Operational and strategic benefits of IOS-enabled inter-organizational integration

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Operational and Strategic Benefits of IOS-Enabled Inter-Organizational Integration

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SUMMARY

In this study, I employ the lens of the resource-based view (RBV) of the firm to examine the strategic value of IOS-enabled inter-organizational integration. We first develop the key construct of IOS-enabled inter-organizational integration, identifying and conceptualizing its two dimensions - inter-organizational system integration and business integration. Next, I present the research framework showing that while both inter-organizational system integration and business integration have positive impacts on operational performance, only inter-organizational business integration is positively associated with strategic performance. I further propose that two inter-organizational factors, i.e. relative bargaining power and relative absorptive capacity, positively influence a company's strategic benefits obtainable in an IOS-enabled inter-organizational relationship and that relative absorptive capacity also has a positive influence on relative bargaining power.

The data for this study were collected through a survey of firms in mainland China. The results show that only inter-organizational business integration is positively associated with operational performance. Surprisingly, inter-organizational system integration is not found to have a positive influence on operational performance. The results also show that only inter-organizational business integration has a significant impact on strategic performance. Inter-organizational system integration only has indirect impact on operational and strategic performance through inter-organizational business integration. As expected, both relative bargaining power and absorptive capacity are positively related to strategic performance. A company can also gain indirect strategic benefits from relative absorptive capacity through its positive influence on relative bargaining power.

The study contributes to research by providing a clear conceptualization of IOS-enabled inter-organizational integration, establishing the theoretical link between its two dimensions (i.e. inter-organizational system integration and business integration) and organizational performance (operational and strategic performance), incorporating two important inter-organizational factors (i.e. relative bargaining power and absorptive capacity) into the research framework, developing scales for inter-organizational system integration and business integration, as well as providing data on the IOS experience of Chinese firms. Based on the findings from this study, I recommend that companies focus on the integration of inter-organizational business to gain strategic benefits and that they enhance their absorptive capacity to the level above their business partners to further gain strategic benefits from the IOS-enabled inter-organizational relationship..

CHAPTER 1 INTRODUCTION

1.1 Introduction

Inter-organizational systems (IOSs) have been used in business for decades. As early as in the late 1960s, IOSs relying on electronic data interchange (EDI) appeared in the transportation industry. The research on IOSs also dates back to the 1960s (Kaufman 1966). However, IOSs did not capture widespread interest among academics and practitioners until the 1980s. Today, more and more companies are involved in IOSs in one way or other. Thus, how to gain benefits from the deployment of IOSs is an important topic, worthy of deeper investigation.

The success of early IOSs such as United Airline's APOLLO reservation system and American Hospital Supply's ASAP led researchers to conclude that the deployment of IOSs could result in strategic advantage¹ (Johnston and Vitale 1988). Although IOSs may significantly improve organizational performance, not all IOS adopters have fully realized the potential benefits. For example, Benjamin et al. (1990) examined the use of EDI, a special case of IOSs, at the Office Technology Corporation (a disguised firm), and found that the deployment of EDI resulted in only small cost savings for the firm. They even concluded that EDI systems often turn out to be a cost of doing business for the supplier. Their doubts about the economic value of EDI systems echo those heard in the research on the business value of IT in general. While the use of IT to gain strategic advantage is well known, IT's strategic

¹ In his response to Priem and Bulter's critics to the RBV [2001a], Barney [2001] suggested the use of strategic advantage rather than competitive advantage due to the proliferation of different definitions of competitive advantage in literature. Strategic advantage refers to a firm's improvement in its efficiency and effectiveness relative to its competing firms.

importance has been questioned by some researchers (Carr 2003). Hence, IS researchers continue to devote much attention to how to gain strategic advantage from IT in general and IOSs in particular.

Moving beyond the early research on IOS adoption, researchers have found various factors that influence the benefits derived from the deployment of IOSs, such as IOS use (Masseti and Zmud 1996) and patterns of use (Subramani 2004), EDI embeddedness (Chatfield and Yetton. 2000), organizational context (organizational support, implementation process, control procedures) and imposition (Clark and Stoddard 1996), partnership attributes such as partner trust, partner interdependence, and partner commitment (Lee and Lim 2003), and internal business reengineering and partnership reengineering (Mukhopadhyay and Kekre 2002; Riggins and Mukhopadhyay 1994). IOS studies have consistently suggested that *IOS-enabled inter-organizational integration* is critical in order to gain superior benefits from IOS deployment (Mukhopadhyay 1993; Swatman, et al. 1994; Truman 2000). For example, Mukhopadhyay (1993) noted that “the single reason many companies may not gain much economic benefits from EDI is the absence of EDI integration” (p.262). With respect to B2B, Meehan (2002) also found that e-business managers target “the lack of a well-integrated technology infrastructure as the chief culprit responsible for many business-to-business projects' failure to deliver the benefits users expected”.

By IOS-enabled inter-organizational integration, I mean the extent to which two organizations connected by IOSs are viewed, operated and managed as a unified system. In this paper, IOS-enabled inter-organizational integration is explored through two dimensions, i.e. inter-organizational system integration and business integration. The primary objective of

this study is to examine the effect of the two dimensions on operational and strategic performance. Specifically, the study examines

Why and how do inter-organizational system and business integration affect operational and strategic performance?

And

What are the important inter-organizational factors that shape the benefits obtainable from IOS-enabled inter-organizational relationship?

The work reported here represents a synthesis and extension of previous studies on IOSs. Firstly, based on literature regarding IOSs and integration, I propose the construct of IOS-enabled inter-organizational integration and clearly conceptualize the two dimensions of this construct, i.e. inter-organizational system integration and business integration. Secondly, while previous studies on the impacts of IOS-enabled inter-organizational integration on organizational performance are exploratory in nature or lack theoretical bases, I build a strong theoretical link between the two. Specifically, the RBV is employed to develop the theoretical links between the two dimensions of IOS-enabled inter-organizational integration and strategic performance. The RBV is useful for explaining the business value of inter-organizational system and business integration as it provides theoretically grounded explanations for how and why firm-specific resources and resources shared with business partners give rise to strategic advantage. Based on the RBV, I propose a framework that explains how inter-organizational system integration and business integration combine to influence organizational performance. Lastly, this study extends resource-based studies by incorporating two inter-organizational

factors, i.e. relative bargaining power and relative absorptive capacity into the research framework, which help understand how relational rents are appropriated by participating companies.

1.2 Boundaries of Theorizing

The theorizing is based on several assumptions. First of all, I assume that organizations make conscious, intentional decisions regarding IOS-enabled inter-organizational integration for explicitly formulated purposes. Secondly, I assume that each organization is part of an open system of other organizations that collectively make up its environments and each organization must exchange information and resources with its environment. While, as noted by Pfeffer and Salancik (1978), some researchers give only token consideration to the environmental context of organizations, I include important inter-organizational factors in my theorizing.

Furthermore, the focus of this research is on the integration issue in an IOS-enabled inter-organizational environment. IOS-enabled inter-organizational relationship refers to the inter-organizational relationship where companies use IOSs to coordinate value chain activities to create business value.

Thirdly, integration may involve multiple members along the supply chain. However, for simplicity of theorizing, this study explores the IOS-enabled inter-organizational integration issues surrounding a supplier-customer dyad. Typically, the two companies are a focal company and either its immediate supplier or its immediate customer. Since this study focuses on issues beyond mere IOS adoption and on IOS-enabled inter-organizational integration and

a company's integration with its partners differs greatly from one partner to another, the focus on a dyad enables the examination of how IOS-enabled supplier-customer integration influences an organization's business performance in greater depth.

Fourthly, I explore the IOS-enabled inter-organizational integration issue from a supplier's perspective. As noted by Subramani (2004), prior work focused largely on the benefits derived from IOSs by network leaders and little attention was paid to the benefits obtained by suppliers and to the mechanisms that enable suppliers to realize benefits. Thus, how suppliers can take advantage of IOSs and benefit from their use of IOSs is not clearly understood.

Fifthly, since the study focuses on the IOS-enabled inter-organizational integration around a supplier-customer dyad and from the supplier's perspective, I conceptualize the strategic advantage as the supplier's advantageous position in the relationship with the customer rather than the supplier's overall strategic advantage, which is consistent with previous studies (Subramani 2004).

Lastly, this study also focuses on the early stage of IOS use. The data I used to test the research model were collected from the mainland China where IOSs are relatively new to most companies. Readers should bear this in mind to better understand the conceptualization of the two dimensions of IOS-enabled inter-organizational integration, the theorizing of the research framework, the interpretation of the findings in this study, as well as discussions presented in the last chapter.

1.3 Thesis Organizations

The remainder of this thesis is organized as follows.

In the next chapter, I conceptualize the concept of IOS-enabled inter-organizational integration. Extending previous research on organizational integration, IOS-enabled inter-organizational integration is conceptualized as a construct which includes two dimensions, inter-organizational system integration and inter-organizational business integration. Based on the definition of integration and IOS-enabled inter-organizational relationship, I define IOS-enabled inter-organizational integration as the extent to which two organizations are viewed, operated and managed as a unified system in an IOS-enabled inter-organizational relationship. Furthermore, inter-organizational system integration is defined as the extent to which relevant information systems located in two different organizations are viewed, operated and managed as unified information systems. Inter-organizational business integration refers to the extent to which relevant business tasks located in two different organizations are viewed, operated and managed as a unified business. Different dimensions of each construct are further examined. Inter-organizational system integration includes two dimensions, 1) the extent to which various transaction types are conducted via IOSs and 2) the extent to which IOSs are integrated with internal systems. Inter-organizational business integration also includes two dimensions 1) communication of various, relevant aspects of interrelated business tasks between two companies, and 2) coordination of interrelated business tasks between two companies

In the third chapter, I first present the theoretical background of the study and then present the research model and various hypotheses. The review of the relevant resource-based studies suggests that heterogeneous firm resources that are valuable, rare, imperfectly substitutable,

and imperfectly imitable will provide a firm with a strategic advantage and that the business value of IS resources, especially resources that are shared with business partners, is affected by various inter-organizational and environmental factors. Grounded on the theoretical foundation of the RBV, I propose a research model that focuses on the impacts of inter-organizational system integration and business integration on operational and strategic performance. I hypothesize that inter-organizational business integration is positively associated with inter-organizational system integration. I also propose that both inter-organizational system integration and business integration have a positive impact on operational performance. Through the lens of the RBV, I hypothesize that while inter-organizational system integration is not associated with strategic performance inter-organizational business integration has a positive, direct impact on strategic performance. I further propose that relative absorptive capacity and bargaining power both have positive impacts on strategic performance and relative absorptive capacity has a positive impact on relative bargaining power as well.

In the fourth chapter, I describe how new instruments were created and how data were collected. Firstly, I show the process through which I developed the instruments to operationalize inter-organizational system integration and business integration. Standard instrument development procedures were followed, which consisted of three stages, item creation, scale development, and instrument testing. The process finalized two scales, with 5 reflective items for the inter-organizational system integration scale and 7 reflective items for the inter-organizational business integration scale. In the later part of this chapter, I show how data were collected in China using the survey method. Seventy complete sets of survey were returned, representing a response rate 21.7%. Non-response bias is assessed through

comparison of responding companies with non-responding companies in terms of industry and ownership. The analysis shows that non-response bias is not an issue in this study.

In the fifth chapter, I present the results and research findings from the data analysis. Except 1 hypothesis, all other hypotheses are supported. Results show that only inter-organizational business integration has a significant impact on operational performance and strategic performance. Inter-organizational system integration does not have a significant influence on either operational performance or strategic performance. Relative bargaining power and absorptive capacity are confirmed to have positive impacts on strategic performance. Relative absorptive capacity is also found to positively affect bargaining power. Overall, the antecedents of strategic performance explain almost half (47%) of its variance.

In the last chapter, i.e. chapter 6, I first discuss several interesting observations of the study which is followed by the discussion of the limitations of this study. Next, I present the contribution of this study to research as well as the implications for practice. And finally, I show some possible directions for future to extend the current study.

Basically, the dissertation contributes to theory in the following ways. First of all, the study provides a clear conceptualization of IOS-enabled inter-organizational integration and its two dimensions. Secondly, the study employs a strong theoretical lens to examine the business value of inter-organizational system integration and business integration, which closes the theoretical gap found in literature on inter-organizational system integration and business integration. Thirdly, I explicitly acknowledge the influences of inter-organizational factors on organizational performance in an IOS-enabled environment. The research model has incorporated relative bargaining power and absorptive capacity to show how companies can

derive strategic benefits by exploiting the IOS-enabled inter-organizational relationship. Fourthly, the study develops two scales to measure inter-organizational system integration and business process integration and thus it also contributes to literature by providing a foundation on which empirical studies examining the operational and strategic benefits of inter-organizational system integration and business process integration can be conducted. Last, the study explores the business value of IT resources in the mainland Chinese business context, which contributes to the understanding of IT phenomena in the transitional economy.

The study also produces insights for practice. Firstly, companies should go beyond IOS adoption to integrate inter-organizational systems and business processes to gain superior operational performance. However, if companies are to gain strategic benefits, they should focus on inter-organizational business integration. Second, companies should enhance their abilities to learn from other organizations since superior learning abilities relative to business partners result in not only direct strategic benefits but also indirect strategic benefits through enhanced bargaining power in their inter-organizational relationship.

CHAPTER 2 IOS-ENABLED INTEGRATION: LITERATURE REVIEW AND CONCEPTUALIZATION

2.1 Prior Studies

Consistent with previous studies (Cash and Konsynski 1985; Johnston and Vitale 1988), I define IOSs as automated information systems shared by two or more companies. Examples of IOS include EDI, and XML-based IOS such as RosettaNet, among others. This paper, following prior IOS research (McGee 1991), focuses on IOSs that support relatively structured interactions between buyers and suppliers along the supply chain.

As discussed in the introduction section in chapter 1, the adoption of IOSs can possibly provide significant benefits to organizations. Researchers have observed operational and /or strategic benefits from EDI adoptions. For example, after examining the EDI use at the assembly centers of Chrysler Corporation, Mukhopadhyay et al. (1995) found that significant savings have been realized from reduced inventories, lower annual write offs, and reduced premium freight. Teo et al. (1997) found that public-sector organizations gained benefits from EDI in terms of increased productivity and that private-sector organizations benefited from EDI in terms of increased competitiveness. Chatfield and Bjorn-Andersen (1997) reported that Japan Airlines' competitiveness has been improved due to the reduction of its IOS-enabled inter-firm joint product innovation cycle time. Lee et al. (1999) showed that EDI can benefit not only the EDI champion but also EDI adopters, if EDI is used as an enabler for inter-organizational process reengineering and that EDI enables adopters to reduce both inventory levels and stockouts simultaneously if EDI is combined with BPR. Tuunainen (1999) showed

that small businesses, often operating as suppliers for larger companies, could benefit in many ways from EDI. Hoogeweegen et al. (1998) even proposed a two-component approach (i.e. information processes related costs and benefits and physical logistic processes related costs and benefits) to help assess the benefits associated with EDI implementation.

However, other studies have noted that mere IOS adoption may not provide many benefits to companies. Clark and Stoddard (1996) noticed that in the literature regarding the benefits of EDI and other IOSs, some researchers found that EDI provides strategic competitive advantage while some others found that EDI implementation provides little or no benefits at all. Their research of EDI use in the grocery industry suggested that mere technology innovation such as EDI can provide only small benefits (Clark and Stoddard 1996). Benjamin et al. (1990) examined the use of EDI and concluded that EDI systems often turn out to be a cost of doing business for suppliers. Markus (2000) also implied that mere IOS adoption may not create many benefits for companies. She reported that many EDI users print out computer-generated order forms or invoices and enter the information manually into their computer systems and thus benefits obtained from EDI implementation is limited due to manual intervention.

Why do companies gain little or no benefits from IOS adoption? One reason consistently suggested by literature is the lack of IOS-enabled inter-organizational integration. Based on the assessment of the economic impacts of EDI, Mukhopadhyay (1993) concluded that “the single reason many companies may not gain much economic benefit from EDI is the absence of EDI integration” (p.262). Meehan (2002) also found that e-business managers target “the lack of a well-integrated technology infrastructure as the chief culprit responsible for many

business-to-business projects' failure to deliver the benefits users expected". The discussion of inter-organizational integration in an IOS-enabled environment began in the 1990s and has gained quite some attend in recent years (see Table 1 for a list of studies).

Table 1 Studies on Inter-Organizational Integration in an IOS-enabled Inter-Organizational Environment

While IOSs such as EDI have become a competitive necessity nowadays (Benjamin, et al. 1990; Chwelos, et al. 2001; Truman 2000), anecdotal and exploratory studies have suggested that investment in IOS-enabled inter-organizational integration can help a company gain superior benefits.

For example, based on examination of the impact of EDI on the components sector of the Australian automotive industry, Mackay (1993) concluded that “the greatest benefits were gained by organizations in which EDI was not only used, but fully integrated into their internal application systems” (p.243). Swatman et al. (1994) also argued that “it is in the areas of systems integration and business reengineering that EDI offers its greatest real benefits” (p.41). Khazanchi and Sutton (2001) proposed a three-stage model of EDI implementation: EDI adoption, EDI integration, and EDI outcomes. Based this model, after a company adopts EDI, to enjoy great benefits from EDI implementation, the company has to go further to integrate EDI processes with its internal business processes (i.e. EDI integration).

Previous studies have also suggested and found various operational benefits gained from IOS-enabled inter-organizational integration. For example, Benjamin et al. (1990) implied that companies can derive cost savings from EDI integration via increased productivity and decreased overhead. Mackay (1993) argued that integration of EDI with internal application systems can reduce re-keying and improve data accuracy. Markus (2000) argued that companies can serve customers more effectively with high business integration. While Hart and Saunders (1997) implied that computer integration may have labor displacement effect, Truman (2000) found that interface integration (the level of integration between the EDI and internal systems) has the labor displacement effect. Srinivasan et al. (1994) found that suppliers with the ability to directly map incoming information from EDI to internal production control systems enjoy greater benefits in terms of reduction in shipment discrepancy. Barua et al. (2004) found that system integration plays an important role in building online informational capabilities, which relate strongly to business performance measures (revenue, gross profit margin, ROA, and return on invested capital). Iacovou et al. (1995) argued that inter-organizational system integration will result in enhanced internal efficiency and tactical and competitive advantage. Zhu and Kraemer (2002) found that supplier integration is positively associated with inventory turnover for both high-tech and traditional companies. Some other studies (Frohlich 2002; Zhu 2004; Zhu and Kraemer 2005) also found that IOS-enabled inter-organizational integration is positively associated with operational performance.

Various strategic benefits associated with IOS-enabled inter-organizational integration have also been suggested and found in literature. While Swatman et al. (1994) argued that EDI integration offers long term strategic benefits, Mukhopadhyay and Kekre (2002) found that

supplier-side EDI integration leads to supplier's strategic benefits such as sales gain. Based on an empirical studies in the insurance industry, Venkatraman and Zaheer (1990) found that electronic integration (the integration of business processes of two or more independent organizations through the exploitation of the capabilities of computers and communication technologies) is positively associated with increases in new business policies. Ramamurthy et al. (1999) found that while external integration of EDI (integration of the firm with its trading partners, both in terms of scope of services to them and penetration of EDI in these business transactions) is positively associated with both operational and market performance, internal integration of EDI (the extent to which EDI interfaces with and is integrated into other key internal IS applications and, thereby, the work processes) is positively associated with only operational performance. Some other researchers also found (Bergeron and Raymond 1997; Frohlich and Westbrook 2001; Min and Mentzer 2004), argued (Swatman and Swatman 1992), or implied (Markus, et al. 2003) that IOS-enabled inter-organizational integration is positively associated with both operational and strategic benefits.

Relevant literature review suggests that IOS-enabled inter-organizational integration can be examined at least from 2 aspects: system integration and business integration. Markus (2000) pointed out that business process integration and systems integration form a unifying concept of organizational integration. Her research and other studies (Clark and Stoddard 1996) implied that IOS-enabled inter-organizational relationship also involves at least two aspects, i.e. technology and business process aspects.

Although previous studies have provided much insight into IOS-enabled inter-organizational integration, there are still gaps in literature. Firstly, less attention has been paid

to strategic implications compared with operational impacts of IOS-enabled inter-organizational integration. Companies deploy IOSs to gain not only operational benefits but also strategic advantage (Johnston and Vitale 1988). While 20 out of the 24 papers I identified before examined the impacts of IOS-enabled inter-organizational integration on operational performance (Barua, et al. 2004; Benjamin, et al. 1990; Bergeron and Raymond 1997; Frohlich 2002; Frohlich and Westbrook 2001; Hart and Saunders 1997; Iacovou, et al. 1995; Mackay 1993; Markus, et al. 2003; Min and Mentzer 2004; Mukhopadhyay and Kekre 2002; Ramamurthy, et al. 1999; Saeed, et al. 2005; Srinivasan, et al. 1994; Swatman and Swatman 1992; Truman 2000; Venkatraman and Zaheer 1990; Zhu 2004; Zhu and Kraemer 2002; Zhu and Kraemer 2005), less than half studies explored the strategic impacts of IOS-enabled inter-organizational integration (Bergeron and Raymond 1997; Frohlich and Westbrook 2001; Iacovou, et al. 1995; Markus, et al. 2003; Min and Mentzer 2004; Mukhopadhyay and Kekre 2002; Ramamurthy, et al. 1999; Swatman and Swatman 1992; Swatman, et al. 1994; Venkatraman and Zaheer 1990).

Secondly, the theoretical background of the impacts of IOS-enabled inter-organizational integration needs to be strengthened. While a few researchers have used theoretical lenses such as RBV (Barua, et al. 2004; Zhu 2004; Zhu and Kraemer 2005), transaction cost economies (Mukhopadhyay and Kekre, 2002), dynamic capability (Zhu and Kraemer 2002), and theory from IS and operations management (Saeed, et al. 2005) to examine why and how IOS-enabled inter-organizational integration influences organizational performance, the majority of studies lack strong theoretical foundations. The lens of the RBV is particularly useful to explore the impacts of IOS-enabled inter-organizational integration on strategic performance because it specifies the mechanism through which organizational resources and capabilities are

linked to strategic advantages. I identified three studies (Barua, et al. 2004; Zhu 2004; Zhu and Kraemer 2005) that used the lens of the RBV to explore the impacts of IOS-enabled inter-organizational integration on organizational performance. From the perspective of the RBV, Barua et al. (2004) examined how system integration together with other technological, organizational, and environmental resources enables a firm to develop online informational capabilities and then leads to improved operational and financial performance. However, they did not examine the direct effect of system integration on organizational performance. Nor did they clarify how system integration has satisfied the conditions set by the RBV to provide superior organizational performance. Zhu and Kraemer (2005) examined the e-business value of back-end integration and found that back-end integration is positively associated with e-business value, a second order construct composed of impacts on sales, impacts on internal operation, and impacts on procurement. While they discussed the imitability of back-end integration, they did not examine whether back-end integration has met other conditions such as value, rareness, and non-substitutability. Furthermore, there is much evidence indicating that the authors' argument for low imitability of back-end integration needs to be revisited. Zhu (2004) discussed the imitability of e-commerce capability (with back-end integration as a dimension) and found that back-end integration, as a dimension of e-commerce capability, is positively associated with the sales per employee, and inventory turnover. However, he did not discuss other requirements such as value, rareness, and non-substitutability set by the RBV either. These resource-based studies have offered much insight into the business value of inter-organizational system integration. However, based on the RBV (Barney 1991), a resource has to be valuable, rare, imperfectly imitable, and imperfectly substitutable for the resource to provide strategic advantage. Only through exploring whether IOS-enabled inter-organizational

integration meets all the requirements needed to create strategic advantage based on the RBV can we know whether IOS-enabled inter-organizational integration provides strategic advantage.

Thirdly, both inter-organizational system integration and business integration should be discussed simultaneously to offer a complete view of IOS-enabled inter-organizational integration. The literature review suggests that 23 out of 24 studies have examined the system integration aspect of IOS-enabled inter-organizational integration while only 2 studies (Markus 2000; Min and Mentzer 2004) explored the business integration issue. And four studies (Benjamin, et al. 1990; Christiaanse and Venkatraman 2002; Frohlich 2002; Frohlich and Westbrook 2001) did not differentiate between system integration and business integration. While Markus (2000) discussed both inter-organizational system integration and business integration from a conceptual perspective, her research on inter-organizational system integration and business integration can be expanded to empirically examine their impacts on operational and strategic performance.

2.2 Conceptualization: IOS-Enabled Inter-Organizational Integration

As an information system expands across the border of an organization, it is increasingly difficult for a company to say that it owns and controls the system (Hasselbring 2000). Such interweaving of IOSs has important implications. Since IOSs typically involve multiple participants and run in a business setting that is beyond the control of an organization, the dynamics of IOSs within and beyond the organization reflect the influences from factors both internal and external to the focal organization.

