

## Information Systems Outsourcing Management Competences as the Antecedents of Inter-Organizational Systems Use: An Empirical Test

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### Abstract

*By increasingly outsourcing inter-organizational systems (IOS) based e-commerce infrastructures to service providers, firms are facing the daunting challenge of ensuring quality IOS services from their providers to consistently support their booming e-commerce activities. Consequently, the issue of how IS outsourcing management competences can impact IOS use deserves to be thoroughly investigated. In this paper, to study this issue, first, a model is developed to conceptualize the impacts from IS outsourcing management competences to IOS use and then survey data are collected to empirically test the model. It is found that contract management is positively and significantly impacting IOS use but informed buying is not significantly influencing IOS use. Further, it is also found that relationship management is the driving force behind informed buying and contract management. Finally, discussions on the empirical findings about the impacts of these IS outsourcing management competences on IOS use will be presented and the implications and limitations of this study will also be discussed in the end.*

**Keywords:** IS Outsourcing Management Competences, IOS Use, Empirical Study.

### Introduction

With the rapid development of Internet technologies, inter-organizational systems (IOS) based business-to-business e-commerce has been booming since late 1990s. Naturally, the question of what factors are enabling this boost deserves thorough investigation. Quite a few studies on the antecedents of IOS use have already been conducted from a variety of perspectives including technological infrastructure (Barua, Konana, and Whinston, 2004), innovation diffusion (Prekumar, Ramamurthy, and Nilakanta, 1994), intra-organizational structuring (Chatterjee, Grewal, and Sambamurthy, 2002; Barua, Konana, and Whinston, 2004; Chwelos, Benbasat, and Dexter, 2001), inter-organizational relationship (Hart and Saunders 1998; Zaheer and Venkatraman, 1994; Chwelos, Benbasat, and Dexter, 2001), and institutional environment perspectives (Teo, Wei, and Benbasat, 2003; Chwelos, Benbasat, and Dexter, 2001).

While all these studies provide many insights into the antecedents of IOS use, one key antecedent, not investigated thus far, is the evolving IS outsourcing management capabilities that enable companies to take advantage of global IS services to develop, maintain, and operate their e-commerce infrastructures with high or reasonable quality at a very low cost. This linkage between IS outsourcing management and IOS use is becoming increasingly more prominent as more firms are outsourcing their IOS infrastructure development, operations, and maintenance jobs to foreign countries and expecting justifiable or even super returns from their outsourcing efforts (Aron, Clemons, and Reddi, 2005).

On the one hand, it is clear that there is a strong demand for outsourcing IOS infrastructures. First, it is found that IS infrastructure including e-commerce infrastructure components such as mainframe operations, networks, client and server operations, and mid-range computing are the most commonly outsourced activities in many US and UK firms (Lacity and Willcocks, 2000). Second, the IOS based business process outsourcing industry in India has reached the position of the second largest and the single fastest growing industry in less than 5 years (Aron, Clemons, and Reddi, 2005). With these facts about the most commonly outsourced activities and the dramatic growth in IOS-based business process service industry in India, it can be concluded that the IOS outsourcing trend is undoubtedly moving up. On the other hand, in order to maximally reduce associated risks and costs, effectively deal with the dynamic outsourcing complexity (Earl, 1996; Aron, Clemons, and Reddi, 2005), and consistently maintain quality IOS services from service providers, outsourcing firms are clearly facing the daunting challenge of effectively managing IOS service providers.

Consequently, with the increased IOS-based business process outsourcing and the daunting challenge of outsourcing management, it is easy to project that firms with better IS outsourcing management competences are more likely to have higher levels of return on investments into IOS infrastructure outsourcing. Naturally, it should be very interesting and meaningful to investigate how a firm's various IS outsourcing management capabilities, as important antecedents, can positively influence IOS use. Unfortunately, research is still lacking in explicitly investigating this relationship. This paper is intended to explore this linkage by integrating previous research on IS outsourcing management competences (e.g., Feeny and Willcocks, 1998; Shi, Kunnathur and Ragunathan, 2005) and IOS use (e.g., Premkumar, Ramamurthy, and Nilakanta, 1994; Massietti and Zmud, 1996) and testing a conceptual model with IS outsourcing management competences as the antecedents of IOS use. In the following section, key constructs of IOS use and IS outsourcing management competences will be discussed and a conceptual model about their relationships will also be presented.

## **The Constructs and the Conceptual Model**

### **The Dependent Variable: IOS Use**

Massetti and Zmud's (1996) pioneering study on the EDI (i.e., one typical IOS) use dimensions including volume, depth, breadth, and diversity is followed to define and measure IOS use

dimensions<sup>1</sup>. Truman (2000) proposed the concept of interface integration, which represents the integration between IOS systems and firm internal systems and is similar to the depth dimension in Massetti and Zmud (1996). Angeles and Nath (2000) developed three levels of EDI implementation, also representing the depth dimension. The highest level of EDI implementation in their research is the use of EDI to reengineer internal and inter-organizational processes. Premkumar, Ramamurthy, and Nilakanta (1994) used the concept of EDI internal infusion to capture the degree of integration between EDI and internal systems and the concept of external infusion to represent the number of different partners connected through EDI and the amount of different types of business documents exchanged through EDI. Their concept of internal infusion is indeed similar to EDI use depth and their external infusion is the combination of EDI use breadth and diversity in Massetti and Zmud (1996). Hart and Saunders (1998), based on Massetti and Zmud (1996)'s conceptualization, developed EDI use measurement items for volume and diversity. Together, these studies both developed the conceptual foundation and proved the empirical validity of the IOS use dimensions (i.e., volume, depth, breadth, and diversity) for defining and measuring IOS use.

