkmeijer, 2009). In an IS project, social capital has a significant relationship with improved performances (Lee et al., 2011). Because an IS project frequently involves IT experts and various functional teams, sharing language and knowledge is important. Therefore, knowledge sharing through effective communication and social interaction can be critical. Based on such characteristics of an IS project team, knowledge sharing among members can have a significant impact the performance of the project (Nelson and Coopridier, 1996).

Sharing a vision positively impacts knowledge transfers among members (Li, 2005), and knowledge sharing is important for the success of an IS system. Therefore, vision sharing can be considered to have a positive impact on the performance of an IS project (Pee et al., 2010). In many studies of leadership, a leader's vision sharing was shown to have a positive impact on the performance of the team (Dionne et al., 2004). Based on this finding, the hypothesis below was formulated.

H7: A team's shared vision has a positive impact on the performance of a project.

In an IT service environment, which develops and maintains information systems, trust is particularly important with the existence of interdependence due to the provision of continuous services (Chakrabarty et al., 2007). Trust between the customer and an information system provider means the shared expectancy that they will be able to make a relational commitment. Moreover, a higher level of trust between them contributes to a higher level of shared knowledge (Nelson and Coopridier, 1996). In IT-based transactions or processes, building trust with customers or partners can eliminate the uncertainty of relationships, lower risk levels, and increase the chances for better performance (Lee and Kim, 1999). Therefore, we concluded that trust has a positive impact on knowledge sharing or project performance. The hypothesis below was derived from this conclusion.

H8 : A team's trust has a positive impact on project performance.

3.4 Project Phases and Roles of Social Capital

The impacts of social capital on project performance can differ depending on the phases. For instance, more knowledge sharing and exchanges are needed at an initial phase than during the roll-out phase (Tiwana and Mclean, 2003). Varying needs for shared knowledge and roles means that the roles of social capital can also differ based on the project phase. In a previous case study on IS, the conclusion was that the role of social capital differs at different phases of the project (Bhandar et al., 2006). The present study plans to demonstrate that the sub-dimensions of social capital have different

impacts on project performance at different phases. Based on this, this study includes the following hypothesis.

H9 : Project phases control the effects of the sub-dimensions of social capital (shared vision and trust) on project performance.

4. Research Method

4.1 Operational Definitions and Measurement Items

In this study, communication can be defined as a process that involves the sharing and creating of information for a mutual understanding between project team members (Rogers, 1981). Therefore, effective communication refers to whether useful, reliable, understandable, and appropriate information was communicated between members (Massey, 2007). Social capital becomes a source of competitive advantage that is formed through trusting and supporting relationships (Nahapiet and Ghoshal, 1998). Based on studies conducted by Chiu et al. (2006) and Chow and Chan (2008), social capital consists of measuring variables that are sub-dimensions of a structural dimension (social ties), relational dimension (trust) and cognitive dimension (shared vision). Social ties refer to derive the numerical index of the strength of social ties, we calculated the average value of frequency of formal and informal interaction with project members (Suh and Shin, 2010). Trust refers to the expectation that mitigates the fear of unexpected changes in relationships. Therefore, trust helps share resources. A shared vision includes the collective goals and ambitions of

members. As a result, when a vision is shared, communication can naturally occur without a misunderstanding and ideas and resources can be shared smoothly. According to Henderson and Lee (1992), project performance was identified to be the fulfillment of technical and business demands, the expected resources, and the project schedule.

Measurement items are summarized in the Appendix and follow the same format, with “Strongly disagree” for 1 point and “Strongly agree” for 7 points based on a seven-point Likert scale. For pre-verification, this study selected five project managers and performed a pilot test. From the feedback of the pilot test, this study corrected a few terms and expressions in some items, but no major corrections were undertaken.

4.2 Characteristics of Respondents

For this study, we study sample consisted of 162 IS project teams of 85 firms randomly selected from the directory of IT project list in a IT service company which has 700 billion won revenue in 2010. The data point was collected for four weeks in December of 2011. Direct telephone conversations with representatives of these IT projects were first made to introduce our objectives and to ask the names of appropriate persons to contact for the survey. A total of 162 projects agreed to participate were sent to each selected participant with online survey. A total of 138 questionnaires were received, and 131 of these questionnaires were used for the data analysis, excluding questionnaires with any missing data, a response rate of 80.1%. As the unit of analysis in this study was a project team, the respondents were project leaders.

