The Kind of Knowledge that makes Network Stronger

It is a key ability that a network members manage a variety of knowledge to survive in the volatile environment to improve the competitiveness of the network. This paper examines how knowledge sharing influences on network solidarity. The purpose of this research is to find out which knowledge type is more useful for robust network. This study classified knowledge into explicit versus tacit and examines how these knowledge types influence network solidarity respectively and which knowledge has stronger effect on the network solidarity. The empirical test was conducted with workers in networks of Korean engineering firms. The result of this study shows that two types of knowledge place different influence on network solidarity. Explicit knowledge sharing has a positive relationship with network solidarity as tacit knowledge sharing does and but, tacit knowledge sharing helps the network solidarity more firmly.

Keywords: Explicit knowledge, Tacit knowledge, Knowledge sharing, Network solidarity

Companies invest lots of money, time and effort to response in the rapidly changing environment. Especially, in these days, knowledge is a core factor of the success improving capabilities of the company (Hamel 1991). Company’s competitiveness is determined by knowledge management including knowledge creating, preserving, and sharing to respond volatile environment (Kogut and Zander 1993). Therefore, they have been struggling to improve company values by sharing resources and information.

Nonaka and Konno (1998) suggested that knowledge of individuals or organizations should be transfer or share with other members to develop the company capability by maximizing value of knowledge and making synergic effect. Sharing knowledge serves as a basis for acquiring competitiveness over other organizations.

As Hutt el al (2000) emphasized network solidarity among network members as a prerequisite for improving performance of network, many researchers have agreed on that socio-psychological factors determine the quality of network members (Sarka et al. 2001) and serve as an important role on network performance (Dhanaraj et. al. 2004, Martin and Salomon 2003). Especially, network solidarity built based on a high degree of reliability between network members and it contributes to improve network performance by placing higher values on the efficiency of long-term relationship and suppression of opportunistic tendency (Dwyer et al. 1987).

In spite of the network solidarity is the important factor for performance, there were few research related to network solidarity. This study chose network solidarity as one of the factors contributing to increase network performance and assumed that network performance can be improved after reinforced network solidarity. In this study, knowledge has been classified into explicit versus tacit and we hypothesized those two types of knowledge place different influence on network solidarity. This research examines how these knowledge types influence network solidarity respectively and which kind of knowledge has stronger effect on the network solidarity.

This study investigates the knowledge sharing in the context of Korean engineering industry network. Members participating in the network with advanced technology require a high degree of cooperative system depending on the various kinds of projects. Therefore, engineering industry network is a good source for studying how knowledge sharing affects the relationship between network members.

Previous studies dealing with knowledge management of the company have focused on sharing or creating knowledge in the intra-organization not inter-organization relationship. Therefore, there were relatively insufficient researches in the area of interfirm knowledge sharing in a network (Ahmed et al. 1999; Molina et al. 2007). Therefore, this study contributes to the literature by studying the phenomena of sharing knowledge among interfirm network members.

Theoretical Background and Hypothesis

Knowledge
One of the main reasons that participate in network is to learn know-how and capabilities from their network partners (Kale et al. 2000). Accessing and acquiring critical knowledge, know-how, or capabilities from the partner is considered to be one of the foremost motivations for network formation (Hamel 1991; Khanna et al. 1998). According to Suseno and Ratten (2007), effective knowledge sharing is the most important variable affecting network success.

As knowledge is the core resource for improving competitive of the firm and network success depends on how well knowledge sharing can be conducted among the network members (Lee and Park 2010), we need to define knowledge before we discuss the importance of the knowledge sharing.

Knowledge has been characterized different dimensions using various perspectives (Foss and Mahnke 2003). Krough et al. (1998) describes it in terms of constructionist perspective and cognitivist perspective. According to constructionist perspective, knowledge is constructed as a unique set gathered and expressed through previous experience, feeling, and mood. To the constructionist knowledge is highly personal, not easily expressed, and therefore not easy to share with others. Meanwhile, from cognitivist perspective, knowledge is considered to be representations of the world that consist of a number of objects or events, and the key task of the brain is to represent or model these as accurately as possible. To the cognitivist, knowledge is a form that can be clearly and easily coded to be transferred to others.