### **IS Outsourcing Management Competences and Their Impacts on IOS Use**

It has been proposed and empirically verified that there are three key IS outsourcing management competences, including informed buying, contract management, and relationship management (Shi, Kunnathur and Ragu-nathan, 2005). In the following, the definitions of these competences and their relationships with IOS use will be discussed.

#### **Informed Buying and Its Impact on IOS Use**

Informed buying involves analyzing the external IS services market, selecting a sourcing strategy to meet business needs and solve technology issues, and leading the tendering, contracting, and servicing management processes (Feeny and Willcocks, 1998). It is a conceptualizing competence responsible for gathering and analyzing information about IS demand and supply, identifying the best outsourcing solution, and communicating the solution to all relevant parties so that all the relevant parties can fully understand and innovatively embrace IS demand–supply interactions to ensure IS outsourcing success (Shi, et al., 2005). Informed buying is information and knowledge intensive in nature and thus demands effective knowledge management to integrate both IS supply and demand knowledge for creating the best outsourcing solution.

Informed buying will impact IOS use by influencing the design and implementation of appropriate inter-organizational systems, which reflect the best fit between demand choices and supply options. These IOSs should follow proper technological standards and include required functions meeting business needs. Further, quality communications of the fit analysis of interactions between IS demand and supply to all involved parties will help build consensus on

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<sup>1</sup> While these EDI use dimensions were proposed ten years ago, they are still alive in today's Web based environment. The difference is that with today's web technologies, all EDI use dimensions could be even better developed and maintained. Further, while IOS is an extension and expansion of EDI system, the volume, depth, breadth, and diversity can still parsimoniously capture the essence of different IOS use facets.

what the IOS should look like and facilitate the establishment of the cognitive foundation for mutual collaborations across organizational boundaries. Consequently, with the informed buying helping construct a solid cognitive foundation for mutual collaborations in IOS design, development, and operations, *it is hypothesized that informed buying positively impacts IOS use (Hypothesis 1).*

### **Contract Management and Its Impacts on IOS Use**

Contract management consists of 1) existing contract execution, 2) contract development and enhancement, and 3) IS supplier accountability for evolving IS service markets and these dimensions clearly describe the required competences in the life cycle of an IS outsourcing contract as pointed out by Shi, et al. (2005):

“First, with an existing contract, efficient execution including effective performance measurement and contract enforcing activities is the prerequisite for any degree of IS outsourcing success. Second, IS outsourcing contract development and enhancement is inevitable because any IS outsourcing contract is most likely an incomplete contract representing only a limited view of the dynamic IS outsourcing process. As IS personnel’s knowledge of IS outsourcing demand and supply is deepening, they are becoming more capable of developing new and enhancing existing contracts. Third, to benefit from these contract developments and enhancements, holding IS suppliers to be accountable for new developments in technology and standards is clearly required.”

With all effective performance measurement and contract development, enforcing, and revising mechanisms in place, it is reasonable to believe that transaction costs and risks in IS outsourcing could be reduced to some degrees.

For example, Aron, et al. (2005) discussed three different strategic risks in IS outsourcing. The first is shirking by the provider, which will undoubtedly impact the IOS performance negatively and decrease the business-to-business transaction processing efficiency and effectiveness. The second is the misuse of information for other purposes by a provider, which may have serious negative impacts on the focal firm. For example, a provider’s using the information to serve the focal firm’s competitor will increase competition and damage the business performance for the focal firm and its partners, which will, in the long run, deteriorate the relationships in the focal firm’s business network. This is particularly devastating in today’s global business competition at the network level (Gulati, 1998). The third is the opportunistic renegotiation, which may temporarily stop daily IOS operations and delay and disrupt both routine updates and major maintenance of IOS components due to conflicts in the contract renew process. All these stops, delays, and disruptions will surely increase operational costs for the focal firm and negatively impact its bottom line.

In order to eliminate or reduce these risks, all the contract management mechanisms are necessary. First, constant contract monitoring is necessary to immediately detect any shirking behaviors and enable the outsourcing company enforce contractual penalties. Second, while contract enforcing mechanisms will deter the provider from using the information and knowledge transferred in the outsourcing process for other purposes that may damage the focal outsourcing

company's performance, contract revising mechanisms will provide opportunities for the focal company to add extra contractual clauses to further strengthen the contractual forces. Third, as to opportunistic contract renegotiations, appropriate contract monitoring mechanisms may help the outsourcing firm identify the danger of opportunistic renegotiation early and then the contract revising mechanisms could be used to enable the quick adjustments of the allocation of tasks to alternative providers, which will prevent the focal outsourcing firm from being trapped in a small number negotiating situation (Aron, et al. 2005). Consequently, it is clear that continuous contract monitoring, enforcing, and revising by the focal firm can help reduce transaction costs and risks, which is necessary to make IOS use based e-commerce activities be executed smoothly and efficiently and ultimately help enhance the focal firm's and its business network's performance. Thus, *it is hypothesized that contract management positively impacts IOS use (Hypothesis 2).*

### **Relationship Management and its Impact on IOS Use by Driving Informed Buying and Contract Management**

Shi, et al. (2005) proposed that relationship management consists of 1) contract facilitation from users' point of view, 2) contract facilitation from IS function's point of view, and 3) strategic IS vendor development. They indicated that "these first-order dimensions measure how well the relationships among IS function, users, and IS vendors are managed so that all parties in the process collaborate with each other to solve problems, resolve conflicts, enhance mutual understanding and trust, create win-win situations, and grow together as a community."

Relationship management activities help build up the structural, relational, and cognitive social capitals (Nahapiet and Ghoshal, 1998). The central point of contact for all users sets up the necessary network structure for all involved users from a focal firm and its partners to get help and consultation. The confidence that users have for the fair and prompt resolution of conflicts and all the coordination and facilitation activities in the sourcing process represent the relational dimension of the social capital. Further, the efforts of increasing mutual understanding, creating win-win situations, and growing together will help build a shared goal and belief that the IS outsourcing relationship will benefit all involved parties, which is clearly a cognitive dimension of the social capital.

