IMPACT OF IT UNIT'S DECISION RIGHT ON ORGANIZATIONAL RISK TAKING IN IT

Completed Research Paper

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Abstract

The objective of this study is to understand how the company's risk-taking decisions in IT adoption are influenced by the decision right of its IT unit. The study builds a theoretical framework capturing how the IT unit's decision right influences two determinants of risk taking, perceived risk and risk propensity. This framework also illustrates how the impacts of these two determinants on the actual actions of IT adoption are moderated by the IT unit's decision right. The framework is empirically tested using a dataset on the adoption of electronic supply chain management (e-SCM) systems. The findings suggest that the IT unit's decision right is not associated with the decrease in perceived risk. However, it is associated with the increase in risk propensity. Moreover, the IT unit's decision right strengthens the positive association between risk propensity and e-SCM adoption, and weakens the negative association between perceived risk and e-SCM adoption.

Keywords: IT governance, risk taking, decision right, IT adoption, supply chain management systems

Introduction

The risk associated with Information Technology (IT) initiatives has been well recognized by both practitioners and scholars. For example, a recent research report by the Standish Group on the survey of 400 US organizations found that over the previous two years, only 32% of IT projects were considered successful (i.e., completed on time, on budget and with required features). Nearly a quarter of IT projects were failed (i.e., cancelled before completion or delivered but never used), and the rest were considered challenged (i.e., completed late, over budget and with fewer features than expectation) (Levinson 2009). The academic research on IS also recognizes that the risk associated with IT investments is normally higher than that of other investments (Dewan et al. 2007).

As IT initiatives often entail risks, it is imperative to understand companies' risk-taking decisions in adopting IT. Extant literature on IT adoption has primarily studied risk-taking from the perspective of risk perception (e.g., Nicolaou and McKnight 2006; Palvou and Gefen 2004). The central argument is that the adoption of risky IT is driven by the mitigation of perceived risk. However, the finding sofar is insufficient to explain the strategic risk taking in organizational IT adoption. When decision makers in companies are fully aware of the high risk of IT, they may still proactively take the risk to adopt IT due to the positive association between risk and return. Therefore, studying what drives the rational and strategic risk-taking actions of companies helps generate more insights on the organizational IT adoption. The Management literature has recognized that risk perception is not the only determinant of risk-taking behaviors. The interpretation of risk-taking decisions based on risk perception alone may lead to inconsistent findings (Sitkin and Pablo 1992). In order to better understand the risk-taking behaviors, decision makers' willingness to take or avoid risk, namely *risk propensity*, needs to be explicitly considered together with risk perception.

The objective of this study is to understand how risk perception and risk propensity jointly influence the decision making for risky IT adoption. More importantly, the study aims to explore how these risk-related factors and their impacts on IT adoption are influenced by a key aspect of IT governance – the IT unit's decision right. The IT unit's decision right refers to the degree of authority that the IT unit has in the decision making for IT adoption. When the IT unit is involved in the strategic decisions on IT adoption, it generates indispensible influence on strategic risk taking of the organization. However, the extant literature has paid inadequate attention to the impact of the IT unit's decision right on organizational risk taking. This study bridges this gap by focusing on the following research questions: When the IT unit has more rights in the decision making, does the company have less perceived risk of IT initiatives? Is the company more willing to take risk in adopting IT? How does the IT unit's decision right influence the impact of risk perception and risk propensity on the actual adoption of risky IT solutions?

To examine companies' IT-related risk-taking, we focus on a specific area of IT adoption: the adoption of electronic supply chain management (e-SCM) systems. E-SCM systems are inter-organizational systems (IOS) that companies implement to transact and collaborate with their upstream suppliers and downstream customers along the supply chains. Compared to other intra-organizational IT systems, the adoption of e-SCM systems are generally considered as more risky initiatives (e.g., Kumar and van Dissel 1996). The main reason is that the successful implementation of e-SCM systems requires companies to adapt to the external environment and coordinate with various outside parties (e.g., key suppliers and customers), which are beyond the control of companies. Prior IS research has also identified various types of risks in IOS adoption, such as technological risk (e.g., Kumar and van Dissel 1996), implementation risk (e.g., Zhu et al. 2006), and transactional risk (e.g., Riggins and Mukhopadhyay 1999). Therefore, studying e-SCM adoption allows us to understand the strategic risk-taking in IT adoption.

Based on the literature on strategic risk-taking and that on IT governance, we develop an integrated research framework to incorporate both the organizational risk perception and the organizational risk propensity for e-SCM adoption. In practice, the strategic initiatives of e-SCM adoption are often the outcomes of organizational decisions rather than individual decisions. Therefore, the risk perception and propensity we consider in this study mainly capture the overall risk perception and propensity of the top strategic decision team of e-SCM. Such decision team is often made up of executives from both the IT and non-IT areas. Our study departs from the extant literature since we do not impose a one-way causality relationship between these two factors. Instead, we use a simultaneous equations model to endogenize both of these factors and capture the mutual influences between them. Our framework also captures the

influences of the IT unit's decision right on risk perception, risk propensity, and the impacts of these two factors on the actual risk decisions on e-SCM adoption.

The theoretical framework was empirically tested using a survey dataset of e-SCM adoption by Chinese companies. In the emerging economy like China, the environment of e-SCM usage is much less established that that in other developed economies (e.g., US). Therefore, e-SCM adoption is a more risky IT initiative for Chinese companies.

This study generates the following findings. First, this study suggests that the increase of the IT unit's decision right is not necessarily associated with a decrease in the perceived risk of e-SCM. An implication is that allowing the IT unit to take more responsibilities in decision making may make companies more rationally anticipate the risk rather than ignore the risk. Second, the results suggest that the IT unit's decision right is positively associated with the risk propensity for e-SCM adoption. Also, the negative association between risk perception and risk propensity is weaker when the IT unit has more decision rights for e-SCM adoption. These findings suggest that allowing the IT unit to take more responsibility in decision making motivates companies' risk-taking in e-SCM adoption. Third, the study finds that providing the IT unit with more decision rights is likely to weaken the negative relationship between risk perception and the actual e-SCM adoption but strengthen the positive relationship between risk propensity and the actual e-SCM adoption. These findings in general suggest that companies' IT units play an important role in driving the e-SCM adoption by encouraging the companies' strategic risk-taking behaviors.

