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# The Impact of Absorptive Capacity of the Firm upon ERP Adoption

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## Abstract

The paper examines the impact of absorptive capacity on ERP adoption of the firm. The comprehensive framework of the relationships among absorptive capacity, trust, and knowledge acquisition is addressed and tested empirically. The results of the path analysis confirm that the proposed model is acceptable and seven out of its nine paths such as 1) between absorptive capacity and knowledge acquisition, 2) between absorptive capacity and trust, and 3) between trust and knowledge acquisition, are significant. In spite of several theoretical and methodological limitations, the study proposes several variables have to be considered for effective knowledge acquisition for practitioners. In addition, this paper can invoke the research on the exchange of various knowledge and more empirical tests on trust theoretically.

*Keywords: absorptive capacity, trust, social capital, knowledge management*

## 1. Introduction

The objective of this paper is to analyze the impact of absorptive capacity on ERP adoption. ERP is "a structured approach to optimizing a company's internal value chain(Norris et al. 2000, 12)," and it connects the whole enterprise through sharing of common data with an integrated system. Although several approach to ERP such as business process reengineering and information systems implementation exists, we regard ERP package adoption as knowledge adoption across the firm's boundary.

Many theorists in strategic management and organizational structure fields have tried to reveal the sources of the sustainable advantages of the firm in times of turbulent technological and administrative changes. For a group of academicians, knowledge is the answer for the question. The assumption of the knowledge-based theory is that the origin of the competitive advantage is peculiar knowledge of the firm. Among other stages of knowledge management, knowledge acquisition has become a popular subject in various research fields such as strategic management(eg. Nicholls-Nixon 1993) and evolutionary economics(eg. Schumpeter 1939).

Although the strategic management perspective has presented how to deal with discontinuous changes, it has not revealed the way to develop technological and administrative capability of the firm and the relationship between the competence and the performance of the firm. Apart from the strategic management literature, evolutionary economics has emphasized on the macro-level process such as the state of knowledge, institutional conditions, endogenous nature of the market structure(Nicholl-Nixon 1993; 9-18). However, evolutionary economics has not answered which firm-level activities makes technological and economic changes happen and why some firms adapt to the change faster than others yet(Nicholl-Nixon 1993, 24-25).

Cohen and Levinthal(1990) propose absorptive capacity to answer the questions on interorganizational differences in capability to appreciate and utilize external knowledge. In conjunction with earlier research such as Cohen and Levinthal(1990)'s, more recent studies expand the concept of absorptive capacity to which includes relational and experiential factors(Dyer and Singh 1997; Lane and Lubatkin 1998). To further our understanding of ERP package adoption, this study tested the relationships between absorptive capacity and knowledge acquisition empirically.

## **2. Literature Review**

### ***2.1 Knowledge Acquisition***

Knowledge acquisition is the state of receiving knowledge from another organizations, and it is performed by various interfirm activities such as technology sourcing, licensing/ franchising, R&D alliance, equity/non-equity based alliance, and M&A.<sup>1</sup> Companies develop knowledge through 1) combining existing knowledge, 2) producing internally, and 3) acquiring external knowledge<sup>2</sup>. Among these things, the study focuses on the external knowledge acquisition because it is significant theoretically as well as practically(Blumenthal 1978; Contractor 1980; Lee 1998).

#### *2.1.1 Resource- and Knowledge-based Theory*

The academic interest in knowledge is originated from the resource-based view of the firm. The resource-based view is against the view of industrial structure theory and instead, focuses on resources and capabilities of the company as a source of organizational advantage(Penrose 1959). Contemporary corporations that face continuous changes and technological developments cannot manage all activities independently. Regardless of its size and history, most of the critical skills and resources for the sustainable competitive advantage of the firm exist beyond the firm's boundary(Doz and Hamel 1998). The previous research on the resource-based view converges that more idiosyncratic and superior resources than those of competitors will be a drive of competitive advantages if they are combined appropriately with external opportunities(Penrose 1959; Lippman and Rumelt 1982; Nelson and Winter 1982; Rumelt 1984; Wernerfelt 1984; Barney 1986; Diericks and Cool 1989; Prahalad and Hamel 1990; Conner 1991; Grant 1991; Peteraf 1993; Chi 1994).

On the other hand, intellectual resources can be viewed as a derivation of strategic resources. From the viewpoint of intellectual resources, the existence of a corporation is sustained by a basic unbalance of knowledge economics. Market contracts do not have the stability of long-term relational agreements. They also cause opportunistic problems creating difficulty in controlling any fluctuation in balance(Kogut and Zander 1992). The coordination within a corporation is based on the intellectual resources that fulfill an organization and the organization's ability to integrate such knowledge resources. In short, the knowledge that is not commonly shared within an organization's detail should be unified through various communications and collaboration,

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<sup>1</sup> Informal knowledge acquisition mechanisms such as informal exchange of technical knowhow and involuntary spillover are excluded due to the convenience of the analysis.

<sup>2</sup> "Knowledge acquisition" and "learning" are used without clear distinction. Strictly speaking, knowledge is a object or results of learning, thus, knowledge acquisition is likely to refer to "the state of getting knowledge."

finalizing a common board between people. This creates a structure of a high-low competitiveness that cannot be imitated (Chi 1994; Grant 1996b, 117).