Nonaka and Takeuchi (1995) explained that knowledge has two different types namely, tacit knowledge and explicit knowledge. Though it is difficult to verbalize, tacit knowledge is a form that exists in a subjective form including personal experience and well-trained functions among individuals, groups, and organizations. Explicit knowledge is also a set knowledge that exists with verbalized form including specifications of the product, documents, database, and manual.

Lundvall and Johnson (1994) classified knowledge as know-what, know-why, know-how, and know-who. Know-what is an understanding of specific fact. Know-why is an understanding of human spirit, behavior, and social changes. Know-how means capability and technology of being able to perform something. At last, know-who is an understanding of knowing who knows what and how they know it.

On the other hand, Quinn et al. (1996) restricted the scope of knowledge into the knowledge shared by experts. He insisted that such definition of knowledge from experts is produced by four types of knowledge suggested by Lundvall and Johnson (1994).

There are many different types of opinion in what perspective to apply for defining knowledge. This study adopted the definition by Polanyi (1966) and Nonaka and Takeuchi (1995) that are most widely accepted and classified into explicit knowledge and tacit knowledge.

*Explicit Knowledge* Organizations' knowledge resources have pertinently been described as an iceberg. The structured, explicit knowledge is the visible top of the iceberg. This part of the knowledge resource is easy to find and recognize and therefore also easier to share. This is also done in organization through different forms of technological and pedagogical methods. Beneath the surface, invisible and hard to express, is a momentous part of the iceberg (Haldin 2000). This hidden part applies to tacit knowledge resources in organizations.

According to Polanyi(1966), explicit knowledge is considered as codified knowledge, it can be shared by language or documents and defined easily modifiable knowledge that can be transmitted "without loss of integrity once the syntactical rules required for deciphering it"

Concepts of Explicit knowledge by many researchers can be listed “know-what,” ‘objective knowledge’, ‘predisposition knowledge’, and ‘declarative knowledge’. For example, facts, axiomatic propositions, symbols, database, instruction books, and so on.

It is the reason that explicit knowledge is said to be ‘leaky knowledge’. This means explicit knowledge can be easily transferred without causing difficulty for the use by anyone and be copied (Alavi 2000).

*Tacit Knowledge* In contrast to explicit knowledge, tacit knowledge is accumulated through learning and experience; often, it is referred to as learning by doing (Reed and DeFillippi 1990) and allows one to do something smoothly and efficient (Hippel 1988). Tacitness suggests that individuals know more than they can tell (Polanyi, 1966). Tacit knowledge entails commitment and involvement in specific contexts and has a ‘personal’ quality (Nonaka 1998). As Polanyi (1966) stated, “the aim of a skillful network performance is achieved by the observance of a set of rules which are not known as such to the person following them”. A scholarly view of this position is that tacit knowledge may best be defined as knowledge that is not yet explained (Spender 1996). Terms such as ‘know-how’, ‘subjective knowledge’, ‘personal knowledge’, and ‘procedural knowledge’ have been used to describe the tacit dimension of knowledge.

Especially, Nonaka and Takeuch (1995) insisted that tacit knowledge is a subjective knowledge derived from the experience that has analog characteristics of resolving complicated issues shared by individuals after being created in a real environment. Such tacit knowledge can be existed in the brain of individuals and also in the procedures of interaction between companies in the network. Because this means the culture including past and present experience on people, process, and values as well as accumulated results from experience, expertise, know-how, transaction secrets, skills, and learning of the organization. (Madhaven and Grover 1998).

