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THE ENABLING ROLE OF ELECTRONIC INTEGRATION AND ABSORPTIVE CAPACITY ON INTERORGANIZATIONAL COST MANAGEMENT IN SUPPLY CHAINS

General Topics

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Abstract

The need to remain competitive is driving firms to increasingly seek competitive advantages by collaborating more intensely with their partner firms. One aspect of collaboration between firms is interorganizational cost management, where the focus is on specifically managing costs from both a focal firm and a partner firm perspective. This study integrates literature from the information systems, managerial accounting, and operations management fields to create a multi-disciplinary view of interorganizational cost management (IOCM) as an IT-enabled organizational capability. We develop a research model that focuses on both the antecedents (electronic integration, absorptive capacity, and internal cost management) and the consequences (benefits) of IOCM. Our model is tested from a sample of managerial accountants who work in firms that are a part of a supply chain. The results show that IOCM leads to specific firm benefits for the focal firm, and that electronic integration and a firm's absorptive capacity for IOCM are both direct antecedents to the IOCM capability.

Keywords: Interorganizational information systems; supply chain partnerships; cost management; strategic cost management.

Introduction

In today's global and competitive economic environment, effective management by an individual firm of its supply chain has become a common and accepted method of improving overall firm performance. The intense focus by firms on supply chain management has resulted in firms achieving a high level of integration among their suppliers and customers, resulting in the sharing of information at the transactional level (e.g. Vickery et al. 2003). Advances in information systems (IS) such as electronic data interchange and enterprise resource planning systems have enabled this integration among suppliers and customers, which has resulted in incremental improvements in efficiencies. However, many firms are not satisfied with the incremental improvements associated with supply chain integration and instead seek more transformational improvements by leveraging partnerships within the supply chain. These partnerships and strategic alliances go beyond the transactional cost focus on operational efficiencies

and are driven by joint strategic and social resource needs and opportunities in order to pursue higher-order goals such as gaining new competencies through joint learning, gaining market power, creating legitimacy, and moving more quickly into new markets and technologies (Eisenhardt and Schoonhoven 1996). According to Eisenhardt and Schoonhoven (1996), the transition from a purely transactional focus to a more strategic focus is based on strategic aspects such as cooperation, collaboration, the sharing of information, and the generation of common knowledge. One specific type of information sharing that can have a strategic impact is the identification of joint cost-reduction opportunities, which is the domain of interorganizational cost management (Cooper and Slagmulder 2004).

Interorganizational cost management (IOCM) refers to a set of practices for cost management that spans organizational boundaries in order to jointly reduce costs and enhance a firm's strategic position (Cooper and Slagmulder 1998a, 2004). In a cost management context, typical supply chain integration benefits are in the transactional area of cost management, such as efficiency gains in the order entry and inventory management systems. However, in addition to the transactional focus, IOCM has more strategic implications and includes identifying ways of reducing cost and increasing revenues through activities such as joint product development and joint interorganizational cost investigations (Cooper and Slagmulder 2004).

The IS discipline has focused on information technology (IT) capabilities (e.g. Bharadwaj 2000) and on linking IT capabilities to firm performance (e.g. Kohli and Devaraj 2003). However, the link between IT and firm performance is often tenuous, with other intermediate organizational or managerial capabilities recognized as mediating the relationship (Barua and Mukhopadhyay 2000; Sambamurthy et al. 2003). For example, Tanriverdi (2005) positions knowledge management as the organizational capability through which IT influences firm performance. Similarly, Vickery et al. (2003) examine a customer management capability enabled by integrative information technologies, while Droge et al. (2004) study operational management capabilities enabled by IT. In our study, IOCM represents a type of managerial capability enabled by a firm's IT capabilities.

Our study takes a multidisciplinary approach in the identification of IOCM as a managerial capability enabled by IT. As early as the 1980s, the IS literature (e.g. Barrett and Konsynski 1982) has recognized the importance of interorganizational information systems in enabling cost reductions and productivity improvements. The IS literature positions information technology as a facilitator of interorganizational coordination at the transaction level (e.g. Short and Venkatraman 1992; Venkatraman 1994; Ramamurthy et al. 1999; Barua et al. 2004). Similarly, operations management (OM) researchers have recognized the role of information systems in interorganizational, supply chain coordination (e.g. Handfield and Nichols 1999; Ellram and Zsidisin 2002; Vickery et al. 2003). The accounting field focuses on the discipline of cost management; however, it has recognized the lack of accounting studies that focus on the effects of integrated, enterprise-wide information systems on management accounting (Granlund and Malmi 2002). Additionally, all three fields (IS, OM, and accounting) have separately identified various environmental conditions (which we call IOCM absorptive capacity in this study) that facilitate the interorganizational collaboration and sharing of information (e.g. Barua et al. 2004; Mouritsen et al. 2001; Kelle and Akbutlut 2005; Tu et al. 2005).

Our study integrates concepts from the three disciplines of IS, OM, and accounting and builds a nomological network that positions IOCM as an IT-enabled capability that can lead to firm benefits. The research questions in this study are:

- 1) Is electronic integration an antecedent of IOCM?
- 2) What are other important antecedents of IOCM?

Specifically, we address the research questions by empirically analyzing the antecedents of IOCM by developing a research model linking a firm's *electronic integration*, a firm's *absorptive capacity* for interorganizational cost management, and a firm's existing *internal cost management practices* as the key enablers of IOCM, which is an organizational capability through which a firm can derive strategic benefits.

The paper is organized as follows. First, we examine the extant literature on IOCM in a supply chain context. Second, we develop the theoretical foundations and the associated hypotheses for the antecedents (electronic integration, absorptive capacity, internal cost management) and consequences (benefits) of IOCM. Next, we test this model in a pilot study through a survey of management accountants working in supply chain environments. Finally, we conclude by discussing how our findings contribute to theory development and to practical applications.

Interorganizational Cost Management

A fundamental concept of supply chain management is that organizations must look beyond their own boundaries to consider relationships with suppliers and customers along the value chain (Berry and Ahmed 1997). For most of the 20th century, the norm for inter-firm behavior has been of autonomous firms engaging in arm's length transactions with other firms (Cullen et al. 1999). This arms-length or independent focus by firms has made it difficult to take advantage of any cost-reduction synergies that exist between partner firms. These cost-reduction synergies require additional coordination mechanisms to extend cost-management programs beyond organizational boundaries, with the overall objective of finding lower-cost solutions than would be possible if the firm and its customers and suppliers attempted to reduce costs independently (Cooper and Slagmulder 1998a).