The rest of the paper is organized as follows. Section 2 presents the theory and hypothesis development. Section 3 describes the data and empirical method used in this study. The empirical results are presented in Section 4. Section 5 discusses the implication of this study and finally, section 6 concludes the paper.

Theory and Hypothesis Development

The objective of this paper is to explore how the IT unit's decision right influences the risk-taking decisions in IT adoption. Since we use e-SCM adoption as the research context, we first consider firms' perceived risk of e-SCM and their risk propensity for e-SCM adoption.

Perceived Risk and Risk Propensity for e-SCM

In the context of IT adoption, risk perception refers to the extent to which decision makers believe uncertainty exists about whether desirable outcomes of adopting an IT solution will occur (Nicolaou and McKnight 2006). Since this study considers organizational adoption of IT, we focus on the general risk perception of the organizational decision team. Compared to the implementation of intra-organizational IT systems, the adoption of e-SCM systems is influenced more by external factors (such as technological uncertainty and requirements by partners) that are beyond the control of the firm. Therefore, the adoption of e-SCM systems is often associated with more risks. Prior IS research has identified various types of risks associated with the adoption of inter-organizational systems (IOS) that connect organizations along the supply chain. For example, Riggins and Mukhopadhyay (1999) recognize the implementation risk of electronic data interchange (EDI) since companies cannot control how their trading partners implement the system inside their own facilities. Zhu et al. (2006) identify managerial complexity and transactional risk as major barriers to the adoption of open-standard IOS. Kumar and Dissel (1996) summarize the potential risks of supply chain IOS using three perspectives: the economic, technical and socio-political perspectives. The perception of these types of risks has a crucial impact on the decision making for e-SCM adoption.

In the existing literature, inconsistent findings have been recognized regarding the relationship between risk perception and risk behavior (Sitkin and Pablo 1992). For example, Prospect theory (Kahneman and Tversky 1979; Wiseman and Gomez-Mejia 1998) suggests a positive relationship between risk perception and risk behavior. That is, decision makers are likely to be risk-seeking (risk-averse) in negative (positive) situations with high (low) perceived risk. The central argument is that in negative (positive) situations, the decision makers may feel that their target (i.e., aspiration) levels of outcomes are harder (easier) to achieve. Therefore, they become risk-seeking (risk-averse) to reach their target levels. However, the threat-rigidity hypothesis in Staw et al. (1981) suggests that the identification of threats (i.e., risk) actually forces the decision maker to pursue more risk-averse actions. Also, March and Shapira (1987) suggest that

with less perceived risk, decision makers direct their attention to opportunities and thus become more risk-seeking in decisions. In the IS literature, the similar contradictions also exist and need to be reconciled. While some studies on the technology adoption suggest that the adoption is driven by the decrease of perceived risk (e.g., Nicolaou and McKnight 2006), the consistent recognition of the risk-return association in IT investment (e.g., Dewan et al. 2007) also indicates that risk-taking and risk-seeking are prevalent in organizational IT adoption. Companies may strategically take risk in implementing IT to pursue higher return.

To reconcile the contradiction, prior research has identified risk propensity as another key determinant of risk actions (Sitkin and Pablo 1992). Risk propensity has been conceptualized as the organizational decision maker's tendency to take or avoid risks (Baird and Thomas 1985; MacCrimmon and Wehrung 1990; Sitkin and Pablo 1992). Using a reconceptualized model, Sitkin and Pablo (1992) proposed that risk propensity is a factor correlated with risk perception and it is essentially separate from and influencing the actual risk behaviors. The inconsistency in the prior findings was actually caused by the variation of risk propensity in different research settings. Many subsequent studies on risk-taking have empirically illustrated the joint influences of risk perception and risk propensity on risk behaviors (e.g., Sitkin and Weingart 1995), including studies in the IS field (e.g., Keil et al. 2000). Moreover, regarding the adoption of e-SCM, prior IS research also suggests that companies are likely to develop high risk propensity in this area. For example, Teo et al. (2003) show that institutional pressures drive organizations to adopt inter-organizational systems even when they face the risk of adoption.

The existing literature suggests that risk propensity mitigates risk perception (e.g., Sitkin and Pablo 1992; Wiseman and Gomez-Mejia 1998). If decision makers in general have risk-averse attitudes, they are more likely to overestimate the potential negative consequences and underestimate the positive consequences. On the other hand, decision makers with risk-seeking attitudes tend to stress the positive consequences and overlook the negative consequences. Prior research has also empirically evidenced this negative impact of risk propensity on perceived risk in other scenarios of technology adoption (e.g., Sitkin and Weingart 1995; Keil et al. 2000). Therefore, we expect that this impact also exists in e-SCM adoption.

The potential influence of risk perception on risk propensity, however, has been less conceptualized in the prior theories, although many earlier studies indicated this potential influence. For example, March and Shapira (1987) suggest that decision makers' risk attitudes are mainly affected by their attention focused on the positive situations (with lower risk) and negative situations (with higher risk). Osborn and Jackson (1988) provide empirical evidence that executives of utility companies investing in nuclear technology were more willing to take risk in violating regulations when they feel likely to reap future return.

To better understand the relationship between risk perception and risk propensity, this study departs from the prior research by not restricting that one of these factors should always be caused by the other. Instead, we posit that risk perception and risk propensity simultaneously affect each other. We use a simultaneous equation modeling approach (Wooldridge 2002) to endogenize both factors and examine the mutual influences between them. Therefore, we first develop the following hypothesis.

H1: The perceived risk of e-SCM and the risk propensity for e-SCM adoption negatively affect each other.

IT Unit's Decision Right

Decision right, which refers to decision-making authority (Jensen and Meckling 1992), is a central element of the governance of IT (Sambamurthy and Zmud 1999; Tiwana 2009). Decision-making processes often encompass different activities that are associated with different rights. For example, Tiwana (2009) classified decision rights in IS development projects into decision control rights (which primarily relate to the approval and evaluation of projects) and decision management rights (which primarily relate to the actually initiation and implementation of projects). Adopting a staged-view of decision making, Xue et al. (2008) identified different decision rights in 3 stages of IT investment decisions (i.e., the initiation, development and approval stages).