Dreyfus and Dreyfus’s (1986) highlights the value of employee longevity in Japanese firms as a business advantage over American businesses. Their premise is based on Japanese employees typically staying with one company.
throughout their career, which provides an intuitive level of knowledge that American firms struggle to duplicate because of high employee turnover (Dreyfus and Dreyfus 1986). The value of intuitive knowledge was also explored by Boisot (1998), who maintained that Japan’s strong preference for uncodified knowledge aided Japanese manufacturers by reducing the ability of competitors to duplicate their products. The more recent expansion of Japanese manufacturing firms into international arenas, however, resulted in codification which has opened the doors to imitation (Boisot 1998). Because tacit knowledge is embedded within individuals versus embedded in training manuals, it is much less susceptible to being exploited by competitors and therefore becomes an even more valuable commodity to capture and protect (Lei et al. 1997).

3M Corporation, widely recognized as one of the most innovative companies in the world, nurtures tacit knowledge sharing by encouraging individuals to share ideas. This company values tacit knowledge based on the belief that the greater good of the company is served when individuals share versus hoard information (Brand 1998).

Tacit knowledge is a set of knowledge that perspective of view, thought, know-how, and experiences are inherent in and also that is subjectively and physically absorbed (Reed and DeFillippi 1990). Therefore, it is difficult to share tacit knowledge due to problems of verbalization (Spender 1996). In order to share tacit knowledge, a procedure of learning and experience should be repeated. Therefore, face-to-face contact and feedback exchanging with a person possessing tacit knowledge is required (Spender 1996).

In addition, considering that shared knowledge is helpful to improve network performance of the company in the network, concepts and characteristics of explicit knowledge and tacit knowledge insisted by many researchers can be reorganized as below.

**Network Solidarity**

Network solidarity defines a bilateral expectation that a high value is placed on the relationship commitment. It prescribes behaviors directed specifically toward relationship maintenance (Heide and John 1992). It means to exert an effort to maintain relationship with others for long term relationship beyond a mere trustworthy connection (Hechter 1987; Lindenberg 1988). Network solidarity itself means an implicit or explicit oath in terms of maintenance of relationship between members including factors such as reciprocality and loyalty (Dwyer et al. 1987). In addition, it indicates a trust for having enough values to guarantee the greatest efforts as to maintenance of steady relationship (Morgan and Hunt 1994).

Network is a group of more than three economical actors. Because they all establish a group with their own core capability in order to pursue interest, a conflict from greed or lack of mutual understanding is naturally occurred. This is a problem or intra firm as well as an issue of interfirm.

Network solidarity is based on the willingness of network members to defend each other in the face of challeng-
kind of knowledge requires much time and effort to accumulate because generally it comes from experiences. The main characteristic of this knowledge is difficult to codify, face to face transfer, and hard to gain without tacit knowledge possessor. Due to above features tacit knowledge is considered a higher strategic value compared to explicit knowledge.

Knowledge intended to be shared in the network is core one and tacit knowledge of partners having higher strategic value. Therefore, it has been insisted that it is difficult to transfer core knowledge of partners. However, if it is once shared along with an increase of an amount of how much knowledge is shared, network members treat their partners as a knowledge possessor.

As knowledge sharing increase, network members consider their partners as important knowledge possessors. It is important that maintenance of relationship with partners who get the knowledge which the firm doesn’t have because knowledge is the core capacity. Therefore they want to make their relationship ongoing and beneficial and are inclined to refrain from behaviors that might jeopardize it (Heide 1994). Moreover network solidarity is the power of binding network members strongly and constructed on the bases of strong relationship among network members. So network solidarity will be increased when knowledge which is important resource is shared (Szulanski 1996; Argote et al. 2000).

The level of network solidarity, however, will be different depending on the knowledge type, tacit and explicit. Explicit knowledge is for everyone to find and use but tacit knowledge separates the masters from the common (Lawson and Lorenzi 1999). An organization’s core competency is more than the explicit knowledge of “know-what”; it requires the more tacit “know-how” to put “know-what” into practice (Brown and Duguid 1998). Thus, core competency caused by tacit knowledge leads to network solidarity.