Straub and Watson (2001) proposed the concept of Net-enablement (NE) and referred to it as the situation where an organization coordinates its activities and interacts with its stakeholders through the exchange of messages over electronic networks. Barua et al (2004) argued and found that business value can be created through Internet-enabled value chain activities. Similarly, many studies show that IOSs can enable firms to change the way they interact and coordinate value chain activities with customers and suppliers to create value. For example, inter-organizational integration can help a firm to counter various uncertainties (Goodhue, et al. 1992; Lee 2002; Truman 2000). The supply chain is full of uncertainties from various sources. Many articles (Davis 1993; Johnson 2001; Lee 2002) have discussed the various types of uncertainties. For example, Lee (2002) discussed in detail two types of uncertainties, i.e. demand uncertainty and supply uncertainty. The influence of uncertainties on organizational operation is enormous. For instance, Davis (1993) illustrated how uncertainties lead to increased inventories and dissatisfied customers. Fortunately, researchers have found that organizational and inter-organizational integration is an effective weapon for companies to counter supply chain uncertainties (Goodhue, et al. 1992; Lee 2002; Truman 2000).

Inter-organizational integration not only helps a firm to counter various uncertainties but also enables a firm to manage inter-organizational dependence. An organization depends on its environment in the sense that the organization typically must interact with others that control the resources that the organization needs to survive. Pfeffer and Salancik (1978) argued that inter-organizational governance is a strategic response to conditions in an organization's environment, especially inter-organizational dependence. In their book, they discussed several strategies used by firms to manage environmental inter-dependence that do not involve

vertical integration. Such strategies include the use of inter-locking directorates, joint ventures, coalitions, etc. Each strategy represents a way of a social agreement that stabilizes and coordinates mutual inter-dependence. Two companies in a supplier-customer dyad are understandably inter-dependent. Inter-organizational integration between the two companies can help stabilize both companies' exchanges with their respective environment and thus enable them to have some degree of assurance and predictability regarding what they can expect from one another. In sum, inter-organizational integration helps a firm counter environmental uncertainties and effectively manage inter-dependence.

I refer to the inter-organizational relationship where companies use IOSs to coordinate value chain activities to create business value as IOS-enabled inter-organizational relationship. In this study, integration is defined as the extent to which the interdependent and distinct components are viewed, operated and managed as a unified system (adapted from (McGee 1991)). Here, the component may refer to information systems, work teams, functional departments, business processes, or organizations. Based on the definition of integration and IOS-enabled inter-organizational relationship, I define IOS-enabled inter-organizational integration as *the extent to which two organizations are viewed, operated and managed as a unified system in an IOS-enabled inter-organizational relationship*.

Business integration and systems integration have been shown to form a unifying concept of organizational integration (Markus 2000). Extending this concept to the inter-organizational domain, I break down IOS-enabled inter-organizational integration into two dimensions, i.e. inter-organizational system integration and inter-organizational business integration. In the following sections I will discuss the two dimensions separately.

2.2.1 Inter-Organizational System Integration

Based on the definition of integration, I define inter-organizational system integration between two organizations as *the extent to which relevant information systems located in two different organizations are viewed, operated and managed as unified information systems*. Typically, a company has various information systems, such as product design systems, procurement systems, manufacturing systems, sales and marketing systems, delivery systems, customer service systems, finance systems, etc (Alter 1999). Even if the company has implemented a single ERP package, it still has various modules within the ERP package and possibly some legacy systems. Some systems are inter-organizational in nature. In other words, these systems communicate with systems located in other companies. For instance, a company’s sales system processes orders from procurement systems located in its customers.

While some companies choose to implement IOSs with most of their business partners, some others choose to establish electronic linkages with only a few business partners. Still others may have not established electronic linkages with any of their business partners at all, and much manual work is used to process data coming in and going out. For example, a company produces an order and mails or faxes it to a supplier. Then the supplier manually enters the order into its information systems. In such a case, much human intervention is present. This may even happen in large companies (Markus 2000). Even if the electronic link between two firms has been established, the degree of inter-organizational system integration varies across firms. Two dimensions of inter-organizational system integration between two organizations in a dyad have been discussed in previous studies (Table 2)

Table 2 Dimension of Inter-Organizational System Integration

	The extent to which various transaction types are conducted via IOSs	The extent to which IOSs are integrated with internal systems
Bergeron and Raymond, (1997)	v	
Iacovou et al. (1995)	v	
Markus et al. (2003)	v	
Ramamurthy, et al., (1999)	v	v
Saeed, et al. (2005)	v	v
Swatman et al., (1994)	v	v
Swatman and Swatman, (1992)	v	v
Zhu and Kraemer, (2002)	v	v
Zhu and Kraemer, (2005)		v
Zhu, (2004)	v	v
Barua, et al. (2004)		v
Hart and Saunders, (1997)		v
Mackay, (1993)		v
Markus, (2000)		v
Mukhopadhyay and Kekre, (2002)		v
Srinivasan et al. 1994		v
Truman, (2000)		v
Venkatraman and Zaheer, (1990)		v

On the one hand, the degree of inter-organizational system integration is reflected in the transaction types conducted through IOSs. Based on the idea of technology cluster presented in Rogers' work on innovation (1995), previous studies (Ramamurthy, et al. 1999; Truman 2000) viewed EDI as a bundle of multiple functionally interrelated transaction types. Transaction types are the data exchanged between trading partners. Some examples of transaction type in insurance industry are eligibility data, enrollment data, claim payment data, claim data, and claim status data (Truman 2000). The concept of transaction type can also be applied to other types of IOS. For example, XML-based IOSs can also be viewed as bundles of transaction types. Transaction types associated with RosettaNet PIPs (Partner Interface Processes) include order data, shipment data, invoice data, remittance advice data, etc (Intel 2004). Companies may use IOSs to process a large variety of transaction types while some

others may use IOSs only to process a limited number of transaction types, say order information.

On the other hand, the degree of inter-organizational system integration is also reflected in the extent to which IOSs are integrated with internal systems. Even in the situation where EDI is installed, many EDI users still print out computer-generated order forms or invoices and enter the information manually into their computer systems (Markus 2000). When IOSs are fully integrated with internal systems, electronically transmitted data from business partners are processed automatically by relevant systems with few human interventions.

To better understand the conceptualization of inter-organizational system integration in this study, the reader should bear in mind that my conceptualization focuses on the supplier-buyer dyad relationship. Elgarah et al. (2005) reviewed EDI literature from multiple lenses, one of which is the lens of inter-organizational relationship typology, which was presented by Hall (1999). According to Hall (1999), there are three types of inter-organizational relationships: dyadic (pairwise) relationship, inter-organizational sets, and inter-organizational networks. A dyad relationship involves just two organizations. An inter-organizational set places emphasis on a focal organization and all of its dyadic relationships with other organizations. An inter-organizational network consists of multiple organizations connected to achieve certain goals or to resolve specific problems. Clearly, my conceptualization of inter-organizational system integration focuses on the dyadic (pairwise) relationship. Other research may focus on inter-organizational sets or networks. For example, Saeed et al.'s (2005) conceptualization of external integration actually focused on inter-organizational sets. Hall's typology and Elgarah et al.'s use of the typology in the IOSs area are useful to understand my

conceptualization of inter-organizational system integration. Consistent with the dyadic level of inter-organizational system integration and business integration, the theorization of the research framework, operationalization of relevant constructs, interpretation of results, and further discussions all focus on the dyadic (pairwise) relationship throughout the study.

2.2.2 Inter-Organizational Business Integration

Davenport and Short (1990) defined business process as “a set of logically related tasks performed to achieve a defined business outcome” (p.12). Inter-organizational processes are those processes taking place between two or more organizations. Based on the definition of integration, I define inter-organizational business integration between two organizations as *the extent to which relevant business tasks located in two different organizations are viewed, operated and managed as a unified business*.

Markus (2000) gave several examples of integrated inter-organizational business. One example is the integrated order fulfillment process between Cisco and its suppliers. Most of the products that Cisco sells are shipped directly to its customers without ever passing through Cisco’s warehouses. In this way, together with its suppliers, Cisco forms a tightly integrated order fulfillment process. Intel corporation (2004) also reported an integrated payment process with the World Peace Group, its distributor in the Asia Pacific region, through implementing RosettaNet PIPs. The payment process is fully automated without much human intervention and manual paperwork.

Two dimensions of inter-organizational business integration have been identified through review of literature on business integration, 1) communication of various, relevant aspects of

interrelated business tasks between two companies, and 2) coordination of interrelated business tasks between two companies (Table 3). On the one hand, inter-organizational business integration is reflected by the communication of such information as feedback about performance and quality (Champy 2002) and key objectives and roles and measures (Fawcett and Cooper 2001) among business partners. On the other hand, inter-organizational business integration is also reflected by coordination, such as the establishing of consistent performance systems (Champy 2002), the setting of compatible strategic and operating goals (Fawcett and Cooper 2001), the constituting of agreements about which formats and protocols to be used during inter-organizational interactions (zur Muehlen, et al. 2005), and the removing of redundancy and inconsistency from the inter-organizational business processes (Hammer 2001). Furthermore, coordination of business tasks spanning several organizations can take many forms, such as joint ownership (Wareham 1998) and coordinating teams (Intel 2004).

Table 3 Dimension of Inter-Organizational Business Integration

	Communication of various, relevant aspects of interrelated business tasks between two companies	Coordination of interrelated business tasks between two companies
Becker et al. (2003)	v	
Kobayashi et al. (2003)	v	
McAdam and McCormack (2001)	v	
Min and Mentzer 2004	v	v
Wareham (1998)		v
Markus (2000)		v
Ho et al. (2002)		v

In summary, IOS-enabled inter-organizational integration, the central construct in the study, comprises both inter-organizational system integration and business integration. Inter-

organizational system integration refers to the extent to which relevant information systems located in two different organizations are viewed, operated and managed as unified information systems and it comprises two dimensions: 1) the extent to which various transaction types are conducted via IOSs and 2) the extent to which IOSs are integrated with internal systems. Inter-organizational business integration is defined as the extent to which relevant business tasks located in two different organizations are viewed, operated and managed as a unified business and it is composed of two dimensions: 1) communication of various, relevant aspects of interrelated business tasks between two companies, and 2) coordination of interrelated business tasks between two companies

It is important to note that the conceptualization of inter-organizational business integration in the current study focuses on the business process aspect of the inter-organizational relationship between two companies, , while quite a few studies have focused on other aspects of inter-organizational relationship, such as cooperation (Bensaou 1997; Nakayama 2003), cooperative behavior with long-term implication (Grover, et al. 2002), relational embeddedness (Grover, et al. 2002), conflict and conflict resolution (Kumar and van Dissel 1996; Nakayama 2003), inter-dependency (Kumar and van Dissel 1996; Nakayama 2003), inter-organizational trust (Zaheer, et al. 1998) to name but a few. The focus of inter-organizational business integration on business process aspect of the inter-organizational relationship is completely consistent with previous studies (Markus 2000).

Premkumar (2000) proposed three levels of sophistication in the use of IOSs: communication, coordination, and cooperation. According to him, at the first level, IOSs are used for electronic communication of messages between trading partners. At the second level,

the computer to computer communication is integrated with the internal information systems. At the third level, two business partners share common goals and use similar performance measures to evaluate the performance of their inter-organizational activities. A comparison between his conceptualization of sophistication in the use of IOSs and my conceptualization of inter-organizational system integration and business integration reveals a rough match between the two. The level of communication is similar to IOSs adoption and the first dimension of inter-organizational system integration (the extent to which various transaction types are conducted via IOSs). The level of coordination is similar to the second dimension of inter-organizational system integration (the extent to which IOSs are integrated with internal systems). The third level of cooperation is similar to inter-organizational business integration (the setting of common goals and the use of consistent performance measure are just two scenarios of integrated inter-organizational business). While his study provided interesting insights of the use of IOSs, the current study further unveils the sophistication in IOSs use by carefully conceptualizing inter-organizational system integration and business integration and empirically testing their impacts on organizational performance.

In the next chapter, we develop the hypothesized relationship between the two dimensions of IOS-enabled inter-organizational integration and organizational performance, drawing on previous studies on IOSs and on the RBV.

CHAPTER 3 RESEARCH MODEL AND HYPOTHESIS

3.1 Theoretical Background

The RBV views a firm as a bundle of resources, and it links those resources to the firm's strategic performance. Although it has been challenged by some researchers (Priem and Bulter 2001a; Priem and Bulter 2001b), the RBV dominates recent strategic management literature (Ramos-Rodriguez and Ruiz-Navarro 2004). It has also been used as a theoretical foundation for IS studies due to its firm roots in microeconomics and its usefulness in examining the business value of IT (Melville, et al. 2004). The RBV has been used in IS field for a number of occasions (for a review, please refer to (Wade and Hulland 2004)). Most recently, Melville et al. (2004) and Wade and Hulland (2004) demonstrated that the RBV can be used to understand how IT contributes to organizational performance. Accordingly, I choose the RBV as the primary theoretical foundation of this study. I will examine the two dimensions of IOS-enabled inter-organizational integration from the perspective of the RBV and show that inter-organizational business integration is a strategic resource, which will be elaborated in later sections.

Wernerfelt (1984) argued that for the firm, resources and products are two sides of the same coin and he went farther to demonstrate that firms can be usefully examined from the resource side rather than from the product side. His analysis focused on the strategic implications of resource heterogeneity. Barney (1986) clarified the nature of the market for resources, i.e. the strategic factor market, a market where firms buy and sell the resources necessary to implement their strategies, and explored how a firm can gain above normal economic performance from better expectation about the future value of strategic resources

acquired from the strategic factor market. Barney (1991) focused on how competitive advantage, once created, can be sustained. He argued that for a resource to produce sustained competitive advantage it must satisfy the following four conditions, i.e. value, rareness, inimitability, and non-substitutability. Since the RBV as elaborated in literature is parsimonious yet powerful, it provides a common ground from which further work can proceed. This is especially true for IS research on the business value of IT resources. Furthermore, the framework presented in their study can be readily used to assess the strategic implications of various firm resources, and accordingly it becomes one of the major theoretical underpinnings of the current study.

The RBV helps to explain when a firm can gain strategic advantage from its resources. However, as noted by Coff (1999), it is not formulated to explain who will appropriate the rent generated by these firm resources. As a result, few relevant RBV studies have explored the rent appropriation issue. Coff (1999) addressed the rent appropriation issue by discussing the distribution of bargaining power among management, employees, and shareholders. Coff's discussion applies well to rent generated by internal resources that are controlled or owned by a firm. However, researchers have shown that rents can also be generated by shared resources. For example, Dyer and Singh (1998) suggested that relational rent, a common benefit accrued to business partners, can be generated through four potential sources, 1) relation-specific assets, 2) knowledge-sharing routines, 3) complementary resources or capabilities, and 4) effective governance. Lavie (2002) noted that relational rents accrue only to jointly possessed resources which are shared by two interrelated companies, say A and B. If shared resources are denoted by RS_A and RS_B , the contribution of relational rents to the competitive advantage of the business dyad can be expressed by the term $V(RS_A \cup RS_B)$. However, the formula does

not specify the proportion of relational rents appropriated by each firm in the dyad. Lavie (2002) extended the relational view by identifying 5 relation-specific factors that determine the proportion of relational rents appropriated by a focal firm relative to its business partner. These factors are relative absorptive capacity, relative scale and scope of resources, contractual arrangement, relative opportunistic behavior and relative bargaining power. If V_{AB} is used to denote the combination of these five factors, the competitive advantage appropriated by a focus firm from the relational rents can be expressed by $V_{AB}V(RS_A \cup RS_B)$.

Lavie's (2002) argument that the distribution of relational rent from shared resources depends on various inter-organizational factors is consistent with recent developments in the RBV in the IS field. For example, Wade and Hulland (2004) argued that environmental factors such as environmental turbulence may affect the relationships between key IS resources and firm performance. The IT business value model in Melville et al.'s paper (2004) explicitly shows that the business value of IS resources is affected by trading partner resources and business processes. In sum, the rent that is generated by shared resources and appropriated by a focal firm depends on various inter-organizational and environmental factors.

To sum up, relevant literature review of the RBV suggests the following implications. Firstly, heterogeneous firm resources that are valuable, rare, imperfectly substitutable, and imperfectly imitable will provide a firm with a strategic advantage. Secondly, the business value of IS resources, especially resources that are shared with business partners, is affected by various inter-organizational and environmental factors.

3.2 Research Model and Hypothesis

In the following section, I examine the influences of inter-organizational system integration and business integration on both operational and strategic performance. The research framework (see Figure 1) includes six key variables, i.e. inter-organizational system integration, inter-organizational business integration, relative bargaining power, relative absorptive capacity, operational performance, and strategic performance.

Figure 1 Research Framework

Consistent with the two-stage model of benefits (Barua, et al. 1995) and the studies on the business value of IT (Barua, et al. 1995; Mukhopadhyay and Kekre 2002; Soh and Markus 1995), I differentiate between operational performance and strategic performance. I argue that both inter-organizational system integration and business integration are positively associated with operational performance. Through the lens of the RBV, I propose that inter-organizational system integration does not have an influence on strategic performance while inter-organizational business integration does.

As shown by Lavie (2002), some inter-organizational factors determine the proportion of relational rents appropriated by the focal firm relative to its business partner. In this study, I incorporate two important inter-organizational factors, i.e. relative absorptive capability and relative bargaining power into the research framework, and propose that both the two factors have positive impacts on strategic performance in an IOS-enabled inter-organizational relationship. Furthermore, I hypothesize that relative absorptive capacity is positively associated with relative bargaining power.

3.2.1 The Relationship between Inter-Organizational System Integration and Business Integration

Previous studies (Markus 2000) have indicated that system integration is required to achieve business integration. Inter-organizational business processes involve multiple organizations and multiple units within each organization. For example, ordering goods from a supplier involves the functions of purchasing, receiving, and accounts payable in the customer company and the functions of sales, manufacturing, delivery, and invoicing in the supplier. To clarify the relationship between inter-organizational system integration and business integration, we must bear in mind that “information systems form the backbone of any business process integration” (p.231, (Becker, et al. 2003)). Based on such an understanding, it may be argued that inter-organizational system integration is needed for business integration and that without integrated information systems across organizational boundaries, inter-organizational business cannot be successfully integrated. First, since inter-organizational business integration requires business tasks across organizational boundaries be coordinated and the entire business be designed and managed as a unit (Hammer 2001), relevant data from

multiple units within each company must be shared with business partners for effective coordination and unified business process management across partners. As a result, within each company, the information systems supporting various units must be internally integrated, and must also be integrated with the relevant information systems located in business partners through IOSs, to allow appropriate data to be transmitted among business partners to facilitate inter-organizational business integration. Second, in the case that information systems located in business partners are not integrated via IOSs and the relevant data and information related to inter-organizational business tasks cannot be shared in a timely manner, inter-organizational business integration would be low due to too much uncertainties resulted from opacity across the entire inter-organizational business processes. Markus (2000) offered an example to illustrate such a case (p.10). In sum, “business integration requires ... integrated information systems capable of combining information from many resources” (Markus 2000).

However, even if a company has integrated its information systems with its partners, this doesn't necessarily mean the company has achieved inter-organizational business integration with its partners. While some companies have established EDI linkages with their business partners, much redundancy such as order re-keying and data inconsistency are still present in inter-organizational business processes and thus the business tasks that comprise those business processes are not well coordinated. Some companies have achieved inter-organizational system integration without reengineering their inter-organizational business processes. Rather, they automate the existing business processes. Existing inter-organizational business processes are seldom well integrated without inter-organizational business process reengineering. For example, the performance systems and reward policies within a firm may be inconsistent with those in its business partner. In such a case, the inconsistency may lead to

business tasks in one firm to cancel out the tasks performed in its partner. Thus, high inter-organizational system integration does not necessarily mean high inter-organizational business integration. Accordingly, I believe that the former is only a necessary but not a sufficient condition for the latter, which is completely consistent with Markus's argument (2000) that "systems integration may be *necessary* for business integration, but it is not always *sufficient* for business integration" (p.36, emphasis in original).

H1: Inter-organizational system integration is positively associated with inter-organizational business integration.

We next look at the relationship of the impacts of inter-organizational system integration and business integration on operational performance.

3.2.2 Impacts on Operational Performance

Malone et al. (1987) noted that interconnection technologies could offer a number of benefits, beginning with the electronic communication effect. The electronic communication effect is the ability of interconnection technologies to communicate more information speedily and at less cost. Inter-organizational system integration enables rapid transmission of information such as purchase orders, forecasting, and invoices among the business partners at low cost, at high speed, and with few errors, resulting in operational improvements such as higher productivity and lower inventory costs. If, on the other hand, information systems across business partners are not integrated via IOSs, organizations will not gain great organizational operational benefits from IOS deployment. For example, a supplier using an IOS which is not integrated with its internal systems, will find that order information from

various customers will have to be separately entered into internal systems, thus reducing the operational benefits due to manual interventions. In sum, higher level of inter-organizational system integration is positively associated with higher level of operational benefits from the deployment of IOSs.

Several empirical studies have verified the significant operational benefits obtainable from inter-organizational system integration. For example, Mackay (1993) reported that significant benefits are achievable in terms of average processing time for MRS (materials release schedule) documents once EDI has been fully integrated with internal systems. Bergeron and Raymond (1997) found that as EDI links a firm's value chain to the value chains of both its upstream and downstream partners, the firm gains operational advantage from reduced cycle times and improved service. Recently, Intel reported that higher inter-organizational system integration resulted in more efficient workforce, reduced communication costs, and fewer errors (Intel, 2004). Thus, based on prior research, I propose that

Proposition 2a: Inter-organizational system integration is positively associated with organizational operational performance

Inter-organizational business integration is also likely to have a positive impact on operational performance because it enables a firm to continuously understand the changing business environment, including its business partners, and thus enables the firm to better adapt to the ever-changing environment. Such a continuous understanding enables firms to coordinate their relevant internal tasks and prevent tasks across organizations from being canceled out by each other, thus leading to cost saving and value creation. For example, Hammer (2001) showed that Geon tightly integrated its ordering and fulfillment processes

with OxyVinyls' (its primary material supplier), which led to great operational performance by reducing time wastage and improving production scheduling. Geon also integrated its inventory management process with some of its major customers, which also led to dramatic operational payoffs through greater information sharing and removal of many redundant activities. Thus, I propose that

Proposition 2b: Inter-organizational business integration is positively associated with organizational operational performance.

We next propose the relationship of both inter-organizational system integration and business integration with strategic performance from the perspective of the RBV.

3.2.3 Impacts on Strategic Performance

According to Barney (1991), in order for a resource to create strategic advantage, the resource must meet four requirements, i.e. value, rareness, inimitability, and non-substitutability. Since I have already showed that inter-organizational system integration and business integration are valuable in that they both have positive impacts on operational performance, I proceed to discuss the other three conditions directly, i.e. rareness, inimitability, and non-substitutability.

Rarity. Inter-organizational system integration tends not be rare for the following reasons. First, a company can easily get its information systems integrated with systems of business partners through many relatively mature tools and technical and organizational approaches documented in literature (Markus 2000; Markus, et al. 2003). Second, as technologies advance, cheaper and simpler solutions will continue to appear in market to facilitate companies,

especially small and medium companies, to conduct inter-organizational system integration. For example, EDI as the earlier form of IOSs, has several inherent limitations: it is batch-oriented, rigidly formatted, and prohibitively expensive for small companies. It seems inevitable that EDI will eventually be replaced by XML-based IOSs (Gaskin 1999). With regard to costs, XML-based IOSs are perceived to have medium costs relative to EDI (Lower 2004). Thus, companies that cannot afford to implement EDI may choose to adopt XML-based IOSs and thus achieve inter-organizational system integration with business partners. And last, in many countries, government has set up agencies to offer financial and technical assistance in order to help companies implement IOSs and integration IOSs with internal systems. For example, with respect to RosettaNet, a XML-based IOS, governments in many countries and regions such as Singapore, mainland China, Taiwan, and Malaysia have set up agencies to help companies, especially, small to medium-sized companies, achieve inter-organizational system integration (Foong 2003). Thus, many companies are involved in a certain degree of inter-organizational system integration.