With various social capitals accumulated through the relationship management of IS service providers, important benefits could be generated (Adler and Kwon, 2002). First, social capital will facilitate the quick access of fine-grained information, which is the basis for efficient knowledge acquisition and integration. In IS outsourcing, the quick access to information helps IS outsourcing management better understand IS supply, IS demand, and their interactions, and eases the process of fully communicating these insights to all involved parties for better outsourcing decision making and implementation (i.e., informed buying).

Second, social capital helps establish mutual obligations (i.e., psychological contracts, Koh, Ang, and Straub, 2004) and nurtures the growth of power and control for efficient conflicts resolution during the outsourcing contract execution process. Third, social capital brings solidarity that encourages compliance of local rules and customs in the contract execution process and reduces the need for formal controls and the associated transactions costs. Consequently, by contributing to social capital building, relationship management could positively support both the

informed buying and the contract management. Thus, *it is hypothesized that relationship management positively impacts informed buying (Hypothesis 3) and it is also hypothesized that relationship management positively impacts contract management (Hypothesis 4)*. All the hypotheses are showed in Figure 1 and it is clear that relationship management will influence IOS use through the mediation of informed buying and contract management in the proposed model.

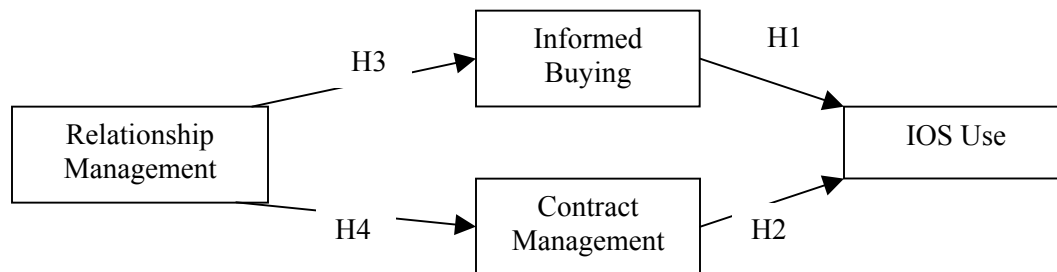


Figure 1. Conceptual Model

## Research Methodology

### Measurement Items

Measurement items are generated based on literature review. The measurement items of IOS use depth are generated based on Massetti and Zmud (1996); those of volume are adapted from Hart and Saunders (1998) and Massetti and Zmud (1996); and those of IOS use diversity are adapted from Bensaou (1997)<sup>2</sup>. IS outsourcing management competence items are based on Feeny and Willcocks (1998) and Shi, et al. (2005).

Field interviews were conducted to explore and verify the content domain and test the validity of measurement items. Two IS directors and one quality director from two automobile suppliers agreed to have four interviews with the researcher. These two companies are identified as D-Corporation and A-Corporation. Their customers are OEMs such as Ford, GM and DaimlerChrysler and they have very high purchasing costs. For example, D-Corporation's annual purchasing cost is around US\$8 billion. Each interview lasts around 1 hour to over 2 hours and feedbacks on the measurement items of IS outsourcing management competence and IOS use dimensions were used to refine and redesign measurement items. Further, a pretest was also implemented to refine measurement items by presenting the questionnaire to two dissertation-stage Ph. D candidates, two IS professors, and one operation management professor. Literature review, field interviews, and the pretest helped improve the quality of the survey design. Next, a pilot study was implemented.

<sup>2</sup> The breadth dimension is not included. This is because the unit of analysis in this study is a chosen supplier-customer relationship rather than a portfolio of business relationships for the responding firm.

## Pilot Study

Prior to the administration of a large-scale study, a pilot study was carried out to enhance the reliability and validity of measurement items and further refine the research design. 500 names were randomly selected from a name list containing 3925 different IS executives. The criteria for the name list are 1) top computer executives and 2) manufacturing and service companies. Further, those companies must meet at least one (and may not meet all) of the following requirements: 1) there are more than 25 IS employees, or 2) there are more than 300 desktop systems, or 3) those companies belong to Fortune 1000, or Forbes 500, or the InformationWeek 500. Applied Computer Research, Inc. provided this name list.

Surveys were then administered and phone calls were made to all the 500 potential respondents. There were 31 responses and 29 of these responses were useful. Corrected item total correlation (CITC) was used to purify the measurement items, and the Cronbach alpha was used to test the reliability of the measurement items. Items were deleted iteratively if their CITC scores are below 0.5. A higher than 0.70 for alpha is also pursued in maintaining or deleting items (Nunnally, 1978). After the pilot study, necessary adjustments were made and it is believed that the quality of measurement items was improved. Appendix 2 lists all the items for the following large scale study.

## Large Scale Study: the Data Collection and the Data

The list with 3425 IS executives' names left after the pilot study was used for the large-scale survey study. Two sets of surveys were administered in US, each having several waves with two or three weeks in between. Three hundred phone calls were also made to remind managers of responding the questionnaire at their earliest convenience. General questions about why IS directors and managers did not respond were also asked. The typical reasons for no responses were company policy not to answer surveys, retirements, time constraints, quitting jobs, changes of departments, and undeliverable addresses, which were consistent with those found in the pilot study<sup>3</sup>.