Compared to the tacit knowledge, little investment will be required to the explicit knowledge. Because it is in written form and an already recognized fact, it can be transferred easily through not only people, but also anywhere (Denise and Githens 2012). Tacit knowledge, on the other hand, is gained through experience and is far more challenging to explain because it exists in peoples’ heads. The only way to share this tacit knowledge is through the person who possesses it (Peterson and Rajan 1994, 2002; Uzzi 1999). Consequently, it needs much more investment to share even though they initiate searches explicit knowledge through people, which often have lower transaction costs than other means of search like tacit knowledge (Granovetter 1974; Geertz 1978).

People tend to exert more effort to preserve knowledge that they have invested in more, while a relationship with knowledge possessor will be given much consideration for a certain type of knowledge obtained from the relationship with people (Elliott 2002).

Tacit knowledge is difficult to access without tacit knowledge possessors and needs a lot of time and efforts to store in his/her brain. It is not codifiable thus, hard to transfer. Therefore, the recipient is dependent on the tacit knowledge holder greatly. Tacit knowledge is shared by only person to person. However explicit knowledge can be gained both with and without knowledge holder. Therefore, it is expected that network solidarity becomes stronger when tacit knowledge is shared than when explicit knowledge is shared.

**Tacit knowledge sharing has a stronger effect on the network solidarity than explicit knowledge sharing.**

**Method**

Data used for testing the Hypotheses was collected through a mail surveys. The sample consisted of 450 workers in different networks or Korean engineering firms. A total of 450 data samples in the engineering network were sampled to fill out the questionnaire. Among these data samples, only 189 samples (42%) are collected and 14 samples were eliminated for incomplete answers to questionnaires. As a result, 175 valid samples are analyzed for this research.

We developed multi-item measures based on construct definitions and research precedents and revised some original questions used in previous studies (Gabesan 1994) to enhance understanding of these items for the respondents. Moreover in-depth interviews were conducted with those engaged in the engineering industries and other interested parties to improve a draft of the questionnaire.

All items were measured using seven-point Likert-type measurement scales where 1 meant “extremely disagreeable” and 7 meant “extremely agreeable”. Data analysis was performed in two stages. In the first stage, reliability analysis was conducted using SPSS to evaluate the stability and consistency of the measured items.

In order to assess whether there was a non-response bias, t-test for early responses and late responses of variables was then performed.

Our measure of explicit knowledge sharing is taken from the work of Heide and John (1992). For this study, the network members were asked to the possibility of sharing the explicit knowledge including price, profits, facts, and formal and codifiable structure without loss of integrity (Kogut and Zander 1992).

Tacit knowledge sharing construct describes the level of the degree to which the firm is willing to allow partners to acquire its capabilities. For example share technological knowledge, marketing know-how, and focal resources. The three items are based on those that Dacin, Michael and Levita (1997) use.

Network solidarity variable explains the extent to which the firm’s sense of unity that binds it to the exchange partner firms (Forgas and Dobosz 1980; Stern 1986) and a belief in being able to depend on one another (Macneil 1983). The three items are developed based on the work of Kim (2003).
Result

Measurement Analysis
The positions of respondents are directors of purchasing department in their company. The number of director is 68 (approximately 39%) of the total respondents, manager is 90 (approximately 51%), and assistant managers and staff is 17 (approximately 10%).

Some items of the measured variables are removed through the scale purification process. First, as shown TABLE1, exploratory factor analysis was performed in order to verify validity. We used principal component analysis to extract the configuration factors and adopted orthogonal rotation (varimax) for the sake of simplicity of factor loading. The selection criteria we based on are 1.0 or more of eigen value and more than 0.40 of factor loading. After factor analysis, reliability test is performed with each variable. The items are concerned with explicit knowledge sharing (3 items), tacit knowledge sharing (3 items) and network solidarity (3 items) had Cronbach’s alpha coefficient over 0.89 with no apparent increase when any of the items were deleted. The coefficient exceeded Nunnally and Bernstein’s (1994) recommendation of 0.70, and supported the use of these items in each scale.