IOCM has emerged in the management accounting field as a term referring to a portfolio of strategic management accounting practices that are specifically targeted at optimization and integration of cost management systems in order to jointly reduce costs in the value chain and enhance a firm's strategic position by means of information sharing (Cooper and Slagmulder 1998a, 2004). Examples (while not exhaustive) of accounting practices commonly included in IOCM are target costing, kaizen costing, and open book accounting. Target costing focuses on the management of the development and design processes of a firm (Monden and Sakurai 1989). Kaizen costing is a system of incremental and continuous improvements to support the cost reduction process of a product in the manufacturing phase (Monden and Hamada 1991). Open book accounting refers to the practice of partners within a supply chain opening up their internal accounting information to each other in order to support active collaboration and partnership (Berry and Ahmed 1997). While these three examples can also be considered internal cost management practices, what brings them into the realm of IOCM is the active involvement of both a focal firm and a partner firm jointly participating in these practices for mutual benefits.

A common thread among IOCM practices is information sharing. In fact, Coad and Cullen (2006, p. 2) identify information sharing as "central to the concept of IOCM" and as enabling "partner organisations to learn skills and identify cost reduction and value creating opportunities, as the glue that binds collaborating organisations together, as a means of reducing uncertainty, and as a basis for sustaining and renewing inter-organisational relationships." Cooper and Slagmulder (2004) further explore the processes that enable firms to collaborate effectively and share information. Several other specific forms of information sharing have been identified as salient in supply chain integration, including the sharing of real-time information about material flow and the sharing of real-time documents, collaborative forecasting and planning processes, and the automation of processes such as order entry, shipping, and billing (Marquez et al. 2004).

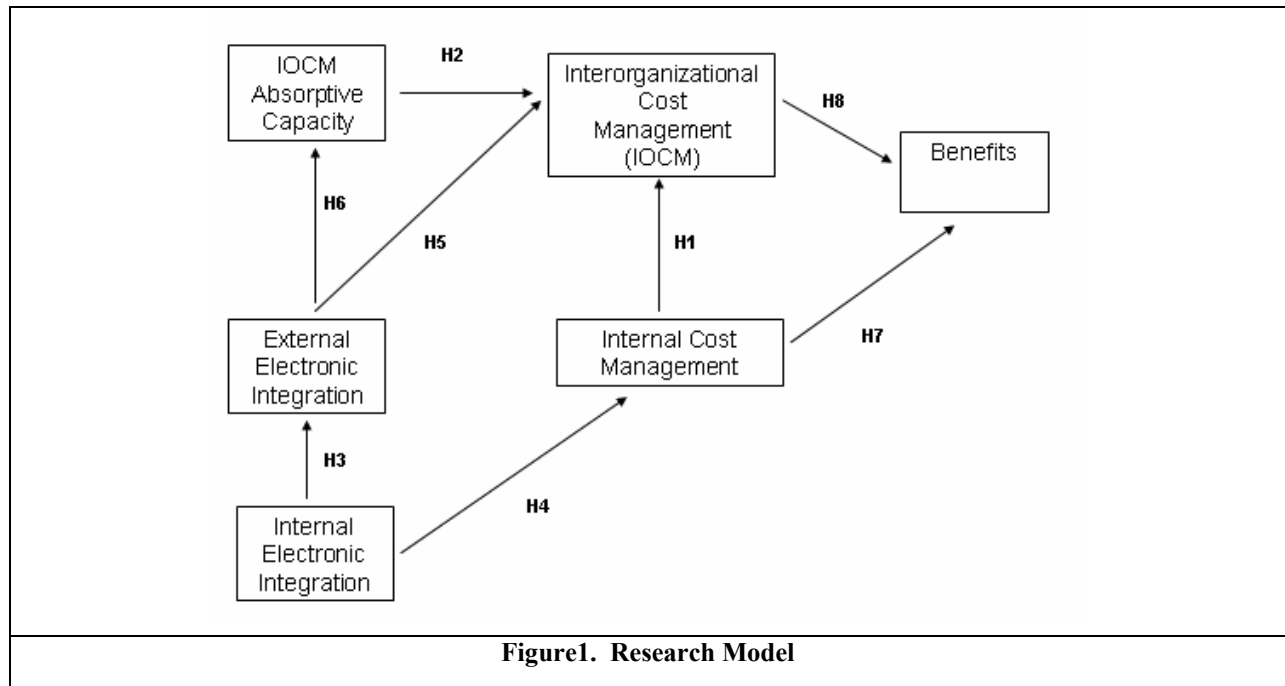
The OM and IS literature also emphasizes the benefits (both overall and long-term) achieved by all parties along the supply chain through cooperation and information sharing (Yu et al. 2001). This information sharing can take the form of including customer requirements in the new product development (NPD) process (e.g. Griffin and Hauser 1996), as well as including supplier integration in the NPD process (e.g. Primo and Amundson 2002). Furthermore, Malhotra et al. (2005) identify the breadth of information exchange as having an impact on leveraging interorganizational partnerships and specifically identify information related to market demand and forecasts, demand shifts and changes in customer preferences, and the sharing of future plans such as long-term production plans and capital investments. In summary, the IOCM construct is multi-faceted, but the common, underlying theme is the interorganizational sharing of cost information for mutual benefit.

Antecedents and Benefits of IOCM

Much of the previous research on IOCM has been qualitative case studies (e.g. Mouritsen et al. 2001; Dekker and Van Goor 2000; Cooper and Slagmulder 2004). Despite the lack of quantitative studies addressing IOCM, several of the case studies have suggested possible antecedents. Mouritsen et al. (2001) identify two important prerequisites for open book accounting to be effectively implemented between partners: 1) a highly developed sense of trust between partners (which is a component of this study's absorptive capacity construct) and 2) a system by which information is actively shared (which is related to our study's electronic integration construct). Cullen et al. (1999) in a case study of three firms identify the quest for continuous improvements as the driving force for adopting IOCM practices (and is related to the knowledge seeking aspect of absorptive capacity).