### *2.1.2 Interorganizational Cooperation and Network*

Meanwhile, the interorganizational cooperation and network sector reveals the limitation of transaction cost economics (eg. Williamson 1975; 1985) and emphasizes the successive transactions and social factors embedded in transactions (eg. Granovetter 1985) instead of asset specificity, human and environmental assumptions, and the hostage mechanism. Knowledge acquisition based on corporate partnerships maximizes competencies and minimizes the exposure of technical uncertainties. Furthermore, such cooperation can be an important means of acquiring dark territory such as purchasing through the market and internal development. On the other hand, because of the knowledge structure and processing characteristics, imitation and movement of knowledge acquisition is difficult (Hamel, Doz, and Prahalad 1989, Cohen and Levinthal 1990). Through this, new research of how an organization learns from its partner, and how new competences are developed through cooperation is arising.

Knowledge Acquisition through Interorganizational Cooperation in relation to existing research is as follows (Simonin 1999); 1) how knowledge is searched in international mutual investments (Inkpen and Peamish 1997), 2) how knowledge is acquired in a partnership (Simonin 1999), 3) how mutual investments acquire knowledge from mother-companies (Lyles and Salk 1996), and 4) how knowledge of cooperation overtime develops and effects the outcome (Doz 1996; Powell et al. 1996; Simonin 1999).

Cooperation behavior organization is related to how much internal value and capability a company has. At the same time, cooperation helps to develop and to strengthen internal competences. Furthermore, cooperation between organizations is not a single transaction, but rather a way to learn how to move knowledge through cooperation and strengthen a partnership (Powell et al. 1996).

### *2.1.3 Organizational Learning*

Organizational learning refers to "the process through which knowledge on relationships between activities and results as well as on the impact of the environment is increased in the organization (Duncan and Weiss 1979)" and it is routine-based, history-dependent, and target-oriented (Levitt and March 1988). Learning from the other organization is related to acquisition of information and knowhow (Kogut and Zander 1992). Information can be codified easily and transferred without damaging its integrity once the syntactical rules are identified. On the contrary, knowhow is tacit, sticky, and complicated. Accumulative practical skill and expertise are good examples of knowhow (von Hippel 1988; Szulanski 1996).

The reasons why the research on organizational learning has become such a trend is as follows: Firstly, since the effort to create new structures and systems for assimilating and reacting to the turbulent changes, the importance of the organizational learning has become increased (Senge 1990). Therefore, learning has been regarded as an important factor for maintaining competitiveness (Garratt 1987). Secondly and partly linked to this idea, the disturbed technological change is closely related to the organizational change. The variations of products, processes and organizations because of technology, heighten the vague future and differences within organizations. Many revolutionary product development processes (Rothwell 1992), the

transfiguration of production processes, such as the "lean production(Womack et al. 1990)" and the increase of computer-aided organizational innovations causes the need for corporations to perform their tasks more quickly and efficiently to achieve the organizational goals(Kwon 1996). The organizational learning theory, which is originally addressed by organization theoreticians such as March and Simon(1963) and Cyert and March(1958), is transcended into an effort to overcome the limits of the structural contingency theory in the 1960s. Organizational learning is different from the structural contingency theory since it emphasizes the adaptability of organizations to changeable environments. Furthermore, it stresses the organizational capability to change and create new environments. In order for this to be accomplished, interest is weighed upon the ability of the accumulation of organizations.

Since the rapid political, economical, and technological changes increase uncertainty around organizations, the advantages such as capital reserve, patents, machines, technology, and distribution channels have become less important than advantage-building capabilities such as flexibility and learning capacity for organizations to survive(Park 1996, 71).

## ***2.2 Absorptive Capacity***

Absorptive capacity is "an ability to recognize the value of new information, assimilate it, and apply it to commercial ends" and "is largely a function of the level of prior related knowledge(Kohen and Levinthal 1990)." Although the absorptive capacity of a firm depends on individual absorptive capacities of its members, organizational absorptive capacity is not the mere sum of the individual absorptive capacities(Cohen and Levinthal 1990, 131-32).

Prior studies on absorptive capacity introduce various variables as surrogate measures for absorptive capacity(eg. Cohen and Levinthal 1990; Nicholls-Nixon 1993; Szulanski 1996; Dyer and Singh 1997; Lane and Lubatkin 1998). Absorptive capacity can be brought forth as a by-product for R&D investments or production experience(Cohen and Levinthal 1990). In addition, organizations with high absorptive capacity are more active in using different forms of alliances in order to develop technological capabilities. It also uses the form of equity-based ownership frequently and have more internal specialty in their techniques that pursue alliances. Likewise, it has more experience in applying alliances and working together with a specific alliance partner, and it is more diligent in applying and acknowledging the importance of mechanism to that it is able to communicate better with the alliance partner(Nicholls-Nixon 1993).

Dyer and Singh(1997) point out that existing research on absorptive capacity did not consider the relations with partners that offer knowledge. So they introduce a new concept called partner-specific absorptive capacity. The partner-specific absorptive capacity is the function of: 1) partners developing the basis of duplicated knowledge, 2) partners developing the routines of interaction in order to maximize the frequency and depth of the sociotechnical interaction. At the same time, partner-specific absorptive capacity improves only if they know who is doing what at the other enterprise and also where the important specialty exists. Almost all the time, this kind of knowledge develops informally through interactions of enterprises<sup>3</sup>.