On the other hand, inter-organizational business integration seems to be rare since business integration across organizational boundaries is socially complex, unlikely to be easily acquired in strategic factor market, and must be developed via ongoing, relationship specific investment. Furthermore, integrating inter-organizational business requires both considerable time and expertise. Because of the magnitude of organizational change typically involved, business integration often takes years to complete. Davenport (1993) reported that he knew no large organization that had fully identified and implemented process innovation in less than two years. Hammer (2001) noted that “No matter how tough it is to get different departments to work together, getting different companies to collaborate is even harder.” (p.90). Thus, inter-

organizational business integration is very likely to be rare. Markus (2000) discussed the origins of lack of business integration and explained why many companies lack the abilities to provide one face to the customers or to promise the scheduled delivery of their products, two scenarios of inter-organizational business integration.

Imitability. Some IS resources may be easier to imitate than others. Inter-organizational system integration has high imitability for several reasons. Firstly, many approaches and tools are easily available for firms to achieve inter-organizational system integration. For example, Markus and her colleagues have documented several approaches to integration information systems. Furthermore, many mature EAI (enterprise application integration) tools such as IBM WebSphere MQ and webMethods are available in factor market. These EAI tools act as the hub of a hub-and-spoke messaging architecture that links enterprise software packages, legacy systems, databases, etc. And they are supposed to provide a complete end-to-end system integration solution. Secondly, although inter-organizational system integration per se cannot be tradable, the persons who help achieve such integration are tradable, allowing system integration to be easily imitated. Companies can hire expertise from existing labor market to help integrate inter-organizational information systems.

In contrast, inter-organizational business integration has relatively low imitability. Firstly, a firm's inter-organizational business processes with its partners are likely to be intrinsically bound to the firm's unique history with a business partner, resulting in the low imitability of inter-organizational business integration. The firm's competitors may face an unbridgeable barrier to achieve similar inter-organizational business integration with the same business partner. Secondly, inter-organizational business integration tends to be socially complex. Inter-

organizational business integration normally requires inter-organizational business process redesign. However, such a redesign involves collaboration and careful negotiation among different organizations (Markus 2000). Lastly, inter-organizational business integration often accompanies great changes (inter-organizational business process reengineering) across organizational boundaries. Firms that attempt to imitate such a resource may not be able to manage such great changes, thus leading to unsuccessful inter-organizational business integration. In sum, although the individual tasks that comprise an integrated inter-organizational process may be well understood, the process of integrating the tasks across multiple organizations and business units to develop a process tailored to a firm's strategic context is complex and deeply embedded in the social environment surrounding the focal firm. Thus, inter-organizational business integration is hard to imitate.

Substitutability. For a resource to be a source of sustained strategic advantage, there must be no strategically equivalent valuable resources that are potentially available to a firm (Barney 1991). While it is difficult to evaluate the exact degree of substitutability of inter-organizational system integration and business integration, it is argued that strategic substitutes for them are likely to be rare. Researchers (Markus 2000; Markus, et al. 2003) have called for integration with business partners in recognition that inter-organizational system integration and business integration is necessary and cannot be perfectly substituted in the environment of new era.

Based on the above discussions, I show that inter-organizational system integration is not rare and comparatively easy to imitate. Thus, it meets only two of the four conditions of strategic resources. Accordingly, I propose that it does not have a significant impact on

strategic performance. On the contrary, inter-organizational business integration meets all the four conditions and I argue that it will positively influence strategic performance.

Proposition 3a: Inter-organizational system integration is not associated with strategic performance;

Proposition 3b: Inter-organizational business integration is positively associated with strategic performance.

3.2.4 Impacts of Inter-Organizational Factors

The RBV helps to explain when a firm can gain strategic advantage from its resources. With respect to resource-based IS studies, not enough attention has been paid to how companies can appropriate the rent derived from the deployment of IT resources. Only until recently (Wade and Hulland 2004) had the appropriability of IS resources been considered and incorporated into resource-based IS frameworks. The purpose of this section is to extend resource-based IS studies by examining how important inter-organizational factors shape a company's benefits obtained from inter-organizational system integration.

Based on previous resource-based studies, I identify two inter-organizational factors, i.e. a firm's bargaining power and absorptive capacity relative to its trading partners that are connected via IOSs and argue that the two factors will help a company gain more strategic advantage in an IOS-enabled inter-organizational relationship.

Absorptive capacity is important to understand inter-organizational relationships. For instance, Malhotra et al. (2005) showed that absorptive capacity configurations in supply chain

have great impacts on operational efficiency and market knowledge creation. Bargaining power is also important to understand the rent appropriation issue. Coff (1999) argued that a complete model of a resource-based advantage must include bargaining power in order to predict above normal returns.

3.2.4.1 Relative Absorptive Capacity

Absorptive capacity refers to a firm's ability to recognize, assimilate and exploit knowledge from external sources (Cohen and Levinthal 1990). Considering that a firm can also learn from other organizations, Lane and Lubatkin (1998) reconceptualize the firm-level construct absorptive capacity as a dyad-level construct, inter-organizational learning, i.e. a firm's ability to value, assimilate, and apply new knowledge from a learning partner, which is jointly determined by the relative characteristics of the student and teacher firms. Based on Cohen and Levinthal's (1990) definition of absorptive capacity and Lane and Lubatkin's reconceptualization, I define relative absorptive capacity as a firm's ability, relative to its business partner, to recognize, assimilate and exploit external knowledge, which is consistent with the conceptualization used by Lavie (2002; 2005).

Since the study focuses on a supplier-customer dyad, let's suppose there a company C with one of its supplier S1. Company C may have other suppliers, say S2... Sk. In other words, I suppose company C has the number of k suppliers, say S1... Sk. Nowadays, one of the most important things for any company is to develop products and/or services to satisfy the needs of customers. For example, suppliers S1... Sk try to satisfy the needs of company C, which also tries to satisfy the needs of its own customers. Firms differ in their absorptive capacity due to idiosyncratic resource stocks, path and history dependencies, and heterogeneous

communication channels (Lavie 2002). Thus, suppliers $S_1 \dots S_k$ are likely to have different abilities to recognize, assimilate, and commercialize new external knowledge to satisfy the needs of company C.

Furthermore, based on Lane and Lubatkin's reconceptualization (1998) of absorptive capacity at a dyadic level, suppliers $S_1 \dots S_k$ have different abilities to learn from the same customer company C. Lane and Lubatkin (1998) argued that a firm's ability to learn from another firm depends on the similarity of both firm's knowledge bases, organizational structures and compensation policies, and dominant logics. Firstly, among these k suppliers, they may have different abilities to value new external knowledge from customer company C due to different basic knowledge and specialized knowledge. Secondly, these k suppliers may also have different abilities to assimilate external knowledge from company C because they have different compensation practices and organization structures. Lastly, these k suppliers may also differ in the ability to commercialize external knowledge because they have different shared organizational problem set with company C. In sum, these k suppliers of company C differ in absorptive capacity and they also differ in their ability to learn from their customer company C.

Customer company C has to serve its own customers for survival. The company has a certain level of absorptive capacity to value, assimilate, and commercialize external knowledge to satisfy the needs of its own customers. To serve its customers, company C depends on its suppliers for input. At minimum, company C expects its suppliers to have the same level of learning ability as C so that the suppliers can commercialize external knowledge and develop new products and/or services to satisfy its own needs. Ideally, company C hopes

its suppliers to have higher absorptive capacity to better serve itself. These suppliers can understand its preferences and thus are more likely to develop and provide products or services that satisfy the company's specific requirements. Thus, customer company C prefers doing business with those suppliers that have higher absorptive capacity relative to its own. In the environment of IOS-enabled inter-organizational relationship, especially in the case that there is a certain degree of system and business integration, suppliers with higher absorptive capacity are likely to learn more from the IOS-enabled inter-organizational relationship and provides customer company C with better products and services. Company C is likely to have the knowledge of its suppliers' learning ability through frequent communication, interactions, and coordination. As a result, company C probably transfers some business from suppliers that have low level of absorptive capacity to those with high level of absorptive capacity relative to its own. Accordingly, those suppliers with higher absorptive capacity than customer company C will gain strategic advantage in the relationship with company C.

Hypothesis 4: Higher relative absorptive capacity will be positively associated with strategic performance for the focal firm.

3.2.4.2 Relative Bargaining Power

Bargaining power is important to understand inter-organizational relationships. Accordingly to Yan and Gray (1994), bargaining power refers to a bargainer's ability to favorably change the 'bargaining set' to win accommodations from the other party and to influence the outcome of a negotiation.

The bargaining power theory (Bacharach and Lawler 1984) and resource dependence theory (Pfeffer and Salancik 1978) each identified a type of bargaining power, i.e. context-based bargaining power and resource-based bargaining power respectively. The bargaining power theory states that the stakes of the bargainer and the availability of alternatives are sources of context-based bargaining power. According to Yan and Gray (1994), a stake refers to a bargainer's level of dependence on a negotiating relationship and on its outcome. Available alternatives specify the extent to which a bargainer can choose different arrangements for achieving the same goals sought in the negotiation.

The resource dependence theory suggests that the possession or control of critical resources constitutes bargaining power in inter-organizational relations. If a company contributes more critical resources to an inter-organizational arrangement than its partner, it will be more powerful than the partner in the partnership between them. Yan and Gray (1994) used resource-based bargaining power to refer to the power gained from these critical resources.

Based on Yan and Gray's (1994) conceptualization of bargaining power, in this study I define relative bargaining power as a company's ability, relative to its business partner, to favorably change the bargaining set to win accommodations from the business partner and to influence the outcome of negotiations. As has been noted by Melville et al. (2004), power is reinforced within electronically connected networks and used by the relatively powerful partner to extract a disproportionate level of the benefits gained from inter-organizational system integration through contract formulation (Lavie 2002) and/or orchestration of the benefits to be skewed to its own interests (Melville, et al. 2004). In the case of a supplier-

customer dyad, if the supplier has a high bargaining power relative to its customer, it may ask for more business from the customer. The customer may even transfer some business from less powerful suppliers to powerful suppliers. Thus, the stronger the bargaining power of the focal firm relative to its business partner, the higher strategic benefits appropriated by the focal firm, *ceteris paribus*. Thus, I propose that

Hypothesis 5: Higher relative bargaining power will be positively associated with strategic performance for the focal firm.

3.2.4.3 The Impact of Relative Absorptive Capacity on Bargaining Power

A supplier, say S_1 , with higher absorptive capacity relative to its customer, company C, will develop superior understanding and refined knowledge regarding the inter-organizational relationship with the customer C. Such superior understanding and refined knowledge allow the supplier to develop products and offer services that are consistent with customer C's preference, which making the customer company C more dependent on the business with the supplier S_1 . In a supplier-retailer relationship, Subramani (2004) argued that an intimate understanding of the preferences and tastes of the customer segments enhances the retailer's reliance on the supplier because these benefits are unavailable to the retailer if the retailer switches to alternative suppliers. As a result, the supplier S_1 will have a high bargaining power relative to customer company C.

Hypothesis 6: Higher relative absorptive capacity will be positively associated with relative bargaining power for the focal firm.

3.2.5 Control Variables

The model incorporates three control variables, firm size, years of IOS usage with the business partner and years of business relationship with the business partner because of their potential influence on operational and strategic performance. Hypotheses related to these control variables were not proposed. The three variables were included in the model to assess the effects of inter-organizational system integration and business integration on organizational performance beyond those attributable to these control variables. The inclusion of firm size in the model controls for such factors as relative bargaining power, size of the resource base that can affect organizational benefits (Zaheer and Venkatraman 1994). In the study, I incorporated the length of IOS usage and length of business relationship with business partner as a control variable, which has two advantages as pointed out by Subramani (2004). First, it controls for the potential effects of IOS usage experience and relationship duration on organizational benefits. Second, it controls for potential recursive relationships between dependent and independent variables. Higher benefits in one period may lead to investments to achieve higher levels of inter-organizational system integration and business integration in subsequent periods. Furthermore, the inclusion of the years of business relationship also helps control the impact of Guanxi on organizational performance. In China, relationship building of different firms is particularly critical for business. Guanxi, which means literally a relationship between objects, forces, or persons (Yang 1994), is an important conduit to nurture business transactions (Luo 2003), especially for private companies in China (Xin and Pearce 1996). The incorporation of the length of business relationship in the research framework and in the data analysis paints a more accurate picture of the Chinese business practices.

CHAPTER 4 METHODOLOGY

The data for this study were collected through the survey method. Wherever possible, measurement items were adapted from existing scales. Since there are no established scales for inter-organizational system integration and business integration that are readily applicable to this study, standard scale development procedures were followed (Moore and Benbasat 1991) to develop appropriate scales for the two constructs. In this chapter, I first discuss the process through which I developed the instrument to measure inter-organizational system integration and business integration. Next, I discuss the data collection process.

4.1 Instrument Development

The instrument development process included three stages, i.e. item creation, scale development, and instrument testing (see Figure 2). The first stage was item creation, the purpose of which was to create item pools for each construct by identifying items from existing and similar scales and by creating additional items that seemed to fit the construct definitions. The next stage in the process was scale development. The basic procedure was to have panels of judges sort the items from the first step into separate categories. Based on the judges' placement, I then examined the items one by one. Any inappropriately worded items, ambiguous items, and indeterminate items were eliminated or revised. The various scales were then combined into an overall instrument for the instrument testing stage. At this stage, the draft scales were subjected to a qualitative testing of relevant validities. The purpose of this stage was to revise the newly developed scales and produce instruments that could be formally validated.

Figure 2 Instrument Development Process

Literature review suggested that some empirical work had been conducted on inter-organizational system integration. In contrast, very few studies operationalized the construct of business integration. Furthermore, some of the measures developed to operationalize system integration and business integration were too idiosyncratic to be used in context of this study. For example, the scales used to measure external and internal system integration in Ramamurthy et al.'s paper (1999) were specially tailored to EDI usage in the motor carrier industry such that they can not be directly used in this study. As a result, I need to develop the instruments for inter-organizational system integration and inter-organizational business integration in order to empirically test the research model. Conceptual definitions from the literature and those adopted in this dissertation were employed to develop the measurement items. Based on the conceptualization of the relevant constructs and boundaries of theorizing, inter-organizational system integration and inter-organizational business integration were operationalized at the dyadic level and from the focal firm's perspective.

In developing scales for the two latent variables, previous studies have differentiated between reflective items and formative items (Diamantopoulos and Winklhofer 2001). Various researchers have also emphasized the difference between formative indicators and reflective indicators (Chin 1998a; Chin 1998b; Jarvis, et al. 2003). In the reflective model, the latent variable influences the indicators, accounting for their inter-correlations. In contrast, in the formative model, indicators all have an impact on the latent variable and the indicators jointly determine the meaning of the latent variable. In developing the instruments for inter-organizational system integration and business integration, I chose to use reflective items. Firstly, standard guidelines (Moore and Benbasat 1991) are available to guide the instrument development for scales using reflective items. Secondly, as Jarvis et al. (2003) noted that formative indicators require a census of all concepts that form the latent variable and the omission of any important indicator is quite serious and may change the meaning of the variable. Due to the complexity of inter-organizational system integration and business integration, it is not clear to me how to identify all important factors that form inter-organizational system integration and business integration. And thirdly, even if a list of formative factors can be obtained, it must be a long list of various aspects of the technological, organizational, inter-organizational, and environmental factors that form inter-organizational system integration and business integration, which is far too complex to handle. Accordingly, a decision was made to develop instruments for the two constructs using reflective items.

Inter-Organizational System Integration Inter-organizational system integration was operationalized using reflective items. Based on the conceptualization of inter-organizational system integration as a construct consisting of two dimensions, the initial item pool of this construct was created so that it included items that measure the extent to which various

transaction types are transferred via IOSs and the extent to which IOSs are integrated with internal systems. Those items used to operationalize similar constructs such as internal diffusion (Truman 2000) and communication capability (Bowersox, et al. 1999) in previous empirical studies were adapted and included in the initial item pool of inter-organizational system integration. The four facets proposed by Massetti and Zmud (1996) and used to measure EDI usage were also considered to generate items to operationalize inter-organizational system integration.

Inter-Organizational Business Integration. Reflected items were also used to operationalize this construct. Items used to operationalize process integration as a dimension of supply chain management in Min and Mentzer's paper (2004) were adapted and included in the initial item pool. Items used to measure similar constructs such as internal integration (Bowersox, et al. 1999) were also adapted and included in the initial item pool. Mostly importantly, relevant work (Champy 2002; Hammer and Stanton 1999) on business process reengineering, process enterprise, and X-engineering were also used to generate items to operationalize business integration. I also referred to relevant conceptual and case studies (Fawcett and Cooper 2001; Markus 2000) to generate appropriate items.

4.1.1 Item Creation

The typical item in previous instruments was a statement to which the respondent was asked to indicate a degree of agreement. This approach was retained for this study. The process of item creation was carried out as follows. First, all items identified in the existing instruments were categorized into the various constructs which they were originally intended to address. This generated an initial item pool for each construct. Then, items considered too

narrow in focus and applicable only in particular situations were eliminated. Next, new items were created for those constructs where I felt that all dimensions of the construct had not been covered. Once the item pools were created, items for the various constructs were then re-examined to eliminate those that appeared redundant. Table 4 and 5 present the item pools for the two constructs at this point.

Table 4 Initial Item Pool for Inter-Organizational System Integration

Item Number	Item	Source
1	The same data are often inconsistent in terms of format and meaning across different application systems within my firm and firm X.	(Truman 2000)
2	The information technology infrastructure between my firm and firm X allows us to exchange information across application systems in a timely, responsive, and usable format.	(Bowersox, et al. 1999)
3	My firm has invested in technology designed to facilitate cross-organizational data exchange with firm X.	(Bowersox, et al. 1999)
4	Key databases are integrated across applications within my firm and firm X	(Bowersox, et al. 1999)
5	My firm and firm X maintain integrated databases and access methods to facilitate information exchange between us.	(Bowersox, et al. 1999)
6	Data from firm X must be rekeyed, as it used and reused by different employees within my firm.	(Truman 2000)
7	A high percentage of all data fields residing in the application systems within my firm and firm X are assigned data standards.	(Truman 2000)
8	For at least some data fields, there are data standards imposed and enforced across most of the application systems within my firm and firm X.	(Truman 2000)
9	A large variety of transaction sets (such as request for quotation, order, shipment information, invoices, remittance advice, payment status inquiry/report, etc.) can be exchanged between my firm and firm X using inter-organizational systems such as EDI, Internet, etc.	(Massetti and Zmud 1996)
10	Practically, my firm uses inter-organizational systems such as EDI, Internet, etc. to exchange most of the transaction sets with firm X	(Massetti and Zmud 1996)
11	In my firm, data exchanged with firm X via inter-organizational systems are integrated into my firm's various	(Massetti and Zmud 1996)

Item Number	Item	Source
	internal systems	

Table 5 Initial Item Pool for Inter-Organizational Business Integration

Item Number	Item	Source
1	My firm and firm X place personnel at the business facilities of each other to facilitate cooperation.	(Min and Mentzer 2004)
2	Tighter coordination among the discrete business activities conducted by my firm and firm X has allowed us to form a unified business process.	(Markus 2000)
3	The interdependent and distinct business processes in my firm and firm X are managed as a unified business process	Newly created
4	Feedbacks about the performance and quality at one point in the inter-organizational business processes across my firm and company X are communicated to other points in the processes timely	(Champy 2002)
5	My firm successfully integrates operations with firm X by developing interlocking programs and activities	(Min and Mentzer 2004)
6	My firm clearly defines specific roles and responsibilities regarding our inter-organizational business processes jointly with firm X.	(Bowersox, et al. 1999)
7	An inter-functional team from our business unit, together with the teams from firm X, has meetings to figure out how to serve our mutual customers better	(Min and Mentzer 2004)
8	Members in my firm and firm X understand how individual efforts contribute to the whole our inter-organizational business processes	(Hammer and Stanton 1999)
9	My firm has reduced formal organizational structures to more fully integrate operations with firm X	(Min and Mentzer 2004)
10	The performance systems regarding the inter-organizational business processes across my firm and firm X are consistent	(Fawcett and Cooper 2001)
11	My firm and firm X have established cross-enterprise and overall business process performance measures.	(Bowersox, et al. 1999)
12	The process-based performance measures have been disseminated throughout the my firm and firm X.	(Hammer and Stanton 1999)
13	One of us owns one of the inter-organizational processes (e.g., manufacturing, transportation, warehousing, distribution, marketing, etc.) for the rest of us	(Min and Mentzer 2004)
14	Redundant activities have been moved from our inter-organizational business processes that cross my firm and firm X	(Champy 2002)
15	Inter-organizational business processes between my firm and firm X operate under the principles of shared rewards and risks	(Bowersox, et al. 1999)

4.1.2 Scale Development

As illustrated in Moore and Benbasat's paper (1991), four rounds of sorting of the initial items were performed, each involving four judges who were MBA students with multiple years of work experience or MIS graduate students. Items were printed on 8× 12-cm cards. The cards were then shuffled into random order for presentation to the judges. Each judge sorted the cards into categories independently. As the final survey was to be administered to Chinese managers, it was necessary to ask judges also to sort Chinese version of those items. So after the first two rounds of sorting, all items were translated into Chinese. The resultant Chinese version was then back-translated into English by four Chinese MIS graduate students, working independently. Revisions were made as required. This was followed by the third and fourth rounds of sorting, which were conducted in China and instructed in Chinese. In all sorting rounds, different sets of judges were used.

Prior to sorting the cards, judges were read a standard set of instructions which had been tested with a set of separate judges to ensure their comprehensiveness and comprehensibility. Judges were encouraged to ask questions so that they understood the procedure. Following this, a trial sort was done by each judge on eight sample items unrelated to the constructs of the study. In this case, these eight statements described various aspects of a photocopy machine. Judges were asked to sort the "test" cards, following the instructions they had received. The judges then labeled and defined the categories. Anything unclear and all misunderstandings resulting from the pilot sorting were clarified.

Next, the judges were asked to sort the real research items. Since all the items were related to inter-organizational relationships, the judges were supposed to be in a business scenario

where his or her company was doing business with a specific business partner. To do so, the judges were read "Suppose you are in a manufacturing company and your company supplies a component, say integrated circuit, to one of your customer, company X. And further suppose you are the general manager of your company. We are interested in evaluating your company's inter-organizational relationship with the customer, company X." Then, the judges were asked to group the items into different categories based on the differences and similarities among these items. There was slight difference between the instruction in the first round and the instruction in each of the following three rounds. In the first round, the judges were not told what the underlying constructs were, but they were asked to provide their own labels and definitions for the constructs. In the following three rounds, the construct labels as well as their definitions were provided to the judges and judges were asked to group the items based on the definitions of these constructs. In all the four rounds of sorting, I explicitly asked the judges not to force fit any item into a particular category. I also recorded any unclear, ambiguous, or indeterminate items.

To assess the reliability and validity of the sorting conducted by the judges, I calculated the inter-rater reliabilities as well as the hit ratio- the extent to which all items are placed by the panel of judges in each round within the "target" construct. Two steps were used to calculate the inter-rater reliability. First, for each pair of judges in each round of sorting, their level of agreement in categorizing items was measured using Cohen's Kappa (Cohen 1960). Once the Kappa scores were calculated, the kappa scores were averaged to assess the level of agreement across all pairs of judges. Though no general authority exists with respect to required scores of Kappa, Moore and Benbasat (1991) suggested that Kappa scores greater than 0.65 are acceptable. I obtained the hit ratio by calculating the overall frequency with

which all judges place items within the intended theoretical construct. The higher the percentage of items placed in the target construct, the higher the degree of inter judge agreement. Thus, the hit ratio can be viewed as an indicator of construct validity (Moore and Benbasat 1991). The hit ratio matrix can also be used to identity problematic items and area. In the next several sections, I present the results of the four rounds of sorting.

4.1.2.1 The First Round of Sorting

In this round of sorting, four MBA students with multiple years of work experience were hired as judges. The four judges were not given the constructs or definitions. Instead, they were required to label and define each of their categories independently. Table 6 presents the results.

Table 6 Results of the First Round of Sorting

Judge	Construct	Items Included	Label
Judge 1	Construct 1	3 IOBI items and 5 IOSI items	Technical aspect of my firm with respect to firm X
	Construct 2	2 IOBI items and 1 IOSI item	Inter-personal relation with firm X
	Construct 3	10 IOBI items and 5 IOSI items	Similar aspects
Judge 2	Construct 1	2 IOSI items	My firm and its technology
	Construct 2	9 IOSI items	Technology/Information interchange between companies
	Construct 3	15 IOBI items	Performance/process between our companies
Judge 3	Construct 1	15 IOBI items and 11 IOSI items	United business process
Judge 4	Construct 1	14 IOBI items and 11 IOSI items	Collaboration with firm X
	Indeterminate	1 IOSI item	Indeterminate items

Note:

- 1) IOSI=Inter-Organizational System Integration, IOBI=Inter-Organizational Business Integration

Several observations can be made from the results shown in Table 6. Firstly, Judges classified these items using different criteria. It is not surprising because they were not given the labels and definitions of the constructs. Secondly, a striking finding was that most judges did not differentiate between the items of inter-organizational system integration and those of inter-organizational business integration.