Drawing from the qualitative work in the literature, our research categorizes the antecedents of IOCM into three primary areas: 1) internal cost management capabilities of the focal firm, 2) electronic integration among supply

chain partners, and 3) the absorptive capacity for interorganizational cost management partnership by the focal firm. Previous research has shown that IT is an enabler of supply chain effectiveness (e.g. Handfield and Nichols 1999). In our research model (Figure 1), IOCM is enabled by electronic integration. Although having electronic integration in place will enhance a firm's IOCM capabilities, it is not sufficient. Environmental factors will also impact the development of capabilities. Barua et al. (2004) cite the importance of the environmental factor of partner readiness as affecting the development of interorganizational capabilities. Kelle and Akbulut (2005) succinctly describe the environmental conditions that affect the coordination among firms in a supply chain to include the trust between partners and the knowledge of personnel. Therefore, we measure these environmental characteristics in the overarching construct of *IOCM Absorptive Capacity*, which is a measure of the ability and readiness of a firm's personnel to recognize the value of new information, assimilate it, and apply the new information to the business in the context of cost management.



Internal Cost Management

Internal cost management refers to the extent to which a firm has implemented various cost management strategies and practices *within* a firm in order to guide current and future operations toward specific objectives. Cost management uses the information from cost accounting systems in order to understand the nature and behavior of costs in managing firm resources (Stenzel and Stenzel 2003). From the Coad and Cullen (2006) perspective, ICM is a capability that captures cost management skills and knowledge and supports the evolution to IOCM. As firms gain more internal expertise within in area, the next step is to move beyond the internal boundaries of the firm and take an external perspective (Cooper and Slagmulder 1998b). Therefore, we posit:

H1: There is a positive relationship between internal cost management and interorganizational cost management collaboration.

IOCM Absorptive Capacity

Originating in the field of macroeconomics, the concept of absorptive capacity refers to the ability of an economy to absorb and utilize external information and resources (Adler 1965). Cohen and Levinthal (1990) adapted this macroeconomic concept to the organizational level and defined absorptive capacity as the “ability of a firm to

recognize the value of new, external information, assimilate it, and apply it to commercial ends” (Cohen and Levinthal 1990, p. 128). In Cohen and Levinthal’s view, the absorptive capacity of an organization is primarily a function of the level of prior related knowledge, as well as a function of the structure of communication between the external environment and the firm.

Following the conceptualization by Cohen and Levinthal (1990), Brown (1997) proposed that a firm’s absorptive capacity consists of three major components: prior relevant knowledge, the communications network, and the communications climate. Prior relevant knowledge provides the foundation that allows individuals to recognize the potential importance of new information (Cohen and Levinthal 1990; Brown 1997). The communications network refers to the flow of information across and within organizational boundaries (Brown 1997). The communications climate is defined as the organizational atmosphere regarding communications behavior (Putnam and Cheney 1985; Brown 1997) and is the absorptive capacity factor that measures trust. Trust has been identified as a factor upon which all inter-organizational relationships are dependent, especially with interorganizational partnerships implying a sense of sharing in knowledge, decision-making, and collective/joint rewards (Tomkins, 2001). Tu et al. (2005) use Brown’s basic three-component conceptualization of absorptive capacity and add a fourth component, knowledge scanning¹, which is defined as an organizational mechanism enabling firms to identify and capture relevant knowledge. We operationalize absorptive capacity using modified items from Tu et al. (2005) and focus on the four dimensions that lead to higher IOCM: (1) prior relevant knowledge, (2) communications network, (3) communications climate, and (4) knowledge scanning.

Although some of these dimensions would also lead to internal cost management capabilities (e.g. prior relevant knowledge and knowledge scanning), the dimensions of communications network and communications climate are both interorganizational in nature and measure the propensity of a company to engage in inter-firm relationships related to cost management. Therefore, our absorptive capacity measure is specifically targeted at IOCM (not internal cost management), and we predict:

H2: There is a positive relationship between absorptive capacity and the extent of interorganizational cost management collaboration

Electronic Integration

In our study, electronic integration refers to the ability of a firm’s IT systems to provide visibility of cost management information to employees both within the firm (internal electronic integration) and to the employees of partner firms (external electronic integration). In other words, it is the degree to which the IT systems employed throughout the firm are integrated and accessed both internally (within-firm) and externally (outside the firm). Simchi-Levi et al. (2003) highlight a staged model of IT systems maturity, where interorganizational integration follows a phase of internal integration. Our definition of electronic integration is based on Barua et al. (2004, p. 593) who define systems integration as “the extent to which a firm integrates its various IT systems to provide visibility to customer and supplier data and to allow online information sharing and transaction execution across the value chain.” While Barua et al. aggregate both internal and external integration in one construct, our study posits that each type of integration will independently impact cost management activities. Therefore, we measure both the internal and external aspects of electronic integration and predict that:

H3: There is a positive relationship between internal electronic integration and external electronic integration.

Internal Electronic Integration and Internal Cost Management: The accounting literature has recognized the importance of information systems in assisting cost accountants in the planning, controlling, and managing of cost aspects of a firm. Information technology allows cost accountants to track costs more accurately and enables the tracing of specific costs to specific activities (Moscove et al., 1999). In fact, the field of accounting information systems emerged to support the collecting, processing, and communicating of financially-oriented information to a firm’s internal parties (e.g. management) to enhance decision-making. Therefore, we posit that:

¹ Knowledge scanning is a part of the original Cohen and Levinthal concept of integrating external knowledge within the firm and is also a component of Brown’s communications network construct.

H4: There is a positive relationship between internal electronic integration and the extent of internal cost management practices.

External Electronic Integration and IOCM: Information technology has been recognized as an important enabler of interorganizational/supply chain integration, allowing multiple organizations to coordinate activities (e.g. Handfield and Nichols 1999). The presence of IT applications has been shown to be a necessary but not sufficient condition to achieve supply chain integration (Short and Venkatraman 1992; Venkatraman 1994). Malone et al. (1987, p. 488) identify an electronic integration effect, which they define as when “a supplier and a procurer use information technology to create joint, interpenetrating processes...not just to speed communication, but to change – and lead to tighter coupling of – the processes that create and use the information.”

Examples from electronic data interchange (EDI) studies have demonstrated that external electronic integration has the potential to significantly reduce the costs of interorganizational transactions (e.g. Ramamurthy et al., 1999). In an interorganizational cost management context, Ellram and Zsidisin (2002) identified cost analysis as one of the most important activities of purchasing and supply management, with many inter-firm cost management activities (such as examining supplier cost structures and encouraging suppliers to share cost data) requiring the extensive use of IT.

Additionally, IOCM activities may simply be interorganizational applications of ICM, with external electronic integration directly leading to IOCM in a similar manner as internal electronic integration is related to internal cost management.

Therefore, we posit that:

H5: There is a positive relationship between external electronic integration and the extent of interorganizational cost management collaboration.