In the meantime, Lane and Lubatkin(1998) conceptualize the existing construct of absorptive capacity to "dyad-level" absorptive capacity. The result of measuring the new techniques and abilities such as the learning ability of the alliances of pharmaceutical industry, the ability for a specific enterprise to learn from other enterprise has a positive relations that deals with similarities between partner's basic knowledge, low degrees of formality, act of compensation,

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<sup>3</sup> Some of these knowledge can be formalized, and a good example is "communication matrix" of Fuji and Xerox.

and research cooperation within an organization. This kind of dyad-level absorptive capacity has more explanation power than the existing variable, the R&D intensity(Lane and Lubatkin 1998). Although several theorists have proposed the concept of absorptive capacity and its variables, there has been a lack of comprehensive view to absorptive capacity and its relationship with knowledge acquisition. To overcome this limitation, this paper presents a comprehensive framework of the relationship between absorptive capacity and knowledge acquisition. In the framework, absolute absorptive capacity such as prior expertise and prior experience, and relative absorptive capacity such as prior relationship with the specific knowledge provider are included. Different from these two concepts, communication mechanism and conflict resolution mechanism is mixture of absolute and relative absorptive capacity.

### **2.3 Trust**

Trust determines effectiveness of interorganizational learning and competitive advantages (Dodgson 1993; Dyer and Singh 1998). Trust is "a state of mind, an expectation held by one trading partner about another, that the other will behave in a predictable and mutually acceptable manner(Sako 1991)." Due to the imperfect nature of interfirm transactions, high level of trust is indispensable for knowledge acquisition across the firm's boundary.

Sako(1991) categorizes trust as contractual, competent, and good-will trust. Contractual trust is related to written or oral agreements, and competent trust concerns the expectation of a trading partner performing his role completely whereas good-will trust is expectations of open commitment to accede to a request from a trading partner or to any observed opportunity that would improve performance. Similarly, Gulati(1995a) classifies trust by its objects as knowledge-based trust and deterrence-based trust. While deterrence-based trust based on fear of punishment, knowledge-based trust relies on information rather than deterrent and develops over time. In the same way, Madhok(1995) and Kale et al.(2000) address the concept of structural and behavioral trust. Structural trust use "mutual hostage situation" whereas behavioral trust is based on "the reliability and integrity of each other." Behavioral trust is similar to knowledge-based trust of Gulati(1995a).

Studies on interorganizational networks have led a new trend that analyzes the relationships between social capital(i.e. trust) and knowledge acquisition. Nahapiet and Ghoshal(1998) and Tsai and Ghoshal(1998) address that social capital has an effect on exchange and combination of intellectual capital. Likewise, Kale et al.(2000) conceptualize interrelation between partners, mutual trust, mutual respect and personal friendship as relational capital, and analyze how relational capital and conflict management affect the learning level of the organization as well as the degree of protecting core assets. However, Locke(1999) suggests that one should remind of the importance of objectivity that deliver information where it is needed rather than where one maintains social relationships. With respect to the loss of objectivity, he gives an example of Japanese banking crisis<sup>4</sup>. In addition, he indicates that the wellsprings of organizational knowledge are knowledge generations in personal level, therefore, it is likely to be dangerous to emphasize organizational knowledge transfer without taking personal knowledge into

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<sup>4</sup> "One factor in this crisis was the desire of banks to keep their networks secure, even at the expense of sound banking practices. Keeping those who are not 'good old boys' out of the communication loop can be very damaging to an organization. Strong personal bonds between executives can facilitate communication between those executives but, for the same reason, can isolate those who do not have such bonds(Locke 1999)."

account(Locke 1999). In spite of such a prudent approach, the importance of social capital has become under discussion vigorously due to the awareness of imperfect contract and advantage of the long-term relationship.

Beside network studies, organizational learning research also concern about trust. If a company would like to learn important information or knowhow from other organizations, the first thing it has to do is to know where knowledge exists in the supplier organization, and who possesses it(Dyer and Singh 1998). Direct and intimate interaction between individuals and ongoing processes of knowledge exchange are considerable factors for transfer and learning of tacit knowhow as well as explicit information(von Hippel 1988). To ease learning from partners, the level of mutual transparency or openness must be high. Opportunistic behavior hampers transparency, and mutual trust lessen the possibility of opportunistic actions(Sako 1991; Gulati 1995a; Lee and Kim 1999). In other words, trust in partners is relational capital that facilitates the acquisition of explicit and implicit knowledge from outside of organizations.

### **3. Research Model and Hypotheses**

The objective of this study is to clarify relationships among constructs such as absorptive capacity, trust, and knowledge acquisition. Based on the review of previous literature, relationships are depicted and relevant variables for the empirical analysis are proposed. Figure 1 reveals the proposed research model.

#### ***3.1 Knowledge Acquisition***

Measures of knowledge acquisition can be divided into several categories. Szulanski(1996) addresses the process and the outcome of intrafirm transfer of best practice to explore internal stickiness. The process includes outcome, initiation, implementation, ramp-up, and integration stages and each step has its own performance measures. In the outcome stage, measures for the "technical success" on time, cost, and the satisfaction of recipients are used. Measures for the other stages are on the assimilation of the acquired knowledge(Szulanski 1996, 40-41).