<Table 1> Sample Characteristics

| Sample Characteristics | Categories | Sample Count | Proportion (%) |
|------------------------|----------------------------------|--------------|----------------|
| Project Type | Data/Contents Management | 26 | 19.8 |
| | Business Intelligence | 4 | 3.1 |
| | Enterprise Resource Planning | 58 | 44.3 |
| | Supply Chain Management | 8 | 6.1 |
| | Knowledge Management | 9 | 6.9 |
| | Human Resource Management | 3 | 2.3 |
| | Customer Relationship Management | 3 | 2.3 |
| | Manufacturing Execution System | 2 | 1.5 |
| | Accounting and Financing System | 17 | 13.0 |
| | Web Application Development | 1 | 0.8 |
| Project Duration | Less than 6 months | 50 | 38.2 |
| | 7~12 months | 23 | 17.6 |
| | 13~18 months | 28 | 21.4 |
| | 19~24 months | 28 | 21.4 |
| | More than 25 months | 2 | 1.5 |
| Project Phase | Requirement Analysis | 47 | 35.9 |
| | System Analysis/Design | 47 | 35.9 |
| | Developing/Testing | 20 | 15.3 |
| | Roll-out/Stabilization | 17 | 13.0 |
| Team Size | Less than 10 members | 59 | 45.0 |
| | 11~20 members | 30 | 22.9 |
| | 21~30 members | 10 | 7.6 |
| | 31~40 members | 6 | 4.6 |
| | 41~50 members | 20 | 15.3 |
| | More than 51 members | 6 | 4.6 |
| Total | | 131 | 100% |

The characteristics of the sample are summarized in <Table 1>. For project types, the highest number was 'Enterprise Resource Planning' projects at 58 (44.3%), followed by 'Data/Contents Management' at 26 (19.8%) and 'accounting and Financing System' at 17 (13.0%). For project duration, 50 cases (38.2%) were shorter than 6 months, followed by 23 cases (17.6%) that ended between 7 to 12 months, 28 cases (21.4%) each at 13 to 18 months and 19 to 24 months, and lastly 2 cases (1.5%) took more than 25 months. For the Project Phase, 47 projects (35.9%) were each in the Requirement Analysis phase and the System Analysis/Design phase, 20 projects (15.3%) were in the Developing/Testing phase,

and 17 projects (13.0%) were in the Roll-out/Stabilization phase. Lastly, regarding Team Size, 59 projects (45.0%) consisted of less than 10 members, 30 projects (22.9%) had between 11 to 20 members, and 20 projects (15.3%) had between 41 to 50 members.

4.3 Data Analysis and Results

For the analysis of the study model, the partial least squares (PLS) approach was used. Because this method relies on an element-based approach, it tends to be more generous with sample sizes or distributions (Lohmöller, 1989). At the same time, this method has an advantage in that the

measurement model and structural model can be analyzed simultaneously (Chin, 1998). It is appropriate for analyzing relatively small numbers of samples and for exploratory research (Gefen et al., 2000). In this study, we chose to use PLS because the conceptual framework of the relationships between main variables was based on theories, whereas the relationships between the sub-dimensions were to be studied in an exploratory approach.

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

To analyze the measuring model and structural model, this study used SmartPLS 2.0 software and applied a bootstrap method and PLS algorithm. For the explorative and relative anal-

yses, this research used PASW Statistics 18.

4.4 Measurement Model Analysis

First, for the analysis of the measurement model, an exploratory factor analysis of the variables was done and the measurement items were verified. After excluding TUS1 and SoTie1, which scored less than 0.6 in terms of their standard loadings, this study conducted a confirmatory factory analysis, a reliability analysis, a convergent-validity analysis and a discriminant-validity analysis.

