The Effects of Interorganizational Information Systems Infrastructure (IOSI) on Electronic Cooperation: An Investigation of the "Move to the Middle"

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Abstract

Information technology (IT) has increasingly been employed to perform interorganizational business activities. Internet, Electronic Data Exchange (EDI), and interorganizational information systems (IOS) have used for transacting products and services, exchanging information, and doing interactions among organizations.

The use of such information technologies contributes to build a tightly coupled relationship among organizations, which is called electronic cooperation. Based on the recognition of the importance of electronic cooperation, the present study examined the relationship between IT capabilities and electronic cooperation. The information technology examined was interorganizational information systems infrastructure (IOSI). Using an IT infrastructure framework, this study conceptualized IOSI as the shared IT resources among organizations and identified three IOSI dimensions based on its capabilities: technological, structural, and informational dimension. Using transaction costs theory and information-processing theory as theoretical foundations, the three IOSI dimensions were further divided into nine sub-dimensions and a theoretical model relating these IOSI sub-dimensions and electronic cooperation was developed.

The examination of the relationship between IOSI dimensions and electronic cooperation was conducted through structural equation modeling (SEM). A mailed-in survey with a self-administered questionnaire was conducted to collect data. The target population for data collection was IS managers in the manufacturing and retailing industries, since companies in these industries have used IOSI for the closer relationships with their partners.

The present study finds that IOSI capabilities determine the electronic cooperation between organizations. Especially structural and informational dimensions of IOSI are positively related with the joint decision-making and purchase/sales. However, the impact of technological dimension was found to be statistically insignificant. The findings of this study suggest that the two-step model will better explain the relationship between IOSI and electronic cooperation. In other words, instead of direct effects, the technological dimension will have indirect effects on electronic cooperation through influencing the structural and informational dimensions. In addition, there is a causal relationship between volumes and amount of sales and joint decision-making.

This study makes theoretical as well as empirical contributions to the literature. It addresses significant gaps in the literature and provides empirical evidence to support the solutions suggested in this study. Other contributions of the study are expected to provide guidelines for future research in both IS and supply chain management area, which examine the impacts of IT on interorganizational relationships.

1. Introduction

As information technology (IT) has made advances in its capabilities in information processing and networking, organizations have sought to utilize these capabilities for the creation and maintenance of interfirm relationships (Bakos, 1991; Cash and Konsynski, 1985; Venkatraman, 1991). Through client-sever computing, hub-and-spoke, and distributed computing environments, organizations have increasingly exchanged information and facilitated the flows of resources such as products, services, money, and equipment. Especially, organizations extend their utilization of IT capabilities for information exchange beyond their organizational boundaries. They use the IT capabilities in order to gather, exchange, and process information that is scattered among multiple information holders (Arrow, 1974). These technological forces enable organizations to create new forms of interorganizational relationships that were not possible in the past. They build virtually vertical integration with other firms without ownership and they increasingly outsource their important resources to the markets.

Well-cited examples of information technologies used for interfirm relationships include interorganizational information systems (IOSs) such as American Hospital Supply Corporation=s ASAP and American Airlines= reservation system SABRE, Internet, and Electronic data exchange (EDI). The use of Internet and EDI is now becoming an increasingly common way of doing business among organizations. Moreover, there are increasing numbers of studies that view these technologies as an IT infrastructure used across organizations (Broadbent, et al., 1999; Duncan, 1995; Keen, 1991; Weill, 1993). Since they are used across organizations, they are called as interorganizational information

systems infrastructure (IOSI) (Bensaou and Venkatraman, 1995). IOSI is a collection of information technology resources, which include communication networks, hardware, IT applications, standards for data transmission, and human IT skills and experiences.

IOSI helps organizations to establish and maintain interfirm relationships such as alliances, partnerships, and buyer-supplier relationships, to cope with the competitive business environment. Its role is to provide the IT foundation for interorganizational businesses and processes (Ross, 1997). It provides organizations shared IT services that enables them to exchange information necessary for building relationships with their partners (Broadbent, et al., 1999; Keen, 1991). Therefore, the basic question remains: how does IOSI influence the formation of interfirm relationships?
The current theme in the literature is a shift from the impact of IT within organization to a focus of IT impact on blurring organizational boundaries. This extension of IT study from organizational to interorganizational level is considered timely and important (Bensaou and Venkatraman, 1995). The interorganizational level of analysis has become attractive to organizational and IS scholars (Mohr and Nevin, 1990; Hart and Saunders, 1998). In addition, the management of interorganizational relationships is directly related to effective functioning of the organization. Building and nurturing cooperative relationships will be the yardstick that measures a firm=s effectiveness to survive in the networked world of business environment. In order to respond to the trend, this study examines the effects of IOSI on electronic cooperation.