Likewise, researchers of organizational learning suggest several items of assessing the outcomes of interorganizational knowledge transfer or learning. Simonin(1999) measures knowledge transfer by 3 items on 1) the amount of the knowhow held by the partner, 2) the degree of reducing its initial technological reliance or dependence upon the partner, and 3) the extent of assimilation and the impact on other projects of the knowhow. In addition, Kale et al.(2000) use items such as 1) the amount of new or important information, 2) the amount of critical capability or skill, and 3) the degree of enhancing its existing capabilities and skills. Measures from Simonin(1999) in conjunction with those of Kale et al.(2000) are used in this study.

#### ***3.2 Absorptive Capacity and Knowledge Acquisition***

Investment in internal R&D is required for the firm to interpret external knowledge because the interpretation needs to have a substantial research capability to understand and evaluate the information. Internal R&D investment is decisive to the firm's capability to appraise the potential R&D spillovers by firms that are pioneering in the new technology(Cohen and Levinthal 1990; Rosenberg 1990).

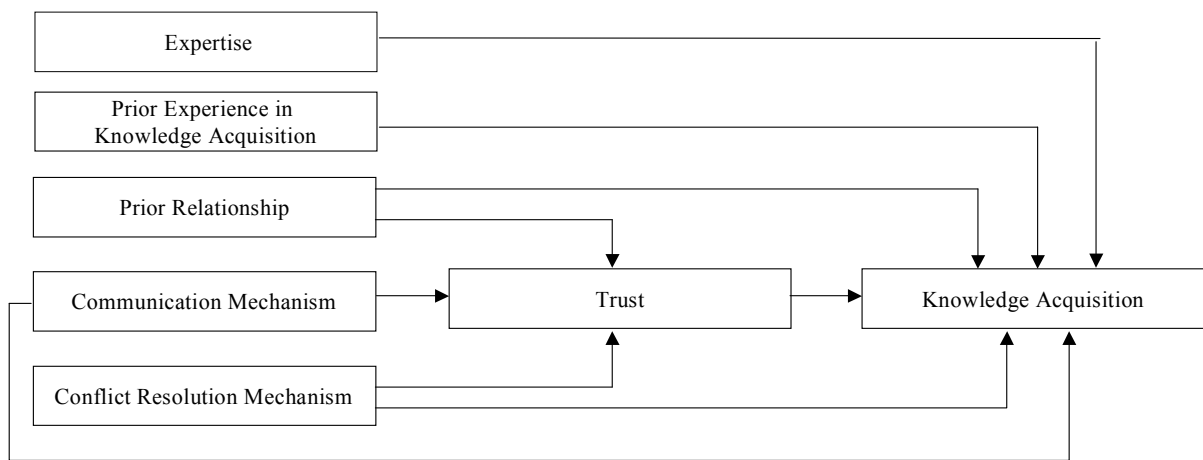


Figure 1 . Research Model

However, R&D spending is not the only measure of prior knowledge. Nicholl-Nixon(1993) extends the boundary of absorptive capacity to prior experience and communication mechanism. Likewise, Lane and Lubatkin(1998) address that absorptive capacity measures such as common knowledge base have more explanatory power than what R&D expenditure has, yet one cannot be confident that whether each variable affects interorganizational learning as a firm-level variable or as a dyad-level one from the results of their research. Since ERP is a management approach as well as technology, "common knowledge base," or "prior knowledge" in recipient's side, is likely to be the more appropriate measure than "R&D intensity" as a measure of prior knowledge.

***Hypothesis 1*** *Prior expertise on the knowledge affects the degree of knowledge acquisition positively.*

While past experiences at acquiring knowledge are essential to manage subsequent knowledge acquisition practices, both practitioners and researchers have ignored the role of experience in alliance and other collaboration practices(Lei and Slocum 1992; Powell et al. 1996). Pisano(1988) asserts that companies accustomed to get technology from outside will accumulate operating experience and get appropriate knowhow to deal with practices. In other words, through knowledge acquisition experience, companies can get rid of unnecessary tasks and obstacles and consequently facilitate knowledge absorption. Furthermore, Leonard-Barton(1995) indicates when a firm successful in doing one type of knowledge acquisition fails in doing another, it does not have skill to manage transfer. In addition, Singh and Zollo(1998) criticize that previous studies dismiss the characteristics of the acquisition experiences.

***Hypothesis 2*** *Prior experience of knowledge acquisition affects the degree of knowledge acquisition positively.*



Since it takes time for people to learn each others distinct ways of communication, working with a specific partner simplifies the problems associated with developing the relationship and managing it. As the partners work with each other for years, they establish effective ways of communication, dealing with problems and balancing the demands of each other's internal reporting requirements(Johanson and Mattson 1987; Doz 1988).

As cooperation between partners continues over the year, cultural distances tend to decrease(Meschi 1997), solidarity established(Inkpen and Beamish 1997), and the partners become familiar with distinction and speciality of each other. Accordingly, a person could anticipate dissimilar ways to acquire information in comparison to the early stage of alliance(Simonin 1998, 604).

Frequent ties build a strong social connection between firms, and the connection helps technology and information exchange(Kale et al. 2000, 225). Moreover, two organizations could establish a specific process for managing their interface so that the firms could easily manage subsequent alliances(Cyert and March 1958; Nelson and Winter 1982).