The reliability analysis was conducted using Cronbach's α and composite reliability (CR), with the factor loadings' levels of statistical significance. In <Table 2>, the score of each variable's Cronbach's α and CR exceeded 0.70 (Anderson et al., 2006; Chin, 1998). Each variable's indicator set the level of significance around 0.001 (Chin, 1998). This study concluded

<Table 2> Indicator Properties of Variables

| Variables | Indicators | Std. Loading | t-Value | AVE | CR | Cronbach's α |
|-----------------------------|------------|--------------|---------|-------|-------|---------------------|
| Communication Effectiveness | ComE1 | 0.868 | 31.05 | 0.729 | 0.923 | 0.907 |
| | ComE2 | 0.848 | 24.82 | | | |
| | ComE3 | 0.867 | 38.16 | | | |
| | ComE4 | 0.868 | 32.84 | | | |
| | ComE5 | 0.819 | 20.24 | | | |
| Social Ties | SoTie1 | 0.980 | 31.79 | 0.963 | 0.981 | 0.962 |
| | SoTie2 | 0.983 | 34.26 | | | |
| Trust | TUS2 | 0.870 | 32.55 | 0.787 | 0.937 | 0.910 |
| | TUS3 | 0.887 | 47.78 | | | |
| | TUS4 | 0.911 | 52.88 | | | |
| | TUS5 | 0.880 | 30.72 | | | |
| Shared Vision | ShVi1 | 0.865 | 30.93 | 0.806 | 0.926 | 0.879 |
| | ShVi2 | 0.910 | 44.89 | | | |
| | ShVi3 | 0.917 | 62.05 | | | |
| Team Performance | PER1 | 0.862 | 20.97 | 0.708 | 0.924 | 0.897 |
| | PER2 | 0.885 | 17.70 | | | |
| | PER3 | 0.826 | 16.41 | | | |
| | PER4 | 0.814 | 12.17 | | | |
| | PER5 | 0.817 | 18.10 | | | |

<Table 3> Correlations between Variables

| | Mean | s.d. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-------------------------------|------|------|-------|-------|-------|-------|-------|-------|-------|------|
| 1 Communication Effectiveness | 5.39 | 0.88 | 0.85 | | | | | | | |
| 2 Social Ties | 5.62 | 1.01 | 0.51 | 0.98 | | | | | | |
| 3 Trust | 5.45 | 0.89 | 0.67 | 0.40 | 0.89 | | | | | |
| 4 Shared Vision | 5.23 | 0.92 | 0.59 | 0.46 | 0.63 | 0.90 | | | | |
| 5 Project Phase | 2.05 | 1.02 | 0.01 | 0.03 | 0.17 | 0.17 | NA* | | | |
| 6 Project Duration | 2.31 | 1.23 | -0.13 | -0.06 | -0.17 | -0.10 | -0.17 | NA* | | |
| 7 Team Size | 2.36 | 1.65 | -0.24 | -0.13 | -0.18 | -0.18 | -0.45 | 0.21 | NA* | |
| 8 Performance | 5.18 | 0.99 | 0.47 | 0.29 | 0.46 | 0.46 | 0.06 | -0.16 | -0.12 | 0.84 |

* AVE unavailable because these items are constructed as one item.

that each indicator obtained reliable measurements of each variable. For the convergent validity analysis, this study used the average variance extracted (AVE) and factor loadings. In <Table 2>, the score for each variable's AVE exceeded 0.50, which was higher than required (Chin, 1998). Generally, when factor loadings exceed 0.7, it can be considered that the measurements are reliable (Chin, 1998). Each indicator's factor loadings scored better than 0.7.

To determine the discriminant validity, this study compared the square root of AVE and the correlation coefficient. In <Table 3>, this study summarized each factor's descriptive statistics quantity and the correlation coefficient, with the square root of AVE showing diagonally. Every factor's square root of AVE was higher than the correlation coefficient with the other variables. Because the measurement items of each variable were thought to have a higher correlation than the other variables, this study can conclude that the measurement items have discriminant validity (Fornell and Larcker, 1981). The only exception was that AVE values were unavailable for the project phase (moderating variable), project duration and team size (control variables) because they were constructed as one item. For analysis purposes, this study coded the

Project Phase as 1 to 4, the Project Duration as 1 to 5, and the Team Size as 1 to 6, as summarized in <Table 3>.