Decision rights of IT development and adoption are often shared to varying degrees between the IT unit and other functional departments (Sambamurthy and Zmud 1999, Weill and Ross 2004; Tiwana 2009). When the IT unit plays more roles in the decision making process and is assigned with more rights and responsibilities, its influence on the decision making outcomes becomes more critical. The allocation of

decision rights is subject to many factors, including internal organization (Ahituv et al. 1989; Brown and Magill 1994), external environment (Xue et al. 2010; Brown 1997), and the characteristics of decisions (Xue et al. 2008).

We first consider how risk perception and risk propensity for e-SCM adoption may be influenced by the decision right of the IT unit. First, there is a potential direct effect of the IT's decision right on perceived risk. That is, when the IT unit is involved more in the decision making, it is more likely to reduce the perceived risk of e-SCM. Existing theories on strategic risk taking suggest that the risk perception of decision makers is often dependent on their familiarity with the problem domain (Baird and Thomas 1985; Wiseman and Gomez-Mejia 1998). When decision makers are more familiar with e-SCM, they form more objective expectation about the potential consequences of adoption and are thus less likely to over-weigh on the potential negative outcomes. Letting the IT unit be involved more in the decision making helps bring more domain knowledge and experience into the decision team. As a result, the decision team in general becomes more familiar with the domain of e-SCM and is thus likely to perceive less risk of e-SCM.

The IT unit may also mitigate perceived risk by influencing the problem framing. Problem framing refers to whether the decision problem is framed in positive or negative terms (Dutton and Duncan 1987; Sitkin and Pablo 1992). Compared to the managers from other functional areas, IT managers normally favor more investments in IT (Ross and Weill 2002; Xue et al. 2008) and are thus likely to frame the problem of e-SCM adoption in favorable terms. This will in turn make other members of the decision team more optimistic about the e-SCM adoption. Therefore, we expect that all else being equal, there is a negative association between the IT unit's decision right and the perceived risk.

H2: IT unit's decision right is negatively associated with the perceived risk of e-SCM.

Second, in addition to the direct effect on perceived risk, the IT unit's decision right may also influence perceived risk through moderating the effect of risk propensity. Involving the IT unit in decision making helps mitigate the perceived risk and ease the concerns of other decision makers. This effect should be more significant when other decision makers are in general more risk-averse since risk-averse decision makers often over-weigh the negative outcomes and the probability of loss (Schneider and Lopes 1986). Therefore, when the IT unit has more rights in decision making, the overall risk-averse attitude of the decision team is less likely to result in significant risk perception.

On the other hand, the lack of experience is likely to cause overconfidence of other decision makers in their assessments of risk (Sitkin and Pablo 1992; March and Shapira 1987). When decision makers are more risk-seeking, they are more likely to underestimate situational risk and overestimate their abilities to handle unforeseen problems. IT managers involved in e-SCM decisions help develop objective views by providing more professional analysis and opinions (Hall et al. 2010). IT managers' experience, especially their past success in performing other IT functions, helps prevent the managerial overconfidence of risk-seeking decision makers from other areas. In this regard, we expect that the IT unit's decision right negatively moderates the negative impact of risk propensity on perceived risk.

H3: The impact of risk propensity for e-SCM on perceived risk is weaker when the IT unit has more decision rights.

Third, the IT unit's decision right is likely to have direct effect on the risk propensity for e-SCM. Extant literature on risk-taking suggests that past successful experience is a key determinant of risk-seeking (Osborn and Jackson 1988). Decision makers are more willing to take risks within the domains where they have prior successful risk-seeking actions. Compared to the decision makers from other areas, IT managers have more successful experience in handling IT-related risks. Such experience in the past makes IT managers more willing to take risk than other decision makers. For example, when Cisco implemented ERP, the IT managers convinced other managers about a more risky do-it-all-at-once approach due to the experience they obtained from previous other monolithic IT projects (Nolan 2001). In this regard, IT managers are likely to bring to the decision group more risk propensity for e-SCM when they have more rights in decision making.

Existing theories also suggest that decision makers' risk orientation in specific contexts tends to persist over time and form a stable pattern (Slovic 1972). Given the constantly risky nature of IT assets (Dewan et al. 2007), IT managers are likely to have more persistent risk propensity for IT initiatives. They may

extend the risk propensity in other IT initiatives to the e-SCM adoption. For example, the e-SCM adoption is normally based on the implementation of advanced internal systems, such as ERP. When the IT unit takes risk in the implementation of ERP, it is also willing to take risk in the decision making for e-SCM adoption (McFarlan et al. 2002). Therefore, we expect that all else being equal, there is a positive association between the IT unit's decision right and the risk propensity.

H4: IT unit's decision right is positively associated with the risk propensity for e-SCM adoption.

The negative impact of perceived risk on risk propensity may also be moderated by the IT unit's decision right. Risk perception may drive decision makers to be risk averse since their attention was directed to the potential loss (Staw et al. 1981; March and Shapira 1987). This effect tends to be stronger when decision makers have little experience in the problem domain. On the other hand, when decision makers have more experience in the domain, they are more likely to perceive the reasonableness of the risk and thus become less risk-averse (Carpenter et al. 2003). Compared to other decision makers, IT managers are more likely to perceive the reasonableness of many technological risks and implementation risks of e-SCM. Due to their prior experience, they are also more confident than others on their capabilities to handle these risks. When the IT unit plays more roles in decision making, the knowledge and experience they bring to the decision team help encourage the risk seeking of other decision makers and mitigate the negative influence of risk perception. Therefore, we expect that when the IT unit has more rights in decision making, risk perception is less likely to cause significant risk aversion.

H5: The impact of perceived risk on risk propensity for e-SCM is weaker when the IT unit has more decision rights.

e-SCM Adoption

In this study, we consider e-SCM adoption as the extent to which firms adopt e-SCM systems in transacting with their suppliers and customers. Since technology is used to support and improve business processes, the decisions of e-SCM adoption concern not only technology but also various business aspects of firms.