There were 82 useful responses from the 1<sup>st</sup> set of mailings and 123 useful responses from the 2<sup>nd</sup> set of mailings. Together, 205 useful responses were received and it was also found that there is no response bias by comparing the size and sales between the first set and second set of respondents (Lambert & Harrington, 1990; Armstrong & Overton, 1977). In the meantime, there were 198 returned without responses due to various reasons as mentioned earlier. The response rate was  $205/(3425-198)=6.35\%$ . Further, 15 of the 205 data points have missing values for constructs used in this current paper<sup>4</sup>, thus only 190 data points from the data set will be used for analysis in this paper and the effective response rate is  $190/(3425-198-15)=5.9\%$ . While this is a low response rate and thus a limitation of this study, there are enough responses for statistical analysis. For example, Sethi and King (1994) used 185 sample points to develop the extent to which IT applications provide competitive advantage with structural equation modeling.

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<sup>3</sup> No statistics were taken in the process. Only different reasons were collected.

<sup>4</sup> These 15 data points can be used in other research and this current research is part of a large research program.

Table 1 shows the characteristics of the 190 data points. 66.3 percent of responding firms are from manufacturing, 17.4 percent from services, 14.7 percent from other industries such as transportation and health care, and 1.6 percent of respondents did not specify their industries. As to firm size, 26.3 percent of responding firms have 1000 to 2499 employees and 33.2 percent have over 2500 employees.

Table 1. Characteristics of the Study Sample

<b>Industry</b>	<b>Frequency</b>	<b>Percent</b>	<b>Respondent Position</b>	<b>Frequency</b>	<b>Percent</b>
Manufacturing	126	66.3	CIO	39	20.5
Services	33	17.4	IS Director	66	34.7
Others (e.g., transportation)	28	14.7	Vice President	22	11.6
Unspecified	3	1.6	IS Manager	41	21.6
<b>Total</b>	<b>190</b>	<b>100</b>	<i>Unspecified</i>	22	11.6
<b>Number of Employees</b>	<b>Frequency</b>	<b>Percent</b>	<b>Total</b>	<b>190</b>	<b>100.0</b>
Less Than 100	11	5.8	<b>Relationship Focus</b>	<b>Frequency</b>	<b>Percent</b>
100-249	12	6.3	Customer Relationship Management	73	38.4
250 to 499	19	10.0	Supplier Relationship Management	28	14.7
500 to 999	32	16.8	Un-Specified	89	46.8
1000 to 2499	50	26.3	<b>Total</b>	<b>190</b>	<b>100.0</b>
Over 2500	63	33.2	<b>Type of IOS</b>	<b>Frequency</b>	<b>Percent</b>
Unspecified	3	1.6	an electronic market with many suppliers and many buyers in the system	43	22.6
<b>Total</b>	<b>190</b>	<b>100.0</b>	One to one connection between the buyer and the supplier	85	44.7
<b>Annual Sales (\$)</b>	<b>Frequency</b>	<b>Percent</b>	One buyer and many suppliers	20	10.5
Less than 10 million	5	2.6	One supplier and many buyers	14	7.4
10 to 49.9 million	9	4.7	Un-specified	28	14.7
50 to 99.9 million	13	6.8	<b>Total</b>	<b>190</b>	<b>100.0</b>
100 to 499.9 million	48	25.3			
500 to 1 billion	44	23.2			
Over 1 Billion	66	34.7			
Unspecified	5	2.6			
<b>Total</b>	<b>190</b>	<b>100.0</b>			



Clearly, big and manufacturing firms are more likely to respond to this survey. Other sizes of firms occupy 38.9 percent of the responses. Sales for 83.2 percent of responding firms are larger than \$100 million, which is consistent with the big percentage of large firms among the respondents. 20.5 percent of the respondents are CIOs, 34.7 percent of the respondents are IS Directors, 21.6 percent are IS Managers, 11.6 percent are Vice Presidents, and the rest 11.6% of respondents did not specify their positions. Thus, respondents are most likely to be aware of or be directly involved in IS outsourcing and IOS management.

Further, 38.4 percent of the respondents answered the survey questions based on IOS use in their customer relationships; 14.7 percent of the respondents answered questions based on IOS use in supplier relationships; and the rest of those respondents did not specify relationships on which their responses were based. 22.6% of the responding firms are using an electronic market with many suppliers and many buyers in the system; 44.7% of the responding firms are using one-to-one IOS connections; 10.5% are using a system with one buyer and many suppliers; 7.4% are using a system with one supplier and many buyers; and the rest 14.7% did not specify the type of system. The diversity of the sampled relationships and IOSs provides a context to verify the generality of the findings in this paper.

Table 2. IOS Use Diversity in the Sample Data

IOS Use Functions and Frequency	Degree of IOS Use ( from 1 to 7 ) 1 means the respondent strongly disagrees that IOS is used in a certain function. 7 means that the respondent strongly agrees that IOS is used in a certain function.							Un-Specified	Total
	1	2	3	4	5	6	7		
IOS Use in Purchasing and Percentage	12 6%	12 6%	13 7%	9 5%	41 22%	55 29%	48 25%	0 0%	190 100%
IOS Use in Engineering and Percentage	30 16%	19 10%	18 9%	27 14%	40 21%	35 18%	17 9%	4 2%	190 100%
IOS Use in Quality Control and Percentage	25 13%	17 9%	20 11%	38 20%	45 24%	25 13%	17 9%	3 2%	190 100%
IOS Use in Production Control and Percentage	30 16%	24 13%	19 10%	25 13%	36 19%	34 18%	20 11%	2 1%	190 100%
IOS Use in Transportation and Percentage	23 12%	11 6%	19 10%	28 15%	50 26%	35 18%	20 11%	4 2%	190 100%
IOS Use in Payment and Percentage	14 7%	10 5%	16 8%	12 6%	37 19%	59 31%	42 22%	0 0%	190 100%
Total IOS Use and Percentage	134 12%	93 8%	105 9%	139 12%	249 22%	243 21%	164 14%	13 1%	1140 100%

In addition, Table 2 describes the use of IOS in different functions such as purchasing, engineering, quality control, production control, transportation, and payment. Table 3 compares firms with the degree of IOS use above level 4 with those with the degree of IOS use below level 4<sup>5</sup>. In total, 57.5% of the IOS use is higher than level 4 and only 29.1% of the IOS use is less than level 4. It is clear that on average, these responding firms do have quite a lot of IOS use in various functions. Thus, it is feasible to investigate the impacts of IS outsourcing management competences on IOS use with this data set.

