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IOS 활용의 관계적 관점 분석

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Relationship Perspective Analysis for IOS Usage

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■ Abstract ■

In this paper, we drew upon IMP group's Interaction model to investigate the contributing impact of Inter-organizational system (IOS) on performance through enhancing inter-organizational relationship. While most extant literature studied the contribution of IOS from transaction efficiency perspective, the relational aspect of IOS contribution on the supply chain was addressed only by a few researches. As such, we intended to fill this gap of the IOS research stream. The conceptual model was developed, with reference to process theory, to analyze how the relational perspective could be applicable to IOS impact on performance. With the 129 sample data collected at the firm level, structural equation model using the LISREL was employed to validate the proposed research model. The empirical results supported the hypotheses such as the extent of IOS usage positively influences the interaction between the firms, which thereby enhances the extent of inter-firm partnership and performance. The results help better understanding the strategic use of IOS from relationship perspective.

Keywords : Inter-Organizational System(IOS), Interaction Model, Inter-firm Partnership, Performance

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1. Introduction

Recently, the spread of commercial Internet accelerated individual firm's value chain to get connected as a network. Internet facilitates firms to look beyond their own boundaries and to consider the overall efficiency of supply chain. Firms are outsourcing more of their business processes, e.g. production of components, to members of supply chain (Baiman [3]). In this respect, inter-organizational relationship is gaining momentum for the sake of enhanced corporate competitiveness.

The inter-organizational system (IOS), traditionally termed as EDI, has been used to support more efficient inter-firm transactions and information sharing (Banerjee and Golhar [5]). The necessity of information sharing on the supply chain has been addressed to reduce the bullwhip effect, and as a basis of more advanced supply chain collaboration strategies such as Quick Response, CRP (Continuous Replenishment Planning), CPFR (Collaborative Planning, Forecasting, and Replenishment), and VMI (Vendor Managed Inventory) (Mukhopadhyay et al. [27], Shah et al. [31]).

The extant literatures on IOS research are manifold (Chatterjee and Ravichandran [10]). The one stream of research is on the investigation of factors driving IOS adoption. Various constructs on environmental factors, the extent of prior engagement, uncertainties are explored to understand the IOS adoption behavior (e.g. Romano et al. [29]). The other focus of the IOS research is on the effectiveness of the IOS with respect to efficiency and firm performance. The gains obtained from IOS implementation could be assessed in terms of efficiency of the transaction and non-transactional aspect such as inter-firm collaboration.

Despite affluent body of literatures on exploring IOS adoption factors (e.g. Lee and Lim [21], Ibrahim and Ribbers [17]) and investigating the economic efficiency gains from the IOS usage, the literature focusing on the IOS impact on inter-firm relationship is rather limited. Recently, Subramani [32] theorized the suppliers benefit from IT use in supply chain relationship. He organized the pattern of IT appropriations as exploitation and explorations, and introduced the relationship specific assets of business process and domain-knowledge as the direct impact of the Inter-organizational IT usage. The importance of Inter-organization relationship (IOR) on firm performance has been traditionally discussed (e.g. Dyer and Singh [11]).

As such, this paper addresses this research gap of how the IOS could influences the non-transactional inter-organizational relationship. Indeed, we intended to theorize the distinguished benefits of IOS usage accountable for the gains resulting from partnership enhancement.

2. Theoretical Development

2.1 IOS and Interaction Process

Inter-organization system is defined as "resultant shared information system that cross organizational boundaries and benefit all participants" (Barret and Konsynski [4]). The difference between intra-organizational and inter-organizational IT systems corresponds well with the dichotomy between hierarchies and markets (Gebauer and Buxman [12]). IOS is also defined as "sharing information system across the boun-

dary of the firms constituting business network" (Cash and Konsynski [9]). IOS has integrated characteristics of technology and organization in the sense of merging computer and communications, and electronic linkages of organizations (Shah et al. [31]).