2. Previous Important Literature

Traditionally, the studies with an economic perspective have examined IT impacts on interorganizational relationships based on efficiency considerations, i.e., hierarchical structures governed by vertical coordination, or market-based structures governed by pricing mechanisms. However, we are still far from a complete understanding of the interorganizational impact of IT from this dichotomous distinction (Bakos and Brynjolfsson, 1993). Some authors have developed that IT has engendered new forms of organizations (Johnston and Lawrence, 1988). The new interfirm relationship that lies between markets and hierarchies is described as cooperation (Clemons and Row, 1992; Clemons, et al., 1993).

The most widely accepted study about the impacts of IT on cooperative interorganizational relationships is the "move to the middle" hypothesis presented by Clemons, et al. (1993). According to them, IT does not simply influence the creation of markets or hierarchies in the interfirm relationships, rather it promotes the creation of interorganizational governance that lies in the "middle" between markets and hierarchies. Like other economic theorists, they explained the phenomena using the transaction costs theory. IT has dramatically reduced the unit cost of computing and communications and has increased economies of scales. IT enables organizations to increase information availability and processing capacity. With these capabilities, IT decouples an investment=s beneficial impact on coordination costs from its damaging impact on transaction risk. Thus, Clemons and Row (1992) suggest that although firms will increase market transactions, they will not rely solely on the use of transaction-oriented spot markets, but will move toward long-term, stable partnerships to increase resource utilization through greater cooperation. Firms now outsource their supplies of goods and services and establish vertical quasi-integration with their partnering firms (e.g., the high level of cooperation between Wal-Mart and Proctor & Gamble). IT=s ability to reduce the costs of cooperation without increasing transaction risk also makes it possible to create new interactions to exploit economies of scale (e.g., Rosenbluth=s Rosenbluth International Alliance, a cooperative organization offering integrated travel management services across the world) and scope (Merrill Lynch=s Cash Management Account, the combination of the function of a brokerage account with the functions of a bank demand deposit account).

Inspired by Clemons, et al.=s (1992; 1993) the "move to middle" hypothesis, studies have empirically examined the impacts of IT on interfirm cooperation. These studies have identified factors that influence cooperation using several perspectives including transaction costs theory, information processing theory, and socio-political approach.

Studies in the information processing approach view that uncertainty and information processing are the most important issues in explaining cooperation. According to this approach, cooperation between organizations involves a certain level of interdependence (Ouchi, 1980) and the interdependence brings problems of uncertainty (Schoderbeck, et al., 1990). As uncertainty increases, the information processing requirements of the relationships increase (Tushman and Nadler, 1978). To solve the uncertainty problems in the interfirm relationships, the increases in information processing capabilities between organizations are considered as a major solution. Increased information processing capabilities indicate that the partnering firms share more information about transactions, monitoring the performance, and controlling resources. Galbraith (1973) views organizations as information processing systems, and appropriate organizational structures are those that best match an organization=s information requirements with its information processing capabilities. More important, in IS area, IT has viewed as tool for increasing information processing capability and thus decreases uncertainty. IT is one of the major factors that determine information processing capabilities in the interorganizational relationships.

Bensaou and Venkatraman (1995) suggest that cooperation clearly is a configuration for high-uncertainty contingencies that require important and rich information processing capabilities. A cooperative interfirm relationship is dependent upon the ways that organizations cope with the uncertainty they face, and with the information processing capabilities they have. They identify three types of uncertainty recognized in the interfirm relationships: environmental

uncertainty (i.e., arising from the general environmental conditions underlying the interorganizational business relationships); partnership uncertainty (i.e., arising due to one firm=s perceived uncertainty about its specific partner=s behavior in the future); and task uncertainty (i.e., arising due to the specific set of tasks carried out by the organizational agent responsible for the interorganizational relationship). They describe three mechanisms that effect information processing capabilities: structural mechanisms, process mechanisms, and information technology mechanisms. Cooperation is influenced by the fit between these uncertainties and three mechanisms.

Traditional studies in transaction costs theory view that asset specificity is considered as a primary source of uncertainty since it represents investments highly specific to the relationship and hence increases the potential risk and damage if the supplier behaves opportunistically. However, since the value of a firm=s capital asset is idiosyncratic to the relationship with the other firm (Son, et al., 1999), the value of transaction-specific assets is significantly lower when employed in alternative uses. Due to these characteristics of asset specificity, an organization may hold the other firm hostage (Anderson and Narus, 1990; Hiede and John, 1992) and the partnering firm is locked into the transaction with its current customer to a great degree (Bensaou and Venkatraman, 1995; Dyer, 1997; Son, et al., 1999). Thus, asset specificity is identified as a major factor that determines cooperation in many studies (e.g., Bakos, 1991; Bensaou, 1997; Bensaou and Venkatraman, 1995; Dyer, 1997; Son, et al., 1999; Zaheer and Venkatraman, 1994). In addition to the uncertainty and asset specificity, power and trust (Hart and Saunders, 1997; 1998; Lee and Kim, 1999; Son, et al., 1999; Zaheer and Venkatraman, 1994), and other partnership characteristics such as behavior and climate of the relationships (Bensaou, 1997) and product characteristics (Lee and Kim, 1999) are also examined intensively as important factors for cooperation.