*Table 3.* The number of firms with various degrees of IOS use

IOS Use and Percentage	IOS Use Level Above 4	Comparison	IOS Use Level Below 4
IOS Use in Purchasing and Percentage	144 75.8%	is greater than	37 19.5%
IOS Use in Engineering and Percentage	92 48.4%	is greater than	67 35.3%
IOS Use in Quality Control and Percentage	87 45.8%	is greater than	62 32.6%
IOS Use in Production Control and Percentage	90 47.4%	is greater than	73 38.4%
IOS Use in Transportation and Percentage	105 55.3%	is greater than	53 27.9%
IOS Use in Payment and Percentage	138 72.6%	is greater than	40 21.1%
Total IOS Use and Percentage	656 57.5%	is greater than	332 29.1%

## Large Scale Study: Data Analysis

### Instrument Development

For the three dimensions of IOS use, first, Exploratory Factor Analysis (EFA) was applied to investigate the relationship between measurement items and the proposed construct dimensions. Second, Confirmatory Factor Analysis (CFA) was applied to verify construct reliability and validity. This is because EFA assumes that measurement items' errors are uncorrelated (Stewart & Segars, 2002; Raghunathan, Raghunathan, & Tu, 1999) and CFA takes item error correlations into consideration and may reveal more complex relationships embedded among all the measurement items. For the three IS outsourcing management competence dimensions, Confirmatory Factor Analysis (CFA) was directly applied to verify the reliability and validity of relevant constructs based on Shi, et al. (2005). It is found that all IS outsourcing management

<sup>5</sup> These levels are based on the survey questions about each firm's use of IOS. The scale is from 1 to 7 with the 7 as the highest use level and 1 as the lowest use level.

competences and IOS use dimensions have good reliability and validity indices. All instrument validation procedures are attached in the Appendix 1.

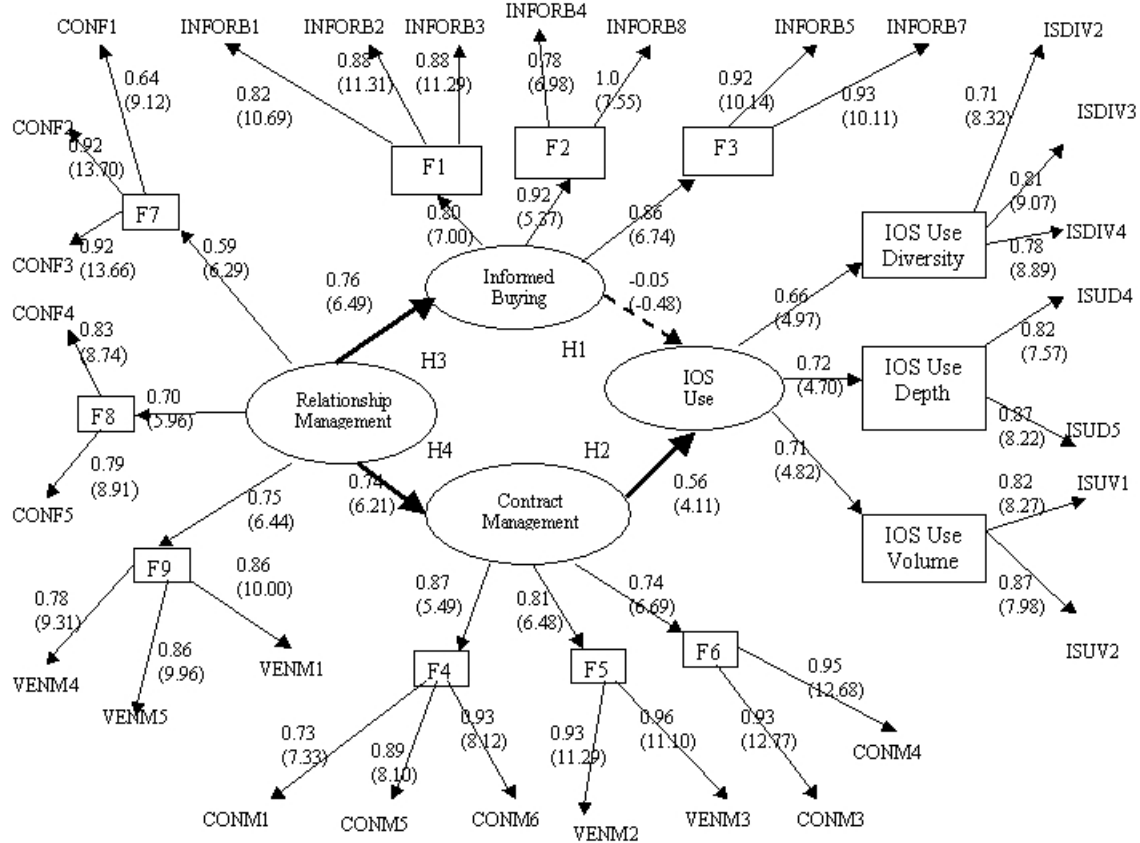


Figure 2. Items, First-Order Factors, Second-Order Factors, Coefficients and Their T-Values)

**Structural Model Test**

The conceptual model is tested with LISREL and it is found that the model has reasonable fit indices (Chi-Square=572.10, df=390, Chi-Square/Df= 1.47, RMSEA=0.05 GFI=0.83, AGFI=0.80, RMR=0.077, CFI=0.98, and NNFI=0.97) and all hypotheses except H1 are supported. Figure 2 displays all path coefficients (Lamdass and Betas) and their T-values.