The critical question on leveraging IT usage for IOR to obtain firm level strategic leverage was addresses by Bensau and Venkatraman [6]. Based on the information processing model of the firm which contends that organization can be conceptualized as information processing system, they suggested the "fit" between the information processing needs and information processing capability. The importance of information partnership of sharing data through IOS to gain competitive advantage without owing it was addressed by Konsynski and McFarlen [19]. IOS also reduces uncertainty through a faster delivery of information with accuracy than conventional ways of communication between businesses, getting the benefit of mediation in transactions and less cost for communication between firms (Boyson et al., 2003). IOS enables to streamline the interaction process, such as buyer's procurement and supplier's order fulfillment process, and enables more information integration which supports better decision making through sharing common database, forecasting accuracy.

IMP (International Marketing and Purchasing Group) developed interaction model to analyze the relational exchange behavior between suppliers and buyers (Hakansson [14]). The model adopted inter-organizational theory, and institutional economic theory, and was developed from the case studies conducted over 300 industrial firms in Europe. Their study suggested significant relational view paradigm shift compared to prevailed transaction oriented exchange focus. The focus of the IMP model is on the factors which lead to close relationship between buyer and seller. They identified four elements which are exchanged by buyer and seller : a product or service, money, information, and sociality.

On the base of IMP group's interaction model, Kalafatis [18] provided extended framework of causal relationship of social exchange, information exchange, and product importance as the antecedents to affect inter-firm co-operation and adaptation. Interaction could enhance the firm's processes of satisfying customer requirements through adapting other firm's practice. Inter-firm's collaboration will lead to inter-firm partnership and these two could be treated as the identical concept.

The terms from the literature having similar meaning with interaction process variables are as follows : communication, information sharing, participation, cooperation, knowledge sharing, joint action, participation and conflict (Anderson and Narus [1], Morgan and Hunt [26], Mohr and Spekman [25], Kalafatis [18]). Among them, we extracted two variables of information exchange and social exchange reflecting the interaction process affected by the IOS usage.

Information exchange can be necessarily facilitated with the information systems usage. As the volume of data communicated via information system is increasing, the information exchange level between the firms will be increasing. Also, as the breadth of information systems includes more business functions, the interaction process in the sense of information sharing will increase. Thomas and Trevino [34] emphasized the roles of inter-organizational

communication to develop successful partnership between the firms. Social exchange could also be enhanced as the IOS usage level increases. Bensaou and Venkatraman [6] also theorized that IOS enhances information processing capability of the firm to effectively cope with the uncertainty. As such, the first set of hypotheses is derived for the causal relationship between the IOS usage and interaction process.

H1-1 : The level of IOS usage positively influences the level of information exchange.

H1-2 : The level of IOS usage positively influences the level of social exchange

2.2 Interaction Process and Partnership Quality

One of the fundamental research streams for industrial partnership is based on relational marketing theory which illustrates diverse relational characteristics such as communication and shared value, their impact on trust and commitment, and resulting outcome behaviors. (Morgan and Hunt [26], Ross et al. [30]). The partnership quality has been referred as diverse terms such as relationship closeness, relationship quality, relationship strength (e.g, Bove and Johnson [7]), and so forth. Variables employed to measure the level of partnership quality in the literature are as follows; trust, dependence, commitment and coordination (Mohr and Spekmam [25]), trust, business understanding, benefit and risk share, conflict, commitment, communication, cooperation, satisfaction (Lee and Kim [20]).

From the perspective of inter-firm partnership, Mohr and Speckman [25] synthesized three factors associated with the success of partnership. The three key antecedents affecting the partnership success are attributes of partnership, communication behavior, and conflict resolution techniques. Bove and Johnson [7] summarized the prior literature and proposed two key attributes of partnership quality, i.e., trust, and commitment.

Trust can be defined as a firm's belief that another company will perform actions that result in positive outcomes for the firm and not engage in unexpected behaviors with negative outcomes (Anderson and Narus [1]). Commitment is defined as an exchange partner's belief that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it. To sum up, we hypothesize these as follows.