3. Research Model and Hypotheses

3.1. Electronic Cooperation

Electronic cooperation is defined as a tightly coupled, integrated interorganizational relationships achieved through the deployment of IOSI (Zaheer and Venkatraman, 1994). It lays the middle between the electronic markets (transaction-oriented markets such as stock exchanges) and electronic hierarchies (centrally directed interactions within a single firm) (Clemons and Row, 1992). According to Clemons and Row (1992), in electronic cooperation, partnering firms increase resource utilization and add value to the relationships. Electronic cooperation also involves explicit coordination through high relation-specific investment and information processing capabilities (Bensaou, 1997; Dyer, 1996; Son, et al., 1999; Zaheer and Venkatraman, 1994).

Electronic cooperation is measured as the level of an organization's dedication to its partners (Zaheer and Venkatraman, 1994). That is, the percentage of business transactions is directed through electronically. The number of partners involved in the transaction (Brynjolfsson, et al., 1994; Johnston and Lawrence, 1988) and the transaction volume (Zaheer and Venkatraman, 1994) is most frequently used as the measures of an organization's dedication in the studies based on the "move to the middle" hypothesis. In strategic management area, cooperation is measured by sales volume flowing between dyadic partners as an objective indicator (Mohr and Spekman, 1994). In the studies of buyer-supplier relationships, economic theorists found that many companies have actually reduced their supplier base after implementing IOSI, despite a significant reduction in their market transaction costs (e.g., Whang and Seidmann, 1995; Bakos and Brynjolfsson, 1993). Partners are also able to increase electronic cooperation as they increase the volume of transaction between the partners (Dyer and Singh, 1998). Automobile manufacturers like General Motors, Ford, and especially Chrysler, for example, have substantially reduced the number of suppliers from whom they purchase components, while simultaneously dramatically increasing the value of parts they procure (Clemons, et al., 1993).

Electronic cooperation is also measured by the frequency of interaction and the degree of working jointly in business activities such as production planning and designing (Bensaou, 1997). Therefore, this study measures electronic cooperation as the degree of joint decision-making and the purchase/sales (volume of transactions) between organizations.

3.2. Research Model and Hypotheses

While there appears to be a common consensus among IS and organization researches that IT supports better cooperative relationships between buyers and suppliers, there have been few attempts at theoretical modeling or empirical testing of this assertion. Based on the constructs derived from relevant reference disciplines, the detailed research model is presented in Figure 1. The premise of the research model is that cooperative relationship between organizations are better explained by incorporating relevant dimensions of IOSI that support their information processing capabilities. The research hypotheses denoted by the model are discussed in the next subsections.