**Discussions, Implications, Limitations, and Conclusions**

In the model test, first, it is found that the social capital based competence-relationship management has significant and positive impacts on both the transaction costs based competence-contract management and knowledge management based competence-informed buying. This empirical finding clearly demonstrates that social capital building through relationship management helps establish an appropriate social atmosphere, that not only facilitates knowledge integration and creation for better identification and communications of the fit between IS supply

and demand, but also lubricates the formal processes and structures for better contract developing, monitoring, enforcing, and revising over a contract's life cycle.

Second, it is also found that contract management has a direct positive and significant impact on IOS use and this finding is consistent with existing case studies (Saunders, Gebelt, and Hu, 1997), demonstrating the critical role contract management is playing for the success of IOS outsourcing. Third, it is found that informed buying does not have any significant impact on IOS use and this finding is inconsistent with the theory based hypothesis. The data shows that in the current IS outsourcing management process, the focus of outsourcing firms is on the management of the IS outsourcing contract itself and the knowledge management perspective is not playing a significant role in directly impacting IOS use. The lack of focus on knowledge management perspective in IOS outsourcing implies that most firms are still at the early stages of IOS outsourcing, emphasizing costs reduction (Willcocks, Feeny, and Lacity, 2004).

These findings have implications for practitioners. Managers should realize not only the immediate impact of contract management on IOS use but also the role of relationship management in driving the contract management through building an appropriate social environment in the outsourcing process. Further, practitioners may have to realize that while cutting costs is the focus of the beginning stages of IS outsourcing, strategic management of IS outsourcing is necessary in elevating the role IS outsourcing could play in enhancing firm operations and their competitiveness in the business to business arena (Carmel and Agarwal, 2002).

There are a few limitations in this research. First, response rate is not very high and future research need to increase this response rate to confirm the findings in this paper. Second, in the current paper, IS outsourcing management competences are directly linked to IOS use without looking at some intermediate variables such as IOS infrastructure functionality, flexibility, stability, expandability, and security. Future research could refine the research model by adding these IOS infrastructure variables as mediating mechanisms and more fine grained findings may be identified. Third, this study does not incorporate the degree of outsourcing into the model testing as a control variable. Selective outsourcing has been argued by scholars as the best strategy in IS outsourcing success (Lacity, Willcocks, and Feeny, 1995). Consequently, it would be helpful to use this variable as a control variable to better understand the "pure" impact of IS outsourcing management competences on IOS use.

In summary, this paper investigated an important but neglected issue regarding the impact of IS outsourcing management competences on IOS use. It is found that the relationship management is the driving force in the interactions among IS outsourcing management competences and IOS use. The lack of significant impact from informed buying to IOS use reveals that many firms are still focusing on cost reductions in IS outsourcing and even though it has been indicated that knowledge management perspective could play a more critical role for the long term IOS use success through IS outsourcing (Willcocks, et. al., 2004; Shi, et al. 2005), the strategic management of IS outsourcing in enhancing IOS use is not yet taken seriously at this time. It is hoped that this paper could remind managers of this important missing link and leads to continuing research in identifying factors motivating firms emphasizing the strategic management (i.e., knowledge management) of IS outsourcing.

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**Appendix 1: Instrument Development**

IOS Use Factor Analysis I: KMO=0.843

<b>Items</b>	<b>1</b>	<b>2</b>	<b>3</b>
ISUD4	0.17	0.29	<b>0.81</b>
ISUD5	0.08	0.17	<b>0.88</b>
ISUD1	<b>0.85</b>	0.21	0.04
ISUD2	<b>0.84</b>	0.18	0.07
ISUD3	<b>0.71</b>	0.42	0.21
ISUV1	<b>0.62</b>	0.10	0.47
ISUV2	<b>0.61</b>	0.05	0.51
ISUDIV1	<b>0.53</b>	<b>0.43</b>	0.13
ISUDIV2	0.09	<b>0.73</b>	0.23
ISUDIV3	0.17	<b>0.81</b>	0.12
ISUDIV4	0.30	<b>0.77</b>	0.18
ISUDIV5	0.25	<b>0.69</b>	0.09
ISUDIV6	<b>0.62</b>	<b>0.46</b>	0.10
Eigen Values	3.56	3.03	2.09
Variance%	27.41	23.30	16.07
Cumulative%	27.41	50.71	66.77

IOS Use Factor Analysis II: KMO=0.760

<b>Items</b>	<b>1</b>	<b>2</b>	<b>3</b>
ISUD4	0.26	<b>0.86</b>	0.19
ISUD5	0.12	<b>0.90</b>	0.20
ISUV1	0.20	0.18	<b>0.88</b>
ISUV2	0.17	0.22	<b>0.88</b>
ISUDIV2	<b>0.75</b>	0.23	0.06
ISUDIV3	<b>0.83</b>	0.13	0.09
ISUDIV4	<b>0.82</b>	0.18	0.20
ISUDIV5	<b>0.71</b>	0.03	0.26
Eigen Values	2.58	1.74	1.74
Variance%	32.22	21.80	21.78
Cumulative%	32.22	54.02	75.80

Note:

1. ISUDIV1, 6 are deleted due to cross loadings. ISUD1, 2, 3 are deleted due to their content not being measuring IOS use volume.
2. Both Factor analyses used SPSS with Varimax rotation.
3. The second factor analysis specified 3 factors based on conceptual measurement model.