Trust and commitment encourages collaborative activities between partners since they could reduce tension to initiate collaborative efforts, thereby lowering transaction cost and enhancing corporate ability to cope with a complex environment (Anderson and Narus [1]). Commitment is mediator that is affected by any other relational characteristics including trust. That is an implicit or explicit pledge of relational partners and implies the adoption of a long-term orientation toward the relationship, a willingness to make short-term sacrifices to realize long-term benefits from the relationship (Morgan and Hunt [26]). The commitment, that is the highest level of partnership, is based on an assumption that the relationship is stable and will last long enough for the partner to realize the long-term benefits. This study adopts trust and commitment as the core attributes of the part-

nership quality.

Interaction between the supplier and seller is the open communication process to enable personal intimacy and trust. Information sharing refers to the extent to which critical, often proprietary information is communicated to one's partner (Mohr and Speckman [25]). By sharing more information and being knowledgeable about each other's business, partners are able to act more productively to maintain the relationship over time. Thus, the information exchange can be an important predictor of the partnership quality. Social exchange enhances formal as well as informal communication and participation. Collaborative participation between partners plays a significant role in enhancing the sustainability of their relationship over time (Henderson [15]).

H2-1 : The level information exchange positively influences the level of trust.

H2-2 : The level of social exchange positively influences the level of trust.

H2-3 : The level of information exchange positively influences the level of commitment.

H2-4 : The level of social exchange positively influences the level of commitment.

2.3 Partnership Quality and Performance

Mohr and Spekman [25] identified antecedents of firm performance from relational perspective as trust, commitment, coordination, and participation. The uncertainty reduction and minimizing mutual conflict caused by uncertainty will contribute to the firm performance. Trust will enable cooperative behavior, and improves problem solving capability of the firm (Morgan and Hunt [26]). Anderson and Narus [1] also showed that commitment between the firms improves customer service capability, and mutual benefit. There are many other literatures investigating the partnership effect to firm performance by reducing operational cost, switching cost, transaction cost (Redondo et al. [28]).

On the other hand, the fundamental benefit from IOS has been attributed mainly to transaction efficiency. Electronic transactions between the parties enables data visibility on the supply chain, and that effect firm's inventory cost, accuracy of forecasting, and operational efficiency (Iacovou and Benbasat [16]). The greater the impact of IT on individual business processes and inter-process linkages, the greater the contribution of IT to firm performance (Tallon et al. [33]). Melvill et al. [24] indicated that IT and complementary resources of the focal firm improve the performance of business processes, which ultimately affect organizational performance (Brynjolfsson and Hitt [8]). By aggregating the above discussions, the following hypotheses are proposed.

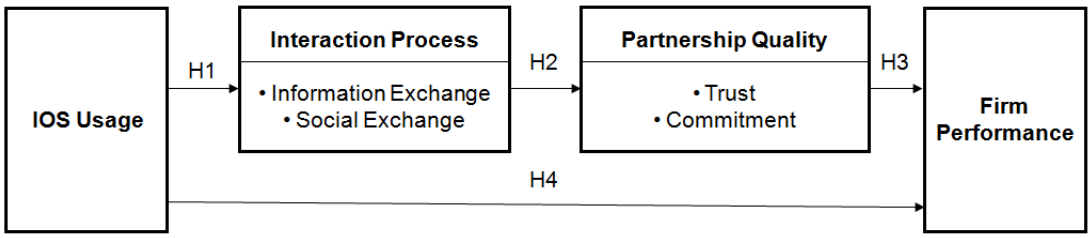
H3-1 : The level of trust positively influences the level of firm performance.

H3-2 : The level of commitment positively influences the level of firm performance.

H4 : The level of IOS usage positively influences the level of firm performance.

2.4 Research Model

As illustrated in <Figure 1>, our research model was developed to depict the successive



〈Figure 1〉 Research Model

causal relationships between the IOS usage, interaction process, partnership, and performance. The model was constructed with reference to process theory which implies a set of causations consisting of sequential, necessary conditions (Markus and Robey [22]). The process model focuses on a sequence of events in order to explain how and why particular outcomes are reached. The process model does not conceive of outcomes as dependent variables. Instead, outcomes are the final result of preceding events. Thus, the process theory ensures that this set of outcomes do not always occur unless the specified set of events in a causation chain is fulfilled. Therefore, the process theory is useful in precisely recognizing and accepting the complexity of the causal relationship.