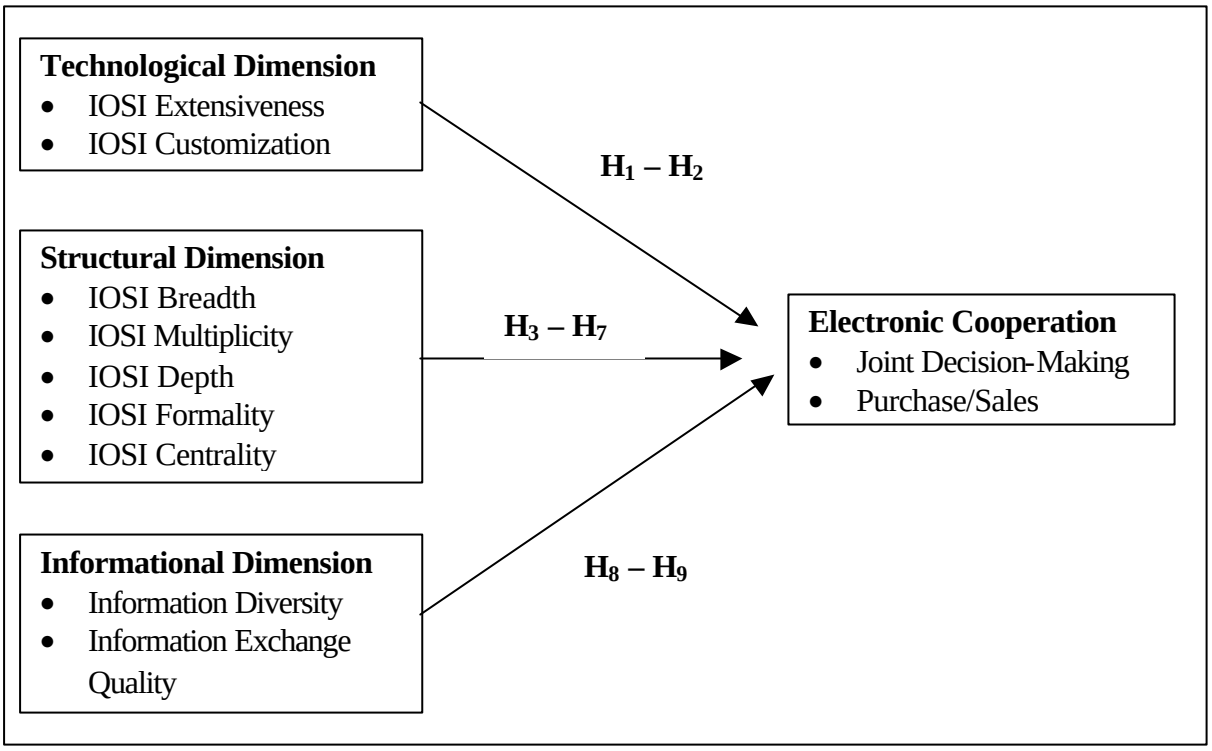


Figure 1. The Research Model

3.3. Technological Dimension

(1) IOSI Extensiveness

When IOSI provides extensive IT functionality, organizations can share a wider range of IT services with their partnering firms, such as an integrated telecommunication network or a united customer database. More extensive IT functionality also supports the integration of organizations' IT activities such as task/team support technologies (e.g., groupware and discussion databases), high bandwidth telecommunications, and information-rich media (such as color graphics and full motion video), so that organizations can exchange a variety of information at a high speed and more accurately. Therefore, the IOSI with higher extensiveness provides organizations a technological platform for greater information access and information processing capabilities (Kumar and Dissel, 1996), and allows easier IT integration between organizations. The increase information processing capabilities between organizations help them to reduce uncertainty about the partner, its inclination of opportunistic behaviors (Benasou, 1997) and hence invite electronic cooperation. Since these specific investments make it costlier and more difficult for organizations to switch their partners, it is expected that organizations to preserve their current relationship more closely and therefore, higher electronic cooperation with their partners.

H_1: IOSI extensiveness is positively associated with electronic cooperation, in terms of joint decision-making and purchase/sales.

(2) IOSI Customization

IOSI customization is related to the integration of business processes between organizations. When an IOSI provides IT functionality specific to a relationship's business processes, the IOSI is customized one to the relationship. To use customized IOSI, organizations are required to customize their personnel's skills, knowledge, and experience specific to IOSI-mediated business processes. Zaheer and Venkatraman (1994) argued that the relation-specific IT functionality and human skills create procedural and human asset specificity for the relationship. The relation-specific IT-based capabilities determine the level of organizational resources that are tied up to support business competencies.

The tied-up resources hold organizations as hostage for the relationship. Thus, organizations try to utilize these resources for better relationships with their partners, instead of revealing opportunistic behaviors to their partners. The resource utilization between organization brings cooperation (Clemons and Row, 1992) As a result, through the creation of relation-specific IT-based capabilities, IOSI customization provides organizations enhanced opportunities for restructuring their relationships with the chosen business partner (Zaheer and Venkatraman, 1994) and consequently increases electronic cooperation.

H_2: *IOSI customization is positively associated with electronic cooperation, in terms of joint decision-making and purchase/sales.*

3.4. Structural Dimension

(1) IOSI Breadth

IOSI breadth refers to the IOSI ability to support an organization to make electronic connection with a variety of partners. When a firm establishes electronic linkages with various types of suppliers, the firm can achieve participation externalities that support interfirm relationships (Kumar and Dissel, 1996). In the airline industry, the SABRE system enables an airline company to make connections with its agents, customers, competing airline companies, as well as companies in other industries. They exchange information about flight schedules, ticketing, hotel reservations, car rentals, and entertainment reservations. As such, IOSI breadth determines the degree to which electronic linkages are established between organizations (Massetti and Zmud, 1996). With higher IOSI breadth, organizations can make electronic connection with their partners regardless the value chain, IT base, and geographic proximity. IOSI breadth makes it easy for a firm to establish interaction structure with the partners to exchange information about their transaction requirements such as products specifications, price, and products delivery. As a result, IOSI breadth facilitates electronic cooperation that involves joint decision-making and consequently increases the volume and dollar amount of transactions.

H_3: *IOSI breadth is positively associated with electronic cooperation, in terms of joint decision-making and purchase/sales.*

(2) IOSI Multiplicity

IOSI multiplicity is related to the interdepartmental relationships among organizations. The interdepartmental relationships can be characterized by the degree to which functional relationships are differentiated (Frazier, 1999; Shrivastava and Mitroff, 1984). Each business function develops its own functional specialization, time horizon, goals, a frame of reference and jargon. Interdependence between business functions increases uncertainty because action by one department can unexpectedly force adaptation to other departments in the value chain. Bridging differences between departments reduces uncertainty and equivocality. IOSI multiplicity determines the strength of interfirm cooperation by influencing the degree of information processing between business functions (Daft and Lengel, 1986). IOSI multiplicity enables organizations to frequently contact and coordinate various business functions of partners (Daft and Lengel, 1986). This IOSI-enabled functional integration allows different business functions to reach a common

frame of reference (Soborero and Schrader, 1998) by facilitating interfirm information-sharing routines to effectively coordinate activities and optimize interfirm cooperation.