***Hypothesis 3            The prior relationship with the specific knowledge provider affects the degree of knowledge acquisition positively.***

According to the prior literature, transferring technology depends on the use of mechanisms that promote communication between organizations. People who are obliged to manage the knowledge acquisition can spot and solve technical and administrative problems that may interfere technology transfer through formal and informal mechanisms. Formal mechanisms are identifying epoch-making activities through regular meetings and reports to review performance and progress, the exchange of staff to help technology transfer and training, and allotting duty to specific people to supervise the ongoing management of the alliance. While on the other, informal mechanisms are sharing information with partners through informal dialogues and holding meetings when it is necessary. These mechanisms allow the people at the interface of the two alliance organizations to deal with both the routine and non-routine problems that appear as the relationship grows.

***Hypothesis 4            The frequency with which interorganizational communication mechanism used to manage relationships with knowledge provider affects the degree of knowledge acquisition positively.***

The conflict management process promotes the learning process. Learning from the alliance partner strongly depend on how close the interaction between the partners is, and which personnel has close and direct contact with each other. Two-way communication and joint problem solving are main points of integrative conflict management, and these points accompany close interaction between alliance partners. Accordingly the interaction makes it easy to learn or exchange critical information or know-how each other. Moreover, integrative conflict management creates procedural justice between partners, and it facilitates easier transfer of knowledge and ideas between them(Kim and Maubrgne 1997).

***Hypothesis 5            The frequency with which interorganizational mechanism for conflict resolution used to manage relationships with knowledge provider affects the degree of knowledge acquisition positively.***

### ***3.3 Absorptive Capacity and Trust***

Trust is an output variable as well as an input variable. It enhances learning through diminishing the possibility of behaving opportunistically (Sako 1991; Gulati 1995a; Lee and Kim 1999) and, at the same time, trust is the results of long-term relationships, intermittent contacts, interrelatedness, information sharing, social interaction ties, and shared vision, and conflict management (Sako 1991; Parkhe 1993; Tsai and Ghoshal 1998). Some of these determinants, such as long-term relationships, intermittent contacts, social interaction ties, and conflict management, are related to absorptive capacity.

With respect to the transaction cost approach, the length of the relationship shapes a safeguard against opportunism that influences the relation-specific abilities of partners (Perrow 1992; Nicholl-Nixon 1993; Gulati 1995a; Dyer 1997; Dyer and Singh 1998). In addition, in the research on interorganizational competitive advantage, transaction volumes as well as the length of the safeguard is reported to influence the ability to generate rents through relation-specific assets (Perrow 1992; Dyer 1996; Dyer and Singh 1998). Thus, the degree of trust in knowledge provider is likely to increase when the duration of the relationship with the provider is longer and frequency of the relationship is higher.

***Hypothesis 6            The prior relationship with the specific knowledge provider affects the degree of trust in the knowledge provider positively.***

The concept of Cohen and Levinthal (1990) is especially helpful to consider how partners may methodically participate in learning each other even though Cohen and Levinthal (1990) mainly focus on the absolute absorptive capacity of individual firms. It is accompanied with implementing a perception of interorganizational processes that makes firms cooperate systematically to identify critical information and then transfer it across the alliance interface.

***Hypothesis 7            The frequency with which Interorganizational communication mechanism used to manage relationships with knowledge provider affects the degree of trust in the knowledge provider positively.***

It is possible that there is a conflict between alliance partners, but the important thing here is how they manage the conflict (Borys and Jemison 1989). Conflict management is accompanied with joint management of conflict that causes a communication- and contact-intensive process of conflict management. Since the communication aspect was dealt with above in Hypothesis 7, the researcher focused on the contact-intensive process of conflict management regarding to Hypothesis 8. Explicit and implicit mechanisms of conflict management and engagement in joint problem solving were included in the analysis.

***Hypothesis 8            The frequency with which interorganizational mechanism for conflict resolution used to manage relationships with knowledge provider affects the degree of trust in the knowledge provider positively.***

### 3.4 Trust and Knowledge Acquisition

The high level of trust influences and enhances learning (Dodgson 1993, 83) through decreasing possibility of opportunistic behaviors (Sako 1991; Gulati 1995b; Lee and Kim 1999). A firm can learn from partners more easily when there is the high level of openness or transparency between them. The main obstruction to transparency is the mutual suspicion of opportunistic behavior between partners (Hamel 1991; Doz and Hamel 1998), and the suspicion causes them to be less favorable to exchange technology and information. Extant research proposes that the mutual trust between partners lessens the suspicion of such opportunistic behavior, and allows them to have high levels of transparency (Zand 1972).

**Hypothesis 9**      *The degree of trust in the knowledge provider affects the degree of knowledge acquisition positively.*

Table 1. Measures of Independent Variables

Variable	Constructional Definition	Operational Definition	Item	References
Expertise	Prior knowledge of the firm with respect to the knowledge acquired	Proportion of ERP experts to number of employees	1	Nicholls-Nixon(1993) Mowery et al.(1996) Tsoukas(1996) Lane and Lubatkin(1998) Simonin(1999)
Prior Knowledge Acquisition Experience	Cumulative total of knowledge acquisition across the firm's boundary	Number of ISP projects + Number of BPR projects + Number of other knowledge acquisition projects	1	Nicholls-Nixon(1993) Powell et al.(1996) Singh and Zollo(1998) Gulati(1999) Simonin(1999)
Prior Relationship	Length and frequency of formal relationships with the knowledge provider	Length of formal relationship with the consulting firm x Cumulative total of projects done with the consulting firm	1	Cyert and March(1963) Nelson and Winter(1982) Nicholls-Nixon(1993) Parkhe(1993) Gulati(1995; 1999)
Communication Mechanism	Implementation of various methods for facilitating communication between firms	Degree of using formal/informal methods for communication in the project	5	Nicholls-Nixon(1993) Dyer and Singh(1997) Lee and Kim(1999)
Conflict Resolution Mechanism	Implementation of various methods for managing conflict between firms	Degree of using formal/informal methods for managing conflict Degree of the joint problem solving	3	Kale et al.(2000) Anand and Khanna(2000)