External Electronic Integration and Absorptive Capacity: Electronic integration can also provide the infrastructure support for much of the interorganizational communications that occur between partners. Business relationships are developed and cultivated through stages of experience and trust intensities (Tomkins 2001). Because communications can be facilitated due to infrastructure support and can therefore occur more frequently, trust and the overall communications climate (two components of our study’s absorptive capacity construct) can improve as a result of electronic integration.

Electronic integration has also been studied as a direct antecedent to a firm’s absorptive capacity. Malhotra et al. (2005, p. 153) explore how firms in supply chain partnerships configure their IT infrastructure and processes to build absorptive capacity to “acquire, assimilate, transform, and exploit information resources.” Specifically, Malhotra et al. (2005) identify two distinct groups of constructs that enhance a firm’s absorptive capacity for engaging in supply chain relationships: 1) integrative interorganizational process mechanisms and 2) partner interface-directed information systems. In our study, external electronic integration focuses on partner interface-directed information systems, such as systems that integrate and process data from suppliers and/or customers and systems that allow data to be shared between firms. In general, external electronic integration enables the communications network, the communications climate, and the knowledge and knowledge-scanning activities related to IOCM. Therefore:

H6: There is a positive relationship between external electronic integration and IOCM absorptive capacity.

Benefits

The benefits of effective of internal cost management and IOCM can be divided into two components: 1) the specific benefits associated with cost management and 2) the more general firm-level benefits. The specific cost management benefits are based on the expected benefits associated with the implementation of various cost management practices, including benefits such as reducing costs associated with daily purchasing or sales transactions. In addition to the benefits directly related to cost management, a firm should also receive benefits that are more macro-level in nature. These general benefits include perception measures of a firm’s financial performance and market share growth.

It is our expectation that benefits related to the capability to manage costs both within and across organizational boundaries will increase as firms engage in more cost management processes. Therefore, we predict:

H7: There is a direct positive relationship between internal cost management and benefits.

H8: There is a direct positive relationship between interorganizational cost management collaboration and benefits.

Research Methodology

Operationalization of Constructs

In order to operationalize the empirical constructs with survey items, we examined literature from the three disciplines of information systems, operations management, and accounting. Tables A1-A6 in Appendix A provide the references used in developing the constructs.

Dependency: Although dependency is not an empirical construct included in our model of hypothesized relationships, we recognize that dependency is a control variable that must be measured. Dependency is a measure that refers to the level of dependence each firm has on its partner and vice versa. Dependency has been defined in the literature as the extent to which a target firm needs the source firm to achieve its goals (Emerson 1962; Frazier 1983; Kale 1986; Frazier et al. 1989; Andaleeb 1995). Based on the work of Emerson (1962), Andaleeb (1995, p. 159) identifies two important factors that create perceptions of dependence: 1) “the importance or criticality of the resources provided by the source firm” and 2) “the number of alternate sources available to the target firm for the needed resources.” Our construct of dependency is based on those two factors. Table A-6 provides a list of the items used in the dependency measure.

Q-sort: Prior to administering our survey, we first evaluated the survey items for reliability as prescribed by Rust and Cooil (1994), which presents guidelines for measuring the reliability of qualitative data through a “Q-sort”. This is particularly important given the fact that several of our items were reworded in order to meet our research requirement. In our initial Q-sort, we asked eight judges to read our preliminary list of 65 items and to categorize each item into 1 of 5 groups (constructs). Two of the eight judges were accounting professors who teach financial and managerial accounting. The remaining six judges were Ph.D. students in the accounting (two), management information systems (two), and operations management programs (two), i.e., two from each of the three disciplines this research spans.

The first step of the Q-sort analysis is to determine the “proportional agreement.” This is the total number of pair-wise agreements between judges across all 65 items divided by the total number of pair-wise comparisons. Next, we used the tables provided by Rust and Cooil (1994) in order to determine the proportional reduction in loss and obtained a value of 1.00, suggesting that the instrument items were reliable.

While this methodology does provide for an overall reliability of the measures based on inter-judge agreement, this methodology does not address any deviation of judgments from the predicted groupings. Therefore, we also examined each item in which there were more than three judges who did not place the item into the predicted category (12 out of 65). These 12 items were then examined and reworded to address the likely cause(s) for misclassification.

Pilot Study

The survey was targeted at managerial accountants who work in firms that are a part of a supply chain. Managerial accountants were identified as the appropriate respondent due to their focus on cost management in firms. Because management accountants are responsible for identifying, measuring, analyzing, interpreting, and communicating accounting information for management decisions, these individuals are in fact the ideal respondents to assess the forces that drive interorganizational cost management. Additionally, as targeted users of accounting information systems, managerial accountants can also assess from an end-user perspective the information systems and environmental factors (absorptive capacity) that enable interorganizational cost management.

The survey (Tables A1-A6) was administered via e-mail to 1833 individuals who are registered members of the Institute of Management Accountants (IMA) of North and South Carolina. Of the 1833 IMA members surveyed, 333 (18%) of the emails were returned as undeliverable, rejected as spam, or not immediately received because the e-mail recipient was out of the office. A total of 144 IMA members participated in the survey for an overall

response rate of 8%. Of those that responded, 95 did not work in a firm that is part of a supply chain (i.e., manufacturer, distributor, retailer, wholesaler), which left 49 responses from our desired audience.

The average age of the 49 respondents is 46, and the gender breakdown is approximately 27% female and 73% male (nine respondents did not disclose their gender). Ninety percent of the respondents reported four-plus years of college. The firm type in the survey include manufacturer (73%), distributor (13%), retailer (4%), and wholesaler (7%), with 80% of the respondents reporting their firm had annual revenue > \$10 million.

Data Analysis

To test the research hypotheses, path analysis was used. The path analysis was conducted using the SAS Calis procedure, which is a maximum likelihood method of parameter estimation. The variables used in the path analysis were obtained by deriving principal component scores for each of the empirical constructs in our model using principal components analysis.² In the cases where the empirical construct is a second order construct (i.e., absorptive capacity and dependency), we obtain a second order component scores using principal components analysis where the inputs into the analysis are the previously derived first order principal component scores.

Path analysis using component scores is the most appropriate methodology due to the formative nature of our constructs (e.g. Chenhall and Morris 1986; Rai et al. 2006). Because our constructs are formative, there is no expectation that the items should have high internal reliability or consistency (Bollen 1984; Bollen and Lennox 1991). Thus, we focused the evaluation of our constructs on their content (face) validity³. The initial development of our constructs supports the content validity because when available, we incorporated constructs and items that have already been successfully implemented in previous research. Additional construct validity is provided through the Q-sort process. Finally, our methodology for obtaining component scores for each of the constructs also provided further support for construct validity. This is primarily due to our assessment of the loadings of first order constructs before the aggregation of those first order scores to form the second order construct.