H_4: IOSI multiplicity is positively associated with electronic cooperation, in terms of joint decision-making and purchase/sales.

(3) IOSI Depth

IOSI depth influences the level of interaction modes by determining the interfirm IT use (i.e., intensity and scope of IT use) (Bensaou and Venkatraman, 1995). IOSI supports basic or shallow linkages where IT use is largely confined to being the conduit for passing massages between parties, or deeper linkages where IT is used to feed information directly into organization's business applications (Massetti and Zmud, 1996). Shallow linkages can be carried out as a standalone, modular activity with minimal integration with related firm processes. In a study in the automobile industry, Bensaou and Venkatraman (1995) report that several suppliers who had such linkages re-keyed the purchase orders received electronically into their internal information systems. In the deeper linkage, organizations eliminate these redundancies of information processing activities and streamline boundary-crossing business processes (Subramani, 1997). Consequently, IOSI depth influences IT integration and the level of IT use for information exchange that influences significantly interfirm cooperation (Choudhury, 1997; Iacavou, et al., 1995; Mukhopadhyay, 1995).

H_5: IOSI depth is positively associated with electronic cooperation, in terms of joint decision-making and purchase/sales.

(4) IOSI Formality

In exchanging information, trading partners are required to adopt formal standards for communication, to establish protocols related to the timing and frequency of exchanging information, to reach agreements related to the sharing of transmission and translating costs, and to establish terms of responsibility when errors occur in transmission process (Vijayasarathy and Robey, 1997). When the use of IOSI requires the strict applications of such constraints, the interaction behaviors are more structured and routinized and there is higher IOSI formality. By formalizing the communication processes and procedures, IOSI enhances the speed, accuracy, and completeness of interorganizational communication (Stern and Kaufmann, 1985). Therefore, IOSI formality enhances the likelihood of developing and implementing cooperation between organizations.

H_6: IOSI formality is positively associated with electronic cooperation, in terms of joint decision-making and purchase/sales.

(5) IOSI Centrality

The extent to which IT resources are shared determines IOSI centrality. In many cases, high IOSI centrality is created when one or a few organizations implement a proprietary IOSI. Since the initiating organizations have the authority to manage IT resources in such areas as coordinating IS planning and operational IT activities across relationships, IOSI centrality usually limits the autonomy of participating firms' interactions with firms outside their IOSI and concentrates the interaction channels to the initiating firms. Moreover, the initiating firms tend to utilize the IOSI to create their firm-specific IT capabilities which provide them opportunities for restructuring their relationships with chosen business partners (Zaheer and Venkatraman, 1994). This high level of control on IT resources and establishment of firm-specific IT capabilities create opportunities for centralized interfirm information sharing which intensifies the frequency and volume of information exchange and thereby induces cooperative interorganizational relationships.

H_7: IOSI centrality is positively associated with electronic cooperation, in terms of joint decision-making and purchase/sales.

3.5. Informational Dimension

(1) Information Diversity

An organization may interact with many partners who use different data types and formats to exchange information in transactions. When IOSI supports diversity of information, organizations can exchange a greater amount of information regardless data types and formats. In EDI studies, it is found that when an organization is able to exchange a large variety of document types across many of its functions and partners using multiple EDI formats, it is positioned to gain further benefits (Massetti and Zmud, 1996). Since distinctiveness of information is related to the distinctive business processes, the ability to exchange the number of distinctive document types invariably increases the extent of data integration across the organizations. The ability to exchange increased number of information formats also improves the accessibility of an organization's information to external trading partners. Implementing different transaction sets in the EDI, for example, contributes to tighter coupling business activities between partners (Hart and

Saunders, 1998). As such, when IOSI supports information diversity, there will be more electronic cooperation between organizations.

H_8: The information diversity of IOSI is positively associated with electronic cooperation, in terms of joint decision-making and purchase/sales.

(2) Information Exchange Quality

Quality of information exchange has been emphasized as an antecedent of successful interorganizational relationship (Lee and Kim, 1999; Morh and Sohi, 1995; Vijayasarathy and Robey, 1997). Poor quality of information exchange often causes incomplete and inaccurate interactions and leads to feeling of frustration; in some instance it may even be a source of confusion (Daft and Lengel, 1986). Poor quality of information exchange leads organizations to be reluctant to contact their suppliers. Quality of information exchange allows people to complete tasks more effectively and improve the quality of information transferred and being knowledgeable about each other's business (Devlin and Bleckley, 1988; Mukhopadhyay, et al., 1995). As a result, Information exchange quality enables organizations to maintain the relationship over time and hence, increases electronic cooperation.