4.5 Structural Model Analysis

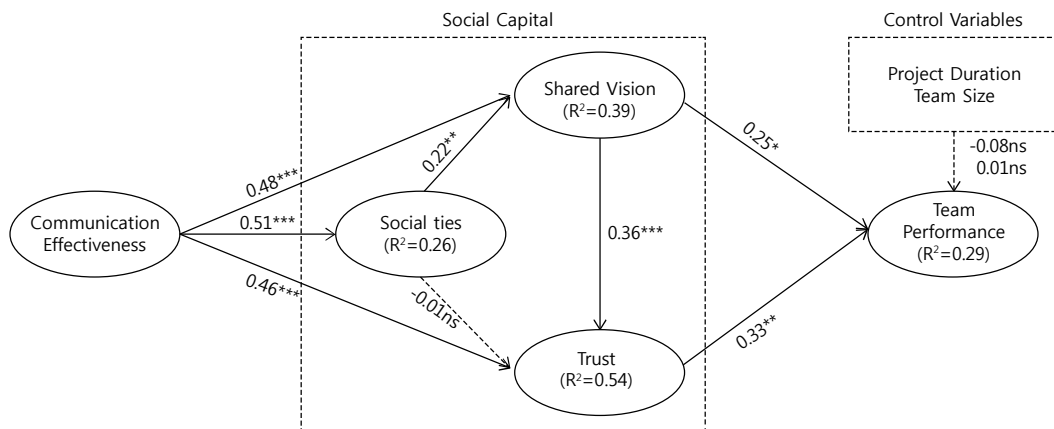
Once the reliability and validity of the measurement model were confirmed, this study conducted research model and hypotheses testing. <Figure 2> shows the results of the structural model analysis using SmartPLS 2.0. Each path's statistical significance relied on a bootstrap method, and each standard β underwent a PLS algorithm to obtain the path coefficient.

First, when reviewing the hypotheses on the relationships between Communication Effectiveness and Social Capital, communication effectiveness was found to be positively related to social ties (H1 : $\beta = 0.51$, $p < 0.001$), shared vision (H2 : $\beta = 0.48$, $p < 0.001$) and trust (H3 : $\beta = 0.46$, $p < 0.001$); therefore, H1, H2 and H3 were accepted. Regarding the associations among the sub-dimensions of social capital, social ties showed a positive relationship with shared vision (H4 : $\beta = 0.22$, $p < 0.01$), but social ties was not associated with trust. Shared vision also showed a positive impact on trust (H6 : $\beta = 0.36$, $p < 0.001$); therefore H4 and H6 were ac-

cepted but H5 was not. Regarding social capital and team performance, shared vision ($\beta = 0.25$, $p < 0.05$) and trust ($\beta = 0.33$, $p < 0.01$) showed a positive relationship. Therefore, H7 and H8 were accepted.

While studying the relationship between social capital and team performance, this study analyzed the moderating effect of the project phase. In <Table 3>, the project phase, the moderator, does not show a significant relationship with the other variables; therefore, this study concluded that multicollinearity was low. This study then analyzed the impact of a mod-

erating variable on the relationship between each sub-dimension of social capital and project performance using PLS. <Table 4> shows a summary of the moderating effect. Only shared vision showed an interaction effect with project phase ($p < 0.001$), and the value of the interaction effect was 0.12, a medium level. The value of the interaction effect can be calculated by $f^2 = \Delta R^2 / (1 - R_{\text{interaction effect model 2}})$, and its value at 0.02 is low, at 0.15 is a medium level, and at 0.35 is high (Cohen, 1992). Therefore, this study can conclude that the project phase in H9 has a moderate impact on the relationship be-



*, $p < 0.05$, **, $p < 0.01$, ***, $p < 0.001$, ns : insignificant at the 0.05 level.

<Figure 2> Results of the Structural Model Analysis

<Table 4> Moderating Effect of the Project Phase

| Variable | Main Model | Model that includes Moderating Variable | Interaction Effect Model | |
|-----------------------------|------------|---|--------------------------|--------------|
| | | | I.V. : Shared Vision | I.V. : Trust |
| Shared Vision | 0.247* | 0.250* | 0.225ns | 0.224ns |
| Trust | 0.343** | 0.347** | 0.345** | 0.368** |
| Project Phase | | -0.037ns | -0.052ns | -0.025ns |
| Shared Vision×Project Phase | | | 0.28*** | |
| Trust×Project Phase | | | | 0.143ns |
| R ² | 0.285 | 0.287 | 0.359 | 0.305 |
| ΔR ² | | | 0.072 | 0.018 |

*, $p < 0.05$, **, $p < 0.01$, ***, $p < 0.001$, ns: insignificant at the 0.05 level.

tween Shared Vision and Team Performance. These items used as controlling variables here, i.e., Project Duration and Team Size, showed no significant impact on project performance.