## IOS Use Convergent Validity Testing Procedures

Iterations	Hypothesized Model	Fit Indices
1	(ISUV1, ISUV2) (ISUD4, 5) (ISUDIV2, 3, 4, 5)	Chi-Square=33.53, df=17, P-value=0.00966, RMSEA=0.072 Chi-Square/df=, RMR=0.036, GFI=0.96, AGFI=0.91
Decision Made	ISUDIV5 is deleted.	
Reasons	ISUDIV5 item error has correlations with other item errors.	
2	(ISUV1, ISUV2) (ISUD4, 5) (ISUDIV2, 3, 4)	Chi-Square=13.68, df=11, P-value=0.25111, RMSEA=0.036 Chi-Square/df=, RMR=0.030, GFI=0.98, AGFI=0.95
Decision Made	Final Model	
Reasons	This model has perfect model fit indices. There is no modification index and all $\lambda$ s are greater than 0.60.	
	ISUV1(0.84) ISUV2(0.85) ISUD4(0.90) ISUD5(0.80) ISDIV2(0.71) ISDIV3(0.82) ISDIV4(0.78)	

**Note:** the model test demonstrates these IOS use dimensions have good convergent validity.

## CFA loadings, AVE and Composite Reliability

Factors	Items	Loadings	AVE	Reliability
Volume	ISUV1	0.84	0.71	0.83
	ISUV2	0.85		
Depth	ISUD4	0.9	0.73	0.84
	ISUD5	0.8		
Diversity	ISDIV2	0.71	0.59	0.81
	ISDIV3	0.82		
	ISDIV4	0.78		



IOS Use Volume, Depth, and Diversity Discriminant Validity Testing

<b>AVE and Square Correlations</b>	ISUV1,2	ISUD4,5	ISUDIV2,3,4
ISUV1,2	<b>0.71</b>		
ISUD4,5	0.26	<b>0.73</b>	
ISUDIV2,3,4	0.21	0.24	<b>0.59</b>
<b>Correlations and 95% confidence Intervals</b>	ISUV1,2	ISUD4,5	ISUDIV2,3,4
ISUD4,5	<b>0.51</b>		
UL	0.65		
LL	0.37		
ISUDIV2,3,4	<b>0.46</b>	<b>0.49</b>	
UL	0.60	0.63	
LL	0.32	0.35	
LL: Lower limit; UL: Upper limit			

**Note:** Discriminant validity refers to the uniqueness and independence of measures, i.e., the extent to which the measures are distinctively different from each other (Sethi & King, 1994). Discriminant validity is checked through comparing AVE (i.e., average variance extracted) and the Square of Correlations and examining correlation confidence intervals. If each factor’s AVE is larger than the square of its correlations with other factors, suggesting its items share more common variance with the underlying factor than any variances the construct shares with other constructs (Fornell & Larcker, 1981), discriminant validity is then demonstrated. Further, if the confidence interval does not contain 1, then discriminant validity is also demonstrated (Anderson & Gerbing, 1988; Barua, Konana, Whinston, & Yin, 2004). All statistics demonstrate good discriminant validity.

IS Outsourcing Management Competence First Order Dimensions  
(CFA loadings, T-Values, AVE and Composite Reliability)

Factors	Items	Loadings	T-Value	AVE	Reliability
F1	INFORB1	0.82	13.47	0.74	0.90
	INFORB2	0.88	14.99		
	INFORB3	0.88	14.91		
F2	INFORB4	0.85	14.22	0.78	0.88
	INFORB8	0.92	16.04		
F3	INFORB5	0.92	16.27	0.86	0.92
	INFORB7	0.93	16.42		
F4	CONM1	0.74	11.53	0.73	0.89
	CONM5	0.89	15.2		
	CONM6	0.93	16.35		
F5	VENM2	0.92	16.04	0.89	0.94
	VENM3	0.97	17.31		
F6	CONM3	0.92	15.86	0.88	0.94
	CONM4	0.96	16.89		
F7	CONF1	0.65	9.73	0.70	0.87
	CONF2	0.92	15.91		
	CONF3	0.91	15.62		
F8	CONF4	0.86	12.19	0.67	0.80
	CONF5	0.77	10.79		
F9	VENM4	0.78	12.22	0.70	0.87
	VENM5	0.86	14.08		
	VENM1	0.86	14.22		

**Note:** All factors have reasonable loadings (i.e., good convergent validity), AVEs and composite reliabilities. F1: purchasing personnel source competence based on both business and technological needs, F2: IS service market analysis, F3: sourcing leadership, F4: existing contract execution, F5: contract development/enhancement, F6: IS supplier accountability of evolving IS market, F7: contract facilitation from both user, F8: contract facilitation from IS function point of views, and F9: strategic vendor development.

IS Outsourcing Management Competence First Order Dimensions: AVE and Square Correlations

AVE and Square Correlations	F1	F2	F3	F4	F5	F6	F7	F8	F9
F1	<b>0.74</b>								
F2	0.66	<b>0.78</b>							
F3	0.42	0.77	<b>0.86</b>						
F4	0.16	0.27	0.23	<b>0.73</b>					
F5	0.08	0.11	0.10	0.52	<b>0.89</b>				
F6	0.14	0.23	0.16	0.40	0.32	<b>0.88</b>			
F7	0.23	0.20	0.26	0.17	0.08	0.21	<b>0.70</b>		
F8	0.31	0.24	0.15	0.18	0.14	0.14	0.12	<b>0.67</b>	
F9	0.31	0.25	0.19	0.21	0.21	0.24	0.16	0.35	<b>0.70</b>

**Note:** All AVEs are higher than square correlations even though the square of F2-F3 correlation (0.77) is close to the AVE F2 (0.78).