H_9: The information exchange quality of IOSI is positively associated with electronic cooperation, in terms of joint decision-making and purchase/sales.

4. Data Collection

This study attempts to understand the effects of IOSI on electronic cooperation through expressed relationships between research constructs. A common approach to studying such phenomena is to put forth hypotheses regarding relationships between constructs and test them statistically. The data was collected through self-administered questionnaires from key informants in manufacturing and retailing industries. The choice of the manufacturing and retail industry as the target population is becoming more common in the EDI and interorganizational information systems (IOS) studies (e.g., Bensaou, 1997; Hart and Saunders, 1998; Nakayama, 1999; Vijayasarathy and Robey, 1997). The unit of analysis for this study is a dyad, dyadic relationship between several large buyers and their respective suppliers.

Within this study, the sampling frame adopted is Internet. Firms that is in automobile manufacturing and retailing industry and has job tiles: Chief information officer, VP of Information Systems, Director of Information Technology, IT/IS Director, IT/IS Manager, MIS director, and MIS manager were selected. Of the 926 questionnaires mailed, a total of 106 were returned for a response rate of 11.6 percent.

5. Data Analysis

5.1. Non-Response Bias

Within the present analysis, non-response bias was tested by comparing early and late respondents along dimensions of number of employee, sales, IOSI type, duration of IOSI use, and the degree of IOSI linkage. The statistical approach was a chi-square goodness-of-fit test. Number of employee to response yielded a χ^2 (df = 4) of 8.65 and p = 0.07. Sales to response yielded a χ^2 (df = 4) of 1.33 and p = 0.86. IOSI type to response yielded a χ^2 (df = 3) of 3.49 and p = 0.18. Duration of IOSI use to response yielded a χ^2 (df = 4) of 4.95 and p = 0.29. Degree of IOSI linkage to response yielded a χ^2 (df = 4) of 1.38 and p = 0.85. These results are not significant at p = 0.05 and imply that no response bias exists in the sample and that the results are generalizable within the boundary of the sample frame.

5.2. Results of SEM Analyses

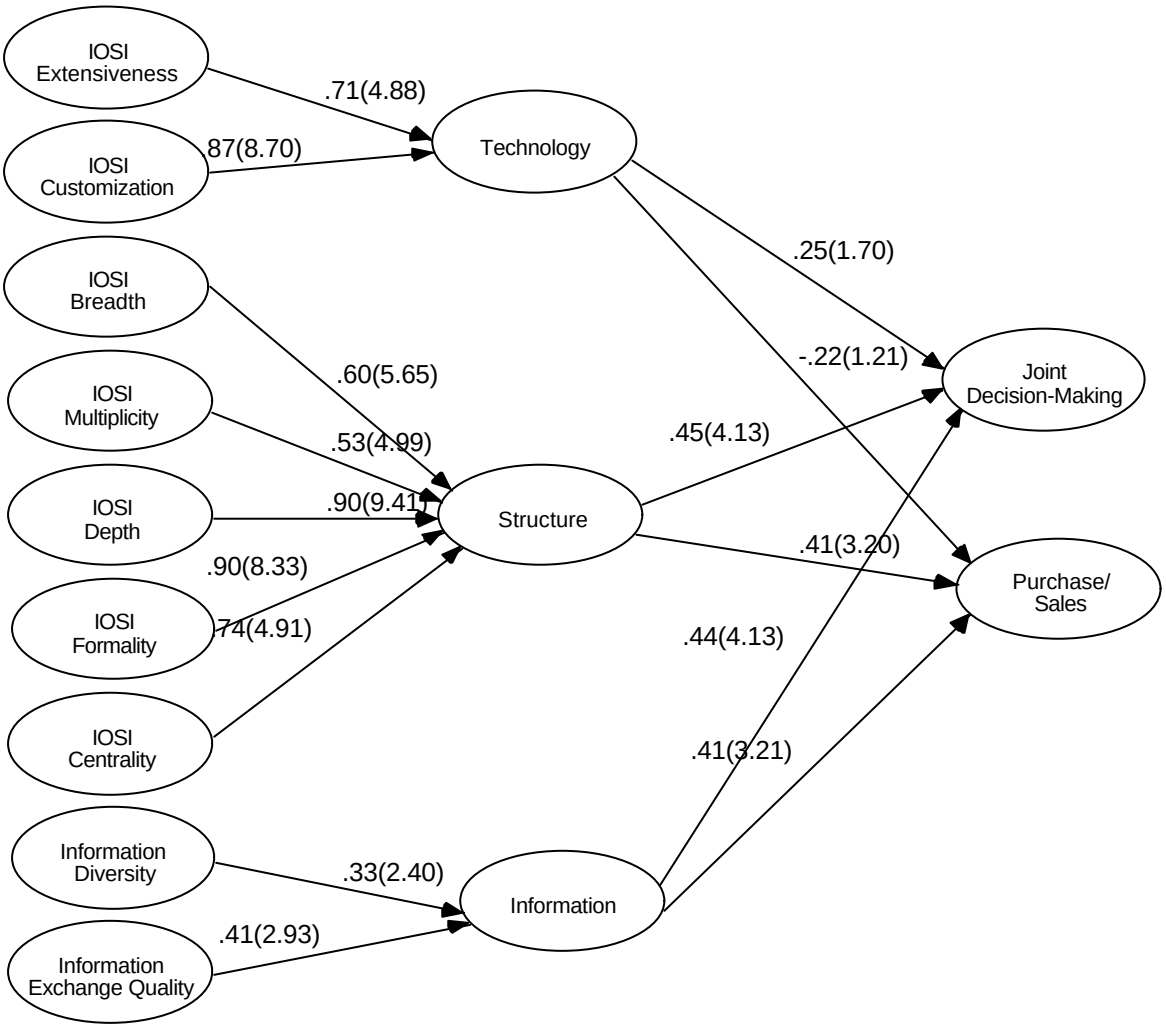
This section reports the results of structural equation modeling designed to empirically test the hypotheses developed. The SEM analyses were performed to investigate the contribution of IOSI dimensions on electronic cooperation.