In <Figure 1>, the hypothesis 1 consists of two distinctive hypotheses of H1-1 and H1-2, each addresses the causal relations between the IOS usage and information exchange and social exchange respectively. That is, the first necessary condition of affecting interaction processes is hypothesized as IOS usage. Secondly, the two independent variables of information exchange and social exchange are hypothesized to affect the partnership quality which consists of two operationalized variables of trust and commitment. The four hypotheses of H2-1, H2-2, H2-3, and H-4 are elaborated for each of the four causal relationships represented as H2 group of hypotheses. Subsequently, two variables operationalizing the partnership quality are related with firm performance, which are treated as hypotheses of H3-1 and H3-2 respectively. Finally, the direct impact of IOS usage on firm performance is treated as H-4.

3. Research Methodology

3.1 Samples and Data Collection

The survey study was conducted with the small and medium sized supplier firms in Korea. We first selected 235 small and medium sized firms that implemented IOS at least six months before. The company list was identified from Korea National Computing Agency's list of IOS implementation firms partially funded from the Korean government's SME informatization program. To get the maximal collection of the questionnaires with reliable quality, we used both methods of telephone calling, web-survey, and mailing. Among them, we collected 145 questionnaires. Next, total 129 questionnaires were used in this research, after excluding 16 questionnaires which contained extreme quotients data and uncompleted items. The demography

of the 129 samples is presented in <Table 1>.

Following the sample, manufacturing companies take up larger share than service firms, with 762.1% in the manufacturing business. In addition, most of the companies are SMEs, showing that 56.6% of the respondents have less than 0.5 million dollar in revenues and 57.4% employ less than 30 workers. The participants in the SCM are divided into two groups.

〈Table 1〉 Sample Profile(N = 129)

Response Classification		Frequency	Percentage (%)
Total		129	100.0
Industry	Manufacturing	93	72.1
	Service/Others	36	27.9
Sales (USD)	Below 5 Million	73	56.6
	Over 5 Million	56	43.4
Employees	Over 30	55	42.6
	Below 30	74	57.4

3.2 Measures and Instrument Validity

This study adopted items that had already been used and validated by other researchers. They were drawn from the review of extensive literatures on the existing IOS studies, relationship marketing, and IOR. Each of the multi items was measured using a seven-point Likert scale with items ranging from “strongly disagree” to “strongly agree.” The initial version of the questionnaire was pre-tested by faculty members, managers in the firms implementing IOS. Each item was reviewed to improve content and construct validity.

Variable of the IOS usage are extracted from the literatures on EDI usage. Massetti and Zmud [23] defined four facets of EDI usages : volume, diversity, breadth, and depth. We used them as the operational measures of the IOS usage variable.

The interaction process variables were developed by revising the instrument proposed by Kalafatis [18]. The measures of the partnership quality variables were based on the commitment-trust theory (Morgan and Hunt [26]) and the relationship theory (Mohr and Spekman [25]). Finally, firm performance was measured in terms of supply chain performance (Iacovou and Benbasat [16]). The measures included 22 items for 6 constructs.

In order to analyze the data collected from the survey, we adopted a two-stage analysis for structural equation modeling in which the measurement model was first estimated. Subsequently, a process much like factor analysis was used, with the measurement model fixed in the second stage when the structural model was estimated (Anderson and Gerbing [2]). Confirmatory factor analysis was first conducted on each construct independently to validate the scale, since each variable was measured by multi-item constructs. Second, an overall confirmatory factor analysis was conducted on all items. To validate the measurement model, three types of validity were assessed : content validity, convergent validity, and discriminant validity of the instrument.

The reliability was then estimated by examining composite reliability. The value of composite reliability ranged from 0.79 to 0.95, as shown in <Table 2>, which is higher than a commonly used threshold for acceptable reliability of 0.7. Content validity was established by ensuring consistency between measurement items and the extant literature. This was done by interviewing the faculties and practitioners and during the pi-

lot-testing of the instrument.