After they finished the sorting, the judges then met as a group for discussion. Unclear, ambiguous, indeterminate, or difficult-to-understand items identified by any judge were discussed. Ways to improve the clarity of these items were recorded. I revised the wording of the problematic items based on the judges’ feedbacks and suggestion.

4.1.2.2 The Second Round of Sorting

In the second round of sorting, another four MBA students were served as judges and were asked to sort the items based on the construct definitions which had been provided. Table 7 and Table 8 present the Kappa scores and hit ratio respectively.

Table 7 Kappa Scores in the Second Round of Sorting

	Judge 1 and 2	Judge 1 and 3	Judge 1 and 4	Judge 2 and 3	Judge 2 and 4	Judge 3 and 4
Kappa	0.85	0.85	0.92	0.85	0.93	0.92
Kappa Average	0.89					

Table 8 Hit Ratio in the Second Round of Sorting

Constructs		Actual Category			Total	Hit Ratio %
		IOBI	IOSI	NA		
Target category	IOBI (15 items)	56	4	0	60	93.3%
	IOSI (11 items)	0	43	1	44	97.7%

Constructs		Actual Category			Total	Hit Ratio %
		IOBI	IOSI	NA		
	Total Item Placement: 104			Hits: 99	Overall Hit Ratio: 95.2%	

Note:

- 1) NA=Not Applicable, which includes situations where items are ambiguous and indeterminate and thus can not be classified properly.

Examination of the results in Table 7 showed high agreement among the judges with Kappa scores averaged 0.89. In other words, results indicated that the classifications were reliable across judges. The overall placement ratio of items within target constructs was 95.2%, with both constructs above 90%. This indicated that items were generally placed as I expected. Accordingly, I concluded that the scales developed to operationalize the two constructs demonstrated construct validity with a good reliability.

Closer examination of all the items showed that in total 3 items (i.e. item No.6 in IOSI item pool, and item No.5 and item No.13 in IOBI item pool) were either grouped into the category other than the target category, or were identified ambiguous or indeterminate at least once, or both. I examined all the 3 items and appropriate revisions were made to improve their clarity. One item, i.e. item No.5 in IOBI item pool, was deleted from the item pool because it was misclassified three times by the four judges and was believed ambiguous.

4.1.2.3 The Third Round of Sorting

As in the second round of sorting, another four judges were employed to sort the revised items. The third round of sorting was conducted in China and was instructed in Chinese. The four judges were MIS graduate students from a Chinese university. They were also provided the labels and definitions of the two constructs and were asked to sort the items based on the

definitions provided. Kappa scores and hit ratio were calculated and shown in Table 9 and Table 10 respectively.

Table 9 Kappa Scores in the Third Round of Sorting

	Judge 1 and 2	Judge 1 and 3	Judge 1 and 4	Judge 2 and 3	Judge 2 and 4	Judge 3 and 4
Kappa	0.85	0.92	0.92	0.93	0.93	1.00
Kappa Average	0.92					

Table 10 Hit Ratio in the Third Round of Sorting

Constructs		Actual Category			Total	Hit Ratio %
		IOBI	IOSI	NA		
Target category	IOBI (14 items)	53	0	3	56	94.6%
	IOSI (11 items)	0	43	1	44	97.7%
Total Item Placement: 100				Hits: 96	Overall Hit Ratio: 96%	

Note:

- 1) NA=Not Applicable, which includes situations where items are ambiguous and indeterminate and thus can not be classified properly.

As shown in Table 9, the level of agreement among these four judges was quite high with Kappa score average 0.92. Moreover, on average, 96% of the items were placed within the target constructs. Further examination indicated that 2 items (i.e. item No. 11 in IOSI item pool and item No. 9 in IOBI item pool) were either misclassified or believed indeterminate. Among the 2 items, the Chinese wording of item No. 11 in IOSI item pool was refined. The other item, i.e. item No. 9 in IOBI item pool, was deleted from the item pool. The item was misclassified or indicated indeterminate three times by the four judges. After this round, the scale of inter-organizational business integration included 13 items while the number of items

for inter-organizational system integration scale remained 11. All items remaining at this point were then passed to the next round of sorting.

4.1.2.4 The Fourth Round of Sorting

The procedures of the fourth round of sorting were the same as those used in the third round. In this round, I used the item pool which had been refined after the first three rounds of sorting. Four Chinese MBA students with years of work experience were employed as the judges. Again, the four judges were given the definitions of the constructs before the sorting. Kappa scores and hit ratio were shown in Table 11 and Table 12 respectively.

Table 11 Kappa Scores in the Fourth Round of Sorting

	Judge 1 and 2	Judge 1 and 3	Judge 1 and 4	Judge 2 and 3	Judge 2 and 4	Judge 3 and 4
Kappa	0.92	1.00	1.00	0.92	0.92	1.00
Kappa Average	0.96					

Table 12 Hit Ratio in the Fourth Round of Sorting

Constructs		Actual Category			Total	Hit Ratio %
		IOBI	IOSI	NA		
Target category	IOBI (13 items)	52	0	0	52	100%
	IOSI (11 items)	0	43	1	44	97.7%
Total Item Placement: 96				Hits: 95	Overall Hit Ratio: 99%	

Note:

- 1) NA=Not Applicable, which includes situations where items are ambiguous and indeterminate and thus can not be classified properly.

The agreement among the pairs of judges was generally above 0.90 with the average Kappa value 0.96. This suggested that the classification was very consistent across the four

judges in this round. The overall placement ratio of items within the target construct was 99%, which showed that a high degree of construct validity and potential reliability had been achieved. Since the Chinese version of the scales demonstrated high degree of construct validity and potential reliability, I made only slight changes to a few items. The refined items were passed to the next stage of scale development.

4.1.3 Instrument Testing

At the stage of instrument testing, the scales used to operationalize the two constructs were combined to form a survey draft. And then the survey draft was subjected to a qualitative testing of all relevant validities. This stage was designed to facilitate revision, leading to instruments that could be formally validated.

Instrument testing was first conducted in three Chinese companies. The three companies were from a variety of industries including retailing, logistics, and manufacturing. I interviewed two to three managers in each company to locate and correct weaknesses in the instruments. The managers I interviewed included IT department manger, the business manager, and the manager from the finance department. The selection of interviewees was designed to get maximum feedback from various expertise, and organizational roles. The instruments were continuously revised based on the suggestion from those managers I interviewed.

The in-depth interviews offered insight into the IOS implementation, inter-organizational system integration, as well as business integration. Respondents were also encouraged to indicate any important elements in information system integration and business integration.

Interviews began with an open-ended general discussion. Respondents spoke on all aspects of information system integration and business integration. Then the interview moved to a highly structured examination of the instruments developed at the first two stages. To eliminate ambiguities and further test validities, participants in the interview were asked to evaluate the relevant section of the survey item-by-item. For example, I asked IT department managers to examine the instrument used to operationalize inter-organizational system integration. Managers were encouraged to single out any pointless, unclear, or redundant questions and suggest new areas for inquiry. Concepts introduced and comments made by any respondent were noted. Revisions were made to the instruments if considered necessary. As a result, several items were removed from the IOSI item pool and the IOBI item pool. In the IOIS item pool, items No. 1, 7 and 8 were considered redundant and I opted to delete items No.1 and 7 and keep item No. 8. Items No. 4 and 5 were also considered redundant and decision was made to remove item No. 4. In the IOBI item pool, items No.6 and No. 8 were considered redundant and decision was made to delete item No. 6 from the item pool. Items No. 10, 11, and 12 were considered redundant and decision was made to delete items No. 11 and 12 from the item pool.

At this point, the scales developed were combined to form a survey. The survey was then subjected to a qualitative examination by 4 MIS professors. Two professors were asked to review the English version of the survey and another two whose mother tongue is Chinese helped to review the Chinese version. The professors were asked to examine the instruments one by one. They were also encouraged to seek out any unclear items and those items that are not consistent with the conceptualization of inter-organizational system integration and business integration. The two professors who reviewed the Chinese version of the survey were

also asked to pick out any awkward wording and un-idiomatic usage of Chinese (due to the introduction of constructs from the West and the translation from English to Chinese) to ensure that respondents have no problem in reading, understanding, and answering the questions. Comments and suggestion were recorded, based on which the survey was updated subsequently. As a result, several items from IOSI and IOBI item pools were considered not consistent with the conceptualization of the two constructs. Since items No. 2, No. 3, and No. 5 in the IOSI item pool were believed to reflect neither of the two dimensions of inter-organizational system integration, both items were deleted from the item pool. Item No. 2 in IOBI item pool was considered not a reflective item and thus was removed from the item pool. Items No. 3 and 15 were believed to reflect neither communication nor coordination and thus were also deleted from the IOBI item pool. At this point, the inter-organizational system integration item pool includes 5 items, i.e. items No. 6, 8, 9, 10, and No. 11. The inter-organizational business integration item pool includes 7 items, i.e. items No. 1, 4, 7, 8, 10, 13, and No. 14.

The final version of the instruments used 5 reflective items to measure inter-organizational system integration (Table 13) and 7 reflective items to measure inter-organizational business integration (Table 14). The two scales were shown in Table 13 and 14, with items re-labeled.

Table 13 Final Items Used to Measure Inter-Organizational System Integration

Item No.	Item
IOSI-1	Data from firm X must be rekeyed, as they are used and reused by different employees within my firm.
IOSI-2	For at least some data fields, there are data standards imposed and enforced across most of the information systems that span my firm and firm X.

Item No.	Item
IOSI-3	A large variety of transaction sets (transaction sets refer to the data exchanged between trading partners, such as order data, shipment data, invoice data, remittance advice data, etc.) can be exchanged between my firm and firm X using inter-organizational systems such as EDI, Internet-based IOSs, etc.
IOSI-4	My firm and firm X use inter-organizational systems such as EDI, Internet-based IOSs, etc. to exchange most of the transaction sets.
IOSI-5	Data exchanged with firm X via inter-organizational systems such as EDI, Internet-based IOSs, etc. are integrated into my firm's various internal information systems.

Table 14 Final Items Used to Measure Inter-Organizational Business Integration

Item No.	Item
IOBI-1	My firm and firm X place personnel at the business facilities of each other to facilitate cooperation.
IOBI-2	Feedback about the performance and quality at one point in the inter-organizational business processes across my firm and company X is communicated to other points in the processes timely
IOBI-3	An inter-functional team from our business unit, together with the teams from firm X, has meetings to figure out how to serve our mutual customers better
IOBI-4	Members in my firm and firm X understand how individual efforts contribute to the whole our inter-organizational business processes
IOBI-5	The performance systems regarding the inter-organizational business processes across my firm and firm X are consistent
IOBI-6	One of us owns one of the inter-organizational processes (e.g., manufacturing, transportation, warehousing, distribution, marketing, etc.) for the rest of us
IOBI-7	Redundant activities have been removed from our inter-organizational business processes that cross my firm and firm X

4.2 The Survey

The data for this study were collected through the survey method in China. To avoid common-method bias, data regarding inter-organizational system integration, inter-organizational business integration, and organizational performance were collected from different respondents. In the following paragraphs, I describe the detailed process through which I collected the data.

4.2.1 Operationalization of Constructs

For measures of inter-organizational system integration and business integration, I used the scales that I newly developed for this study. Based on the conceptualization of the relevant constructs, inter-organizational system integration, inter-organizational business integration, relative bargaining power, and relative absorptive capacity were operationalized at the dyadic level and from the focal firm's perspective. I asked each respondent to identify a customer enterprise and then evaluate his or her company's system integration and business integration with the customer. Operational performance was operationalized at the organizational level. Strategic performance was also operationalized at the organizational level, relative to the focal company's major competitors. I measured all these constructs using 7-point Likert scale, anchored at 'strongly disagree' (1), 'strongly agree' (7), and 'neutral' (4).

Inter-organizational system integration. Inter-organizational system integration was measured with 5 reflective items (see Table 13). The scale includes items that measure the extent to which various transaction types are conducted via IOSs and items that assess the extent to which IOSs are integrated with internal systems. Such operationalization is consistent with the conceptualization of inter-organizational system integration.

Inter-organizational business integration. Inter-organizational business integration was measured with 7 reflective items (see Table 14). Items were adapted from previous studies or newly created to reflect the communication and coordination facets of business integration so that the operationalization was consistent with the conceptualization of inter-organizational business integration.

Operational performance. In this study, I used 4 items to measure operational performance (see Table 15). The scale of operational performance was designed as a

subjective measure, consisting of questions about the firm's capacity utilization (Kohli and Devaraj 2003), inventory turnover (Kohli and Devaraj 2003), productivity (Ravichandran and Lertwongsatien 2002), and cost efficiencies (Subramani 2004). I asked each respondent to indicate the extent to which his or her company is receiving the operational benefits as a result of the company's relationship with the chosen customer, company X. The way we measured operational performance is consistent with previous studies (Subramani 2004).

Table 15 Items Used to Measure Operational Performance

Item No.	Item
OP-1	As a result of my firm's relationship with firm X, my firm's capacity utilization increases
OP-2	As a result of my firm's relationship with firm X, my firm's inventory turnover increases
OP-3	As a result of my firm's relationship with firm X, my firm's productivity increases
OP-4	As a result of my firm's relationship with firm X, my firm's cost efficiency increases

Strategic performance. Strategic performance was operationalized with 4 items which reflect the focal firm's performance relative to its major competitors (see Table 16). Previous studies suggested that strategic performance includes facets such as market share (Ravichandran and Lertwongsatien 2002), the development of new business (Subramani 2004), and sale growth (Mukhopadhyay and Kekre 2002; Powell and Dent-Micallef 1997). Relevant items used in previous studies were adapted in this study to operationalize the construct of strategic performance.

Table 16 Items Used to Measure Strategic Performance

Item No.	Item
SP-1	Firm X's purchases from my firm are increasing
SP-2	In firm X's purchases in the category of my firm's products, my firm's market share is increasing

Item No.	Item
SP-3	My firm has gained a strategic advantage relative to our major competitors in the business with firm X
SP-4	My firm's development of new business opportunities with firm X exceeds our major competitors' development of new business opportunities with firm X

Relative Bargaining Power. Relative bargaining power was operationalized using formative items (see Table 17). Since the relative bargaining power discussed in this study is undoubtedly embedded in the context of the focal firm where the firm interacts with its environment, I found that the concept of context-based bargaining power in Yan and Gray's study (1994) was especially useful to the operationalization of the construct of relative bargaining power. Yan and Gray identified two sources of context-based bargaining power, stakes and alternatives. The scale used to operationalize relative bargaining power were adapted from Kemp (1999).

Table 17 Items Used to Measure Relative Bargaining Power

Item No.	Item
RBP-1	The business between my firm and firm X makes a much smaller contribution to my firm's <i>sales</i> than to firm X's sales
RBP-2	It is easier for my firm to replace firm X than firm X replace my firm in doing business.
RBP-3	My firm has more alternative ways of replacing firm X than does firm X to replace my firm
RBP-4	We are less dependent on firm X than is firm X on my firm.
RBP-5	The business between my firm and firm X makes a much smaller contribution to my firm's <i>profits</i> than to firm X's profits

Relative Absorptive Capacity. This construct was measured using 10 reflective items (see Table 18). Based on Zahra and George's (2002) conceptualization of absorptive capacity as a construct consisting of four dimensions, i.e. acquisition, assimilation, transformation, and exploitation, Pavlou (2004) operationalized the construct using 10 items. In the current paper,

I adapted the 10 items used in his paper to reflect the focal company's absorptive capacity relative to its business partner.

Table 18 Items Used to Measure Relative Absorptive Capacity

Item No.	Item
RAC-1	Relative to firm X, we are more successful in learning new things
RAC-2	Relative to firm X, we are more effective in developing new knowledge or insights that have the potential to influence product development
RAC-3	Relative to firm X, we have higher ability to identify and acquire internal and external knowledge
RAC-4	Relative to firm X, we have more effective routines to identify, value, and import new information and knowledge
RAC-5	Relative to firm X, we have more adequate routines to <i>analyze</i> the information and knowledge obtained
RAC-6	Relative to firm X, we have more adequate routines to <i>assimilate</i> new information and knowledge
RAC-7	Relative to firm X, we can more successfully integrate our existing knowledge with the new information and knowledge acquired
RAC-8	Relative to firm X, we are more effective in transforming existing information into new knowledge
RAC-9	Relative to firm X, we can more successfully exploit internal and external information and knowledge into concrete applications
RAC-10	Relative to firm X, we are more effective in utilizing knowledge into new products

Control variables. In this study, I incorporated three control variables, i.e. firm size, the length of IOS usage with the business partner identified, and the length of business relationship with the partner. To measure firm size, the respondents were asked to indicate whether their companies are small, medium, or large based on the number of employees, but adjusted slightly to the industry in which their companies operate. According to standards issued by the National Bureau of Statistics of China, a manufacturer is considered large when its number of employees exceeds 2000, medium when the number is between 300 and 2000, and small when the number is smaller than 300. In contrast, a company in the retailing industry is considered large when the number of employees is large then 500, medium when the number is between 100 and 500, and small when the number is smaller than 100. Since the

CFO or the financial department manager is the person who is most likely to know various accounting standards in China, I collected the firm size information from them. To measure the length of IOS use with the specific business partner, I asked the IT department manager or CIO to indicate how many years his or her company had used IOSs with their chosen customer enterprises. To measure the length of business relationship with the partner, I asked the business manager or vice president for business how many years his or her company had a business relationship with the partner.

4.2.2 Sample Selection

The population of this study was those supplier-customer dyads where inter-organizational systems were being used. The data used in this study were collected from Chinese companies through questionnaire. I obtained the access to these companies through the executive MBA students in a Shanghai-based university. These students worked in their companies on weekdays and studied at the university on weekends. Data were obtained from the managers of those companies where the students were working. Each student was asked to identify, together with his or her company's business manager and IT department manager, a supplier-customer dyad in which the company where student was working served as a supplier and where some forms of inter-organizational systems were being used. The degree of inter-organizational system integration and business integration was an evaluation, from the supplier's perspective, of the inter-organizational relationship between the two companies that formed the supplier-customer dyad.

4.2.3 Survey Administration

To avoid common-methods bias, the assessment of inter-organizational system integration were obtained from the IT department manager or CIO, the assessment of inter-organizational business integration were obtained from the business manager or the vice president for business, and the assessment of operational and strategic performance were obtained from the financial department manager or the CFO. Accordingly, the whole questionnaire was divided into three parts. Specifically, the first part included scales used to operationalize inter-organizational system integration and questions regarding IT usage and this part was completed by the IT department manager or the CIO. The second part included scales used to operationalize inter-organizational business integration and was completed by the business manager or the vice president for business. The information regarding relative absorptive capacity was also collected from the business manager or the vice president for business because the discussion with managers suggested that business managers interact with business partners frequently and know their companies' absorptive capacity relative to their companies' business partners. And the third part included scales used to operationalize operational and strategic performance and was completed by the financial manager or the CFO. The information regarding relative bargaining power was also collected from the financial department manager because financial managers are likely to know their companies' alternatives as well as the extent to which the business with a specific partner contributes to their companies' sales and profits.

A package containing a cover letter stating the study objective and three envelopes with one part of the survey in each envelope (one for the IT department manager or the CIO, one for the business manager or the vice president for business, and one for the financial department manager or the CFO) was given to every student in the first-year and second-year

executive MBA classes. Each envelope was labeled so that the content of survey in the envelope can be easily and clearly identified. Cover letters tailored to the IT department manager, the business manager, and the financial department manager were also attached to the corresponding part of the survey. The definition and description of inter-organizational systems and inter-organizational business processes were included in relevant cover letters in order to improve the validity of the responses. Especially, I listed some examples of IOSs such as EDI, proprietary IOSs, XML-based IOSs like RosettaNet, ERP-to-ERP, and so on. I also explicitly noted that email and fax do not belong to IOSs.

In the survey, some items, especially those that were used to operationalize inter-organizational system and business integration, bargaining power, and absorptive capacity, were designed to evaluate the aspects of the focal company relative to one of its business partners. Thus, a business partner must be identified so that the IT department manager and the business manager could evaluate their company's inter-organizational system and business integration with the *same* business partner and that the business manager and the financial manager could evaluate the bargaining power and absorptive capacity also in comparison with the *same* business partner. Thus, when I presented the survey package to those executive MBA students, I asked each student, together with his or her company's IT department manager and business manager, to identify a customer of his or her company. The customer should satisfy the following conditions. Firstly, the customer must be real customer. Moreover, it is an enterprise customer not an individual customer. Secondly, some forms of inter-organizational systems are being used between the company where the student works and the customer. And lastly, there are regular working relationships between the company where the student works and the customer. Once the student, together with the IT department manger and the business

manager, identified the enterprise customer, he or she was required to write down the name of the customer on the labels attached to each envelope inside the survey package. I used firm X to refer to the customer identified throughout the three parts of the survey.

Here, I asked the students to identify a customer rather than a supplier because I wanted the managers to respond to the survey from a supplier's perspective. As noted by Subramani (2004), prior work focused largely on the benefits derived from IOSs by network leaders and little attention was paid to the benefits derived from IOSs by suppliers and to the mechanisms that enable suppliers to realize benefits. Thus, how suppliers can take advantage of IOSs and benefit from their use of IOSs is not clearly understood. This study that was built on previous studies and that examines IOS issues from the suppliers' perspective would enhance the understanding toward this.

In each cover letter, I assured that the responses would be treated confidentially and that the results would only be reported in aggregate. I also guaranteed that the information would not be disclosed to any third parties. In return for each company's cooperation, I promised to offer an aggregated report to the company if email address is provided.

In all, I gave out 323 packages of survey. Three sets of sub-surveys addressed to the IT department manager, the business manager, and the financial department manager respectively were included in each package. Two rounds of follow-up emails and calls were made to the students. I asked these students to help forward the survey to relevant managers, collect completed surveys from managers, and then return the surveys to us. Following two reminders, 75 complete responses were received with the response rate 23.2%.

4.3 Response Rate and Nonresponse Bias

The 75 sets of survey returned were scrutinized for data reliability and completeness. As the data were collected from three respondents in different departments, it is likely that one or two respondents did not return the relevant parts of the survey. In such a case, the survey was considered incomplete. The survey was also considered incomplete if answers to any questions regarding research variables in the three individual parts were missing. It is also possible that respondents did not complete the survey carefully so that the answers displayed a clear response pattern. For example, answers to all the questions of one construct were the same. As a result of this scrutiny, 5 questionnaires were discarded because the survey was incomplete or because the survey had clear response patterns, resulting in 70 complete sets of useful surveys for data analysis (response rate 21.7%).

The non-response bias was assessed through the comparison of responding companies with non-responding companies. Among those non-respondents, I randomly picked 100 companies and collected information about the ownership of the company and about the industry in which the company mainly operates. The source of information is on the Internet obtained by using search engine such as google.com and baidu.com (the largest Chinese document search engine). As a result, I obtained two pieces of information for almost all companies, ownership of the company and the industry in which the company mainly operates. Only 15 companies' industry information and 18 companies' ownership information can not be obtained on the Internet. Chi square tests were performed to check whether industry and ownership differ between those responding companies and those non-responding companies. Results show that

respondents and non-respondents do not differ in terms of industry (chi square=2.876, $p=0.411$) and ownership (chi square=3.722, $p=0.155$).

In sum, the above analysis has alleviated the concern regarding non-response bias that non-response bias might not be a serious problem in the study.

CHAPTER 5 DATA ANALYSIS AND FINDINGS

In this chapter, I will present the research findings based on data analysis. Structural equation modeling (SEM) was used to perform a simultaneous evaluation of both the measurement model and the structural model. The issue of statistical power was discussed in the later part of this chapter.

5.1 Informant and Sample Demographics

Of the informants to the first part of the survey, 88.6% were CIO, CTO, or IS department managers. Other titles included deputy general manager, etc. 77.1% of the respondents to the second part of the survey identified their positions as vice president for business, business department managers, general manager, or deputy general manager. About 20% indicated other positions such as marketing department manager. Of the informants to the third part of the survey, 90.0% were CFO, vice president for finance, or financial department managers. Other titles included general manager, etc.