We first consider the direct impact of IT unit's decision right on e-SCM adoption. Comparing to decision makers from other functional areas, the IT unit generally favors high level of IT adoption. For example, Ross and Weill (2004) point out that the executives of companies need to be cautious in over-delegating decision rights to the IT unit since IT managers may be too technology-oriented and are thus likely to overinvest in IT. Therefore, we expect that all else being equal, firms allowing their IT units to play more roles in the decision making have higher levels of e-SCM adoption.

H6: The IT unit's decision right is positively associated with e-SCM adoption;

Prior IS studies have also evidenced the negative relationship between perceived risk and IT adoption (e.g., Keil et al. 2000; Nicolaou and McKnight 2006). With risk propensity held constant, higher perceived risk may still leads to less adoption since companies need to manage their different risk-taking initiatives. The increase in the perceived risk of certain initiative may make this initiative less attractive compared to others. In this regard, given risk propensity, it makes sense to expect that the increase in perceived risk leads to less actual adoption of e-SCM. Also, what has been underexplored in the literature is whether this negative relationship is moderated by the IT unit's decision right. Compared to other decision makers, IT managers are more capable of figuring out solutions to better manage the anticipated risk of e-SCM implementation. This helps improve the attraction of e-SCM in the presence of perceived risk. Allowing the IT unit to play more important roles in decision making can thus mitigate the negative impact of perceived risk on the actual actions of adoption. Therefore, we develop the following hypotheses on how perceive risk impacts e-SCM adoption and how this impact is influenced by the IT unit's decision right.

H7: The perceived risk is negatively associated with e-SCM adoption;

H8: The association between perceived risk and e-SCM adoption is weaker when the IT unit has more decision rights.

Since risk propensity is conceptualized as the willingness to take or avoid risk, a hypothesis on the positive relationship between risk propensity and actual risky decision making (e.g., e-SCM adoption) "makes

extensive explanation unnecessary" (Sitkin and Weingart 1995). However, it is worthwhile to consider how this relationship is potentially moderated by the IT unit's decision right. The theory on reasoned risk-taking (Carpenter et al. 2003) provides a useful lens. As Carpenter et al. (2003) notice, decision makers may not actually convert their risk-seeking willingness into actual risky initiatives in a certain area if they lack experience in this area. In this regard, with risk perception held constant, decision makers' domain experience is likely to strengthen the positive relationship between the willing to seek risk and the actual risk-seeking. When the IT unit brings more domain experience into the decision team, the decision team is more likely to realize their risk-taking intention in the final decisions for e-SCM. We therefore develop the following hypotheses on how risk propensity impacts e-SCM adoption and how this impact is influenced by the IT unit's decision right.

H9: The risk propensity is positively associated with e-SCM adoption;

H10: The association between risk propensity and e-SCM adoption is stronger when the IT unit has more decision rights.

Figure 1 illustrates the theoretical framework. In the empirical analysis, we also include some exogenous control variables that are potential determinants of perceived risk and risk propensity. For perceived risk, we control for the modularity between the e-SCM and other internal IT systems and the company's security management level. Prior research on IT modularity (e.g., Tiwana 2008) suggests that modularity reduces the potential impact of subsystems on each other. In this regard, the high modularity between e-SCM and other internal systems should ease the concerns on the potential risk that e-SCM brings to other systems. Also, companies with sufficient security management should worry less about the technological risk that e-SCM may introduce (Kumar and Dissel 1996). Therefore, we include security management as a determinant for perceived risk and expect that security management negatively influences perceived risk.

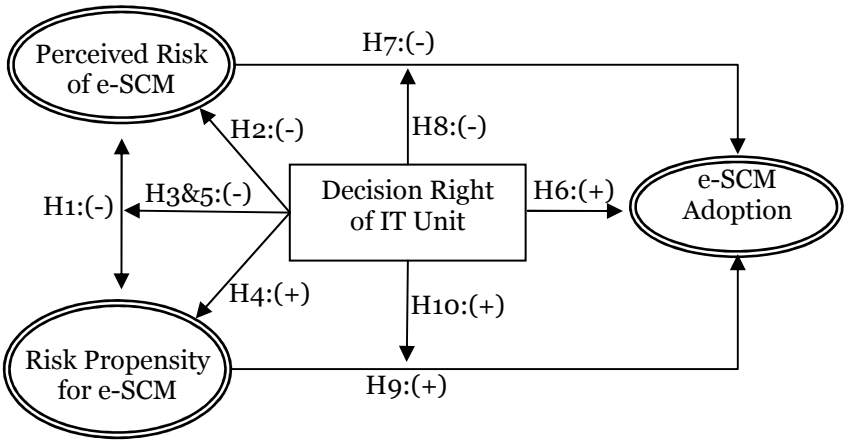

Figure 1: Research Framework

For risk propensity, we control for the managers' aspirations for e-SCM adoption and the external IT adoption. Aspiration refers to the extent to which the managers expect that the e-SCM will benefit the company. It is also considered as the target level of benefit and may be used by the decision maker as a reference point in deciding whether to take or avoid risk (Kahneman and Tversky 1979; Wiseman and Gomez-Mejia 1998). Therefore, we include aspiration as a determinant for risk propensity and expect that aspiration positively influences risk propensity. In addition, when the company's external partners (e.g., suppliers and customers) have high levels of IT adoption, the company may have the incentive to take risk in adopting e-SCM (Teo et al. 2003; Zhang and Dhaliwal 2009). Therefore, we include external IT adoption as a control for the risk propensity and expect that external IT adoption is positively associated with risk propensity. We also consider firm size, IT spending, and industry as the general controls.

Data and Empirical Method

Data Collection

We empirically test the theoretical framework using a survey dataset. The survey questionnaire was designed based on a comprehensive literature review. A panel of both academic scholars and practitioners was used to review the question items. We tailored the survey questions to fit with the context of SCM adoption. A pretest of ten firms was used to verify the content validity of the survey. After the pretest and revision of the questionnaire, the survey was conducted in two rounds in March and December 2010 using a Chinese consulting company. Responses were collected by the company using online surveys and phone calls. For each firm, the respondent is the top executive or director who is responsible for leading the strategic decision team of implementing and adopting e-SCM systems. Such team leader can be either an IT executive (e.g., CIO) or a non-IT executive (e.g., CEO). Since many of our survey questions are about the general opinions of the decision teams (e.g., risk perception and risk propensity), the views of these team leaders are representative. The firm sample was selected from various industries and geographical regions. We received feedbacks from a total of 341 firms, with 17 firms providing incomplete surveys. Therefore, 324 firms were used in the analysis. The sample covers a variety of industries, with 48.8% of the companies in construction, mining, and manufacturing industries, and 51.2% in service-oriented industries. Geographically, the sample covers 31 of the total 34 provinces and municipalities in China. To assess the non-response bias, we compared between the group with complete feedbacks and the group with incomplete feedbacks, and did not find any statistically significant difference between the two groups in terms of sales and the number of employees.