The hypothesized model posits a second-order model. This model indicates that three IOSI dimensions moderate the effects of the first-order IOSI constructs on electronic cooperation. The three second-order constructs are technological, structural, and informational dimensions. The theoretical interpretation of these second-order constructs

is an overall trait of the first-order constructs. This second-order model was also estimated using the covariances among the indicators in the first-order constructs. The Figure 2 shows the second-order model.

The observed χ^2 for the second-order (hypothesized) model is 2197.17 (df = 755, p = 0.000). The CFI, NFI, RFI, and IFI are 0.60, 0.50, 0.45, and 0.60 respectively. Adjusting for degrees of freedom, the normed value of χ^2 is 2.91; indicating good model fit and no evidence of over-fitting. As anticipated, the fit of the second-order model was reduced from that of the first-order model, because the second-order model is a nested (hierarchical) model of the first-order model and has more restrictive assumptions. Because the first- and second-order components of the model were fit simultaneously, misfit could have arisen from either portion of the model. Hence March's target coefficient (TC) was estimated to measure the ability of the second-order model to explain the intercorrelations among the first-order constructs. In other words, Target coefficient evaluates the fit of only the second-order portion of the model (March, 1991). Target coefficient equaled 0.83, indicating that 83% of the covariation among the nine first-order constructs was accounted by the three second-order constructs.

As shown in Figure 2, most path coefficients are of high magnitude and exhibit high t-values. These values are much higher than those in the first-order model, ranging 0.22 to 0.90 in absolute value. The t-value indicates that except two paths between technology and electronic cooperation, all path coefficients are significant at p = 0.05 and p = 0.01. Furthermore, the coefficient of determination for structural equations is 0.86 for the model, indicating that 86% of variance of electronic cooperation is explained by indicators. Therefore, the second-order model represents a parsimonious representation of observed covariances.



[a] The λs and δs are omitted for schematic simplicity

Figure 2. The Hypothesized Model[a]

5.3. Evaluation of the Proposed Model

Based on the acceptance of the proposed model, the hypotheses developed were tested. Since the proposed second-order model represents the effects of IOSI constructs on electronic cooperation are mediated by the second-order constructs, indirect effects between IOSI constructs and cooperation should be calculated and their significance also be tested. Based on the path coefficient represented in Figure 2, Table 2 outlines the indirect effects of IOSI constructs and their t-value. The indirect effects range from 0.16 to 0.41. Cohen (1988) provides recommendations about the effect size interpretation of path coefficient (β) in the social science. Standardized path coefficients with absolute values less than 0.10 may indicate a "small" effect; values around 0.30 a "medium" one; and "large" effects may be suggested by coefficients with absolute values of 0.50 or more. Based on his recommendation, all constructs in structural dimension have the values around 0.30 and their direction is positive. IOSI breadth has positive and moderate association with electronic cooperation, in terms of joint decision-making ($\beta = 0.27$) and purchase/sales ($\beta = 0.25$). Like a standardized regression coefficient, it means that IOSI IOSI breadth is expected to improve by 0.27 and 0.25 standard deviations given the change of one full standard deviation in joint decision-making and purchase/sales respectively when other constructs are controlled.