5. Conclusions and Implications

The main objective of this study was to clarify whether effective communication has a positive impact as an antecedent of social capital and then to test empirically how the role of social capital changes based on the relationships among the sub-dimensions of social capital and team performance. From the results, this study derived several important conclusions and implications.

5.1 Discussion

First, regarding the hypotheses pertaining to the influence of communication effectiveness on social capital, all hypotheses were adopted (H1, H2 and H3). This study concluded that it is appropriate to assume that communication effectiveness serves as an antecedent of social capital. In addition, this indicates that effective communication may affect all dimensions of social capital.

Second, regarding the associations among the sub-dimensions of social capital, social ties had a significant impact on shared vision (H4), and shared vision had a positive impact on trust (H6). This is in good agreement with the association model of social capital's different dimensions as proposed by Tsai and Ghoshal (1998). This shows that social capital's different dimensions are interrelated with each other, which can be a basis of the convertibility of social cap-

ital into other forms of economic capital. Third, regarding the influences that social capital has on project performance, shared vision and trust each have a positive influence. From the previous analysis of communication effectiveness, the overall relationship from communication to project performance is significant. Fourth, regarding the analysis of the moderating effect of the project phase on project performance per social capital's sub-level, the interaction between shared vision and the project phase has a positive impact. Because the interaction effect is positively related to the project performance ($\beta = 0.31, p < 0.001$), the impact will become stronger as the project progresses. In other words, social capital's cognitive dimension is weaker while its relational dimension is stronger in the early phase. Then, as the project progresses, the cognitive dimension tends to have a greater influence on project performance. This phenomenon also concurs with the finding of Bhandar et al. (2006), who showed that social capital's role changes at different project phases.

5.2 Theoretical and Practical Implications

Although social capital is an intangible asset that has a positive influence on knowledge sharing and group performance, studies of the antecedents that form social capital have been insufficient. This study empirically validated that social capital's antecedent, communication effectiveness, has a significant influence. In addition, this study found that communication effectiveness and the sub-dimension of social capital are significantly linked. This indicates that effective communication should be considered seriously when attempting to build social capital regard-

less of the dimension.

This study also clarified that social capital's components has different impacts on project performance via the moderating effect of the project phase. In other words, the different influences by the sub-levels of social capital signify that the combination of social capital's internal factors varies, indicating that there could be an optimal combination. This is significant because this study was able to verify the results of previous case studies empirically. This provides a basis with which to explain the changing role of social capital with changes of the combined influence of its sub-dimensions. At this point, this study also supports the findings of Oh et al. (2004), who showed that the best existing combination has a positive impact on group performance.

Concerning the practical implications of this study, we would like to stress that a project manager must strive to come up with ways to make social capital in order to improve his/her team's performance. This study found that the sub-dimensions of social capital have different degrees of influence according to the project phase. At an early phase, the relational dimension may become more important than the cognitive dimension, but as the project progresses, the influence of the cognitive dimension increases. Therefore, it is more effective for team members to communicate to build trust at an early phase than for them to try to exchange common visions or goals as the project moves to the final phase. In this context, this study provides valid implications for project managers and their members with appropriate methods of communication to develop the best combination of social capital.

5.3 Limitations and Future Research

For further research, some limitations must be considered.

First, this study was conducted cross-sectional basis. But it might be insufficient for the investigating of social capital formation, because the social capital could be formed through a longitudinal and complex process. And prior cooperation experiences among members might influence the level of social capital in the present project. Thus longitudinal study is recommended for the future research.

Second, this study selected the moderating effect of the project phase as one of the hypothesis. However, the sample distribution of the project phase skewed to earlier phases such as the Requirement Analysis and System Analysis /Design phases for 94 samples (71.8%). If this study had collected data that followed a normal distribution, the moderating effect would have been different.