Measurement

We used a 7-point scale to measure questionnaire items, where "1" represented "low degree/strongly disagree" and "7" represented "high degree/strongly agree". Table 1 presents the measurement details of the key constructs used in this study. Table 2 presents the summary statistics and correlation matrix.

e-SCM Adoption (eSCM): The measure for e-SCM adoption is developed based on the literature on supply chain and inter-organizational systems (Dedrick et al. 2008; Barua et al. 2004; Mukhopadhyay et al. 1995). The measure captures to what extent firms conduct transactions with their key suppliers and customers through e-SCM systems.

Perceived Risk (PR): The measure for perceived risk of e-SCM is grounded primarily on the prior research on the adoption of inter-organizational systems (e.g., Nicolaou and McKnight 2006; Zhu et al. 2006). The measurement items reflect typical risks associated with e-SCM adoption, including technological risk, implementation risk, management complexity and transactional risk.

Risk Propensity for e-SCM (RP): The measurement items for risk propensity of e-SCM are adapted from the literature on strategic risk-taking (e.g., Sitkin and Weingart 1995) and prior research of IT adoption (e.g., Nicolaou and McKnight 2006). The measurement captures the extent to which the decision makers are willing to take risk in adopting e-SCM.

IT Unit's Decision Right (ITDR): In this study, the decision right of IT unit is defined as the degree to which the IT unit takes responsibilities and has authorities in the key decision making of e-SCM adoption. The measurement items are adapted from prior studies on IT governance, e.g., Tiwana (2008).

e-SCM Modularity (Mod): The measure of the modularity between the e-SCM system and other internal systems is developed based on the literature on modular system theory (e.g., Schilling 2000) and prior research on IT modularity (e.g., Tiwana 2008; Tanriverdi et al. 2007). We adapt the items primarily from Tanriverdi et al. (2007) and Tiwana (2008). These items capture to what extent the internal IT systems and the e-SCM system are interrelated to each other and communicate through standardized interfaces.

Security Management (SM): The measure of security management captures to what extent firms develop IS security policies and implement advanced IS security safeguards. The measurement items of the security management are adapted primarily from the literature on IT security (e.g., Straub 1990).

Aspiration for e-SCM (Asp): The measure of aspiration for e-SCM is grounded on both the theory on goal setting (e.g., Chacko and McElroy 1983; Brown et al. 1998) and prior studies on the benefits of inter-organizational systems (e.g., Mukhopadhyay and Kekre 2002). The measurement items capture to what extent the top executives and middle managers expect that the adoption of SCM will bring strategic and operational benefits to the firms.

Table 1. Constructs and Measures

Construct	Measurement Items	Literature
e-SCM Adoption	The proportion of: (1) suppliers that the company transacts with through e-SCM; (2) transaction volume that the company conducts with its suppliers through e-SCM; (3) transaction activities that the company conducts with its suppliers through e-SCM; (4) customers that the company transacts with through e-SCM; (5) transaction volume that the company conducts with its customers through e-SCM; (6) transaction activities that the company conducts with its customers through e-SCM. (Cronbach alpha=0.97)	Dedrick et al. (2008); Barua et al. (2004); Mukhopadhyay et al. (1995)
IT Unit's Decision Right	The IT unit has the power to decide on the following aspects of SCM adoption: (1) long-term strategies and goals; (2) system functionality; (3) budget; (4) management policies; (5) project priorities; (6) performance evaluation; (7) time scheduling. (Cronbach alpha=0.94)	Tiwana (2009)
Perceived Risk of e-SCM	Our decision makers feel that: (1) e-SCM implementation is a risky project; (2) e-SCM may potentially generate negative impact on our business processes; (3) The use of e-SCM may enable our suppliers or customers to take advantage on us; (4) There is technological uncertainty of e-SCM implementation in our company. (Cronbach alpha=0.94)	Nicolaou and McKnight (2006);
Risk Propensity	Regarding e-SCM adoption, our decision makers are willing to: (1) try unfamiliar new technolgy; (2) invest aggressively in emerging applications; (3) take the challenge of adapting the business/organization to the new technology implementation. (Cronbach alpha=0.91)	Sitkin and Weingart (1995); Nicolaou and McKnight (2006)
e-SCM Modularity	The e-SCM and other internal systems: (1) are highly interrelated; (2) are highly independent; (3) are highly functionally integrated; (4) interact through standardized interfaces; (5) The changes in e-SCM affect the internal systems to a great extent and vice versa. (Cronbach alpha=0.91)	Tiwana (2008); Tanriverdi et al. (2007)
Security Management	Our managers: (1) put weight on IS security management; (2) have developed short- and long-term policies on IS security management; (3) are actively involved in IS security management. We have implemented: (4) advanced hardware and software on IS security management; (5) effective internal controls over the data and the systems; (6) authentication and authorization systems for identity management. (Cronbach alpha=0.95)	Straub (1990)
Aspirations for e-SCM	Our top executives have clear aspirations for: (1) the use of e-SCM; (2) the contribution of e-SCM to the future success of the company; (3) the strategic benefits of e-SCM to the company. Our middle managers have clear aspirations for: (4) the contribution of e-SCM to the future success of the company; (5) the positive impact of e-SCM on the business processes; (6) the operational benefits of e-SCM to their function departments. (Cronbach alpha=0.95)	Chacko and McElroy (1983); Brown et al. (1998); Mukhopadhyay and Kekre (2002)
External IT Adoption	The levels of IT adoption of: (1) key competitors; (2) key suppliers; (3) key customers; (4) key business partners. (1-Very Low; 7-Very High) (Cronbach alpha=0.94)	Xue et al. (2008)

External IT Adoption (Ext): In this study, we define the external IT adoption as the general levels of IT adoption by the focal firm's key competitors, suppliers and customers. High levels of IT adoption in these external organizations are likely to generate competitive and institutional pressures that influence the focal firm's decision to adopt SCM. The measure is developed based on multiple streams of literature examining how external environment influences IT decision making (e.g., Xue et al. 2008) and the adoption of inter-organizational systems (e.g., Teo et al. 2003).