Measurement Model

The first phase of our data analysis focused on the measurement properties of the constructs. Appendix A provides the factor structure for the constructs. In all cases (first-order and second-order constructs), we used the principal components axis method and set the prior communality estimates to one, which are the options required in a principal components analysis (Hatcher 1994). When appropriate (in cases where there is more than 1 factor), we used oblique (oblimin) rotation. We selected oblique rotation over varimax⁴ because it was our expectation, based on the literature from which our items were adapted, that the components would be correlated.

The number of components retained was based on the eigenvalue-one criterion, where any components with an eigenvalue greater than 1.00 are retained (Sharma 1996). In interpreting the factor loadings, items were said to load on a component if the loading was greater than or equal to .50 (Sharma 1996). The loading of item components ranged from .55 to .97. Components were then named based on the items that loaded on it. In the cases where previous research provided insight on the expected loadings, our items loaded as predicted, thus providing additional construct validity support.

For our second order construct of absorptive capacity and the control variable of dependency, we used SAS's Proc Factor program to first obtain a component score for each of the first order constructs. These component scores are a linear combination of only the items that were found to load on that construct⁵. Next, we conducted principal

² Principal components analysis is a data reduction technique that is useful when trying to obtain a reduced number of variables in the form of scores or indexes to parsimoniously represent a much larger set of variables.

³ Due to the formative nature of the constructs, the calculation of Cronbach's alpha for our constructs is not applicable in this study (Jarvis et al. 2003).

⁴ Principal components analysis was also run with varimax on each of these components and the number of factors remained the same.

⁵ In addition to the method describe in the text, we also obtained component scores that were a linear combination of all of the items used to measure the AC construct which is referred to as a true component score according to

component analysis where the first order construct components scores were used as the measure of the first order construct in the formation of a single construct score for the second order construct. The single construct score was then used as input in the path analysis.

Based on the results of the principal components analysis, our survey items are linked to formative constructs as described in Appendix A. Overall, our constructs were formed as predicted, with the few exceptions noted in Appendix A. Our empirical model includes the following constructs, with dependency as a control variable:

1. Absorptive Capacity
2. Internal Electronic Integration
3. External Electronic Integration
4. Internal Cost Management
5. Interorganizational Cost Management
6. Firm Benefits

The correlation among these constructs is presented in Table 2.

	AC	IOCM	ICM	BEN	Ext EI	Int EI
AC	1.0000					
IOCM	0.5349*	1.0000				
ICM	0.1569	0.1146	1.0000			
BEN	0.3240*	0.5361*	0.4051*	1.0000		
Ext EI	0.4885*	0.5083*	0.3000*	0.4842*	1.0000	
Int EI	0.3364*	0.1937	0.3788*	0.2821*	0.4559*	1.0000
Key:	AC	Absorptive Capacity				*p < .05
	IOCM	Interorganizational Cost Management				
	ICM	Internal Cost Management				
	BEN	Benefits				
	Ext EI	External Electronic Integration				
	Int EI	Internal Electronic Integration				

Structural Model

Path analysis with SAS’s Proc Calis was used to assess the structural portion of the model. Goodness-of-fit measures were used to indicate an acceptable fit between the model and the data. Our model has a Goodness of Fit Index (GFI) of .945, a normed fit index (NFI) of .905, and a comparative fit index (CFI) of .999. Model fit is also assessed by a Chi-square test. Our model has a Chi-square value of 11.08 with 11 degrees of freedom and a p-value of .436. This value does not allow us to reject the null hypothesis that the proposed model is a good fit to the data. Taken together with each of our fit indices meeting or exceeding the desired level of .90 (Bentler and Bonnett 1980; Bentler 1989; Hatcher 1994), we conclude that our model provides a good fit to the data.

Results

Figure 2 shows the results of the path analysis. This figure presents standardized path coefficients for our model, the accompanying (t-statistics), and a summary of the results of our hypotheses.

Hatcher (1994). The component scores for both methods were very similar and did not affect any of our empirical findings.