Table 2. Measures of Dependent Variables

Variable	Constructional Definition	Operational Definition	Item	References
Knowledge Acquisition	A state of getting knowledge which the firm would like to have from the project	Degree to get new and important knowwhat, knowhow, knowwhere, and knowwhen	4	Szulanski(1996) Lane and Lubatkin(1998) Simonin(1999) Kale et al.(2000)
Trust	A state of mind that the other will behave or respond in a predictable and mutually acceptable manner	Expectation that the consulting firm 1) adheres to agreement. 2) keeps implicit promises 3) performs its roles competently 4) makes efforts to achieve performance beyond the coverage of agreements. 5) helps the firm in exceptional situations	5	Zucker(1986) Gambetter(1988) Sako(1991) Parkhe(1993) Mohr and Spekman(1994) Dyer(1996), Lewicki and Bunker(1996) Kale et al.(2000)

Measures of variables were defined and operationalized in Table 1 and Table 2.

#### 4. Research Design and Analysis

##### 4.1 Research Setting - Korean ERP Market

With this research we establishes a thesis about the relations between the absorptive capacity of an enterprise and its knowledge acquisition result. Therefore, we have to form a research environment that minimizes the effect of knowledge, the quality of the knowledge provider, and other variables that influence the knowledge acquisition results of the enterprise. For these reasons, this research introduces the ERP system that relatively standardizes knowledge and the quality of the knowledge provider as the research setting.

Korean firms that adopt ERP in 1999, grew 48% more than the year before due to prosperity in the domestic information technology market and also recorded 90 billion won sales amount(Management and Computers 2000). In the year 1999, the manufacturing industry had 76.9%, trade industry had 7.6%, and service industry had 5% of the ERP. We can see that manufacturing industry has the biggest part. As the importance of ERP grew, the small-to-medium-sized enterprises have been imported increasingly extending the basis of the market. On the other hand, from 1999, for three years, the construction started in the areas of extended ERP such as SCM and CRM based on their experience of ERP construction. ERP vendors are relating ERP and e-commerce so that they can make a new methodology and use it.

When a specific firm introduces the ERP package, it is usually accompanied by a consulting section of the vendor or professional consulting firm. The expenses for consulting occupies a

suitable part of the ERP adoption expenses, and the result of consulting is an important factor that has a lot of influence upon the introduction of ERP. Nevertheless, because of the ineffective communication between the staff of the firm and consultants(Kim, Chung, and Lee 1999), consulting sometimes becomes an obstacle rather than a useful tool to adopt ERP packages. For that reason, in this research we are empirically trying to examine how the absolute absorptive capacity of the firm that has introduced ERP package and the relative absorptive capacity between the firms and the ERP consulting part affect a knowledge acquisition result.

#### ***4.2 Data Collection Method - Survey Methodology***

To insure the quality of survey research, three key elements must be managed(Fowler 1993). First, the researcher must choose an research design that is appropriate for the research interest. The time dimension and degree of problem sophistication are good examples of factors considered. Second, sampling method must be defined clearly. The researcher has to define the target population and sample size in proper way before collecting data. Third, data analysis method, such as testing nonresponse bias, judging reliability and validity of instruments, and testing model and hypotheses, should be considered. Research questions of this study can be better answered by the survey research methodology because ERP practices happen in the business sector currently and hypotheses of the study are about why and how effective knowledge acquisition happens. The questionnaire design and procedures referred to the Tailored(or Total) Design Method(TDM) approach(Dillman 2000). This study accepted the general recommendations of TDM, and complemented them to be suitable for collecting data through e-mail and fax.

#### ***4.3 Sample and Data Collection***

The survey questionnaire was sent to target population of 158 companies by e-mail, fax, or mail. A week after sending the questionnaire, a follow-up call was made to check difficulties in answering and requested the prompt response. After five months of period, 85 responses were received on 90 ERP projects. Among them, five responses were discarded to control the characteristics of the companies and two were excluded due to incomplete data. 82 usable questionnaires were used for the analysis representing a response rate of about 54%.

The possibility of non-response bias was checked by comparing the characteristics of the 82 respondents to those of the original population with regard to two features: sales volume( $t = -0.803$ ,  $p < 0.423$ ) and number of employees( $t = -0.951$ ,  $p < 0.343$ ), and the result suggested that there are no significant differences between the respondent and the population.

#### ***4.4 Tests for Reliability and Validity***

Reliability and validity tests were conducted for each latent variable and construct. They display satisfactory level of reliability as indicated by Cronbach's alpha value ranging from 0.6913 to 0.9271.