We used confirmatory factor analysis (CFA) to verify the convergent and discriminant validity of the multi-item constructs. All items have high loadings on the constructs they were designed to capture and low loadings across the other constructs. This provides evidence of convergent and discriminant validity.

We also compared three alternative measurement models (Tanriverdi et al. 2007) to confirm the dimentionality, convergent validity, and discriminant validity of the perceived risk and risk propensity. These models include a model with a uni-dimensional construct that contains all measurement items, a model specifying perceived risk and risk propensity as uncorrelated factors, and a model specifying perceived risk and risk propensity as freely correlated factors. The superiority of the third model over the other two confirms the multi-dimentionality of these two constructs and the correlation between them. The details are in the Appendix that is available for the authors upon request.

Table 2. Description Statistics

Measures	Correlation Matrix									
	1	2	3	4	5	6	7	8	9	10
1. e-SCM Adoption	1.00									
2. Perceived Risk	-0.46	1.00								
3. Risk Propensity	0.68	-0.49	1.00							
4. IT Unit's Decision Right	0.65	-0.42	0.74	1.00						
5. e-SCM Modularity	0.60	-0.53	0.62	0.70	1.00					
6. Security Mgmt.	-0.57	0.42	-0.64	-0.58	-0.73	1.00				
7. Aspirations for e-SCM	0.59	-0.34	0.59	0.69	0.61	-0.59	1.00			
8. External IT Adoption	0.71	-0.50	0.64	0.61	0.58	-0.50	0.53	1.00		
9. Employee	0.20	-0.11	0.15	0.15	0.24	-0.26	0.30	0.24	1.00	
10. IT Spending	0.24	-0.17	0.20	0.15	0.25	-0.30	0.22	0.21	0.53	1.00
Mean	4.40	3.66	4.67	4.72	5.37	3.34	4.77	4.51	5.76	7.10
Standard Deviation	1.45	1.42	1.47	1.46	1.29	1.41	1.57	1.34	1.67	1.11

Note: Pearson correlation is reported; $|p|$ above 0.15 is significant at the 0.01 level; $|p|$ above 0.11 is significant at the 0.05 level.

Method

The econometric approach we use to examine perceived risk and risk propensity is a simultaneous equations model (SEM) using a three-stage least square (3SLS) estimation (Wooldridge 2002). This approach has been well adopted in prior research to model the case where multiple endogenous factors mutually influence each other (e.g., Poppo and Zenger 2002). The simultaneous equations are specified as follows,

$$PR=\alpha_0 + \alpha_1 RP + \alpha_2 ITDR + \alpha_3 RP\times ITDR + \alpha_4 Mod + \alpha_5 SM + \alpha_6 Other\ Controls + \varepsilon \quad (1)$$

$$RP=\beta_0 + \beta_1 PR + \beta_2 ITDR + \beta_3 PR\times ITDR + \beta_4 Asp + \beta_5 Ext + \beta_6 Other\ Controls + \eta \quad (2)$$

The simultaneous equations of (1) and (2) capture how the two endogenous variables, perceived risk and risk propensity, affect each other in decision making for e-SCM adoption. The interaction terms in (1) and (2) capture how the IT unit's decision right moderates the mutual influences between perceived risk and risk propensity. The error terms ε and η are also assumed to be correlated to capture the potential correlation between the two endogenous variables.

To examine the impact of these factors on actual e-SCM adoption, we use the following regression model,

$$eSCM=\theta_0+\theta_1 PR+\theta_2 RP+\theta_3 ITDR+\theta_4 PR\times ITDR+\theta_5 RP\times ITDRi+ \theta_6 Exogeous\ Variables + \theta_7 Other\ Controls + \zeta \quad (3)$$

where *Exogeous Variables* include *Mod*, *SM*, *Asp* and *Env* that are used in the simultaneous equations of (1) and (2). A Kolmogorov-Smirnov test indicates no issue of homoskadasticity. To address the issue of multicollinearity, we use the residual-centering approach in Lance (1988) to reduce the correlation between the singular and interaction terms. In this approach, the interaction terms are regressed against their corresponding singular terms and the residuals are used in equation (3) as the interaction terms. Moreover, since several independent variables are correlated with each other, we examine Variance Inflation Factor (VIFs) of independent variables in (3) to check whether there is a multicollinearity

problem. We find that all VIFs are less than 4, suggesting that there is no severe issue of mulitcolinearity. Therefore, the ordinary least square (OLS) approach is used for parameter estimation.

Results

Table 3 summarizes the results of empirical analysis. The left portion of Table 3 shows the results of the simultaneous equations model on perceived risk and risk propensity. We also include the results of a base model without the interaction terms (between *ITDR* and two endogenous variables *PR* and *RP*) as a benchmark. The results in Table 3 indicate that the coefficients of exogenous control variables in the equations for perceived risk and risk propensity are consistent with expectation. Specifically, the coefficient of *e-SCM Modularity* in the equation for perceived risk is negative and significant (p<0.01), suggesting higher levels of modularity between the e-SCM system and other internal IT systems is associated with less perceived risk. The coefficient of *Security Management* in the equation for perceived risk is negative and significant (p<0.01). This result suggests that firms with more security practices perceive less risk about e-SCM adoption. Regarding the equation for risk propensity, the positive and significant coefficient of *Aspiration* (p<0.05) suggests that higher levels of aspirations for e-SCM are associated with higher risk propensity for e-SCM adoption. Finally, the positive and significant coefficient of *External IT Adoption* (p<0.01) suggests that firms in environment with higher levels of IT adoption have higher risk propensity for e-SCM adoption.