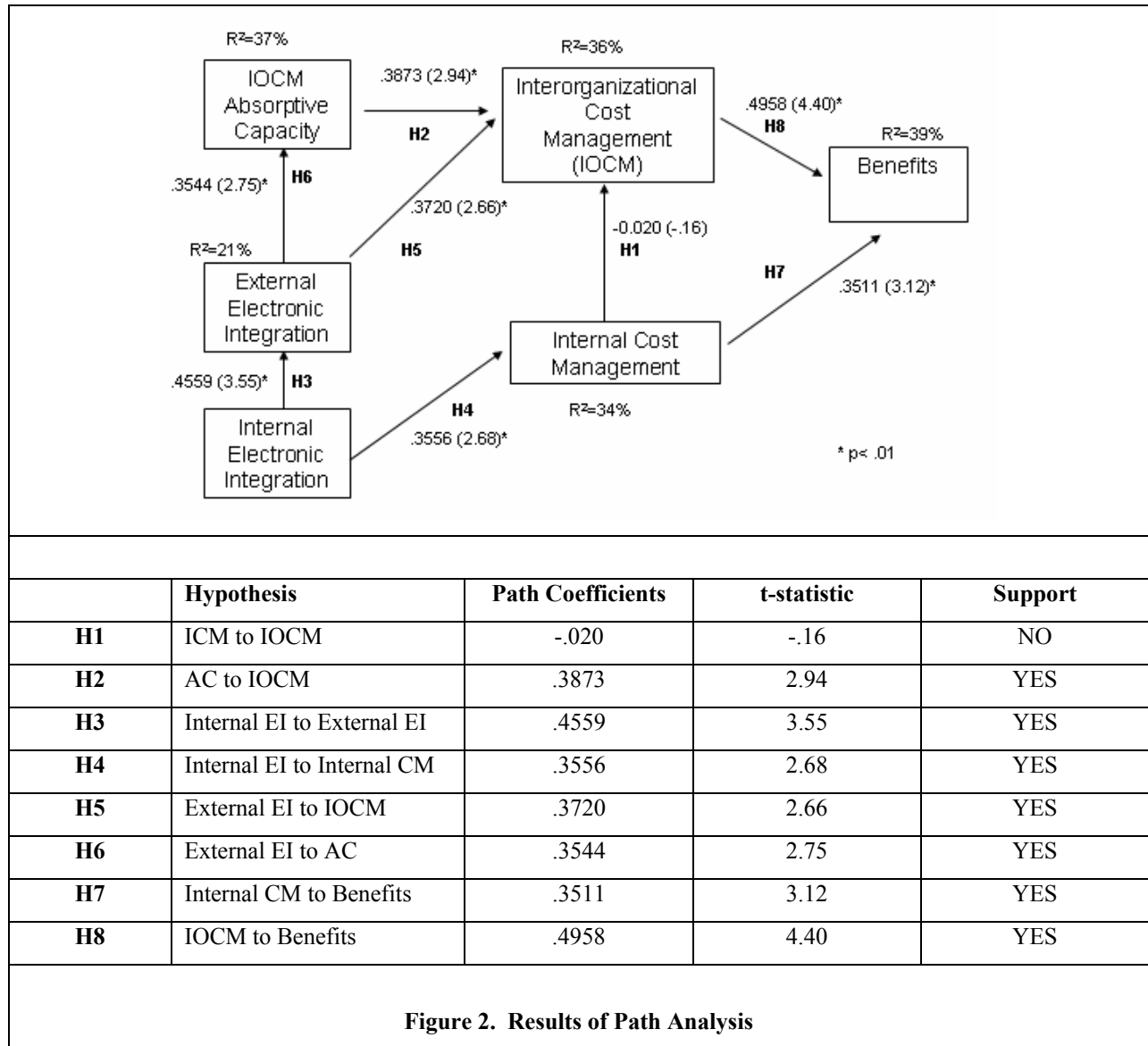


Figure 2. Results of Path Analysis

Hypothesis 1: In evaluating our initial hypothesis, we find that the use of internal cost management practices does not appear to be a precursor to the use of IOCM. This finding fails to support Hypothesis 1.

Hypothesis 2: Our second hypothesis, which predicts a positive relationship between absorptive capacity and IOCM, is supported with a standardized coefficient of .3873 and a t-statistic of 2.94. This supports our belief that firms possessing the environmental factors embodied by IOCM absorptive capacity (knowledge, communications network, and communications climate) facilitates or enables IOCM.

Hypothesis 3: Next, we find support for Hypothesis 3, which predicts a positive relationship between internal electronic integration and external electronic integration. This is supported with a standardized coefficient of .4559 and a t-statistic of 3.55. This supports our belief that internal, within-firm electronic integration sets the stage for external, between-firm electronic integration.

Hypothesis 4: The fourth hypothesis predicts a positive relationship between internal electronic integration and internal cost management. This path has a standardized coefficient of .3556 and a t-statistic of 2.68. This supports our expectation that a firm’s level of internal cost management is dependent on the degree to which the firm’s internal information systems are integrated.

Hypothesis 5: The fifth hypothesis predicts a positive relationship between external electronic integration and IOCM. This relationship is supported with a standardized coefficient of .3720 and a t-statistic of 2.66. This supports the hypothesis that electronic integration is indeed an enabling factor for IOCM.

Hypothesis 6: The sixth hypothesis predicts a positive relationship between the degree of a firm's external electronic integration and absorptive capacity. Thus Hypothesis 6 is supported with a path coefficient of .3544 and a t-statistic of 2.75. Support for this hypothesis suggests that the external integration between the partners leads to greater trust, a more effective communication environment, and the necessary communication network to support IOCM.

Hypothesis 7 and Hypothesis 8: Our final test of the hypotheses focuses on the impact of cost management practices on perceived firm benefits. Hypothesis 7, which predicts that high levels of ICM will lead to perceived benefits, is supported by a path coefficient of .3511 with a t-statistic of 3.12. Hypothesis 8, which predicts that high levels of IOCM will lead to perceived firm benefits, is also supported with a path coefficient of .49588 and a t-statistic of 4.40. Taken together, firms clearly perceive that they are benefiting from both intra-organizational and inter-organizational cost management.

Discussion

Overall, our results suggest that electronic systems integration and absorptive capacity play an important role in determining interorganizational cost management practices in a firm, which in turn results in firm benefits.

Internal Cost Management: Although it seems intuitive that a firm emphasizing internal cost management practices could easily mature to engage in inter-firm cost management, the non-support of H1 demonstrates there are perhaps other factors that affect the relationship between ICM and IOCM. While we were able to capture the focal firm's knowledge of ICM, we were not able to assess the partner firm's ICM level, which may have played a role in the non-support of H1. Future work may also investigate possible moderating factors in the relationship between ICM and IOCM.

Absorptive Capacity: One result of our study that may be particularly of interest to practitioners is the role of a firm's absorptive capacity in influencing IOCM. Our study provides empirical support that absorptive capacity does indeed enable the interorganizational cost management capabilities of a firm. This suggests that the somewhat intangible factors of absorptive capacity, such as employee knowledge, trust, the communications climate and the communications network between firms, are important enablers of extending cost management practices beyond the walls of a single firm. By focusing on these intangible factors, managers can set the stage for IOCM.

Electronic Integration: The role of information technology infrastructure has long been recognized as an enabler of business capabilities (e.g. Broadbent et al. 1999). Our study provides further support of IT enabling yet another business capability, IOCM. We find that external electronic integration directly enables AC and IOCM, while internal electronic integration enables internal cost management. The influence of electronic integration on absorptive capacity factors like knowledge sharing and the communications climate can help practitioners understand the value of IT in setting the stage for interorganizational relationships.

Benefits: The results of this research provide additional support for the importance of employing cost management practices both within the organization and beyond the boundaries of the organization and the enabling factors that make this feasible. The benefits of interorganizational cost management range from operational cost-saving strategies to strategic benefits such as new business opportunities and increased levels of product and service innovation.

Limitations and Future Research

A primary limitation of this research is the size of our sample (49). Path analysis is a large-sample procedure and is best used in situations where the sample size is at least 200 (Hatcher 1994). However, despite the small sample size, we were able to find significant results and support the validity of our constructs through the use of principal components analysis. We plan on extending this research by collecting additional data in order to continue testing our model.

Another limitation of this research is its reliance on one source from each firm in providing responses for all the variables. Ideally we would like to have multiple respondents from each firm to minimize any bias resulting from a common source.

One weakness of survey methodology is that the nature of a cross-sectional survey makes interpreting the temporal nature of the constructs difficult. Nevertheless, our use of path analysis provides support for the direction of the predicted relationship.

Our study has the focal firm's perspective of a dyadic relationship between the focal firm and a partner firm, which is another possible limitation. We measured directly one side of the relationship between a focal firm and its partner firm, and measured the partner firm indirectly through the focal firm's perspective. Future studies might take a dyadic perspective, which would directly measure both the focal firm and the partner firm and allow two perspectives of the supply chain relationship.