The profile of organizations that responded to the survey is shown in Table 19. The majority of the organizations that responded were from the manufacturing industry (41.4%), IT (20.0%), finance (12.9%), communication (7.1%), and trading (5.7%) industries. Responses that represented less than 10% came from other industries such as retail industry. 43.1% of responding companies were large companies, with 31.9% medium-sized companies and 22.2% small-sized companies. It is not surprising that a large percentage of the responding companies are large companies. IOSs are new in mainland China. Thus only those companies with sufficient financial and technical resources are using IOSs. Those companies are likely to be

medium to large-sized companies. More than 60% of the responding companies were either foreign-invested enterprises (38.6%) or private companies (27.1%) while state-owned enterprises and collectively owned companies accounted for less than 30%, which reflects the booming market economy in mainland China. The majority (90%) of the responding companies had multiple years of association with their chosen business partner. The average of the length of association is 4.9 years with the minimum 1 year and maximum 15 years. The majority (about 80%) of the responding companies had three or less years of IOS usage with the chosen business partner, with the mean 2.6 years, minimum 1 year, and maximum 6 years. This indicates that IOSs are in fact quite new to companies in mainland China and most companies began using IOSs only recently.

Table 19 Profile of Organizations that Responded

Demographic/ Control variable	Category	Frequency (n=70)	Percentage	Missing
Industry	Manufacturing	29	41.4%	4
	IT	14	20.0%	
	Finance	9	12.9%	
	Communication	5	7.1%	
	Trading	4	5.7%	
	Others	5	7.1%	
Firm Size	Large	31	44.3%	0
	Medium	23	32.9%	
	Small	16	22.9%	
Ownership	Foreign-invested enterprises or ventures	27	38.6%	4
	Private	19	27.1%	
	State-owned Enterprise	14	20.0%	
	Collectively owned	5	7.1%	
	Others	1	1.4%	
Years of association with the chosen business partner	1 year	7	10.0%	0
	2 years	7	10.0%	
	3 years	9	12.9%	
	4 years	12	17.1%	

Demographic/ Control variable	Category	Frequency (n=70)	Percentage	Missing
	5 years	15	21.4%	
	6 years	7	10.0%	
	8 years	7	10.0%	
	10 years and above	6	8.6%	
Years of IOS usage with the chosen business partner	1 year	21	30.0%	0
	2 years	17	24.3%	
	3 years	17	24.3%	
	4 years	6	8.6%	
	5 years	2	2.9%	
	6 years and above	7	10.0%	

The information technologies and IOS usage in the responding companies are shown in Table 20. Most companies (87.1%) have implemented office automation while around half (48.6%) have implemented ERP. With respect to IOSs, I classify IOSs into various categories. If a supplier mainly uses some standards to interact with a buyer, then the IOSs would be EDI or XML-based standards. In mainland China, UN/EDIFACT is the official standard for EDI. Thus the definition of EDI in mainland China follows that of United Nations, which is electronic data interchange based on “a set of internationally agreed standards, directories and guidelines for the electronic interchange of structured data, and in particular that related to trade in goods and services between independent, computerized information systems” under the rule of the United Nations. XML-based standards include RosettaNet, Chemical Industry Data Exchange (CIDX), Petroleum Industry Data Exchange (PIDX), etc. If the supplier uses IOSs other than standards, then the IOSs would be either in-house developed proprietary IOSs, or system provided by the buyer such as online purchase platform (something like iHaier, which is an online purchase system used by the suppliers of Haier, one of the most well-know and prestigious whitegoods manufacturer in mainland China), or purchased from the market such as ERP-to-ERP connection supported by middle ware. The results show that 34.3% of the responding companies used EDI to transfer data with their chosen business partner, while

17.1% used ERP-to-ERP connection to transfer data. It is interesting to note that almost half (44.3%) used proprietary IOSs while less than 10% companies used industry standards such as RosettaNet, AIAG (Automotive Industry Action Group), SWIFTNet, and PIDX. This is not surprising because while ERP has been introduced to mainland China for more than a decade, industry standards have their presence in mainland China only recently. For example, not until late 2004 had RosettaNet Consortium set up its office in mainland China.

With respect to transaction types, I found that, to a large extent, companies use IOSs for transactional data exchange. More than half (61.43%) of the responding companies transfer order information with its chosen business partner via IOSs. Other data types that have been transferred between the responding companies and their chosen business partners are invoice, shipping information, inventory information, shipping status, remittance, etc. Very few responding companies use IOSs to interact with production planning and control systems of their chosen buyer firms. Only one company mentioned that it transferred R&D information with its chosen business partner. Combining the information regarding the years of IOSs usage, I see that mainland Chinese companies are at their early stages of IOSs use for business where the use of IOSs focus on transactional data exchange.

Table 20 Information Technologies and IOS Usage in Companies that Responded

	IT	Frequency (n=70)	Percentage	Missing
Companies that have implemented or are implementing these technologies	OA	61	87.1%	0
	EDI	24	34.3%	
	ERP	34	48.6%	
	SCM	13	18.6%	
	PDM	12	17.1%	
	CRM	23	32.9%	
	EC	27	38.6%	
	CIMS	1	1.4%	
Percentage of	EDI	23	32.9%	0

	IT	Frequency (n=70)	Percentage	Missing
companies that are using these IOSs to do business with the selected business partner	ERP-to-ERP	12	17.1%	
	Proprietary IOSs	31	44.3%	
	Online purchase platform	5	7.1%	
	Others	4	5.7%	
Transaction Types transferred between the company and its business partner	Order	43	61.43%	0
	Invoice	34	48.57%	
	Shipping	33	47.14%	
	Inventory	30	42.86%	
	Shipping Status	25	35.71%	
	Remittance	24	34.29%	
	Business Data	2	2.86%	
	R & D	1	1.43%	
	Debit Instruction	1	1.43%	

Note

- 1) OA=Office Automation, EDI=Electronic Data Interchange, ERP=Enterprise Resource Planning, SCM=Supply Chain Management, PDM=Product Data Management, CRM=Customer Relationship Management, EC=Electronic Commerce, CIMS=Computer Integrated Manufacturing Systems

5.2 The Measurement Model

Structural equation modeling (SEM) was used to perform a simultaneous evaluation of both the measurement model and the structural model. PLS, as implemented in PLS Graph version 03.00 Build 1126, was chosen and used for hypothesis testing primarily because PLS Graph provides the ability to model latent constructs that are measured using formative indicators and because it works well under conditions of small- to medium-sized samples (Chin, et al. 2003).

The sample of 70 cases is adequate for the PLS analysis. It satisfies the heuristic that the sample size be at least 10 times the larger of the following two numbers, the largest number of formative indicators and the largest structural paths directed at any one construct (Chin 1998b). The largest number of paths to any construct in the research model shown in Figure 3.1 is 7.

This count also includes the paths from the two control variables to the variable of strategic performance. Thus, the minimum sample size is 70 for the research model shown in Figure 3.1.

Following the two-step analytical procedures, I first examined the measurement model, and then the structural model. Psychometric properties of the inter-organizational system integration and business integration, operational performance, and strategic performance were assessed in terms of discriminant validity, convergent validity, and internal consistency.

Factor analysis was performed to ascertain that inter-organizational system integration, inter-organizational business integration, operational performance, and strategic performance are distinct constructs. One item (IOSI-1) was deleted from the inter-organizational system integration scale because of its low loading on the target construct and high loading on other constructs. IOBI-1 was deleted from the inter-organizational business integration, because its loading on IOBI was low and it also loaded on other construct.

The validity of the measurement model was then assessed by examining the loadings and cross-loadings of indicators in Table 21. Results in Table 21 indicate that the latent variable component score predicts each indicator in its block better than indicators in other blocks because the loadings for the indicators in each block are higher than any other indicators from other blocks.

Table 21 PLS Results of Loadings and Cross-Loadings

	Loadings and Cross-Loadings					Weights
	IOSI	IOBPI	OP	SP	RAC	RBP
IOSI_2	0.88	0.51	0.35	0.27	0.18	
IOSI_3	0.77	0.40	0.23	0.15	0.15	
IOSI_4	0.91	0.57	0.54	0.41	0.36	
IOSI_5	0.84	0.45	0.17	0.19	0.14	
IOBI_2	0.41	0.75	0.31	0.26	0.33	
IOBI_3	0.45	0.84	0.35	0.32	0.38	
IOBI_4	0.43	0.76	0.17	0.23	0.40	

	Loadings and Cross-Loadings					Weights
	IOSI	IOBPI	OP	SP	RAC	RBP
IOBI_5	0.32	0.64	0.26	0.16	0.27	
IOBI_6	0.39	0.72	0.26	0.17	0.15	
IOBI_7	0.59	0.88	0.50	0.49	0.36	
OP_1	0.29	0.22	0.77	0.53	0.34	
OP_2	0.33	0.27	0.73	0.41	0.39	
OP_3	0.42	0.43	0.88	0.52	0.39	
OP_4	0.29	0.39	0.83	0.45	0.31	
SP_1	0.29	0.29	0.61	0.87	0.32	
SP_2	0.20	0.35	0.54	0.89	0.44	
SP_3	0.39	0.36	0.41	0.85	0.59	
SP_4	0.22	0.30	0.49	0.83	0.46	
RAC_1	0.38	0.48	0.43	0.50	0.83	
RAC_2	0.13	0.30	0.36	0.30	0.71	
RAC_3	0.19	0.26	0.38	0.51	0.87	
RAC_4	0.24	0.42	0.38	0.38	0.85	
RAC_5	0.07	0.28	0.34	0.53	0.87	
RAC_6	0.10	0.28	0.40	0.47	0.81	
RAC_7	0.32	0.38	0.36	0.45	0.81	
RAC_10	0.36	0.37	0.27	0.35	0.84	
RBP_1						0.02
RBP_2						-0.01
RBP_3						0.58
RBP_4						0.33
RBP_5						0.23
Composite Reliability	0.91	0.9	0.88	0.92	0.94	N.A.

Note

- 1) IOSI=Inter-Organizational System Integration, IOBI=Inter-Organizational Business Integration, OP=Operational Performance, SP=Strategic Performance, RBP=Relative Bargaining Power, RAC=Relative Absorptive Capacity
- 2) Composite reliability is only applicable for construct with reflective indicators

Discriminant validity was also assessed by calculating the square root of average variance extracted (AVE) and comparing it to the correlations among constructs. According to Chin (1998b), AVE measures the amount of variance that a latent variable component captures from its indicators relative to the amount due to measurement error. And it is only applicable for reflective models. He (1998b) further recommended that the AVE of a latent variable be greater than 0.5, which means more than 50% variance of the indicators should be accounted for and that the AVEs of latent variables be greater than the square of the correlations among

the latent variables, which means more variance is shared between the latent variable component and its indicators than with another component representing a different block of indicators. Table 22 provides this information with the square root of AVE given in the diagonals. The facts that all square root of AVE is greater than 0.707 and that the square root of AVE is greater than the correlations among the latent variables suggest discriminant validity was established. The PLS results confirm that each of these constructs is distinct and that all items used to operationalize a particular construct load onto a single factor. As a measure of internal consistency, composite reliability was calculated for all the constructs. Results show that the composite reliability of all constructs is higher than 0.85.

In sum, these results provide strong empirical support for the reliability, and discriminant and convergent validity of the scales used in this study. The means, standard deviation, correlation of constructs are also shown in Table 22.

Table 22 Inter-Construct Correlation and Average Variance Extracted (AVE)

	IOSI	IOBPI	OP	SP	RAC	RBP	YrsOfIOS	FirmSize	YrsOfRel
IOSI	0.85								
IOBPI	0.58	0.77							
OP	0.42	0.42	0.80						
SP	0.32	0.38	0.60	0.86					
RAC	0.27	0.41	0.45	0.54	0.83				
RBP	0.16	0.10	0.19	0.43	0.33	N.A.			
YrsOfIOS	0.36	0.08	0.27	0.25	0.10	-0.12	N.A.		
FirmSize	0.22	0.21	0.02	0.05	0.15	0.11	0.17	N.A.	
YrsOfRel	0.29	0.27	0.27	0.16	0.18	-0.18	0.52	0.23	N.A.
Mean	4.34	4.33	5.06	4.99	4.74	4.39	2.61	N.A.	4.95
S.D.	1.30	1.08	0.84	1.11	1.01	0.97	1.55	N.A.	2.65

Note

- 1) IOSI=Inter-Organizational System Integration, IOBI=Inter-Organizational Business Integration, OP=Operational Performance, SP=Strategic Performance, RBP=Relative Bargaining Power, RAC=Relative Absorptive Capacity, YrsOfIOS=Years of IOS Usage, FirmSize=Firm Size, YrsOfRel=Years of Business Relationship
- 2) Figures in the shaded area are square root of average variance extracted (AVE)
- 3) AVE is only applicable for construct with reflective indicators

5.3 The Structural Model

The data were analyzed using PLS Graph Version 03.00 Build 1126 to test the research model. After I considered the trade-off between computational time and efficiency (Chin 1998b), bootstrap resampling (500 resamples) was chosen since computational time was not a problem for us and I pursued higher efficiency. The path coefficients and explained variances for the research model are shown in Figure 3.

Figure 3 shows that inter-organizational business integration is predicted by inter-organizational system integration, which explains 33% of the variance of inter-organizational business integration. Hypothesis 1 is supported and inter-organizational system integration is found to be positively associated with business integration. The results suggest that operational performance is predicted by inter-organizational business integration but not system integration, supporting Hypothesis 2b but rejecting Hypothesis 2a. Twenty seven percent of the variance of operational performance is explained by its predictors. While inter-organizational business integration has a significant effect on strategic performance, inter-organizational system integration does not, which supports both Hypothesis 3a and 3b. I also find that relative absorptive capacity and bargaining power have significant effects on strategic performance, supporting both Hypothesis 4 and 5. Moreover, relative absorptive capacity has a significant effect on relative bargaining power, with the former explaining 11% of the variance of the latter, supporting Hypothesis 6. Regarding the three control variables, I find only years of IOS usage has significant on strategic performance while firm size and years of business relationship do not. Neither of the three control variables is found to have a significant impact on operational performance. Overall, the antecedents of strategic performance explain 47% of the variance. The findings are summarized in Table 23.

Figure 3 PLS Results

Note: 1. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ — — — —> Non-significant path —————> Significant path

Table 23 Summaries of Findings

	Hypothesis	Findings
H1	Inter-organizational system integration is positively associated with inter-organizational business integration	Supported
H2a	Inter-organizational system integration is positively associated with organizational operational performance	Not Supported
H2b	Inter-organizational business integration is positively associated with organizational operational performance	Supported
H3a	Inter-organizational system integration is <i>not</i> associated with strategic performance	Supported
H3b	Inter-organizational business integration is positively associated with strategic performance	Supported
H4	Higher relative absorptive capacity will be positively associated with strategic performance for the focal firm	Supported
H5	Higher relative bargaining power will be positively associated with strategic performance for the focal firm	Supported
H6	Higher relative absorptive capacity will be positively associated with relative bargaining power for the focal firm	Supported

5.4 The Power Analysis

According to Chin and Newsted (1999), the parameter estimates obtained via PLS falls into three stages. The first stage results in weight estimates to be used to create the latent variable scores. The second stage results in estimates for the inner model (structural model) and outer model (measurement model). And the last stage yields the means and location estimates for indicators and latent variables. Because of the partial nature of the estimation procedure, only a portion of the model is involved at any one time. Furthermore, either simple or multiple regressions are performed at one time. As such, only the regression that requires the largest multiple regression is relevant to the requirements for sample size.

At stage 2 and 3, to calculate the sample size requirement, I only need to find the construct with the largest number of formative indicators and the latent variable with the largest number of latent variables impacting it (Chin and Newsted 1999). The only block with formative indicators in the model consists of 5 indicators impacting relative bargaining power. The dependent latent variable with the largest number of independent latent variables impacting it is strategic performance with 6 paths going into it (among which two are from control variables). Thus, the largest regression at any one time consists of 6 independent variables. With a medium effect size $f^2=0.15$ as defined by Cohen (1988), I would need a minimum sample size of 98 to obtain a statistical power of 0.80 (calculated based on procedures and tables provided by (Cohen 1988)) at $\alpha=0.05$. With a large effect size $f^2=0.35$, the sample requirement drops to 45 to obtain a statistical power of 0.80.

The structural model involves 4 subsets of multiple regression, with strategic performance, operational performance, inter-organizational business integration, and relative bargaining

power as the dependent variable respectively. Let's consider the subset of multiple regression analysis with strategic performance as the dependent variable. In this case, with a level 0.05, sample size 70, $R^2=0.47$ (i.e. effect size $f^2 = R^2 / (1 - R^2) = 0.89$), and number of independent variables 7, I obtain a statistical power that is greater than 0.995. In other words, given that these 7 variables together account for 47% of the variance in strategic performance, the odds is greater than 199 to 1 that the sample of 70 cases will yield a sample R^2 that is significant at $\alpha=0.05$.

Next, let's consider the subset of multiple regression analysis with operational performance as the dependent variable. In this case, with a level 0.05, sample size 70, $R^2=0.27$ (i.e. effect size $f^2=0.37$), and number of independent variables 5 (among which there are three control variables), I obtain a statistical power 0.979.

Then, let's consider the subset of multiple regression analysis with inter-organizational business integration as the dependent variable. In this case, with a level 0.05, sample size 70, $R^2=0.33$ (i.e. effect size $f^2=0.49$), and number of independent variables 1, I obtain a statistical power that is greater than 0.995.

Finally, let's consider the subset of multiple regression analysis with relative bargaining power as the dependent variable. In this case, with a level 0.05, sample size 70, $R^2=0.11$ (i.e. effect size $f^2=0.13$), and number of independent variables 1, I obtain a statistical power 0.83.

If I assume that the four subsets of regression are run independently, I have an overall statistical power that is greater than 0.805, a value slightly larger than the suggested cutoff of 0.8 (Baroudi and Orlikowski 1989).

At stage 1, there are three primary weighting schemes to calculate weight estimates: centroid, factor, and path weighting (Chin and Newsted 1999). The use of path weighting scheme requires the same sample size as at stage 2 and 3. With the use of a factor or a centroid weighting scheme, if all latent variables are measured with reflective items, the entire stage 1 process involves only a series of simple regressions. By consulting the power tables provided by Cohen (1988), I find that for a medium effect size ($f^2=0.15$) I need a sample size of 55 to achieve a statistical power of 0.8 and for a large effect size ($f^2=0.35$) I need a sample size of 25 to obtain a power of 0.8. With the use of a factor or a centroid weighting scheme, if some latent variables are modeled as formative, only the measurement model with the largest number of formative indicators becomes the critical factor in sample size requirement.

As demonstrated in literature, the minimum sample size required to evaluate component loadings for reflective indicators is even smaller (Chin and Newsted 1999). Chin and Newsted showed that for a 0.60 component loading (i.e. effect size $f^2=0.56$), I need only a sample size of 15 to obtain a power of 0.80.

Based on the analysis, I conclude that the study has enough statistical power to detect worthwhile effects.

CHAPTER 6 DISCUSSIONS, IMPLICATIONS AND FUTURE RESEARCH

In this chapter, I review some of the important findings from the data analysis and discuss several interesting observations. Next, I highlight the limitations of this study. This is followed by discussions regarding the implications of this study for theory and for practitioners. In the last few sections of this chapter, limitations of this study and directions to extend the current study are highlighted.

6.1 Discussions

Motivated by the need to better understand how companies can obtain superior benefits from IOS deployment, in this study I examine the influences of inter-organizational system integration and business integration on operational and strategic performance. The findings present support for the hypothesized relationship of inter-organizational business integration with operational performance but not for the relationship of system integration with operational performance. Moreover, this study also suggests that only inter-organizational business integration has a significant impact on strategic performance. In contrast, companies would not gain strategic benefits from inter-organizational system integration.

Also motivated to better understand the role of inter-organizational factors in shaping the strategic benefits obtainable from IOS-enabled inter-organizational relationships, I identify two inter-organizational factors, i.e. relative bargaining power and relative absorptive capacity, and empirically test their impacts on the strategic performance. Both relative bargaining power and absorptive capacity are found to have significant impacts on organizational strategic

performance. Furthermore, relative absorptive capacity is found to be positively associated with relative bargaining power.

In the following section, I will discuss our hypotheses one by one.

6.1.1 The Relationship of Inter-Organizational System Integration with Business Integration

The relationship between inter-organizational system integration and business integration is quite interesting. Markus (2000) argued that system integration is a prerequisite to business integration. Although the current study finds that inter-organizational system integration and business integration is positively associated, further data analysis seems to suggest that inter-organizational system integration is not necessarily required to achieve inter-organizational business integration.

If the median is used to split low and high level of inter-organizational system integration and business integration, a cross tabulation can be created to display the joint distribution of the two variables (see Table 24). As can be seen from Table 24, there are 28 cases out of 70 where when the level of inter-organizational system integration is high, the level of business integration is also high and 24 cases when the level of system integration is low the level of business integration is also low. In all, 52 out of 70 cases fall into the cells where inter-organizational business integration goes in the same direction with system integration, which indicates that system integration maybe a prerequisite to business integration. The observation that 8 cases exist where the level of inter-organizational system integration is high while the level of inter-organizational business integration is low seems to further support Markus (2000)’s assertion that “it is by no means certain that systems integration will produce the

kinds of business integration required” (p.36) and that “it [systems integration] is not always sufficient for business integration” (p.36). For these 8 cases, the mean of inter-organizational system integration is 5.28 while the mean of inter-organizational business integration is low, only 3.83.

However, 10 cases do exist where the level of inter-organizational system integration is low while the level of inter-organizational business integration is high. For those 10 cases, the mean of inter-organizational system integration is 3.70 while the mean of inter-organizational business integration is 5.17, which means in certain situations medium to high level inter-organizational business integration can be achieved with low level of inter-organizational system integration. The above analysis indicates that inter-organizational system integration is not necessarily a prerequisite to business integration.

However, it has also been recommended that business process be reengineered before they are automated (Hammer 1990). Davenport and Short (1990) proposed 5 steps to redesign business process with IT. They also recommend that understanding the current processes and identifying ways to redesign and integrate processes precede the consideration of IT capabilities although they argue for early consideration of IT in process redesign. Their discussion also includes inter-organizational processes. Accordingly, it is also reasonable to argue that inter-organizational business integration would be a prerequisite for inter-organizational system integration. Data in Table 24 show that when high level of inter-organizational business integration has been achieved, it is most likely (28 out of 38 in this study, i.e. 73.7%) that high level of system integration can be achieved and that when the level of business integration is low, it is also most likely (24 out of 32, i.e. 75%) that the level of system integration is also low. However, the existence of 8 cases where when the level of inter-

organizational business integration is low, the level of system integration is high also suggests that inter-organizational business integration is not necessarily the prerequisite to system integration.

In sum, the current study suggests that neither inter-organizational system integration nor business integration is necessarily the prerequisite to the other. Nevertheless, they two do have a significant positive association.

Table 24 Cross Tabulation of Inter-Organizational System Integration and Business Integration

		IOBI						Total		
		H			L					
IOSI	H	Count: 28			Count: 8			Count: 36		
		IOSI		IOBI	IOSI		IOBI	IOSI		IOBI
		Mean	5.35	5.21	Mean	5.28	3.83	Mean	5.33	4.91
		S.D.	0.58	0.54	S.D.	0.49	0.45	S.D.	0.56	0.78
		Min	4.75	4.33	Min	4.75	2.83	Min	4.75	2.83
	Max	7.00	6.50	Max	6.25	4.17	Max	7.00	6.50	
	L	Count: 10			Count: 24			Count: 34		
		IOSI		IOBI	IOSI		IOBI	IOSI		IOBI
		Mean	3.70	5.05	Mean	3.10	3.17	Mean	3.28	3.73
		S.D.	0.56	0.57	S.D.	1.07	0.54	S.D.	0.98	1.02
Min		2.75	4.33	Min	1.00	1.83	Min	1.00	1.83	
Max	4.75	6.00	Max	4.75	4.17	Max	4.75	6.00		
Total		Count: 38			Count: 32			Count: 70		
		IOSI		IOBI	IOSI		IOBI	IOSI		IOBI
		Mean	4.91	5.17	Mean	3.65	3.34	Mean	4.34	4.33
		S.D.	0.93	0.55	S.D.	1.35	0.59	S.D.	1.30	1.08
		Min	2.75	4.33	Min	1.00	1.83	Min	1.00	1.83
Max	7.00	6.50	Max	6.25	4.17	Max	7.00	6.50		

Note
1) IOSI=Inter-Organizational System Integration, IOBI=Inter-Organizational Business
2) H=High, L=Low

6.1.2 The Relationship of Inter-Organizational System Integration and Business Integration with Organizational Performance

Regarding the impacts of inter-organizational system integration and business integration on organizational performance, the relationships between inter-organizational system integration and operational and strategic performance deserve further discussion.