We assessed convergent validity by examining composite reliability and average variance extracted (AVE). AVE for our measures ranged from 0.56 to 0.87, while the threshold for acceptable convergent validity is 0.5 (Hair et al. [13]). For discriminant validity, it was assessed by looking at the square root of the average variance extracted. The square root of the average variance extracted for each construct was greater than the correlations between all other constructs, as described in <Table 3>. In <Table 3>, the numbers on the diagonal are the square root of the average variance extracted.

4. Analysis Results

The statistical test results indicated that overall fitness of the other model was guaranteed with the chi-square result was significant χ^2 = 105.13, d.f = 81, normed χ^2 = 1.298. And, the values of GFI, AGFI, and CFI were 0.90, 0.85, and 0.98 respectively. As illustrated in <Table 4>, the overall model fit measures indicated that this model is acceptable.

The hypotheses were tested by calculating the significance of the path coefficients (t-value). Significance levels of $p < 0.01$ ($t > 2.576$), $p < 0.05$ ($t > 1.96$), $p < 0.10$ ($t > 1.645$) criteria

〈Table 2〉 Reliability and Validity

Measure	Items		Estimate (t-value)	Composite Reliability	AVE
	Initial	Final			
IOS Usage	4	3	1.83(14,07), 1.78(14.07), 1,75(13.7)	0.95	0.87
Information Exchange	3	2	0.91(13.15), 0.9(11.71)	0.79	0.65
Social Exchange	3	2	0.7(8.85), 0.88(11.95)	0.82	0.70
Trust	4	3	1.02(13.06), 1.03(13.23), 1.11(13.91)	0.93	0.81
Commitment	3	2	0.84(10.47), 0.93(11.55)	0.86	0.75
Firm Performance	5	3	0.67(9.3), 0.8(11.39), 0.57(7.41)	0.79	0.56

〈Table 3〉 Correlations between the Variables

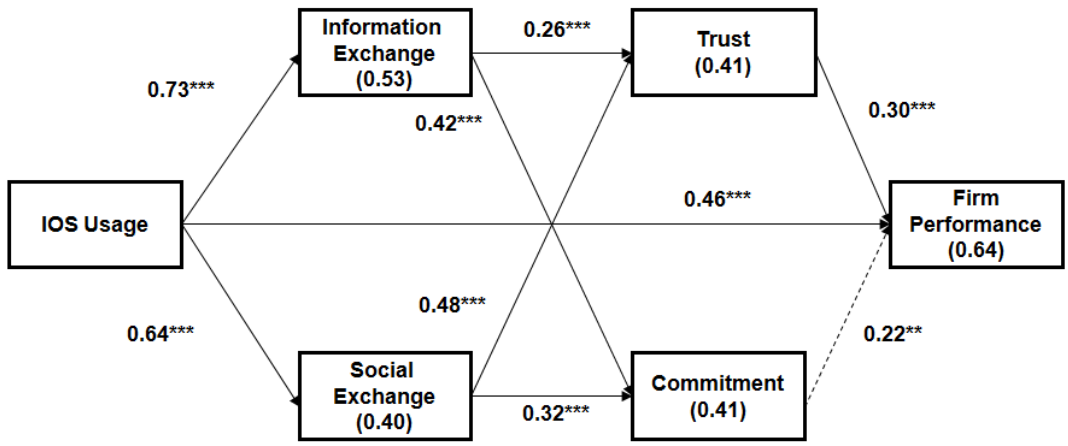
	1	2	3	4	5	6
1. IOS Usage	0.87					
2. Information Exchange	0.56	0.65				
3. Social Exchange	0.51	0.61	0.70			
4. Trust	0.57	0.51	0.57	0.81		
5. Commitment	0.72	0.62	0.44	0.54	0.75	
6. Performance	0.74	0.74	0.61	0.60	0.69	0.56