The absorptive capacity aspect of cost management is a ripe area for future research in collaborative supply chains. The underlying constructs of absorptive capacity (communications climate [including trust], communications network, and knowledge) can be further explored in an interorganizational cost management context.

A final area for future research is to further explore the specific types of IT that supports IOCM. Our research demonstrates that electronic integration in general is an antecedent to IOCM. Future research might explore the repertoire of interorganizational systems that best facilitate IOCM.

Conclusion

The results of our pilot study demonstrate a direct link among external electronic integration and absorptive capacity and IOCM. Through our multi-disciplinary approach of drawing from the literature of IS, OM, and accounting, we were able to develop a richer understanding of IOCM as an IT-enabled managerial capability.

Our results have several implications for practice. We have provided empirical support that collaboration between firms on cost management issues can result in tangible benefits, which can encourage more firms to participate in IOCM practices. Our results can also be extended to practice by providing specific areas a firm can focus on to improve its IOCM capability. Specific examples include focusing on electronic integration between firms, improving the cost management knowledge of employees, developing the communications climate (e.g. trust) between firms, and increasing the amount of communications interactions, all of which can result in firm benefits that are both operational and strategic in nature.

From a theoretical perspective, our study provides a framework for understanding the drivers of IOCM, utilizing the theoretical construct of absorptive capacity and providing a concrete example of the concept in a managerial accounting context. Furthermore, our study adds to the IT and firm performance literature by identifying IOCM as an IT-enabled capability that can lead to firm benefits.

This study provides initial support that IOCM leads to recognizable, tangible benefits for firms in today's highly competitive environment. The results provide empirical support in identifying and understanding the direct and indirect factors such as IT and absorptive capacity that facilitate IOCM. We plan to continue this research by collecting additional data in order to further validate our model.

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Appendix A: Summary Analysis of the Measurement Model: Factor Structure^a, Composite Reliability^b, and Average Variance Extracted^c

Tables A-1 – A-6 provide the results of the principal components analysis for the constructs in the research model and also include the composite reliability and average variance extracted calculations for the constructs.

Overall, our constructs were formed as predicted with the following exceptions:

1. Absorptive capacity items that were expected to load separately as “working knowledge” and “knowledge seeking,” loaded together under one factor called knowledge (Table A-1).
2. Three items from internal cost management (ICM 3, ICM 5, and ICM 6 from Table A-5) were dropped because they did not load on either IOCM or ICM.
3. The kaizen costing item of IOCM (Item IOCM 4 – Table A-4) was dropped because it did not load on either IOCM or ICM.

Notes for Tables A-1-- A-6:

- a. Rotated factor solution is based on principal component analysis with an oblique (oblimin) rotation. All loadings above .50 are kept.
- b. Internal consistency was measured by calculating the composite reliability as proposed by Fornell and Larcker (1981) using the formula:

$$\text{Composite reliability} = (\sum L_i)^2 / ((\sum L_i)^2 + \sum \text{Var}(E_i))$$

where

L_i = the standardized factor loadings for the factor

$\text{Var}(E_i)$ = the error variance associated with the individual indicator variables.

- c. Average variance extracted (AVE) is calculated using the formula:

$$\text{AVE} = \sum L_i^2 / (\sum L_i^2 + \sum \text{Var}(E_i))$$

where

L_i = the standardized factor loadings for the factor

$\text{Var}(E_i)$ = the error variance associated with the individual indicator variables.

- d. Item was dropped because it did not meet the cut-off criteria of .50.

Latent Construct	Variable	Absorptive Capacity	Origin of Items in Scale	Factor Structure and Loadings		
				Communications Climate	Knowledge	Communications Network
Working Knowledge	KN-1	Our firm's employees are knowledgeable about the characteristics of operational costs in our firm.	Tu et al. 2005	0.0024	0.7495	0.2496
Knowledge Scanning	KN-2	Our firm's employees seek to learn from cost information to improve our business activities.	Tu et al. 2005	-0.0753	0.9170	-0.0761
Knowledge Scanning	KN-3	Our firm's employees seek to learn from benchmarking the best cost management practices in our industry.	Tu et al. 2005	0.0345	0.7203	-0.3749
Communications Network	CN-1	The communications between our firm and our partner firm are FREQUENT.	Tu et al. 2005	0.0952	0.0183	0.8675
Communications Network	CN-2	The communications between our firm and our partner firm are EXTENSIVE.	Tu et al. 2005	-0.0556	-0.0957	0.9049
Communications Climate	CC-1	The employees in our firm and in our partner firm tend to trust each other.	Tu et al. 2005	0.8883	-0.1070	-0.0398
Communications Climate	CC-2	Our firm and our partner firm have a very open communications environment.	Tu et al. 2005	0.8611	-0.1058	0.1126
Communications Climate	CC-3	The employees in our firm and our partner firm are willing to SHARE ideas freely with each other.	Tu et al. 2005	0.6229	0.2802	0.3524
Communications Climate	CC-4	The employees in our firm and our partner firm are willing to ACCEPT new ideas from each other.	Tu et al. 2005	0.6961	0.2925	0.2591
Communications Climate	CC-5	Our firm is confident that our partner firm can maintain commitments without constant reminders or monitoring.	Stuart and McCutcheon, 2000	0.7461	0.0806	-0.0946
Communications Climate	CC-6	The employees in our firm and our partner firm both deal with each other fairly.	Dyer, 1997	0.9271	-0.1317	-0.1318
		Average Variance Extracted		63.66%	64.05%	78.57%
		Composite Reliability		0.9112	0.8408	0.8799

Variable	Electronic Integration	Origin of Items in Scale	Factor Structure and Loadings	
			Internal Electronic Integration	External Electronic Integration
IEI-1	Our firm's information systems allow continuous monitoring of order status at various stages in the process (e.g. manufacturing, shipping)	Barua et al. 2004	0.7841	0.1515
IEI-2	Data can be shared easily among various internal systems (e.g. forecasting, production, manufacturing, shipment, finance, accounting, etc.)	Barua et al. 2004	0.8827	0.0622
IEI-3	Order changes are automatically reflected in downstream processes or systems (e.g. inventory, manufacturing resource planning, and manufacturing systems.)	Barua et al. 2004	0.8948	-0.1792
IEI-4	Employees are able to retrieve information from various databases for decision support (e.g. cost information, reporting tools.)	Barua et al. 2004	0.7338	0.1882
EEI-1	Our systems can easily transmit, integrate, and process data from suppliers and/or customers.	Barua et al. 2004	-0.0939	0.8809
EEI-2	Our firm's operational systems can easily be connected to our partner firm's operational systems, allowing data to be shared easily between firms.	New	0.0806	0.8629
EEI-3	Our firm and our partner firm have the technical systems to facilitate information exchange across firm boundaries.	New	0.1389	0.8298
	Average Variance Extracted		68.32%	73.63%
	Composite Reliability		0.8955	0.8933