Based on the relevant theories of information technologies and findings of prior studies, I propose that inter-organizational system integration is positively associated with operational performance (hypothesis H2a). Surprisingly, the hypothesis H2a is not supported by the current study, that is, higher level of inter-organizational system integration does not necessarily mean higher level of operational performance. Regarding the influence of system integration on strategic performance, it is hypothesized that that inter-organizational system integration will not be associated with strategic performance (hypothesis H3a). Such a hypothesis has been empirically supported in this study. To summarize, this study confirms that inter-organizational system integration is neither a predictor of operational performance nor of strategic performance.

Previous studies (Bergeron and Raymond 1997; Mackay 1993) did find that inter-organizational system integration has a positive impact on operational performance. Furthermore, some researchers (Iacovou, et al. 1995; Markus, et al. 2003; Swatman and Swatman 1992; Swatman, et al. 1994) even argued that inter-organizational system integration provides strategic advantage. For example, Markus et al. (2003) argued that there is no doubt about inter-organizational system integration's potential advantages in terms of business efficiency and competitive advantage. What's more noteworthy is that, some researchers (Mukhopadhyay and Kekre 2002; Ramamurthy, et al. 1999; Venkatraman and Zaheer 1990) even found a positive relationship between inter-organizational system integration and strategic performance.

One possible explanation of the discrepancy of findings between this study and previous studies is that previous studies did not partial out the influence of inter-organizational business integration on operational and strategic performance when the impact of inter-organizational system integration on organizational performance was examined in previous studies. A quick review of Table 1 reveals that prior studies seldom examine system integration and business integration simultaneously. In this study, by incorporating both inter-organizational system integration and business integration in the same research model and examining their impacts on organizational performance simultaneously, only inter-organizational business integration is found to have a positive impact on operational and strategic performance.

With respect to the relationship between inter-organizational system integration and operational performance, the finding is contradictory to my hypothesis. Such a contradictory may also be the result of the conceptualization and operationalization of inter-organizational system integration as well as the current status of IOS use in mainland China. In this study, I conceptualize inter-organizational system integration as the overall evaluation of a company's system integration with one of its business partner and the focus of the conceptualization is the transactional data exchange aspect of the system integration. Consistent with such conceptualization, the operationalization also focuses on the transactional aspect of inter-organizational system integration. Considering the early stage of IOS use in mainland Chinese companies, such operationalization is appropriate. Results in Table 20 confirm that, in the current stage of IOS use in mainland China, the responding companies use IOSs mainly to transfer transactional data and mainly to interact with the purchasing functions of their buyer firms.

Previous studies (Saeed, et al. 2005; Shah and S.M.; Ward 2002; Swatman and Swatman 1991; Swatman and Swatman 1992) have suggested different levels or stages of inter-organizational system integration, often in progressive order. For example, Saeed et al. (2005) conceptualized and operationalized inter-organizational system integration (in their term, external integration) as including two levels. At the first level, only the purchasing function of the buyer firm is interacting with the supplier. At the second level, the planning function also gets involved. They found that only the second level of inter-organizational system integration is positively associated with process efficiency while the first level is not. It is likely that inter-organizational system integration at the first level with a focus on transactional data exchange, as the conceptualization and operationalization of inter-organizational system integration in the current study, may not have a significant impact on operational performance. Thus Hypothesis 2a is not supported.

Regarding the effect of inter-organizational system integration on strategic performance, although the Hypothesis 2b is supported, the finding is not consistent with previous studies that argued for a positive effect between the two (Iacovou, et al. 1995; Markus, et al. 2003; Swatman and Swatman 1992; Swatman, et al. 1994) and those studies that found a positive association between the two (Mukhopadhyay and Kekre 2002; Ramamurthy, et al. 1999; Venkatraman and Zaheer 1990). Other than the explanation that inter-organization business integration partials out inter-organizational system integration's influence, it may be also due to the study's specific conceptualization and operationalization of inter-organizational system integration as well as the current status of IOSs use in mainland China. Because of the focus of the transactional data exchange of inter-organizational system integration in the current study, I argue that inter-organizational system integration is common and imitable. Accordingly,

based on the RBV, I hypothesize that inter-organizational system integration is not associated with strategic performance. However, as I mentioned early, previous studies have suggested the level perspective of inter-organizational system integration. The conceptualization and operationalization of inter-organizational system integration in this study is at the lower level where the focus is on the transactional data exchange. If inter-organizational system integration is at the higher level of production planning, scheduling, and modeling as well as R&D, there maybe a positive relationship between inter-organizational system integration and strategic performance.

Although this study finds that only inter-organizational business integration has a positive impact on operational and strategic performance and system integration does not have such influences on either operational or strategic performance, further analysis suggests that to derive maximum benefits from the deployment of IOSs, a company should achieve both high degree of inter-organizational system integration and business integration (see Table 25). Based on the degree of inter-organizational system integration (high vs. low) and the degree of inter-organizational business integration (high vs. low), I classify all the cases into four categories, Category 1 (IOSI=H and IOBI=H), Category 2 (IOSI=H and IOBI=L), Category 3 (IOSI=L and IOBI=H), and Category 4 (IOSI=L and IOBI=L). Results in Table 25 suggest that organizations can obtain greater benefits (both operational and strategic) when the degree of both inter-organizational system integration and business integration is high than when either is low or both are low. In other words, the combination of inter-organizational system integration and business integration provides greater (operational and strategic) benefits than does inter-organizational system integration or business integration alone.

**Table 25 Cross Tabulation of the Relationship of Inter-Organizational System
Integration and Business Integration with Organizational Performance**

Organizational Performance		IOBI						Total		
		H			L					
IOSI	H	Count: 28			Count: 8			Count: 36		
		OP		SP	OP		SP	OP		SP
		Mean	5.42	5.39	Mean	4.85	4.67	Mean	5.30	5.23
		S.D.	0.57	1.03	S.D.	0.69	0.66	S.D.	0.63	1.00
	L	Count: 10			Count: 24			Count: 34		
		OP		SP	OP		SP	OP		SP
Mean		4.98	5.15	Mean	4.73	4.55	Mean	4.80	4.73	
S.D.		0.80	0.83	S.D.	1.02	1.28	S.D.	0.96	1.18	
Total		Count: 38			Count: 32			Count: 70		
		OP		SP	OP		SP	OP		SP
		Mean	5.30	5.33	Mean	4.76	4.58	Mean	5.06	4.99
		S.D.	0.66	0.97	S.D.	0.94	1.14	S.D.	0.84	1.11

Note

- 1) IOSI=Inter-Organizational System Integration, IOBI=Inter-Organizational Business
- 2) OP=Operational Performance, SP=Strategic Performance
- 3) H=High, L=Low

To check whether the level of operational and strategic performance statistically differs across the four categories, I conducted a series of nonparametric tests (nonparametric tests were chosen because the sample size in each category is different and the size is not very large). Table 26 presents the comparison of the level of operational performance and strategic performance across the four categories using the nonparametric Kruskal-Wallis test. Results show that the level of operational performance and strategic performance does differ across the four categories (at the 5% level).

To find which category differs from which category, I opted to run a post hoc Mann-Whitney U test on all pairs of groups. Results (shown in Table 26) suggest that Category 1 and

Category 2 differ in terms of the level of both operational performance and strategic performance, which means when the degree of inter-organizational system integration is high, it makes a difference whether the degree of inter-organizational business integration is high or not. The operational and strategic benefit is significant higher when the degree of inter-organizational business integration is high than when it is low. Mann Whitney U Test also suggests that operational and strategic performance differ between Category 1 and Category 4, which is not surprising.

That operational and strategic performance does not differ between Category 3 and Category 4 deserves more attention. When the degree of inter-organizational system integration is low, the degree of inter-organizational business integration does not make a difference. One possible explanation is that for companies to gain operational and strategic benefits from inter-organizational business integration, a certain degree of inter-organizational system integration is required. This is reasonable since business integration involves a lot of coordination that requires at least, to some extent, transactional data can be exchanged between a company and its business partners in a timely manner and then be integrated with internal systems. Thus the degree of inter-organizational system integration is low, the degree of business integration can not be high enough for companies to gain any operational and strategic benefits.

That operational and strategic performance does not differ between Category 1 and Category 3 also deserves more attention. This suggests that when the degree inter-organizational business integration is high, the degree of inter-organizational system integration does not play a very important in gaining more operational and strategic benefits.

To sum up, results from Mann Whitney U tests confirm the critical role of inter-organizational business integration in generating operational and strategic benefits. The results also lend support to Clark and Stoddard's (1996) argument that a merger of technological and process change is needed to achieve dramatic performance improvements with business partners.

Table 26 Nonparametric Tests across Four Categories for OP and SP

	Kruskall-Wallis Test			Mann Whitney U Test (2 Tailed)
	Chi-Square	df	Asymp. Sig.	Significant Contrast Values
OP	8.463	3	0.037	Category 1- Category 2*, Category 1- Category 4*
SP	9.56	3	0.023	Category 1- Category 2*, Category 1- Category 4*

Note

- 1) OP=Operational Performance, SP=Strategic Performance
- 2) Category 1: IOSI=H and IOBI=H, Category 2 IOSI=H and IOBI=L
- 3) Category 3 IOSI=L and IOBI=H, Category 4 IOSI=L and IOBI=L
- 4) * p<0.05

Another point that is worth discussion is the Chinese context. The Chinese business environment is quite different from North America business environment. For example, the national business environment of in China and in North America is quite different in terms of political systems and regulatory systems. On the one side, in China, the government controls many key economic activities and government intervention is extensive (Davies and Walters 2004). Furthermore, the legal system in China is also not fully established. On the other side, the company practices between Chinese firms and western firms are also quite different. In China, relationship building among top management teams of different firms is particularly critical for business and Guanxi, which means literally a relationship between objects, forces, or persons (Yang 1994), is an important conduit to nurture business transactions (Luo 2003), especially for private companies (Xin and Pearce 1996).

The RBV is employed as the main theoretical foundation for this study. Although there is no convincing reason why the RBV will not stand in the Chinese business environment, the great difference in terms of national business environment and company practices between China and other western countries (Luo and Park 2001) suggests that it is a worthwhile effort to explore whether western countries oriented theories such as the RBV are applicable in the Chinese business environment.

According to RBV (1991), in order for a resource to have strategic value, the resource must be valuable, rare, imperfect imitable, and imperfect substitutable. With respect to inter-organizational system integration, although the current study does not support a direct effect of inter-organizational system integration on operational and strategic performance, it does have a positive albeit indirect impact on both operational and strategic performance, through inter-organizational business integration. Such a finding clearly reveals that inter-organizational system integration is a valuable asset to a company, though it must be combined with complements, such as process changes, in order to deliver value. In the current study, the inter-organizational business integration has been found to be valuable in terms of its positive influence on operational and strategic performance. Based on a seven point grading scale, the responding companies in this study only have slightly positive evaluation of their inter-organizational system integration and business integration, with the mean 4.34 and 4.33 respectively. This seems to indicate that both inter-organizational system integration and business integration are still relatively rare at the current stage of IOSs use in China. With respect to imitability, due to the comparatively high imitability of IT resources and the lack of full protection of intellectual property rights in China, companies in China can relatively easily achieve a certain degree of system integration by imitating each other. As argued in chapter 3,

inter-organizational business integration has relatively low imitability due to unique history background, social complex, and great changes associated with business integration. However, as time goes by, the use of IOSs in mainland Chinese companies will migrate to a higher level where suppliers interact not only with the purchasing function of their buyers but also with the buyers' production planning and control systems. Such interactions also require extensive communication as well as coordination. Integration at this level is rare since a company typically exchanges such information as production planning and scheduling, modeling, and R&D information with only a few selected partners. It is also hard to imitate since integration at this level requires a well-developed inter-organizational relationship which may take years to build. Regarding to substitutability, it is still difficult to evaluate the exact degree of substitutability of inter-organizational system integration and business integration at this stage of the study. However, it is very likely that strategic substitutes for both of them are rare, especially in China where the legal system has not been fully established yet and where the business competition becomes fiercer and fiercer.

Researchers have implied that gaps exist in the study of Chinese management (Lin and Germain 2003). This study provides an opportunity to examine how Chinese firms manage their relationships with business partners. This study suggests that the RBV is also applicable in the Chinese business environment where the economy is in the process of great transition from a planned economy to a market economy and where the business settings are quite different from those in western countries.

6.1.3 The Relationship of Relative Bargaining Power and Absorptive Capacity with Strategic Performance

In this study, relative bargaining power and relative absorptive capacity are incorporated into the research model. Relative absorptive capacity is defined as a firm's ability, relative to its business partner, to recognize, assimilate and exploit external knowledge. Relative bargaining power is defined as a company's ability, relative to its business partner, to favorably change the bargaining set to win accommodations from the business partner and to influence the outcome of negotiations. The conceptualization of relative bargaining power and relative absorptive capacity is completely consistent with previous studies (Lavie 2002; Lavie 2005). It has been proposed that both relative bargaining power and relative absorptive capacity have a positive impact on strategic performance. I further propose that relative absorptive capacity has a positive influence on relative bargaining power based on reasoning that a company's relatively higher absorptive capacity will enable the company's business partners to rely more on the company and thus enhance the company's bargaining power relative to its business partners.

The propositions are empirically supported by the current study. Specifically, in an IOS-enabled inter-organizational relationship, if a company has a higher level of bargaining power and absorptive capacity relative to its business partner, the company is likely to gain superior strategic benefits from the relationship. The current study enriches literature in the way that it empirically exams the influence of a company's bargaining power and absorptive capacity, relative to its business partner and at a dyadic level, on the company's strategic performance. For example, Malhotra et al. (2005) propose that absorptive capacity configuration in supply chains can influence organizational performances in terms of operational efficiency and market knowledge creation. The results of this study seem to strengthen their arguments. Empirically, I find that different levels of absorptive capacity configuration in supply chains

have different implications for organizational strategic performance. For another example, researchers (Lavie 2002; Lavie 2005; Melville, et al. 2004) have argued that power is reinforced within electronically connected networks and that power is used by the relatively powerful partner to extract a disproportionate level of the benefits gained from inter-organizational system and business process integration through contract formulation and/or orchestration of the benefits to be skewed to its own interests. The current study empirically finds that in an IOS-enabled inter-organizational relationship, the distribution of bargaining power does have a significant influence on organizational strategic performance.

6.2 Limitations

This study suffers from several limitations. Firstly, an ideal empirical design for testing the strategic value, especially long-term strategic value, of inter-organizational system integration and business integration would be a longitudinal study. The cross-sectional nature of this study restricted the examination of the impacts of inter-organizational system integration and business integration on long-term strategic performance.

Secondly, the small sample size influences the statistical power of the analysis. Although the sample size is enough to empirically test the research model, a larger sample size would have been preferred. Considering I collected data from 3 different departments, it is understandably difficult for us to increase the sample size.

Thirdly, the study employs a convenience sample. Alternative sampling approaches can be used in future studies. For example, questionnaire can be administered to a certain number of randomly selected suppliers of a common buyer, as used in the study by Subramani (2004). Hopefully, the buyer has a large supplier base, say thousands and there are some relatively

large and powerful companies in the supplier base. Analysis based on the sample obtained through such a sampling method would paint a more accurate picture of the relationship among inter-organizational system integration and business integration, relative bargaining power and absorptive capacity and operational and strategic performance.

6.3 Contribution to Theory

The study contributes to theory in the following ways. First of all, this study offers a clear conceptualization of IOS-enabled inter-organizational integration. I go deeper into the concept of IOS-enabled inter-organizational integration by exploring it through two important dimensions, i.e. inter-organizational system integration and business integration, to reflect the broad domain of IOS-enabled inter-organizational integration. Based on previous studies regarding IOSs and inter-organizational integration, I conceptualize inter-organizational system integration as a construct including two dimensions, the extent to which various transaction types are conducted via IOSs, and the extent to which IOSs are integrated with internal systems. I also conceptualize inter-organizational business integration as a construct with two dimensions, i.e. communication between interrelated organizations and coordination of relevant business tasks spanning interrelated organizations. Such conceptualization of inter-organizational system integration and business integration not only enables us to investigate the operational and strategic value of IOS-enabled inter-organizational integration from a theoretical point of view but also makes operationalization of these constructs and empirical test of the hypothesized value of IOS-enabled inter-organizational integration possible. Furthermore, the conceptualization of IOS-enabled inter-organizational integration and of its two dimensions allows future studies to extend the current study. For example, the

conceptualization of inter-organizational system integration at the dyadic level can be extended to the network level since the domain of inter-organizational system integration at the network level still includes the extent to which various transaction types are conducted among business partners and the extent to which IOSs are integrated into various internal systems within business partners.

Secondly, the study employs a strong theoretical lens to examine the business value of inter-organizational system integration and business integration, which closes the theoretical gap found in literature on the relationship between inter-organizational system integration and business integration with organizational performance. As I have discussed in chapter 2, the theoretical foundation of the impacts of IOS-enabled inter-organizational integration needs to be strengthened. Researchers seldom investigate whether the four conditions (value, rareness, imperfect imitability, and non-substitutability) set by the RBV have been satisfied before they conclude that IOS-enabled inter-organizational integration has strategic value for organizations. The RBV is used as the theoretical lens to close this gap. The theoretical exploration indicates that while inter-organizational system integration is less likely to bring strategic value to organizations, inter-organizational business integration has strategic value. The empirical results confirm the strategic value of inter-organizational business integration. The finding that inter-organizational business integration is positively associated with strategic performance is completely consistent with Malhotra et al.'s observation (2005) that the locus of value creation is no longer within the boundaries of a single firm but rather occurs at the nexus of relationships among a variety of parties that contribute to the production function.

Thirdly, I explicitly acknowledge the influences of inter-organizational factors on organizational performance in an IOS-enabled inter-organizational relationship. The research

model has incorporated relative bargaining power and absorptive capacity to show how companies can derive strategic benefits by exploiting the IOS-enabled inter-organizational relationship. While some researchers give only token consideration to the environment where an organization is embedded, this study extends the understanding of the rent appropriation issue by incorporating important inter-organization factors into the resource-based IS research model regarding the business value of IT. Melville et al. (2004) identified several industrial, inter-organizational, and macro environmental variables and argued that these variables may shape the benefits gained from IS resources. They also hypothesized that the focal firm's power relative to its trading partners will enhance its share of net value from the deployment of IOSs. This research extended their study by empirically testing how relative absorptive capacity and relative bargaining help a company gain strategic advantage in an IOS-enabled inter-organizational relationship.

Fourthly, the study develops two scales to measure inter-organizational system integration and business process integration and thus it also contributes to literature by providing a foundation on which empirical studies examining the operational and strategic benefits of inter-organizational system integration and business process integration can be conducted. This study is also among the first to operationalize inter-organizational system integration and business integration at the dyadic level. Most previous studies on business integration are conceptual. Standard scale development procedures (Moore and Benbasat 1991) were followed to develop instruments for inter-organizational system integration and business integration. Every effort has been taken to ensure that the newly developed scales have high reliability and validity. The results provide strong empirical support for the high reliability and validity of the two scales. Thus this study provides a foundation on which empirical studies

examining the operational and strategic implications of inter-organizational system integration and business integration can be conducted.

Last, the study explores the business value of IT resources in the Chinese business context. The data used in this study were collected from mainland China to empirically test the research model, which contributes to the theoretical effort to understand IT phenomena in the Chinese business context. The RBV originated in the North America. Although a few studies have been conducted to examine the usefulness of the theory to explore IT phenomena in North America and Europe (see (Wade and Hulland, 2004) for a review of resource-based studies in IS research), little research has been conducted to investigate the applicability of the RBV in understanding IT Phenomena in China. This study confirms that the RBV is also useful to understand what is happening in the area of IT in organizations located in mainland China, which is in the process of a major transformation to a market economy. The study thus enriches the literature with the Chinese experience.

6.4 Implications for Practice

While this study has several interesting implications for theory and research, it is also relevant for practitioners. Firstly, this study suggests that only inter-organizational business integration has a positive impact on organizational operational performance while system integration does not. Furthermore, the combination of inter-organizational system and business integration provides more operational and strategic benefits to organizations than each alone. Managers in companies that are using IOSs to do business with partners should invest in integrating information systems and business across boundaries to expect more operational benefits. If companies stay at the level of mere IOS adoption and not go further to integrating

inter-organizational systems and business tasks, IOSs may become just expensive fax machines and few operational benefits will be derived from the IOS deployment.

Secondly, this study also suggests that only inter-organizational business integration has strategic value for organizations. Inter-organization system integration does not have a significant impact on operational performance. Nor does it have an impact on strategic performance. These findings suggest that companies should strive to integrate inter-organization business with business partners. The deployment of IOSs and the integration of inter-organizational systems have laid foundations of integrating inter-organizational business. Clark and Stoddard (1996) reported that inter-organizational process innovation provides greater benefits than inter-organizational technological innovation. Combining the findings from this study and those from Clark and Stoddard (1996), it is very clear that it is advisable for companies to take into account how IOSs can enable inter-organizational business process innovation and integration right at the beginning of IOS implementation to harvest strategic benefits from the deployment of IOSs.

Lastly, companies should enhance their abilities to learn from other organizations since superior learning abilities relative to business partners result in not only direct strategic benefits but also indirect strategic benefits through enhanced bargaining power. On the one side, inter-organizational system integration facilitates greater availability of information being transferred across organizational boundaries. Superior absorptive capacity allows a company to transfer and exploit such information and ultimately turn it into concrete products and applications to gain strategic advantage against competitors. Malhotra et al.'s study (2005) suggested that those companies that excel at the acquisition, assimilation, transformation, and exploitation of information have the highest likelihood to gain superior operational efficiency

and create market knowledge. On the other side, the company that has superior absorptive capacity relative to its business partner also has an opportunity to enhance its bargaining power in their inter-organizational relationship. It is because this company can better make use of the information available through the inter-organizational relationship to offer products and/or services that can better satisfy its business partner's specific needs. As a result, the company increases its business partner's dependence on its products and services, and its bargaining power in their relationship, which in turn leads to more business and strategic advantage ultimately. This study implies that company can get direct and indirect strategic benefits from investment in enhancing its learning capability to a level higher than that of its business partner. Combining their study and ours, I suggest that companies invest in enhancing absorptive capacity to win superior competitive positions.

Literature has suggested some ways to enhance learning capability. Absorptive capacity has four dimensions, acquisition, assimilation, transformation, and exploitation (Zahra and George 2002). Malhotra et al (2005) suggested that a company in an inter-organizational relationship can enhance its ability to acquire and assimilate by 1) joint decision making (the company and its business partner make joint decisions regarding their interlinked business activities), 2) improving inter-organizational process modularity (the company and its business partner structure their inter-organizational processes to get relatively independent sub-processes with clear interfaces), and 3) using standard electronic business interfaces (the company and its business partner use common or similar specifications or formats to exchange and process information at the interface between the two).

Furthermore, according to them (Malhotra, et al. 2005), the company can enhance its assimilation and transformation ability by 1) setting up memory systems (such as through the

installation of databases that store and enable retrieval of the history of events related to interactions with business partner) for inter-organizational activities so that knowledge from the past can be used to understand and influence current activities, and 2) constructing interpretation systems (such as the installation of data analysis and mining software) to help uncover patterns in data and generate insights.

Scott (2000) also suggested ways to use IT to facilitate learning in an inter-organizational relationship. Firstly, a company can ask its business partner to provide feedback acquired in inter-organizational collaboration to adjust its own behavior. Email, fax, videoconference, inter-organizational systems, together with face-to-face meeting, can be used for feedback and for more efficient use of explicit knowledge (in her terminology, the use of monitoring IT to facilitate lower level of inter-organizational learning). Secondly, the company can use computer simulations together with business partner to stimulate reconsideration of current practices, which may lead to changes in production or design routines and thus knowledge creation (in Scott's terminology, the use of modeling IT to directly facilitate higher level of inter-organizational learning). The skills and knowledge gained are often tacit and could neither be created nor acquired inside the organizational boundaries. Thirdly, the company can use communication technologies, such as email, videoconference and fax, to enable inter-organizational collaboration and virtual integration, which then can lead to reconsideration of assumptions and routines and ultimately knowledge creation (the use of collaborative IT to indirectly facilitate higher level of inter-organizational learning in Scott's terminology).

In sum, companies have multiple ways to enhance their acquisition, assimilation, and transformation abilities and ultimately enhance their absorptive capacity in an inter-organizational relationship. They can also use various information technologies to facilitate

both lower level and higher level of inter-organizational learning in an inter-organizational relationship. For a supplier, the enhancement of absorptive capacity to the level above its customer's can positively affect its strategic benefits, directly and indirectly as discussed above.

6.5 Future Research

Investigating the operational and strategic implications of inter-organizational system integration and business integration is a first step toward better understanding of IOS-enabled inter-organizational integration. Future studies can extend this study in the followings ways.