Correlation is used in order to determine the degree and direction of the relevance between the measured variables before the hypothesis test. There is a significant relationship under the 0.01 significance level of correlation between all the variables. As shown TABLE2, correlation coefficients between all variables are high and significant under 0.01 significant level.

Hypothesized Model Analysis
Hypothesis predicted that tacit knowledge sharing will affect stronger on the solidarity than explicit knowledge sharing. TABLE3 shows the result analyzed by hierarchical regression which is used to determine the order the magnitude of the relative influence of the independent variables.

Model1 (independent variable: explicit knowledge sharing) presents that explicit knowledge sharing explains 28% of variance of network solidarity and has a positive effect on the network solidarity (t=10.477, p=.000). Model 2 shows that explicit independent variables, knowledge sharing and tacit knowledge sharing, explain 51% of network solidarity variance. Model 2 added the other independent variable, tacit knowledge sharing to Model 1 and it explains 22% more than model 1 and positive effect between tacit knowledge sharing and network solidarity (t=11.365, p=.000). Standardize coefficient (β value) means relative influence of independent variables. This result explains that tacit knowledge sharing (.573) has greater effect on the network solidarity then explicit.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
<th>Factor Loading</th>
<th>Cronbach α</th>
<th>Eigen-value</th>
<th>% of Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tacit Knowledge Sharing</td>
<td>The degree to which a partner is willing to allow your firm to acquire its technological knowledge.</td>
<td>0.86</td>
<td>0.92</td>
<td>2.76</td>
<td>25.08</td>
</tr>
<tr>
<td>Tacit Knowledge Sharing</td>
<td>The degree to which a partner is willing to allow your firm to acquire its marketing know-how.</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tacit Knowledge Sharing</td>
<td>The degree to which a partner is willing to allow your firm to acquire its core resource.</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit Knowledge Sharing</td>
<td>Information is always shared among our firm and network partners.</td>
<td>0.89</td>
<td>0.89</td>
<td>2.64</td>
<td>24.06</td>
</tr>
<tr>
<td>Explicit Knowledge Sharing</td>
<td>Information is periodically shared among our firm and network partners.</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit Knowledge Sharing</td>
<td>Information is continuously shared among our firm and network partners.</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Solidarity</td>
<td>A high sense of unity exists between our firm and network partners.</td>
<td>0.85</td>
<td>.90</td>
<td>3.03</td>
<td>27.61</td>
</tr>
<tr>
<td>Network Solidarity</td>
<td>These network partners are a very important ally of our distributorship.</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Solidarity</td>
<td>Our network partners are strongly tied together.</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 1
Factor Analysis of variables
knowledge sharing (.215).

When comparing the influence of explicit knowledge sharing with tacit knowledge sharing on the network solidarity, Hypothesis is regarded to be accepted insisting that tacit knowledge places greater influence on the network solidarity than explicit knowledge.

**Discussion**

Previous research had emphasized on knowledge sharing for a company’s performance. To date, little empirical work has been conducted to find out how different kinds of knowledge influence the network solidarity which should be prerequisite to the network performance. The purpose of this study is to examine that which knowledge has a greater effect on the network solidarity. Knowledge can be divided into explicit knowledge and tacit knowledge, and sharing these two types has disparity in terms of how much it influences on network solidarity.

Considering that network is an intended group of economical actors with common objective to pursue benefits, the concept of network solidarity serves as an important factor for network performance. Because network solidarity is a variable containing not only a high degree of reliability but also characteristics of suppressing opportunistic behaviors of network members. In spite of such characteristics, there has been rarely studied on network solidarity. Thus, this study intends to identify the types of knowledge, and examines the effect of knowledge on network solidarity.