Variable	Due to our firm's interorganizational cost management practices with our partner firm:	Reference	Factor Structure and Loadings
BEN -1	... our firm has been able to reduce costs associated with day-to-day purchasing or sales transactions.	Barua et al., 2004; Poston Grabski 2001; Mitra and Chaya 1996	0.7618
BEN -2	... our firm has been able to reduce costs through the streamlining of inter-firm processes.	Ramos 2004	0.7554
BEN -3	... our firm has been able to reduce costs through reducing uncertainty about market information.	Barua 2004; Marquez 2003	0.8349
BEN -4	... our firm has been able to decrease response time to market changes.	Hartung and MacPherson, 2000	0.7648
BEN -5	... our firm has been able to identify new business opportunities.	Hartung and MacPherson, 2000;	0.6348
BEN -6	... our firm's market share growth has increased.	Marchand, Kettinger, and Rollins, 2001	0.8669
BEN -7	... our firm's financial performance has increased.	Marchand, Kettinger, and Rollins, 2001	0.8280
BEN -8	... our firm has improved our level of product and service innovation.	Marchand, Kettinger, and Rollins, 2001	0.7423
	Average Variance Extracted		60.30%
	Composite Reliability		0.9234

Table A-4. Inteorganizational Cost Management			
			Factor Structure and Loadings
Variable	Interorganizational Cost Management	Origin of Items in Scale	IOCM
IOCM-1	Together, our firm and our partner firm engage in processes to create joint sales forecasts and/or order forecasts.	Marquez et al. 2004	0.7308
IOCM-2	Together, our firm and our partner firm engage in joint target costing processes.	Cooper and Slagmulder, 2004; Ramos 2004	0.7227
IOCM-3	Together, our firm and our partner firm engage in the process of "functionality-price-quality trade-offs" analysis to resolve cost problems.	Cooper and Slagmulder, 2004; Ramos 2004	0.5547
IOCM-4	Together, our firm and our partner firm engage in concurrent and continuous cost management processes such as Kaizen. ^d	Cooper and Slagmulder, 1998b	
IOCM-5	Our firm engages in inter-organizational cost investigation techniques when our partner cannot meet target cost objectives.	Cooper and Slagmulder, 2004	0.6251
IOCM-6	Together, our firm and our partner firm have established processes for placing employees at the other firm's location.	Cooper and Slagmulder, 2004	0.5497
IOCM-7	Together, our firm and our partner firm have established processes for sharing common assets or for placing assets at the other firm's location.	Dekker 2003	0.7463
IOCM-8	Together, our firm and our partner firm have established processes for fostering and developing inter-organizational collaboration.	Cooper and Slagmulder, 2004,	0.7703
IOCM-9	Together, our firm and our partner firm have established processes to manage and control inventory levels.	Simchi-Levi et al., 2003	0.7500
IOCM-10	Together, our firm and our partner firm have established automated processes for order entry, shipping, and/or billing.	Simchi-Levi et al., 2003; Barua et al., 2004; Mitra and Chaya 1996; Poston and Grabski, 2001	0.5587
IOCM-11	Together, our firm and our partner firm engage in open book accounting.	Berry and Ahmed, 1996	0.6479
IOCM-12	Together, our firm and our partner firm have established a process for sharing information on future plans such as long-term production plans, capital investments, and capacity utilization plans.	Malhotra et al. 2005	0.7619
IOCM-13	Together, our firm and our partner firm have established a process for sharing information on market demand trends and forecasts.	Malhotra et al. 2005	0.7058
IOCM-14	Information sharing processes that have been established between our firm and our partner firm is very relevant and timely to both our firms' business needs.	Malhotra et al. 2005	0.7953
IOCM-15	Information sharing processes that have been established between our firm and our partner firm include the exchange of proprietary and/or confidential information.	Malhotra et al. 2005	0.5500
IOCM-16	Information sharing processes that have been established between our firm and our partner firm allow for the exchange of information that is not available from other sources.	Malhotra et al. 2005	0.6119
	Average Variance Extracted		45.93%
	Composite Reliability		0.9261

Variable	Interorganizational Cost Management	Origin of Items in Scale	Factor Structure and Loading
			Internal CM
ICM-1	When making business decisions, the senior management in our firm relies on cost system information.	Stenzel and Stenzel, 2003	0.7929
ICM-2	Our firm uses our cost system to help realign resources when our business priorities change.	Stenzel and Stenzel, 2003	0.8533
ICM-3	Our firm's cost system regularly warns us when unhealthy financial thresholds are approaching. ^d	Stenzel and Stenzel, 2003	
ICM-4	Our firm uses our cost system to hold individuals and groups accountable for reasonable performance standards.	Stenzel and Stenzel, 2003	0.8586
ICM-5	Our firm uses an activity-based cost system. ^d	Stenzel and Stenzel, 2003	
ICM-6	When trading with our partner firm, standard market prices (e.g. published prices) are used. ^d	New	
Average Variance Extracted			69.80%
Composite Reliability			0.8738

Variable	Dependency	Reference	Factor Structure and Loadings	
			Partner Dependent On Respondent (PDOR)	Respondent Dependent On Partner (RDOP)
RDOP-1	Our firm is heavily dependent on the partner firm that was considered for this survey.	Andaleeb, 1995	0.9294	-0.0931
RDOP-2	It would be difficult for our firm to replace the partner firm considered for this survey.	Andaleeb, 1995	0.7658	0.1177
RDOP-3	Our firm can easily switch from the partner firm considered in this survey to another partner.	Andaleeb, 1995	0.7707	-0.0022
PDOR-1	The partner firm that was considered for this survey is heavily dependent on our firm.	Andaleeb, 1995	0.3443	0.5807
PDOR-2	It would be difficult for the partner firm considered in this survey to replace our firm.	Andaleeb, 1995	0.2342	0.7707
PDOR-3	The partner considered in this survey can easily switch from our firm to another firm.	Andaleeb, 1995	0.2054	0.7863
Average Variance Extracted			68.14%	51.65%
Composite Reliability			0.8642	0.7591