Firstly, researchers may refine the conceptualization and operationalization of inter-organizational system integration to incorporate the level perspective (Saeed, et al. 2005; Shah and S.M.; Ward 2002; Swatman and Swatman 1991; Swatman and Swatman 1992). Enhancement can be made to incorporate the exchange of such information as production planning and scheduling information into the conceptualization and operationalization of inter-organizational system integration. My understanding is that at the high level of inter-organizational system integration where a supplier also interacts with the production planning, scheduling and control systems of a buyer, inter-organizational system integration can still be examined through two dimensions, the extent to which various transaction types are conducted via IOSs and the extent to which IOSs are integrated with internal systems.

Secondly, more studies can be conducted to track the relationship between inter-organizational system integration and operational and strategic performance in mainland China as the use of IOSs become more mature. In the current study, I do not find a direct association between the inter-organizational system integration and operational performance.

With respect to its impact on strategic performance, I argue and find that inter-organizational system integration is not associated with strategic performance. However, if the companies in mainland China are given more time to develop higher level of IOS use (such as the suppliers' interaction of production planning and control system with the buyer for the exchanges about planning, scheduling, modeling, R&D, etc), the relationship between inter-organizational system integration and operational and strategic performance maybe also be revisited. Trading partners do not typically exchange information about planning, scheduling, modeling, and R&D with all trading partners. Higher level of inter-organizational system integration is relatively uncommon and requires a well-developed relationship with the trading partner and thus imperfectly imitable. Thus, strategic performance may have a positive association with inter-organizational system integration at this level. More studies are needed to clarify the effect of inter-organizational system integration on organizational performance.

Thirdly, researchers can validate the findings in other business environments. The data of this study were collected from China where a great economic transition to a market economy is in progress and where the use of IOSs is at its early stage. The replication of this study in other business contexts, is necessary before the results can be generalized to other situations. Specifically, replication of the study in economies where IOS use is at its early stage and where inter-organizational system integration is mainly at the lower level and in economies where IOS use is more mature and inter-organizational system integration is typically at the higher level would allow researchers to better evaluate my arguments presented in previous sections.

Last but not least, further studies can also be conducted to clarify the relationship between inter-organizational system integration and business integration. A possible lens to examine

the relationship is the level perspective of inter-organizational system integration. Considering the current stage of IOS use in mainland China, this study focuses on the lower level of inter-organizational system integration and it finds that neither inter-organizational system integration nor process integration is necessarily the prerequisite for the other. However, this may be true only for lower level of inter-organizational system integration where the focus is on the transactional data exchange. For higher level of inter-organizational system integration, it is likely that both inter-organizational system integration and business integration are the prerequisite for each other.

On the one hand, at the higher level of inter-organizational system integration, inter-organizational business integration is required to achieve inter-organizational system integration. For example, a supplier may transmit its production design and modeling to a buyer via IOSs. The buyer may provide feedback or make changes to the design to tailor to its own requirements. Later, the buyer may transfer its production schedules to the supplier. The supplier then adjusts its production based on the information received from the buyer. Without ongoing communication and business coordination across the two companies, the buyer or the supplier may not well understand the data received from the other and this may not integrate the information with its various internal systems. In other words, no inter-organizational business integration, no inter-organizational system integration.

On the other hand, if a supplier and a buyer are to coordinate and integrate business across boundaries, they need real time transactional data as well as data about production planning and scheduling from the partner. They also need to integrate the data received from each other with their own various systems to form unified business across the two companies so that they two, as a supplier buyer dyad, can respond to ongoing changes in business environment timely.

Nowadays, the vast geographic dispersion of supplier-buyer network also requires companies to achieve inter-organizational system integration to allow for exchange of transactional data and production planning and scheduling data before these companies can effectively coordinate and integration their business. In other words, no inter-organizational system integration, no inter-organizational business integration. In sum, at the higher level of inter-organizational system integration, inter-organizational system integration and business integration are highly intertwined and each may be the prerequisite for the other. More study should be conducted to validate the above argument and clarify the relationship between the two.

6.6 Conclusions

In summary, I argue that both inter-organizational system integration and business integration have positive impacts on operational performance. Based on the RBV, I hypothesize that while inter-organizational business integration has a significant influence on strategic performance, inter-organizational system integration does not. In addition, I further argue that relative bargaining power and absorptive capacity both have a positive impact on strategic performance while at the same time relative absorptive capacity influences relative bargaining power positively.

The empirically findings confirm the positive impact of inter-organizational business integration on operational performance. However, I do not find empirical support for the influence of inter-organizational system integration on operational performance. Inter-organizational business integration is found positively associated with strategic performance while system integration is not, as expected. This study finds that relative bargaining power

and absorptive capacity do help an organization gain strategic benefits from an IOS-enabled inter-organizational relationship. Furthermore, relative absorptive capacity has a positive impact on relative bargaining power, which means a company can gain direct and indirect strategic benefits from investment in enhancing learning ability to a level higher than that of its business partners.

I began this research effort by asking two research questions: 1) what are the impacts of inter-organizational system and business integration on organizational performance and 2) what are the important inter-organizational factors that influence the benefits obtainable from an IOS-enabled inter-organizational relationship. The empirical study shows that while inter-organizational business integration has a significant and positive impact on operational performance, inter-organizational system integration has only an indirect impact. While I find that inter-organizational business integration is positively associated with strategic performance, no direct impact of inter-organizational system integration on strategic performance is found. With respect to the second research questions, the data analysis shows that relative bargaining power and absorptive capacity are important inter-organizational factors that shape the benefits gained from an IOS-enabled inter-organizational relationship.

This study has taken the first steps towards understanding how inter-organizational system integration and business integration influence organizational performance. Considering that this study has raised many interesting questions that are worthy of further research, I hope that this study promotes additional theoretical and empirical investigation to better understand the issue.

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APPENDIX I

Table 1 Prior Studies on Inter-Organizational Integration in an IOS-enabled Inter-Organizational Environment

Source/Title	Research type	Constructs ²	IOSI	IOBI	Theory ³	Findings ⁴	OP	SP	Note
Electronic data interchange: How much competitive advantage? (Benjamin, et al. 1990)	Empirical (case study)	<ul style="list-style-type: none">EDI Integration: the effective integration of EDI into organizations.	x	x	x	<ul style="list-style-type: none">Implied that companies can derive cost savings from EDI integration via increased productivity and decreased overhead.	v	x	Didn't differentiate between system integration and business integration
An Empirical Investigation of Net-Enabled Business Value (Barua, et al. 2004)	Empirical (survey)	<ul style="list-style-type: none">System integration: The extent to which a firm integrates its IT systems to provide visibility to customer and supplier data and to allow online information sharing and transaction execution across the value chain.	v	x	RBV	<ul style="list-style-type: none">argued that the effective combination of technological, organizational, and environmental resources enables a firm to develop online informational capabilities with their customers and suppliers, which then leads to improved operational and financial performance;Found that system integration plays an important role in building online informational capabilities, which, in turn, relate strongly to business performance measures.	v	x	They failed to clarify how system integration has satisfied the conditions set by the RBV to create value.

² I list only those constructs relating to integration in an inter-organizational environment.

³ Here I focus on the theory used by the authors to establish the linkage between integration and organizational performance.

⁴ Here I also focus on the findings relating to the impacts of integration on organizational performance.

Source/Title	Research type	Constructs ²	IOSI	IOBI	Theory ³	Findings ⁴	OP	SP	Note
Managing EDI for Corporate Advantage: a Longitudinal Study (Bergeron and Raymond, 1997)	Empirical (survey / longitudinal study)	level of integration of EDI examined through two facets: <ul style="list-style-type: none">Internal integration: the variety of the value chain functions (orders, shipments, inventory, etc.) interconnected through EDI within the organization.External integration: the variety of trading partners (clients, suppliers, distributors, etc.) with which the organization interacts through EDI.	v	x	Diffusion of innovation theory	<ul style="list-style-type: none">In both phase 1 and 2, the integration of EDI were found to be positively related to the attainment of EDI advantages.	v	v	<ul style="list-style-type: none">Items measuring operational performance and strategic performance form a second order construct EDI advantage.Operational performance and strategic performance was not examined separately.
Beyond Sabre: An Empirical Test of Expertise Exploitation in Electronic Channels (Christaanse and Venkatraman 2002)	Empirical (survey)	Electronic integration in the paper means vertical quasi-integration, which refers to the fact that interfirm cooperative arrangements may, under certain conditions, be employed as viable substitutes for vertical integration. The term refers to control without ownership.	x	x	x	N.A.	N.A.	N, A.	Didn't differentiate between system integration and business integration
e-Integration in the Supply Chain: Barriers and Performance (Frohlich, 2002)	Empirical (survey)	Supplier and Customer e-Integration: the extent of using web-based technologies to establish strong customer and supplier integration for inventory planning, demand forecasting, order scheduling, and customer relationship management	x	x	x	<ul style="list-style-type: none">Found that E-Integration is positively associated with e-Business performance and operational performance.	v	x	Didn't differentiate between system integration and business integration

Source/Title	Research type	Constructs ²	IOSI	IOBI	Theory ³	Findings ⁴	OP	SP	Note
Arcs of Integration: an International Study of Supply Chain Strategies (Frohlich and Westbrook, 2001)	Empirical (survey)	Arc of supplier customer integration: <ul style="list-style-type: none">• Inward-facing• Periphery-facing• Supplier-facing• Customer-facing• Outward-facing	x	x	x	<ul style="list-style-type: none">• Found that companies with the greatest arcs of supplier and customer integration will have the largest rates of performance improvement.• Found that there were significant differences in terms of performance indicators between the five different arcs of supply chain integration.	v	v	Didn't differentiate between system integration and business integration
Inter-Organization Networks, Computer Integration, and Shifts in Interdependence: the Case of the Semiconductor Industry (Hart and Estrin, 1991)	Empirical (case study)	External integration is not explicitly defined but implies that external integration refers to the effect use of computer networks for exchanging information between firms.	v	x	x	<ul style="list-style-type: none">• Found that IOSs' potential for greatest improvement is achieved when they link organizations who have achieved internal system integration because the greater the internal system integration, the greater the opportunity for selecting specific information to facilitate inter-organization coordination.• Found that greater internal integration provides the opportunity for greater integration with external units.• Found that vulnerability increases with internal integration in the same way that opportunities	x	x	
Power and Trust: Critical Factors in the Adoption and Use of Electronic Data Interchange (Hart and Saunders 1997)	Empirical (case study)	Computer integration refers to the use of computer networks, hardware, and software that makes it possible for data generated within a specific functional area of an organization to be processed seamlessly within that area or between the area and other functional areas internal or external to the organization.	v	x	x	<ul style="list-style-type: none">• Implied that computer integration may and have labor displacement effect	v	x	

Source/Title	Research type	Constructs ²	IOSI	IOBI	Theory ³	Findings ⁴	OP	SP	Note
Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology (Iacovou, et al., 1995)	Empirical (case study)	EDI Integration <ul style="list-style-type: none">Internal integration: the variety of applications interconnected through EDI, such as order-entry, invoicing, billing, and payment transferExternal integration: the number of trading partners, such as suppliers, customers, governmental units, and financial Institutions with which the firm can transact business through EDI	v	x	x	<ul style="list-style-type: none">Argued that system integration will result in enhanced internal efficiency and tactical and competitive advantage	v	v	
The Impact of EDI on the Components Sector of the Australian Automotive Industry (Mackay, 1993)	Empirical (survey)	Integration of EDI with internal application systems	v	x	x	<ul style="list-style-type: none">Argued that integration of EDI with internal application systems can reduce re-keying , improve data accuracy, etc.	v	x	

Source/Title	Research type	Constructs ²	IOSI	IOBI	Theory ³	Findings ⁴	OP	SP	Note
Paradigm shifts e-business and business/systems integration (Markus, 2000)	Conceptual	<ul style="list-style-type: none">• System integration: the creation of tighter linkages between different computer-based information systems and databases (including internal system integration and system integration across organizations).• Business integration: the creation of tighter coordination among the discrete business activities conducted by different individuals, work groups, or organizations, so that a unified business process is formed (including internal business process integration and external business process integration).	v	v	x	<ul style="list-style-type: none">• Argued that companies can serve their customers more effectively with high business integration.• Argued that system integration is required for business integration.• Argued that low system integration may cause various problems for companies;• Argued that companies may have more system integration than needed or have the wrong kinds of system integration	x	x	
The Future of Enterprise Integration: Strategic and Technical Issues in Systems Integration (Markus, et al., 2002)	Conceptual	External System Integration: IT-mediated transactions between independent business entities.	v	x	x	<ul style="list-style-type: none">• Argued that external system integration has a potential advantage in terms of business efficiency and competitive advantage.	v	v	
Developing and Measuring Supply Chain Management Concepts (Min and Mentzer 2004)	Empirical (survey)	Business process integration as a dimension of supply chain management: the integration of processes across time and place in a supply chain from sourcing, to manufacturing, and to distribution.	x	v	x	<ul style="list-style-type: none">• Found that supply chain management is positively associated with business performance	v	v	<ul style="list-style-type: none">• OP was measured comparatively to competitors.• With respect to SP, competitive growth is a dimension of the second order construct: competitive business performance

Source/Title	Research type	Constructs ²	IOSI	IOBI	Theory ³	Findings ⁴	OP	SP	Note
Strategic and Operational Benefits of Electronic Integration in B2B Procurement Processes (Mukhopadhyay and Kekre, 2002)	Empirical (matched pairs)	Integrated EDI: the mapping between the customer's item ID code and the supplier's item code.	v	x	TCE	<ul style="list-style-type: none">Found that Supplier-side EDI integration leads to supplier's strategic benefitsFound that suppliers still get competitive advantage in the long run (greater than 3.5 years)Found that EDI with full integration decreases the frequency of errors in order processing.	v	v	
Organizational and Interorganizational Determinants of EDI Diffusion and Organizational Performance: A causal Model (Ranamurthy, et al., 1999)	Empirical (survey)	EDI Diffusion: <ul style="list-style-type: none">Internal integration represents the extent to which EDI interfaces with and is integrated into other key internal IS applications and, thereby, the work processes.external integration: integration of the firm with its trading partners, both in terms of scope of services to them and penetration of EDI in these business transactions	v	x	x	Found that <ul style="list-style-type: none">External integration of EDI is positively associated with both operational and market performance;Internal integration of EDI is positively associated with operational performance of the firm but not with market performance.	v	v	
Examining the Impact of Interorganizational Systems on Process Efficiency and Sourcing Leverage in Buyer-Supplier Dyads (Saeed, et al. 2005)	Empirical (survey)	External Integration: <ul style="list-style-type: none">Level 1: the integration of a supplier with the purchasing function of its buyer firmsLevel 2: the integration of a supplier with both the purchasing function and the production planning and control system of its buyer firms	v	x	Information systems and operations management	Found that: <ul style="list-style-type: none">External integration Level 1 is not positively associated with process efficiency,External integration Level 2 is positively associated with process efficiency.	v	x	Process efficiency was measured in terms of the extent to which the electronic linkages reduce transaction costs, inventory costs, and uncertainty.
Impact of electronic data interchange technology on JIT shipments (Srinivasan, et al. 1994)	Mathematic modeling	Integration: whether supplier has integrated EDI linkage with customer.	v	x	x	<ul style="list-style-type: none">Suppliers with the ability to directly map incoming information to internal production control systems are found to enjoy greater benefits in terms of reduction in shipment discrepancy	v	x	

Source/Title	Research type	Constructs ²	IOSI	IOBI	Theory ³	Findings ⁴	OP	SP	Note
A Model of EDI Integration and Strategic Business Reengineering (Swatman, et al., 1994)	Empirical (case study)	Four stage of EDI integration: <ul style="list-style-type: none">• Stage 1: stand-alone PC• Stage 2: PC up/download or M/F to M/F communications• Stage 3: seamless software• Stage 4: structural integration	v	x	x	<ul style="list-style-type: none">• Argued that EDI integration offers long term strategic benefits.	x	v	
EDI System Integration: a Definition and Literature Survey (Swatman and Swatman 1992)	Empirical (case study)	Four stage of EDI system integration: <ul style="list-style-type: none">• Stage 1: stand-alone PC• Stage 2: PC up/download or M/F to M/F communications• Stage 3: seamless software• Stage 4: structural integration	v	x	x	<ul style="list-style-type: none">• Argued that EDI system integration would reduce administrative overheads such as overtime premiums, overnight courier charges, late or incorrect shipments from suppliers, excess inventories, poor forecasting, incorrect order entry, and disruptive production schedules.• Argued that EDI system integration is positively associated with competitive advantage.	v	v	
Integration in Electronic Exchange Environments (Truman 2000)	Empirical (survey)	Integration in the context of EDI: <ul style="list-style-type: none">• Interface integration: the level of integration between the EDI and internal systems	v	x	The information processing model of the organization	<ul style="list-style-type: none">• Found that Interface integration has labor displacement effect.• Interface integration is not associated with claim error rate and claim payment time.	v	x	
Electronic Integration and Strategic Advantage: A Quasi-Experimental Study in the Insurance Industry (Venkatraman and Zaheer 1990)	Empirical (matched pairs)	Electronic integration: the integration of business processes of two or more independent organizations through the exploitation of the capabilities of computers and communication technologies.	v	x	x	<ul style="list-style-type: none">• Electronic integration is positively associated with only increases in new business policies but not with effectiveness- namely, neither increases in premiums and commissions nor operating efficiency.	v	v	

Source/Title	Research type	Constructs ²	IOSI	IOBI	Theory ³	Findings ⁴	OP	SP	Note
e-Commerce Metrics for Net-enhanced Organizations: Assessing the Value e-Commerce to Firm Performance in the Manufacturing Sector (Zhu and Kraemer 2002)	Empirical (mixed data collection method, including secondary data collection, content analysis, and survey; manufacturing industry)	Supplier integration (connection); electronic linkages to integration suppliers via information sharing	v	x	Dynamic capability	<p>Found that</p> <ul style="list-style-type: none"> Supplier integration is negatively associated with cost of goods sold for both high-tech and traditional samples; Supplier integration is positively associated with inventory turnover for both samples; The complementarity of EC and IT is negative for high-tech sample but positive for traditional sample when DV is cost of goods sold; The complementarity of EC and IT is positive for both samples when DV is inventory turnover; 	v	x	
Post-Adoption Variations in Usage and Value of E-Business by Organizations: Cross-Country Evidence from the Retail Industry (Zhu and Kraemer 2005)	Empirical (survey)	Back-end integration: the extent to which Web applications link with back-office databases and the extent of information sharing along the value chain.	v	x	RBV	<ul style="list-style-type: none"> Argued and found that back-end integration is positively associated with e-business value (a second order construct); Argued and found that while both front-end and back-end capabilities contribute to e-business value, back-end integration has a much stronger impact. 	v	x	<ul style="list-style-type: none"> The authors' argument that back-end integration is difficult to imitate may need re-consideration; The authors also failed to discuss whether back-end integration has met other conditions such as value, rarity, non-substitutability etc. set by the RBV
The Complementarity of Information Technology Infrastructure and E-Commerce Capability: A Resource-Based Assessment of Their Business Value (Zhu 2004)	Empirical (primary data collection and secondary database; retail industry)	Back-end Integration (as a dimension of E-commerce capability): tight electronic integration to facilitate coordination, fulfillment, and inventory management in back offices and with external partners.	v	x	RBV	<ul style="list-style-type: none"> Found that EC capability as a second order construct is positively associated with sales/employee, and inventory turnover, negatively associated with cost of goods sold/employee, and not associated with ROA; the complementarity between EC capability and IT infrastructure positively contributes to firm performance in terms of sales per employee, inventory turnover, and cost reduction. 	v	x	<ul style="list-style-type: none"> The author failed to discuss whether back-end integration has met other conditions

APPENDIX I: SURVEY --- ENGLISH VERSION

Instructions for the Survey

(January 2005)

The survey is supervised by Professor Christina Soh from Nanyang Technological University and Professor Huang Lihua from Fudan University. It includes three parts that will be completed by IT department manager or CIO, business manager or vice president for business, and financial manager or CFO respectively.

- Part I : Survey on your company’s IT applications
- Part II : Survey on your company’s business
- Part III : Survey on your company’s organizational performance

The objective of this survey is to understand how a company’s IT applications and business management influence the company’s competitive performance. To complete the survey, you and the respondents need to know inter-organizational systems. We define inter-organizational systems as follows.

Key Terms and Definitions	
inter-organizational systems (IOSs)	Inter-organizational systems refer to automated information systems shared by two or more companies. Examples of IOS include EDI, proprietary inter-organizational systems, industry wide inter-organizational systems (such as RosettaNet, AIAG, ODETTE, SPEC2000, SWIFTNet, CIDX, ACORD, PIDX, and PapiNET), online purchase portal, and ERP-to-ERP. It should be noted that Email and fax do not belong to inter-organizational systems.

In the survey, some questions are designed to be used to evaluate the internal aspects of your company while others relate to the inter-organizational relationship between your company and one of your company’s customers. Accordingly, we need you, together with the IT manager and business manager, to identify one of your company’s customers. The customer should satisfy the following conditions.

- Firstly, the customer must be real customer. Moreover, it is an enterprise customer not an individual customer.
- Secondly, some form of inter-organizational systems are using between the company where the student woks and the customer.
- And lastly, there are regular working relationships between the company where the student works and the customer.

Then please write down the name of the customer on the label attached to each envelop within the survey package. We use firm X to refer to the customer throughout all parts of the survey.

All information that you and your company provide will be kept confidential. Only the researchers have the access to the information. And the results would only be reported in aggregate. In return for your company’s cooperation, we will send an aggregated report to your company if email address is provided.

Thanks for your cooperation.

南 洋 商 学 院
新加坡·南洋理工大学

復旦大學

Survey on Your Company's IT Applications

Project Supervisor

Project Supervisor	Professor Christina Soh , Vice dean, Nanyang Business School, Nanyang Technological University
	Professor Huang Lihua, Vice dean, Management School, Fudan University

Instructions For the Survey

In the survey, some items are designed to evaluate the internal aspects of your company while others are designed to evaluate the aspects of your company in relation to one of your business partners. Based on the inter-organizational relationship between your company and firm X, please indicate the degree to which you agree or disagree with the statements and tick accordingly (v). The seven-point scale includes (1) Strongly Disagree, (2) Disagree, (3) Slightly Disagree, (4) Neutral, (5) Slightly Agree, (6) Agree, and (7) Strongly Agree. For example, if you *slightly agree* with the following statement "My firm has invested in technology designed to facilitate cross-functional data exchange within my firm", you should choose 5 and tick accordingly as follows.

	1	2	3	4	5	6	7
	Strongly Disagree						Strongly Agree
My firm has invested in technology designed to facilitate cross-functional data exchange within my firm					v		

Key Terms and Definitions

inter-organizational systems (IOSs)	Inter-organizational systems refer to automated information systems shared by two or more companies. Examples of IOS include EDI, proprietary inter-organizational systems, industry wide inter-organizational systems (such as RosettaNet, AIAG, ODETTE, SPEC2000, SWIFTNet, CIDX, ACORD, PIDX, and PapiNET), online purchase portal, and ERP-to-ERP. It should be noted that Email and fax do not belong to inter-organizational systems.
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Announcement

1. All information that you and your company provide will be kept confidential. Only the researchers have the access to the information. And the results would only be reported in aggregate.
2. In return for your company's cooperation, we will send an aggregated report to your company if email address is provided.

Would you, or your Firm, like to receive an electronic copy of the final aggregate (summarized) survey results?		☐ Yes (Email: _____)
		☐ No
Your name (Optional):		Your title:
Survey Completion Date:		

----- Please answer based on your firm's operation -----

Section I: Information Systems Used in Your Firm

*In the following statements, firm X refers to the firm on the label attached to the envelope.

1	Applications & systems implemented or being implemented			
	☐ Office Automation	☐ EDI		
	☐ ERP	☐ SCM		
	☐ Product Data Management	☐ CRM		
	☐ EC	☐ CIMS		
2	Which IOSs are used between you and firm X?			
	☐ EDI	☐ AIAG	☐ ODETTE	☐ SPEC2000
	☐ RosettaNet	☐ SWIFTNet	☐ CIDX	☐ ACORD
	☐ PIDX	☐ PapiNET	☐ Online purchase platform	
	☐ ERP to ERP	☐ Proprietary Inter-Organizational Systems		
3	What data are transferred between your company and firm X using IOSs?			
	☐ Order	☐ Shipping information	☐ Shipping status	
	☐ Invoice	☐ Remittance advice	☐ Inventory	
	☐ R & D	☐ Debit Instruction	☐ Other(Please specify: _____)	
4	How long does your company use IOSs to transfer data with firm X (in years)?			
	☐ 1 year	☐ 2 years	☐ 3 years	☐ 4 years
	☐ 5 years	☐ 6 years	☐ Other(Please specify: _____ years)	

-----Please answer based on your firm's inter-organizational relationship with firm X -----

Section II: Inter-Organizational System Integration

		1	2	3	4	5	6	7
		Strongly Disagree			Strongly Agree			
5	Data exchanged with firm X via inter-organizational systems such as EDI, Internet-based IOSs, etc. are integrated into my firm's various internal information systems.							
6	For at least some data fields, there are data standards imposed and enforced across most of the information systems that span my firm and firm X.							
7	My firm and firm X use inter-organizational systems such as EDI, Internet-based IOSs, etc. to exchange most of the transaction sets.							
8	Data from firm X must be rekeyed, as they are used and reused by different employees within my firm.							
9	A large variety of transaction sets (transaction sets refer to the data exchanged between trading partners, such as order data, shipment data, invoice data, remittance advice data, etc.) can be exchanged between my firm and firm X using inter-organizational systems such as EDI, Internet-based IOSs, etc.							