Content validity of the instruments was established through the adoption of constructs that have already been used and validated by the pretest with seven experts of ERP. Both convergence and discriminability are required for testing construct validity. Factor analysis was used to test convergent validity. Items with item-to-total correlation score lower than 0.5 and with

communality score lower than 0.4, CM3 and CM5, were discarded. Since some items were correlated significantly, discriminant validity was investigated (Bagozzi and Phillips 1982). The results of chi-square difference tests shows that constructs are not correlated perfectly, and discriminant validity is achieved among all constructs.

#### ***4.5 Testing the Model and Hypotheses***

##### *4.5.1 Structured Equation Modeling (SEM)*

Path analysis was applied to test model and hypotheses. As a type of SEM, path analysis not only explains the determinants of dependent variables, but also analyzes relationships among variables. SEM have become highly attractive to the social science because the models provide a direct and statistically efficient method of managing numerous relationships at the same time, and comprehensive relationship management makes it possible to provide a transition from exploratory to confirmatory analysis (Hair et al. 1998).

There are several assumptions for structural equation modeling: 1) independent observations, 2) random sampling, 3) linearity of all relationships, and 4) normality of the data (Hair et al. 1998). To meet with the first assumption, only one questionnaire from a specific company was included in the analysis. Since questionnaires were sent to the whole population, this research did not use any sampling method. To complement this limitation, nonresponse bias was checked. In terms of the linearity, mean, standard deviation, kurtosis and skewness were measured on all items, and the results showed that all of them had moderate skewness and kurtosis. Finally, normality was examined by the Kolmogorov-Smirnov (K-S) test. Two items, COMM1 and CONF3, passed the test at the 0.05 level and other items passed it at the 0.01 level.

##### *4.5.2 Testing the Model and its Hypotheses*

After considering assumptions of structural equation model and the modeling strategy, the structural model for the proposed model were evaluated. Table 3 proposes fit measures for the research model.

The chi-square value of 3.376 with 2 degree of freedom is statistically nonsignificant at the 0.05 level and chi-square to degree of freedom ratio are indicative of an acceptable fit between the model and sample data (Carmines and McIver 1989). Although one attempts to infer the validity of the hypothesis of no difference between model and data, one should remember the power of the chi-square is controlled namely by the size of the sample. Therefore, instead of depending on chi-square value only, several fit measures must be considered simultaneously.

Causal effects between independent variables and dependent variable are illustrated in the Figure 2. Except two paths between the prior relationship and knowledge acquisition and the prior relationship and trust, the paths are significant at the 0.1, 0.05, and 0.01 level. In addition, since the effects of prior relationship, communication mechanism, and conflict resolution mechanism on knowledge acquisition were divided into direct and indirect effects. Hence, the researcher calculated these two effects of three paths, and the results are presented in Table 4 and Table 5.

Table 3. Fit Measures

Fit Measure		Research Model	Recommended Level
Chi-square(CMIN)		3.376	-
Df		2	-
CMIN/DF		1.688	> 2~5
P value		0.185	> 0.05
Absolute Fit Measure	NCP	1.376	minimum value
	ECVI	0.856	minimum value
	RMSEA	0.092	< 0.1
Incremental Fit Measure	NFI	0.984	> 0.9
	TLI	0.898	> 0.9
	RFI	0.782	maximum value
Parsimonious Fit Measure	PNFI	0.070	maximum value
	AIC	69.376	close to 0
SMC(KACQ)		0.659	-

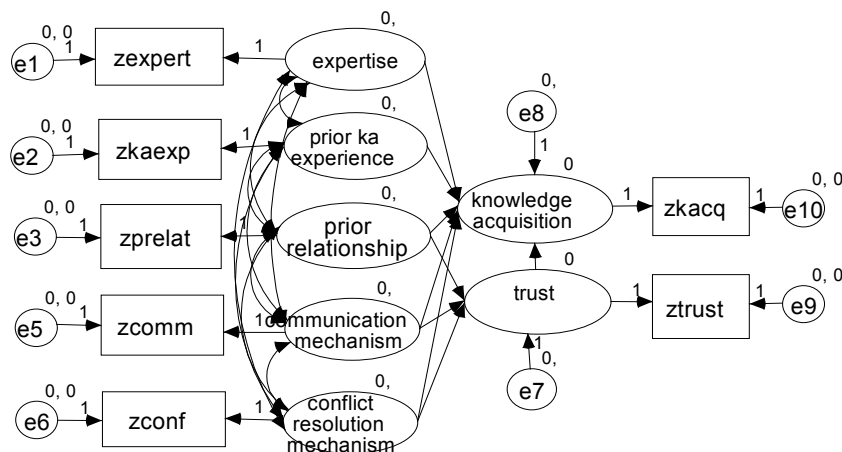


Figure 2 . Structural Equation Model for the Research

## 5. Conclusion

### 5.1 Summary of the Results

With respect to the relationships between absorptive capacity and knowledge acquisition, prior expertise(0.133,  $p < 0.1$ ), prior experiences(0.351,  $p < 0.01$ ), communication mechanism(0.207,  $p < 0.05$ ) and conflict resolution mechanism(0.248,  $p < 0.01$ ) were presented to affect knowledge acquisition affirmatively. The result is in line with previous studies on prior knowledge bases(Dyer and Singh 1997; Lane and Lubatkin 1998), previous knowledge acquisition experiences (Pisano 1988; Lei and Slocum 1992), and facilitating mechanisms between organizations(Borys and Jemison 1989; Nicholl-Nixon 1993; Kim and Maubrgne 1997).