In the simultaneous equations model in Table 3, the coefficient of *Risk Propensity* in the equation for perceived risk and the coefficient of *Perceived Risk* in the equation for risk propensity are both negative and significant (p<0.01). These results suggest that perceived risk and risk propensity negatively influence each other, and thus support H1. The coefficient of *ITDR* in the equation for perceived risk is positive but not significant. Therefore, H2 is not supported. This finding suggests that when the IT unit has more decision rights, the company does not necessarily perceive less risk for e-SCM. However, the coefficient of *ITDR* in the equation for risk propensity is positive and significant (p<0.05), which supports H4. This finding suggests that when the IT unit has more decision rights, the company is more willing to take risk in adopting e-SCM.

In the simultaneous equations model in Table 3, the coefficient of the interaction between *ITDR* and *Perceived Risk* in the equation for risk propensity is positive and significant (p<0.05), and the coefficient of the interaction between *ITDR* and *Risk Propensity* in the equation for perceived risk is also positive and significant (p<0.10). These results suggest that when the IT unit has more decision rights, the negative mutual influences between perceived risk and risk propensity is weakened. Therefore, H3 and H5 are supported.

The right section of Table 3 shows the results of the regression model for e-SCM adoption. Again, we include both a base model without the interaction terms and the full model with the interaction terms. The coefficient of *Aspiration* is positive and significant in both the base model and the full model (p<0.05 and p<0.10, respectively). This suggests that higher levels of aspiration are associated with more adoption of e-SCM. The coefficient of *External IT Environment* is also positive and significant in the base model and the full model (p<0.01), suggesting that the e-SCM adoption level is higher when the company's external partners along the supply chain have higher levels of IT adoption. These results are consistent with expectation.

Regarding the direct effect of IT unit's decision right on e-SCM adoption, the coefficient of *ITDR* is positive but not significant in the base model. However, it becomes significant (p<0.05) in the full model when the interaction terms are added. Therefore, H6 is partially supported, which means more decision rights of the IT unit potentially lead to more e-SCM adoption. Similarly, the coefficient of *Perceived Risk* is negative but not significant in the base model. It becomes significant (p<0.10) in the full model. Therefore, H7, which is about the negative direct impact of perceived risk on e-SCM adoption, is partially supported. The results, however, provide a clear support to H9 on the direct impact of risk propensity on e-SCM adoption. The coefficient of *Risk Propensity* is positive and significant in both the base and full models. This suggests that greater risk propensity is associated with more e-SCM adoption.

The results provide clear support to H8 and H10, which are about the moderating effect of the IT unit's decision right. Specifically, the coefficient of the interaction between *ITDR* and *Perceived Risk* is positive and significant (p<0.05). These results suggest that when the IT unit has more decision rights, the

negative relationship between perceived risk and e-SCM adoption is weaker, and the positive relationship between risk propensity and e-SCM adoption is stronger. Therefore, H8 and H10 are supported.

Table 3. Results

	Simultaneous Equations Model on Perceived Risk and Risk Propensity					**Regression Model on e-SCM Adoption**		
	Expected Sign	Base Model		Full Model		Expected Sign	Base Model	Full Model
		PR	RP	PR	RP		e-SCM	e-SCM
Intercept		10.555**	2.083**	11.514**	3.278**		1.062†	1.452*
Perceived Risk (*PR*)	- (H1)		-0.276**		-0.570**	- (H6)	-0.038	-0.092†
Risk Propensity (*RP*)	- (H1)	-1.045**		-1.291**		+ (H9)	0.181**	0.112*
IT Unit's Decision Right (*ITDR*)	- on PR + on RP (H2)	0.504	0.451*	0.272	0.226*	+ (H7)	0.101	0.138*
PR × *ITDR*	+ (H5)				0.059*	+ (H8)		0.062*
RP × *ITDR*	+ (H4)			0.052†		+ (H10)		0.093**
e-SCM Modularity		-0.534**		-0.531**			0.022	0.026
Security Management		-0.400**		-0.391**			-0.092	-0.095
Aspiration for e-SCM			0.106*		0.101*		0.119*	0.096†
External IT Adoption			0.197**		0.196**		0.410**	0.415**
Coefficients of control variables and industry dummies are omitted for brevity.								
Sys. Weighted R^2		0.516		0.520				
Adj. R^2							0.612	0.624
F							27.81**	29.41**

Note: Num. of observation=324; † $p<0.1$; * $p<0.05$; ** $p<0.01$

Common Method Bias

We used multiple approaches to assess the threat of common method bias. First, we conducted Harman's *single-factor test*, where existence of a single factor that accounts for a large proportion of the variance indicates a common method bias (Harman 1976). In our results, no such single factor emerged in the factor analysis with all constructs. The first factor accounts for 9.87% of the 67.75% explained variance. Second, we employed Lindell and Whitney's (2001) approach of *marker variable test*. We use the dummy of company location and the dummy of company type (i.e., 1 for *state-owned*; 2 for *private*; 3 for *foreign-invested*) as marker variables, which are theoretically uncorrelated with other constructs. The average correlation between the study's principal constructs and location dummy (r=0.033, T=0.559), and type dummy (r=-0.027, T=0.856) is low and non-significant, providing no evidence of common method bias. Third, we checked the correlation matrix. Common method bias should have resulted in extremely high correlation (r>0.9) (Pavlou and Gefen 2004), whereas the highest correlation in this study is 0.74. Overall, there is no evidence of common method bias.

Discussion

In this section, we discuss the major empirical findings of this study and their implications. First, the results of this study suggest that when the IT unit has more decision rights in e-SCM adoption, the company may not necessarily have less perceived risk about e-SCM. A plausible explanation is that the IT unit is likely to well understand the risk associated with e-SCM due to its domain knowledge. When involved in decision making, IT managers bring this knowledge to the decision team and thus help other decision makers to rationally expect the risk. Also, when the IT unit has more responsibilities, it is also motivated to be more diligent in identifying risks. The identification of risk enables the company to better manage the risk later in adoption. In this regard, the IT unit does not necessarily help reduce the perceived risk when it plays a more important role in decision making. Rather, it may lead to more reasonable risk perception.