## IS Outsourcing Competence First Order Dimensions: Correlations and Confidence Intervals.

Correlations, 95% confidence Intervals	F1	F2	F3	F4	F5	F6	F7	F8	F9
F2	0.81	1.00							
UL	0.89								
LL	0.73								
F3	0.65	0.88	1.00						
UL	0.75	0.94							
LL	0.55	0.82							
F4	0.40	0.52	0.48	1.00					
UL	0.54	0.64	0.60						
LL	0.26	0.40	0.36						
F5	0.28	0.33	0.32	0.72	1.00				
UL	0.42	0.47	0.46	0.80					
LL	0.14	0.19	0.18	0.64					
F6	0.38	0.48	0.40	0.63	0.57	1.00			
UL	0.52	0.60	0.54	0.73	0.67				
LL	0.24	0.36	0.26	0.53	0.47				
F7	0.48	0.45	0.51	0.41	0.29	0.46	1.00		
UL	0.60	0.59	0.63	0.55	0.43	0.58			
LL	0.36	0.31	0.39	0.27	0.15	0.34			
F8	0.56	0.49	0.39	0.43	0.38	0.37	0.35	1.00	
UL	0.68	0.63	0.53	0.57	0.52	0.51	0.51		
LL	0.44	0.35	0.25	0.29	0.24	0.23	0.19		
F9	0.56	0.50	0.44	0.46	0.46	0.49	0.40	0.59	1.00
UL	0.68	0.62	0.58	0.60	0.58	0.61	0.54	0.71	
LL	0.44	0.38	0.30	0.32	0.34	0.37	0.26	0.47	

**Note:** It is found that no interval contains 1, which demonstrates discriminant validity.

**Appendix 2: Measurement Items And Dimensions Used In The Large Scale Study**

<b>Items</b>	<b>Business needs-based IS sourcing competence (F1)</b>
INFOB1	IS purchasing personnel have the capability to select the right IS sourcing strategy (F1)
INFOB2	IS purchasing personnel make decisions based on business needs (F1)
INFOB3	IS purchasing personnel understand the firm's technological criteria (F1)
	<b>IS service market analysis (F2)</b>
INFOB4	IS purchasing personnel analyzes the externally available IS/IT services (F2)
INFOB8	IS purchasing personnel understand the internal IS service options (F2)
	<b>IS purchasing personnel-IS sourcing leadership (F3)</b>
INFOB5	IS purchasing personnel lead tendering process in IS outsourcing (F3)
INFOB6	IS purchasing personnel lead contracting process in IS outsourcing (deleted)
INFOB7	IS purchasing personnel lead service management process in IS outsourcing (F3)
	<b>Existing contract execution (F4)</b>
CONM1	There are processes to ensure that all IS outsourcing agreements are met and protected at all times.
CONM2	IS suppliers are held accountable on existing contracts (deleted)
CONM5	There are reports highlighting IS suppliers' achievement against industry benchmarks (F4)
CONM6	There are reports highlighting IS suppliers' achievement against standards in the contracts. (F4)
	<b>Contract development and enhancement (F5)</b>
VENM2	There are annual meetings with IS suppliers to develop new IS outsourcing. (F5)
VENM3	There are annual meetings with IS suppliers to enhance current IS outsourcing. (F5)
	<b>IS supplier accountability for evolving IS market (F6)</b>
CONM3	IS suppliers are held accountable on the developing standards in IS services market. (F6)
CONM4	IS suppliers are held accountable on the evolving IS functionality in IS services market. (F6)
	<b>Contract Facilitation-User perspective (F7)</b>
CONF1	User functions have a single point of contact provided by IS function in IS outsourcing process
CONF2	User functions are confident that conflicts in IS outsourcing will be resolved fairly by IS function
CONF3	User functions are confident that conflicts in IS outsourcing will be resolved promptly by IS function (F7)
	<b>Contract Facilitation-IS function Perspective (F8)</b>
CONF4	IS function facilitates the contracting process between user functions and the IS suppliers (F8)
CONF5	IS function coordinates activities between users and the IS suppliers (F8)
	<b>Strategic Vendor Development (F9)</b>
VENM1	There are efforts to explore the potential to create win-win situations for both your business unit and IS suppliers (F9)
VENM4	There are efforts to make IS suppliers understand your business unit's operations and processes.
VENM5	There are efforts to grow with your IS suppliers over time. (F9)

<b>IOS Use Depth</b>	
ISUD1	Your IS applications transfer files to your partner's application automatically (Deleted)
ISUD2	Your partner's IS applications transfer files to your IS applications automatically(Deleted)
ISUD3	Your IS applications and your partner's applications can communicate with each other automatically. (Deleted)
ISUD4	Your IS applications can directly access the data base in your partner's computer systems
ISUD5	Your partner's IS applications can directly access the data base in your computer systems
<b>IOS Use Diversity</b>	
ISUDIV1	Purchasing personnel exchange data in electronic form with the partner (Deleted)
ISUDIV2	Engineering personnel exchange data in electronic form with the partner
ISUDIV3	Quality personnel exchange data in electronic form with the partner
ISUDIV4	Production control personnel exchange data in electronic form with the partner
ISUDIV5	Transportation personnel exchange data in electronic form with the partner(Deleted)
ISUDIV6	Payment personnel exchange data in electronic form with the partner (Deleted)
<b>IOS Use Volume</b>	
ISUV1	A high percentage of the total transactions with the partner is conducted through the IS
ISUV2	A large number of documents associated with the partner are exchanged through the IS
All the above items have a scale from 1 to 7 with 1 being strongly disagree, 4 being neutral, and 7 being strongly agree.	
<b>Sales</b>	
The average annual sales \$(in millions) for your business unit: 1 means less than 10, 2 means between 10-49.9, 3 means between 50 and 99.9, 4 means between 100 and 499.9, 5 means 500 and 1 billion, 6 means over 1 billion.	

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