This concludes the survey. Thank you for your participation!

南 洋 商 学 院
新加坡 · 南洋理工大学

复旦大学

Survey on Your Company's Business Management

Project Supervisor

Project Supervisor	Professor Christina Soh, Vice dean, Nanyang Business School, Nanyang Technological University
	Professor Huang Lihua, Vice dean, Management School, Fudan University

Instructions For the Survey

In the survey, some items are designed to evaluate the internal aspects of your company while others are designed to evaluate the aspects of your company in relation to one of your business partners. Based on the inter-organizational relationship between your company and firm X, please indicate the degree to which you agree or disagree with the statements and tick accordingly (v). The seven-point scale includes (1) Strongly Disagree, (2) Disagree, (3) Slightly Disagree, (4) Neutral, (5) Slightly Agree, (6) Agree, and (7) Strongly Agree. For example, if your *slightly agree* with the following statement "In my firm, all the members understand how individual efforts contribute to the whole business processes", you should choose 5 and tick accordingly as follows.

In my firm, all the members understand how individual efforts contribute to the whole business processes	1	2	3	4	5	6	7
	Strongly Disagree			Strongly Agree			
					v		

Key Terms and Definitions

Business Process	Business process refer to a set of logically related tasks performed to achieve a defined business outcome
------------------	--

Announcement

1. All information that you and your company provide will be kept confidential. Only the researchers have the access to the information. And the results would only be reported in aggregate.
2. In return for your company's cooperation, we will send an aggregated report to your company if email address is provided.

Would you, or your Firm, like to receive an electronic copy of the final aggregate (summarized) survey results?		☐ Yes (Email:) ☐ No
Your name (Optional):		Your title:
Survey Completion Date:		

-----Please answer based on your firm's inter-organizational relationship with firm X -----

- 1 How many years has your company had a business relationship with firm X (Firm X refers to the firm on the label attached to the envelope)? _____ Years

Section I: Inter-Organizational Business Process Integration

		1	2	3	4	5	6	7
		Strongly Disagree		←→		Strongly Agree		
2	One of us owns one of the inter-organizational processes (e.g., manufacturing, transportation, warehousing, distribution, marketing, etc.) for the rest of us							
3	Members in my firm and firm X understand how individual efforts contribute to the whole our inter-organizational business processes							
4	An inter-functional team from our business unit, together with the teams from firm X, has meetings to figure out how to serve our mutual customers better							
5	Feedback about the performance and quality at one point in the inter-organizational business processes across my firm and company X is communicated to other points in the processes timely							
6	Redundant activities have been moved from our inter-organizational business processes that cross my firm and firm X							
7	My firm and firm X place personnel at the business facilities of each other to facilitate cooperation.							
8	The performance systems regarding the inter-organizational business processes across my firm and firm X are consistent							

Section II: Relative Absorptive Capacity

* Firm X refers to the firm on the label attached to the envelop

		1	2	3	4	5	6	7
		Strongly Disagree ← → Strongly Agree						
9	Relative to firm X, we are more effective in transforming existing information into new knowledge							
10	Relative to firm X, we are more effective in developing new knowledge or insights that have the potential to influence product development							
11	Relative to firm X, we can more successfully exploit internal and external information and knowledge into concrete applications							
12	Relative to firm X, we are more effective in utilizing knowledge into new products							
13	Relative to firm X, we can more successfully integrate our existing knowledge with the new information and knowledge acquired							
14	Relative to firm X, we are more successful in learning new things							
15	Relative to firm X, we have more effective routines to identify, value, and import new information and knowledge							
16	Relative to firm X, we have higher ability to identify and acquire internal and external knowledge							
17	Relative to firm X, we have more adequate routines to <i>analyze</i> the information and knowledge obtained							
18	Relative to firm X, we have more adequate routines to <i>assimilate</i> new information and knowledge							

This concludes the survey. Thank you for your participation!

南 洋 商 学 院
新加坡 · 南洋理工大学

复旦大学

Survey on Your Company's Organizational Performance

Project Supervisor	
Project Supervisor	Professor Christina Soh, Vice dean, Nanyang Business School, Nanyang Technological University
	Professor Huang Lihua, Vice dean, Management School, Fudan University

Instructions For the Survey															
In the survey, some items are designed to evaluate the internal aspects of your company while others are designed to evaluate the aspects of your company in relation to one of your business partners. Based on the inter-organizational relationship between your company and firm X, please indicate the degree to which you agree or disagree with the statements and tick accordingly (v). The seven-point scale includes (1) Strongly Disagree, (2) Disagree, (3) Slightly Disagree, (4) Neutral, (5) Slightly Agree, (6) Agree, and (7) Strongly Agree. For example, if you <i>slightly agree</i> with the following statement "My firm's financial performance exceeds our major competitors", you should choose 5 and tick accordingly as follows.															
	<table><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td colspan="3">Strongly Disagree</td><td>↔</td><td colspan="3">Strongly Agree</td></tr></table>	1	2	3	4	5	6	7	Strongly Disagree			↔	Strongly Agree		
1	2	3	4	5	6	7									
Strongly Disagree			↔	Strongly Agree											
My firm's financial performance exceeds our major competitors'	<table><tr><td></td><td></td><td></td><td></td><td>v</td><td></td><td></td></tr></table>					v									
				v											

Announcement	
<div>1. All information that you and your company provide will be kept confidential. Only the researchers have the access to the information. And the results would only be reported in aggregate.</div> <div>2. In return for your company's cooperation, we will send an aggregated report to your company if email address is provided.</div>	

Would you, or your Firm, like to receive an electronic copy of the final aggregate (summarized) survey results?		☐ Yes (Email:) ☐ No
Your name (Optional):		Your title:
Survey Completion Date:		

-----Please answer based on your firm's operation-----

Section I: Demographic Characteristics of Your Company

1	Company name:			
2	Industry of your main business: ☐ Manufacturing ☐ Construction ☐ Communication, Storage, & Post ☐ IT ☐ Hotel ☐ Wholesale and Retailing ☐ Finance ☐ Real Estate ☐ Others(Please Specify:)			
3	Ownership	☐ Government owned	☐ NPO	☐ State-owned
		☐ Collectively owned	☐ Private	☐ Foreign-invested enterprises / ventures
4	Is your company listed? ☐ Yes ☐ No			
5	What's the firm size of your company, based on the number of employees adjusted to the industry of your company's main business and according to standards issued by the National Bureau of Statistics? ☐ Large ☐ Medium ☐ Small			
6	How many employees does your company have? _____(persons)			
7	Your company last year's sales? ☐ Less than 10 million RMB ☐ Less than 30 million RMB ☐ Less than 40 million RMB ☐ Less than 150 million RMB ☐ Less than 300 million RMB ☐ Less than 400 million RMB ☐ Greater than 400 million RMB			

Section II: Operational Performance

		1	2	3	4	5	6	7
		Strongly Disagree			Strongly Agree			
* Firm X refers to the firm on the label attached to the envelop								
8	As a result of my firm's relationship with firm X, my firm's capacity utilization increases							
9	As a result of my firm's relationship with firm X, my firm's inventory turnover increases							
10	As a result of my firm's relationship with firm X, my firm's productivity increases							
11	As a result of my firm's relationship with firm X, my firm's cost efficiency increases							

-----Please answer based on your firm's inter-organizational relationship with firm X -----

Section III: Competitive Performance

		1	2	3	4	5	6	7
		Strongly Disagree			Strongly Agree			
* Firm X refers to the firm on the label attached to the envelop								
12	Firm X's purchases from my firm are increasing							
13	In firm X's purchases in the category of my firm's products, my firm's market share is increasing							
14	My firm has gained a strategic advantage relative to our major competitors in the business with firm X							
15	My firm's development of new business opportunities with firm X exceeds our major competitors' development of new business opportunities with firm X							

Section IV: Relative Bargaining Power

		1	2	3	4	5	6	7
		Strongly Disagree			Strongly Agree			
* Firm X refers to the firm on the label attached to the envelop								
16	The business between my firm and firm X makes a much smaller contribution to my firm's sales than to firm X's sales							
17	It is easier for my firm to replace firm X than firm X replace my firm in doing business.							
18	My firm has more alternative ways of replacing firm X than does firm X to replace my firm							

* Firm X refers to the firm on the label attached to the envelop

		1	2	3	4	5	6	7
		Strongly Disagree					Strongly Agree	
19	We are less dependent on firm X than is firm X on my firm.							
20	The business between my firm and firm X makes a much smaller contribution to my firm's <i>profits</i> than to firm X's profits							

This concludes the survey. Thank you for your participation!

APPENDIX II SURVEY --- CHINESE VERSION

问卷调查说明

(2005 年 1 月)

本问卷调查由新加坡南洋理工大学苏慧玲教授以及复旦大学黄丽华教授共同负责。该问卷共分为三个部分，分别由您公司的三位主管完成（第一部分由 IT 主管完成，第二部分由业务主管完成，第三部分由财务主管完成）。

- 第一部分：企业 IT 应用情况问卷调查
- 第二部分：企业管理与业务状况问卷调查
- 第三部分：企业绩效问卷调查

问卷调查的内容，主要是要了解公司在电子商务环境下 IT 应用和企业管理对企业竞争绩效的影响。完成本问卷，需要了解跨组织信息系统。对于跨组织信息系统，我们定义如下：

主要术语及定义	
跨组织信息系统	指被两个或多个企业共享的信息系统。通常的跨组织信息系统包括：EDI，企业独有的跨组织信息交互系统，行业标准(如 RosettaNet, AIAG, ODETTE, SPEC2000, SWIFTNet, CIDX, ACORD, PIDX, 以及 PapiNET)，在线采购平台如海尔公司的 iHaier，企业 ERP 对企业 ERP 的交互系统。值得注意的是，电子邮件(Email)和传真不属于跨组织信息系统的范畴。

在这份问卷中，有些问题是关于您公司内部情况的，而另外一些问题是有您公司（作为某个客户的供应商）和这个客户的相互关系的。为此，请您根据您公司的实际情况，和公司 IT 部经理以及业务经理共同确定您公司的一个主要企业客户，这个客户需要满足以下条件：

- 这个客户是真实存在的，且是公司客户而非个人客户；
- 这个公司和您公司之间使用某种形式的跨组织信息系统(见上表的定义)；
- 这个公司是您的主要客户，也就是说您公司是这个公司的供应商，且两个公司之间有较大的业务往来。

请您把这个客户的全称以正楷字写于装有问卷的三个信封封面指定的标签上。这是因为这份问卷需要您公司的三位主管从同一客户的供应商的角度来完成。在问卷里，我们用“X 公司”来代指您所选定的这个客户。

所有提供的信息我们都将严格保密，仅供研究使用，研究人员承诺不向任何第三方公布贵公司所提供的数据。作为回报，我们将免费提供一份综合性研究报告。该报告可以作为贵公司制定竞争战略的标杆(Benchmark)。

多谢您的合作。

南 洋 商 学 院
新加坡·南洋理工大学

复旦大学

企业 IT 应用情况问卷调查

项目负责人

项目负责人

苏慧玲教授，新加坡南洋理工大学，南洋商学院副院长
黄丽华教授，复旦大学，管理学院副院长

问卷填写指南

从第二页开始的一些语句描述了您公司以及您公司和 X 公司(即写于信封封面的那个公司)之间交往的方方面面。请根据您公司以及您公司与 X 公司交往的具体情况，来选择您同意还是不同意这些表述的程度，并在相应的表格里打勾(√)。右边刻度上的数字表示：(1) 强烈不同意，(2) 不同意，(3) 有点不同意，(4) 即非不同意亦非同意，(5) 有点同意，(6) 同意，和 (7) 强烈同意。比如说，您是有点同意“我公司已经投资于用来推进公司跨部门数据交换的技术”这样的表达，按照以上规则，您应选择(5)并在(5)所对应的表格处打勾(√)，结果如下。

	1	2	3	4	5	6	7
	强烈不同意						强烈同意
我公司已经投资于用来推进公司跨部门数据交换的技术					√		

主要术语及定义

跨组织信息系统

指被两个或多个企业共享的信息系统。通常的跨组织信息系统包括：EDI, 企业独有的跨组织信息交互系统, 行业标准(如 RosettaNet, AIAG, ODETTE, SPEC2000, SWIFTNet, CIDX, ACORD, PIDX, 以及 PapiNET), 在线采购平台如海尔公司的 iHaier, 企业 ERP 对企业 ERP 的交互系统。值得注意的是，电子邮件(Email)和传真不属于跨组织信息系统的范畴。

声明

1. 所有提供的信息我们都将严格保密，仅供研究使用，研究人员承诺不向任何第三方公布贵公司所提供的数据
2. 作为回报，我们将免费提供一份综合性研究报告。该报告可以作为贵公司制定竞争战略的标杆(Benchmark)

您是否希望我们通过电子邮件给您寄送一份调研报告?		☐ 是(电子邮件:) ☐ 否	
您的名字(可不填):		您的职位:	
您完成此调查表的日期:	月	日	

-----以下各部分，请根据您公司的实际情况作答-----

第一部分：企业信息系统使用情况

*在以下表述中，X 公司指写于信封封面的那个公司

1	本公司已经或者正在实施(请打√，可多选) ☐ OA(办公自动化系统) ☐ EDI (电子数据交换系统) ☐ ERP(企业资源计划) ☐ SCM(供应链管理) ☐ PDM(产品数据管理系统) ☐ CRM(客户关系管理) ☐ EC(电子商务) ☐ CIMS(计算机集成制造系统)
2	您公司和 X 公司目前使用何种跨组织信息系统(请打√，可多选)? ☐ EDI ☐ AIAG ☐ ODETTE ☐ SPEC2000 ☐ RosettaNet ☐ SWIFTNet ☐ CIDX ☐ ACORD ☐ PIDX ☐ PapiNET ☐ 在线采购平台(类似于海尔的 iHaier) ☐ 企业 ERP 对企业 ERP 的交互 ☐ 企业独有的跨组织信息交互系统
3	您公司和 X 公司使用跨组织信息系统来传输以下哪些数据(请打√，可多选)? ☐ 订单信息 ☐ 送货信息 ☐ 货运状态信息 ☐ 发票信息 ☐ 汇款信息 ☐ 库存信息 ☐ 研发信息 ☐ 扣款指令/信息 ☐ 其它信息(请指明:)
4	您公司和 X 公司之间使用跨组织信息系统(参见首页定义)已经多少年了? ☐ 1 年 ☐ 2 年 ☐ 3 年 ☐ 4 年 ☐ 5 年 ☐ 6 年 ☐ 其它(请指明: 年)

-----以下内容，请根据您公司和 X 公司相互关系的实际情况作答-----

第二部分：企业间信息系统集成

*在以下表述中，X 公司指写于信封封面的那个公司

		1	2	3	4	5	6	7
		强烈不同意 < ----- > 强烈同意						
5	和 X 公司通过跨组织信息系统(参见首页定义)相互传输的数据被集成到了我公司的各个内部信息系统中去了							

*在以下表述中，X 公司指写于信封封面的那个公司

		1	2	3	4	5	6	7
		强烈不同意 < ----- > 强烈同意						
6	至少对于一些数据字段来说，在跨越我公司和 X 公司的大部分信息系统之间有数据标准被推广和执行							
7	我公司和 X 公司使用跨组织信息系统(参见首页定义)来相互传输大部分交易数据（比如订单、运货信息、发票、汇款通知等等）							
8	从 X 公司来的数据必须被重新键入，当这些数据被我公司的不同员工使用和再使用的时候							
9	多种类的交易数据（如订单、运货信息、发票、汇款通知等等）能够在我公司和 X 公司之间用跨组织信息系统(参见首页定义)来相互交换							

问卷调查到此结束，感谢您的参与！

南 洋 商 学 院
新加坡·南洋理工大学

复旦大学

企业管理与业务状况问卷调查

项目负责人	
项目负责人	苏慧玲教授，新加坡南洋理工大学，南洋商学院副院长 黄丽华教授，复旦大学，管理学院副院长

问卷填写指南

从第二页开始的一些语句描述了您公司以及您公司和 X 公司(即写于信封封面的那个公司)之间交往的方方面面。请根据您公司以及您公司与 X 公司交往的具体情况，来选择您同意还是不同意这些表述的程度，并在相应的表格里打勾(√)。右边刻度上的数字表示：(1) 强烈不同意，(2) 不同意，(3) 有点不同意，(4) 即非不同意亦非同意，(5)有点同意，(6) 同意，和 (7) 强烈同意。比如说，您是有点同意“在我公司，所有的成员都明白个人的努力如何对整个业务流程做出贡献”这样的表达，按照以上规则，您应选择(5)并在(5)所对应的表格处打勾(√)，结果如下。

	1	2	3	4	5	6	7
	强烈不同意			←————→		强烈同意	
在我公司，所有的成员都明白个人的努力如何对整个业务流程做出贡献					√		

主要术语及定义	
业务流程	业务流程指的是一组逻辑上相互联系的任务，这些任务被执行以实现预定的商业目标
跨组织业务流程	跨组织业务流程指的是那些在两个以及两个以上公司间发生的业务流程。典型的跨组织业务流程包括客户关系管理、顾客服务管理、顾客需求管理、订单完成、供应商关系管理、新产品开发及商业化、产品回收管理
企业电子商务化转型	是指在电子商务环境下，企业应对生存环境和技术的变革而转换组织的行为与运营方式，以获得可持续竞争优势

声明	
1. 所有提供的信息我们都将严格保密，仅供研究使用，研究人员承诺不向任何第三方公布贵公司所提供的数据	
2. 作为回报，我们将免费提供一份综合性研究报告。该报告可以作为贵公司制定竞争战略的标杆(Benchmark)	

您是否希望我们通过电子邮件给您寄送一份调研报告?		☐ 是(电子邮件:) ☐ 否	
您的名字(可不填):		您的职位:	
您完成此调查表的日期:	月 日		

-----以下内容，请根据您公司和 X 公司相互关系的实际情况作答-----

1 您公司和 X 公司(指写于信封封面的那个公司)有业务往来已经 年了(如不清楚请估计)?

第一部分：跨组织业务流程集成

*在以下表述中，X 公司指写于信封封面的那个公司		1	2	3	4	5	6	7
		强烈不同意 < ----- > 强烈同意						
2	我公司和 X 公司双方中的某一方为对方拥有或者管理某个跨组织业务流程（比如制造、运输、仓储、分销、营销等）							
3	在我公司和在 X 公司的成员明白个人的努力如何对跨越我们两个公司的整个跨组织业务流程做出贡献							
4	我公司的跨职能部门团队和 X 公司的相应团队，有举行会议来找到如何更好地服务于双方公司共同客户的办法							
5	有关跨越我公司和 X 公司的跨组织业务流程中某个环节的绩效和质量的反馈，被及时地传达到该业务流程中的其它环节							
6	重复的活动已经从跨越我公司和 X 公司的跨组织业务流程中除去了							
7	我公司和 X 公司各自在对方的组织机构中安置人员以推动合作							
8	有关跨越我公司和 X 公司的跨组织业务流程的绩效系统是一致的							

第二部分：企业间相对学习能力

*在以下表述中，X 公司指写于信封封面的那个公司

		1	2	3	4	5	6	7
		强烈不同意 < ----- > 强烈同意						
9	和 X 公司相比较，我公司在把已经存在的信息转化成新的知识方面更加有效							
10	和 X 公司相比较，在获得具有影响新产品开发潜力的知识和洞见方面我公司更加有效							
11	和 X 公司相比较，我公司能够更加成功地利用内部以及外部的信息和知识以形成具体的应用							
12	和 X 公司相比较，在利用知识形成新产品方面我公司更加有效							
13	和 X 公司相比较，我公司能够更加成功地把现有知识和获得的新信息/知识集成起来							
14	和 X 公司相比较，我公司在学习新事物方面更加成功							
15	和 X 公司相比较，我公司拥有更加有效的途径来识别、评估、以及引入新的信息和知识							
16	和 X 公司相比较，我公司具有更高的能力来识别和获得内部以及外部的知识							
17	和 X 公司相比较，我公司拥有更加足够的途径来分析获得的信息和知识							
18	和 X 公司相比较，我公司拥有更加足够的途径来吸收新的信息和知识							

问卷调查到此结束，感谢您的参与！

南 洋 商 学 院
新加坡·南洋理工大学

复旦大学

企业绩效问卷调查

项目负责人

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苏慧玲教授，新加坡南洋理工大学，南洋商学院副院长

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我公司的财务表现超过了我公司的主要竞争对手

1	2	3	4	5	6	7
强烈不同意			强烈同意			
				√		

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您是否希望我们通过电子邮件给您寄送一份 调研报告?		☐ 是(电子邮件: ☐ 否
您的名字(可不填):		您的职位:
您完成此调查表的日期:	月 日	

-----以下各部分，请根据您公司的实际情况作答-----

第一部分：企业基本信息

1	公司名称	
2	公司所在主要行业	☐ 制造业 ☐ 建筑业 ☐ 交通运输、仓储和邮政业 ☐ 批发和零售业 ☐ 住宿和餐饮业 ☐ 信息传输、计算机服务和软件业 ☐ 金融业 ☐ 房地产业 ☐ 其它行业(请指明:)
3	您公司的性质	☐ 政府部门 ☐ 集体企业 ☐ 非盈利组织 ☐ 国营企业 ☐ 民营企业 ☐ 三资企业
4	请问您公司是否上市?	☐ 是 ☐ 否
5	您公司的企业规模是(根据您公司的员工人数及国家统计局标准回答)? ☐ 大企业 ☐ 中企业 ☐ 小企业	
6	请问您公司有多少员工? (人)	
7	请问您公司上年度销售额(选一项)有多少? ☐ 小于 1 千万元人民币 ☐ 小于 3 千万元人民币 ☐ 小于 4 千万元人民币 ☐ 小于 1 亿 5 千万元人民币 ☐ 小于 3 亿元人民币 ☐ 小于 4 亿元人民币 ☐ 大于 4 亿元人民币	

第二部分：运营绩效

		1	2	3	4	5	6	7
		强烈不同意 < ----- > 强烈同意						
8	因为我公司和 X 公司的业务往来关系，我公司的设备利用提高了							
9	因为我公司和 X 公司的业务往来关系，我公司的库存周转增加了							
10	因为我公司和 X 公司的业务往来关系，我公司生产率提高							

		1	2	3	4	5	6	7
		强烈不同意 < ----- > 强烈同意						
	了							
11	因为我公司和 X 公司的业务往来关系，我公司的成本效率提高了							

-----以下内容，是评估您公司和 X 公司相互合作对您公司绩效的影响的-----

第三部分：竞争绩效

		1	2	3	4	5	6	7
		强烈不同意 < ----- > 强烈同意						
*X 公司指写于信封封面的那个公司								
12	X 公司从我公司采购的趋势是增加的							
13	我公司产品在 X 公司采购的该类产品中的市场份额是提高的							
14	在和 X 公司的生意关系中，与我公司主要的竞争对手相比，我公司有竞争优势							
15	我公司与 X 公司新的商业机会的发展超过了我公司的主要竞争对手与 X 公司新的商业机会的发展							

第四部分：相对讨价还价的能力

		1	2	3	4	5	6	7
		强烈不同意 < ----- > 强烈同意						
*在以下表述中，X 公司指写于信封封面的那个公司								
16	我公司和 X 公司之间的交易对我公司的销售做出的贡献比对 X 公司的销售做出的贡献要小							
17	在做生意方面，我公司找 X 公司的替代者比 X 公司找我的替代者容易些							
18	与 X 公司具有的可供选择的替代我公司的方式相比较，我公司具有更多的可供选择的方式来替代 X 公司							
19	我公司比 X 公司对对方有更少的依赖							
20	我公司和 X 公司之间的交易对我公司的利润做出的贡献比对 X 公司的利润做出的贡献要小							

问卷调查到此结束，感谢您的参与