Table 2. Direct Effects, Indirect Effects, and T-Value

Path	Coefficient (β)	t-Value
IOSI Extensiveness – Joint DM	0.18	1.57
IOSI Extensiveness – Purchase/Sales	-0.16	1.45
IOSI Customization – Joint DM	0.39	1.66
IOSI Customization – Purchase/Sales	-0.19	1.19
IOSI Breadth – Joint DM	0.27	3.31**
IOSI Breadth – Purchase/Sales	0.25	2.75**
IOSI Multiplicity – Joint DM	0.23	3.15**
IOSI Multiplicity – Purchase/Sales	0.22	2.66**
IOSI Depth – Joint DM	0.41	3.02**
IOSI Depth – Purchase/Sales	0.37	3.69**
IOSI Formality – Joint DM	0.41	3.77**
IOSI Formality – Purchase/Sales	0.37	3.00**
IOSI Centrality – Joint DM	0.33	3.12**
IOSI Centrality – Purchase/Sales	0.31	2.64**
Information Diversity – Joint DM	0.14	2.04*
Information Diversity – Purchase/Sales	0.13	1.87
Info. Exchange Quality – Joint DM	0.18	2.35*
Info. Exchange Quality – Purchase/Sales	0.16	2.11*

* significant at $p < 0.05$
** significant at $p < 0.01$

IOSI multiplicity also impacts the electronic cooperation ($\beta = 0.23$ and $\beta = 0.22$). Other three IOSI constructs also have positive and moderate association with electronic cooperation: IOSI depth to electronic cooperation ($\beta = 0.41$ and $\beta = 0.37$); IOSI formality to electronic cooperation ($\beta = 0.41$ and $\beta = 0.37$); and IOSI centrality to electronic cooperation ($\beta = 0.33$ and $\beta = 0.31$). Furthermore, the t-values of these constructs are significant at $p < 0.01$. Overall, all IOSI constructs in structural dimension have moderately relationships with the electronic cooperation, in terms of joint decision-making and purchase/sales, and are significant at $p < 0.01$. Therefore, H_3, H_4, H_5, H_6, and H_7 were supported.

The constructs in informational dimension also show positive and mild relationships with electronic cooperation, in terms of joint decision-making and purchase/sales, and they are significant at $p < 0.05$. The path coefficients of information exchange quality to joint decision-making and purchase/sales are 0.18 and 0.16 respectively, indicating positive and moderate relationships with electronic cooperation. Information diversity impacts joint decision-making ($\beta = 0.14$) and statistically significant. It also has positive and moderate relationship with purchase/sales ($\beta = 0.13$) but is not significant at $p = 0.05$ with it's a little low t-value (1.87). Therefore, H_9 was supported, but H_8 was partially supported.

The constructs in technological dimension reveal some problematic features. IOSI extensiveness and IOSI customization have positive and moderate relationships with joint decision-making ($\beta = 0.18$ and $\beta = 0.39$, respectively). However, t-values of these relationships turn out to be insignificant (1.57 and 1.66, respectively). Furthermore, IOSI

extensiveness and IOSI customization have negative relationships with electronic cooperation, despite of moderate magnitude of their coefficients (β = -0.16 and β = -0.19, respectively). Their t-values also indicate the insignificance of the relationships. As a result, H_1 and H_2 were not supported.

6. Discussion and Conclusion

As noted by Clemons, et al. (1993), IT has the impact on emergence of new organizational form established through tightly couple relationship between organizations. Since such cooperative interorganizational relationship lies between electronic markets and electronic hierarchies, this new trend was called the "Move to the Middle". Within existing literature, the "move to the middle" framework is based on the establishment of explicit coordination between organization without ownership and this relationship is achieved by reducing transaction costs. This study adopts IOSI and examines whether IOSI capabilities contribute to the establishment of such cooperative interorganizational relationship. This study focuses on the role of IOSI on increasing information processing capabilities instead of on reducing transaction costs. As described above sections, the findings of this study supports the "move to the middle" hypothesis. IOSI provides organizations technological, structural, and informational capabilities. these capabilities improves the quality, speed, and business values of information exchanges (Mackay, 1993; Mukhopadhyay, et al., 1995). They also support organizations to establish electronic linkages for interactions with their partners. Therefore, IOSI has become a pivotal technology for organizations' movement to the middle in interorganizational relationships.

As the use of IT for interorganizational activities gains wider acceptance among academics and businesses, research that accurately describes and measures both aspects of IT, especially IOSI, capabilities and dimensions of their success become increasingly important. One of the important consequences of IOSI use is obviously the benefits accrued among organizations. Fortunately, there is no shortage of theoretical works from which these important benefits can be identified. However, there exists a shortage of studies that attempt to empirically test proposed theory and further its definitional aspects through empirical operationalization and formal testing. This study is a step toward assessing one of the popular benefits attributed to IOSI.

Through theoretical conceptualization of IOSI dimensions and their associated consequences, this study provides a theory-driven model to explain the relationships between IOSI and electronic cooperation. The data analysis provided partial support for the model and suggested possible modifications. It is hoped that the lens of this study provides a more accurate view and growing knowledge on the use of IT beyond organizational boundaries.

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