〈Table 4〉 Indices of Model Fit

Measures	Results	Recommended Model	Measures	Results	Recommended Level
χ^2	105.13	-	NFI	0.93	Above 0.9
p-value	0.037	Above 0.05	CFI	0.98	Above 0.9
Normed χ^2	1.298	Below 3	IFI	0.98	Above 0.9
GFI	0.90	Above 0.9	RFI	0.91	Above 0.9
AGFI	0.85	Above 0.8	Std. RMR	0.058	Below 0.10
RMSEA	0.048	90% C.I (0.013 : 0.073)	ECVI	1.43	90% C.I. (1.26 : 1.67)

were used respectively. Strong causal relationship with path coefficient of 0.73 and 0.64 were revealed of IOS usage on information exchange and social exchange (H1-1 and H1-2). The hypotheses on interaction process and partnership quality are shown to be statistically significant relationship. Also, information exchange and trust (H2-1), social exchange and trust (H2-2), information exchange and commitment (H2-3), and social exchange and commitment (H2-4), are accepted at $p < 0.01$. The statistical analysis result on partnership quality and firm performance shows positive impact. The hypothesis of positive influence between trust and performance (H3-1), between commitment and performance (H3-2) are accepted at $p < 0.01$ level. Also the impact of IOS usage and performance (H4) shows strong positive relationship at $p < 0.01$ with path coefficient of 0.46 (t-value : 4.45). Total 64% of performance variations were explained from IOS exploitation. In summary, the results of hypotheses testing are presented in <Figure 2> and <Table 5>.

Finally, the indirect effect of IOS usage on firm performance through enhancing interaction and partnership quality is illustrated in <Table



( ) : SMC value, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

〈Figure 2〉 Results of the Model Analysis using LISREL

〈Table 5〉 Results of Hypothesis Testing

Hypothesis	Path	Path Coefficients	t-value	Result
H1-1	IOS Usage → Information Exchange	0.73	8.76	Accept
H1-2	IOS Usage → Social Exchange	0.64	5.83	Accept
H2-1	Information Exchange → Trust	0.26	2.76	Accept
H2-2	Social Exchange → Trust	0.48	4.75	Accept
H2-3	Information Exchange → Commitment	0.42	4.15	Accept
H2-4	Social Exchange → Commitment	0.32	3.10	Accept
H3-1	Trust → Performance	0.30	3.35	Accept
H3-2	Commitment → Performance	0.22	2.37	Accept
H4	IOS → Performance	0.46	4.48	Accept

〈Table 6〉 Direct and Indirect effect

	IOS Usage		Information Exchange		Social Exchange	
	Total	Indirect	Total	Indirect	Total	Indirect
Trust	0.49(6.19)	0.49(6.19)	0.26(2.76)	-	0.48(4.75)	-
Commitment	0.51(5.96)	0.51(5.96)	0.42(4.15)	-	0.32(3.10)	-
Performance	0.72(6.81)	0.26(3.82)	0.17(3.03)	0.17(3.03)	0.21(3.45)	0.21(3.45)

5>. The path coefficient (t-value) indicating total effect of IOS usage on performance is 0.72 (6.81), and the indirect effect is revealed as 0.26 (3.82). It indicates that significant mediating effect incurs for IOS usage impact on firm performance through enhancing relational aspects of partnership quality, and it is affected by the interaction process definitely.

5. Conclusion

We studied the impact of IOS usages on the enhancement of the inter-firm relationship and performance in Korea. The IOS impact on performance improvement through enhancement of commitment and trust was hypothesized and empirically tested. The empirical testing results indicated that IOS usage is a critical antecedent to influence the interaction between the supplier and buyer. All associations between the variables of interaction process and partnership quality showed strong statistical significance. Finally, significant mediating effect is revealed from the indirect effect of IOS on performance via enhancing interaction process and partnership quality.

The contribution of this study is to theorize the relationship model that encompasses the effect of IOS usage on firm performance through interaction process of information exchange and social exchange. We believe that the model provides a better understanding on how the IOS could be utilized to enhance the performance. Practical contribution must be directed toward strategic utilization of IOS in the sense of enhancing interaction between the firms.

However, in generalizing the results, the following limitations are worth noted. The first limitation is the composition of the sample. The sample profile was more focused on manufacturing sector and the data was collected only from limited Korean companies. Secondly, this study was conducted as a snapshot research without considering the dynamic nature of partnership. On the base of this research, further research could be expandable in the fields of IOS and supply chain collaboration.

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