As for summary of the result of this research, hypothesis which compares the influence of explicit knowledge and tacit knowledge on network solidarity is supported. It turned out that tacit knowledge had a greater influence on network solidarity than explicit knowledge.

**Managerial Implication**

There are several meaningful implications to be suggested according to the result. First of all, the positive effect of knowledge sharing is examined in this study. Secondly, network solidarity is required for maintaining interfirm network for a long time, and two types of knowledge places different influence on network solidarity. Specifically tacit knowledge is much influential than explicit knowledge for network solidarity. Many researches reveal that knowledge sharing has a positive effect on the firm’s performance. However few papers related to the relationship of network

**TABLE 2**

<table>
<thead>
<tr>
<th>Mean</th>
<th>Standardize Variation</th>
<th>Inter-Construct Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ExplicitK.</td>
<td>2.956</td>
<td>1.065</td>
</tr>
<tr>
<td>Tacit K.</td>
<td>2.527</td>
<td>0.993</td>
</tr>
<tr>
<td>Solidarity</td>
<td>3.230</td>
<td>0.880</td>
</tr>
</tbody>
</table>

* p < 0.01

**TABLE 3**

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SE β T-value (significant level)</td>
<td>SE β T-value (significant level)</td>
</tr>
<tr>
<td>Constant</td>
<td>.132 7.791(.000)</td>
<td>.118 4.389(.000)</td>
</tr>
<tr>
<td>Explicit Knowledge</td>
<td>.042  .532 10.477(.000**)</td>
<td>.042  .215 4.261(.000**)</td>
</tr>
<tr>
<td>Tacit knowledge</td>
<td>.045  .573 11.365(.000**)</td>
<td></td>
</tr>
</tbody>
</table>

R²=.283, Adjusted R²=.280,  
F=109.764, P=.000

R²=.511, Adjusted R²=.508,  
F=144.764, P=.000

* P<0.05,  **P<0.01
solidarity and knowledge sharing. Especially, because there is a difference in the influence on the solidarity according to the type of knowledge, it is important to manage a network with a focus on the tacit knowledge sharing. It is highly possible that explicit knowledge has been shared already among network members. Because it is essential that network members set shared common information (i.e. price, profit, manual and so on) to achieve the same purpose. Therefore we interpreted the result of this study that tacit knowledge instructing kind of know-how or experience is more effective to make a network stronger than explicit knowledge required in the process of network formation.

Limitation and Future Research
This study has three potential limitations as follows and, therefore, is intended to suggest a proper direction of study in the future. First, it has limitation on the generalization of the results to other industries. This research collects data from the field of Korean engineering industry network requiring project-require long-term relationship and collaboration among network members, which do not always occurred among other industries. Therefore, it might be difficult to expand the result of this study into companies in other industry that pursue long-term network.

Second, there are differences of network maintenance period among the engineering networks. Therefore, it is worth dividing a period for when a specific company has entered to the network for investigation of the network solidarity. For instance, a member entering to the network when it is in a prime time might produce different feeling of solidarity compared when it enters to the network in a decline phase.

Last, social approach as well as psychological approach should all be introduced for asking psychological status such as network solidarity. Because this concept is related to relationship of the network members and the relationship is certain feeling to anyone who involved on the network. Thus the network solidarity can be said that these are in the psychological area as well as sociological area. More extensive conclusion might be derived if using social concept and psychological concept at the same time since the concept of such variables is abstract.

REFERENCES
Alavi, Mariam (2000), Managing organizational knowledge.
Elliot, Turiel (2002), The culture of morality: Social development, context, and conflict, Berkeley: Univ. of California Press.


Kim, Yong Hak (2003), Social Network Theory, Seoul, Bakyounsa.


Mora, Valenton Eva, Angelo MontoroSneck and Luis Guerras Martin (2004), “Determining Factors In The
Success if R&D Cooperative Agreements Between Firms and Research Organizations; "Research Policy, 33(1), 17-40.