Third, this research took samples from one particular conglomerate; therefore, it may be limited in terms of external validity. It would be helpful for future studies to incorporate samples that are collected from other organizations or even countries.

Fourth, the unit of analysis for this study was the team. Because responses were drawn from team managers, it is likely that objective answers were obtained in some areas of the questionnaire, such as those related to the project characteristics and project performance. However, team managers were not always able to represent their team. For instance, they may not have known the levels of team communication or social capital. The team members could not share

precisely the same perceptions with their managers. Consequently, it would be more beneficial if future studies involved additional members from each team to increase the reliability of the data.

Fifth, this study limited the scope of the social capital of a team. However, it will be necessary for future studies to involve external social relationships. Particularly, an IS project is highly likely to involve different areas of expertise. Therefore, not only internal knowledge sharing but also an understanding of the requirements of the entire organization or business may be necessary. As Drach-Zahavy and Somech (2010)'s conceptual model of inter-team boundary activity, this study believes that any research that focuses on social capital with external groups will be meaningful to the success of an IS project.

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〈Appendix A〉 Measurement Items

| Dimensions | Variables | Items |
|-----------------------------|-----------------------------|---|
| Communication Effectiveness | Communication Effectiveness | <ol style="list-style-type: none"> 1. The information provided by project members was very useful for my work on this project 2. The content of the information provided by project members on this project was very satisfactory 3. The information provided by project members was highly relevant to their jobs on project 4. The information provided by project members was highly credible 5. The form and presentation of the information provided by project members was very satisfactory |
| Social Capital | Social Ties | <p>Project Manager rated how frequently they interacted with the project members by :</p> <ol style="list-style-type: none"> 1. Formal meeting for a week 2. Informal meeting for a week |
| | Trust | <ol style="list-style-type: none"> 1. My project members will not take advantage of others even when the opportunity arises. 2. My project members will always keep the promises they make to one another. 3. My project members would not knowingly do anything to disrupt the conversation. 4. My project members behave in a consistent manner. 5. My project members are truthful when dealing with one another. |
| | Shared Vision | <ol style="list-style-type: none"> 1. My project members share a vision of helping others solve their professional problems. 2. My project members share the same goal of learning from each other. 3. My project members share the same value that helping others is pleasant. |
| Team Performance | Team Performance | <p>How well did the entire project team perform on the following so far?</p> <ol style="list-style-type: none"> 1. The productivity of project team's operation 2. The project team's adherence to the schedule 3. The project team's adherence to the budget 4. The quality of the project team's deliverables 5. The project team's achievement of the project targets |

◆ About the Authors ◆



Jun-Gi Park (warren.pak@gmail.com)

Jun-Gi Park is a Senior Researcher in the Institute of East West Studies at the Yonsei University. He earned Ph.D in Information Systems at the Yonsei University. His research interests include knowledge sharing in organizational and team settings, project management, behavioral aspects of IT services, and service marketing.



Seyoon Lee (suyfj77@gmail.com)

Seyoon Lee received the B.S. degree at Seoul National University in 2000 and M.S. degree at Graduate School of Information (GSI), Yonsei University in 2007. He is currently a doctoral candidate at GSI and working as an associate researcher of Center for Work Science. His research interests are communication with ICT, IT project management and changing nature of work.



Gyoo Gun Lim (gglim@hanyang.ac.kr)

Gyoo Gun Lim is currently a Professor of MIS at School of Business, Hanyang University. He received his Ph.D. in Management Engineering from Korea Advanced Institute of Science and Technology (KAIST) in 2001. He received an award from Korea Ministry of Information and Communication for his contribution to Korea SW industry in 2007 and an award from Korea Ministry of Knowledge Economy for his contribution to Korea IT innovation in 2009. His current research interests include IT service, innovative business models, e-business, intelligent information & knowledge management, and etc.



Jungwoo Lee (jlee@yonsei.ac.kr)

Jungwoo Lee is a Professor of Information Systems and the Director of the Center for Work Science at the Yonsei University, Republic of Korea. He received his PhD in Computer Information Systems from the Georgia State University in 1998. His research interests are focused primarily around social and organizational changes incurred by information and communication technologies.