Table 4. Results of the Hypotheses Testing

Causal Path	Standard Coefficient	P-value
Knowledge Acquisition ← Expertise	0.133	0.089*
Knowledge Acquisition ← Prior knowledge acquisition Experience	0.351	0.000***
Knowledge Acquisition ← Prior Relationship	0.072	0.300
Knowledge Acquisition ← Communication Method	0.207	0.015**
Knowledge Acquisition ← Conflict Resolution Method	0.248	0.005***
Trust ← Prior Relationship	0.119	0.233
Trust ← Communication Mechanism	0.236	0.047**
Trust ← Conflict Resolution Mechanism	0.339	0.005***
Knowledge Acquisition ← Trust	0.211	0.007***

\* p<0.1, \*\* p<0,05, \*\*\* p<0.01

Table 5. Direct and Indirect Effects

Causal Path	Effect	Standard Coefficient
Knowledge Acquisition ← Prior Relationship	Direct	0.072
	Indirect	0.025
	Total	0.097
Knowledge Acquisition ← Communication Mechanism	Direct	0.207
	Indirect	0.050
	Total	0.257
Knowledge Acquisition ← Conflict Resolution Mechanism	Direct	0.248
	Indirect	0.071
	Total	0.319

On the contrary, relationship between the prior relationship and knowledge acquisition were not found to be significant. The small number of sample firms lower than 100 is likely to make chi-square values underestimate the explanation power of the model.

In the relationship between absorptive capacity and trust, communication mechanism(0.236, p<0.05) and conflict resolution mechanism(0.339, p<0.01) are shown to have affirmative effect on trust. However, the prior relationship did not impact on trust. It is likely to be the possible explanation that the short history of Korean ERP consulting and consequently, lack of time to build long-term relationships that lead mutual trust. .

Trust was shown to affect knowledge acquisition positively(0.211, p<0.01) as Dodgson(1993) and Sako(1991) suggested. However, the low explanation power of the trust suggests that trust is not the only sufficient factor of the knowledge acquisition as Locke(1999) asserted.

## 5.2 Limitations



This study has several limitations. First of all, theoretically, as Mowery et al.(1996) proposed, capacity acquisition perspective itself has a limitation. In their research on strategic alliances, they found that after initial alliance, the capabilities of a firm became less convergent in succeeding alliances. In other words, the more a company gets to know knowledge of others, the more the knowledge of the firm is likely to be divergent "rather than acquiring them(knowledge) or developing them internally(Mowery et al. 1996, 78)."

Second, the problem of controlled variables can be indicated. This study chose the ERP project as the research setting to control the effects of knowledge itself and knowledge providers. Yet, quality gaps may exist among ERP packages and the capability of consulting firms. This paper did not assess the quality of EPR packages and consulting firms.

Third, in order to focus on the interorganizational practice, this research does not include internal factors such as the organizational structure, organizational culture, and intraorganizational communication. The more comprehensive model for absorptive capacity of the firm will need to consider such internal factors.

Finally, and with respect to the analysis, the number of respondents is small. Most studies on SEM suggest that 100 to 200 samples are recommended since the minimum level of the sample size for the maximum likelihood estimation procedure is 100 to 150, and the appropriate sample size for the chi-square analysis is 100 to 200(Arbuckle 1997, 555; Hair et al. 1998, 605).

### **5.3 Contributions**

The results of this study address several issues to practitioners and researchers. For practitioners, most of all, this paper proposes relevant variables for effective knowledge acquisition. Absorptive capacity explains 66% of knowledge acquisition, and includes prior expertise, prior experience in knowledge acquisition, communication mechanism, and conflict resolution mechanism. In addition, trust also affects interfirm knowledge transfer. Other than variables reported in previous studies such as prior relationship and number of ties, communication mechanism and conflict resolution mechanism are presented to have an effect on trust. That is to say, companies must invest in streamlining communication mechanism and conflict resolution mechanism and use them vigorously to sustain and enhance their competitive position in the environment of ongoing changes.

On the other hand this study has several implications for researchers. Firstly, a comprehensive framework of the relationship between absorptive capacity and knowledge acquisition is addressed. In the framework, absolute absorptive capacity such as prior expertise and prior experience, and relative absorptive capacity such as prior relationship with the specific knowledge provider are included. The third group of constructs, communication mechanism and conflict resolution mechanism is mixture of absolute and relative absorptive capacity. In addition, in order to distinguish the relative characteristics of absorptive capacity from its absolute nature, trust in knowledge provider is introduced.

Secondly, the role of trust in knowledge acquisition is indicated as a mediator. Trust mediates the relationships between two exogenous variables, communication mechanism and conflict resolution mechanism, and knowledge acquisition. In addition, trust itself has a significant effect on knowledge acquisition. Studies on trust are in its initial step, and this paper may contribute to reveal the characteristics of trust.

Finally, this study has some implications for IS implementation research tradition. This paper does not cover generic issues on IS implementation reported by Zmud and Cox(1979) and

Ginzberg(1981). Instead, since ERP package is adopted in the perspective of the organization as a whole, other factors related to the package implementation have to be considered such as: 1) time and costs of customization, 2) vender capability, 3) quality of the package(Gross and Ginzberg 1984, 211-226) and 4) recipient organization of the package(Lucas et al. 1988). This study tries to control other factors and assesses the capacity of the recipient organization.

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