Second, this study shed lights on how the IT unit's decision right increases the company's willingness to take risk in e-SCM adoption. The results suggest that when the IT unit has more decision rights, the company has higher risk propensity in e-SCM adoption. It is likely that the IT managers directly bring their technology-related risk-seeking intentions to the decision group. Another way that the IT unit increases the company's risk-taking intention is to mitigate the negative mutual influences between perceived risk and risk propensity. When the company can rationally anticipate the risk and thus better manage the risk, it is more willing to take the risk. Therefore, with more decision rights, the IT unit may encourage the company to proactively take risk. Considering the association between the risk and the return, a risk-seeking company can rely on the IT unit to better identify both the opportunities and the associated risk of IT adoption. At the same time, the risk identification facilitated by the IT unit helps the company more rationally bear the risk and profit from the opportunities.

Third, the findings of this study explain the impact of the IT unit's decision right on the actual e-SCM adoption from a perspective of risk taking. The IT unit involved more in the e-SCM decision making is likely to directly increase the adoption of e-SCM. However, a more important role of the IT unit with more decision rights is to realize the company's risk-taking intention. The risk propensity for e-SCM may not necessarily lead to enough actual adoption of e-SCM since decision makers may have other risk initiatives and need to balance the resources allocation. Therefore, the more involvement of the IT unit in the decision making ensures that the risk-taking willingness is eventually converted to the actually actions of adoption. In this way, the positive relationship between risk propensity and the actual adoption of e-SCM is strengthened by the IT unit's decision right. This result is in line with the view of reasoned risk taking (Carpenter et al. 2003).

In summary, the above results provide a better understanding about how the IT unit motivates the company's strategic risk-taking. When involved more in the decision making, the IT unit does not encourage risk-taking by reducing the perceived risk. Rather, the IT unit encourages proactive risk-taking in the presence of perceived risk.

Conclusion

By developing and testing a theoretical framework of risk taking in e-SCM adoption, this study addresses an important research topic at the intersection of organizational IT adoption and IT governance. The theoretical framework conceptualizes how the risk perception and risk propensity in e-SCM adoption is influenced of a key aspect of IT governance—the IT unit's decision right. Also, the framework demonstrates how IT unit's decision right interacts with risk perception and risk propensity in influencing the actual risk decisions of e-SCM adoption. The empirical findings suggest that the IT unit encourages the strategic risk-seeking in e-SCM adoption. That is, the involvement of IT unit in the decision making enables the company to both anticipate the risk and proactively take the risk. The theoretical implications and empirical evidence of this study contribute to multiple streams of literature on IT adoption, IT governance, and IT risk.

It is worthwhile to recognize some limitations of this study and the directions in which future studies can contribute to this line of research. First, in this study, although we assessed the IT unit's overall decision rights, we did not observe many specific details of the decision making processes. The decision making for IT adoption often encompasses multiple stages and the IT unit often plays varying roles in different stages (Xue et al. 2008). Therefore, in order to better understand how the IT unit influences risk taking, future research may explore the IT unit's different specific responsibilities in these stages and how these specific

responsibilities lead to risk taking. Second, future research may benefit from exploring how senior decision makers' individual characteristics influence the IT risk taking of the organization. Third, future research may examine the performance impact of the risk taking and see if the IT unit's decision right leads to higher return from risk taking. Fourth, in this study, we focus on the risk taking in e-SCM adoption. Future research may examine risk taking in other IT-related as well as business-related areas. Finally, this study focuses on a single-country sample of Chinese companies. The risk behaviors of companies in China may be different from companies in other countries (e.g., western countries) due to factors such as cultural environment and the senior leaders' individual characteristics. Future research may validate the findings by using broader sample and incorporating more constructs at the individual and macroeconomic levels.

References

Ahituv, N., Neumann, S., and Zviran, M. 1989. "Factors Affecting the Policy for Distributing Computing Resources," *MIS Quarterly* (13:4), pp. 389-401.

Baird, I. S., and Thomas, H. 1985. "Toward a Contingency Model of Strategic Risk Taking," *Academy of Management Review* (10:2), pp. 230-243.

Barua, A., Konana, P., Whinston, A., and Yin, F. 2004. "An Empirical Investigation of Net-Enabled Business Value: An Exploratory Investigation," *MIS Quarterly* (28:4), pp. 585–620.

Bose, I., Pal, R., and Ye, Alex. 2008. "ERP And SCM Systems Integration: The Case of a Valve Manufacturer in China," *Information & Management* (45:4), pp. 233-241.

Brown, C. V. 1997. "Examining the Emergence of Hybrid IS Governance Solutions: Evidence From A Single Case Site." *Information Systems Research* (8:1), pp. 69-94.

Brown, S. P., Cron, W. L., and Slocum, J. W. 1998. "Effects of Trait Competitiveness and Perceived Intraorganizational Competition on Salesperson Goal Setting and Performance." *Journal of Marketing* (62:4), pp. 88-98.

Brown, C. V., and Magill, S. L. 1994. "Alignment of the IS Function with the Enterprise: Toward a Model of Antecedents," *MIS Quarterly* (18:4), pp. 371-403.

Carpenter, M. A., Pollock, T. G., Leary, M. M. 2003. "Testing a Model of Reasoned Risk-Taking: Governance, The Experience of Principals And Agents, and Global Strategy In High-Technology IPO Firms," *Strategic Management Journal* (24:9), pp. 803-820.

Chacko, T. I., and McElroy, J. C. 1983. "The Cognitive Component in Locke's Theory of Goal Setting: Suggestive Evidence for A Causal Attribution Interpretation," *Academy of Management Journal* (26:1), pp. 104-118.

Dedrick, J., S. X. Xu, and K. Zhu. 2008. "How does information technology shape supply-chain structure? Evidence on the number of suppliers," *Journal of Management Information Systems* (25:2), pp.41-72.

Dewan, S., Shi, C., and Gurbaxani, V. 2007. "Investigating the Risk–Return Relationship of Information Technology Investment: Firm-Level Empirical Analysis," *Management Science* (53:12), pp.1829-1842.

Dutton, J. E., and Duncan, R. B. 1987. "The Creation of Momentum For Change Through The Process of Strategic Issue Diagnosis," *Strategic Management Journal* (8:3), pp. 279-295.

Hall, O. P., Scott, A., and Chun, M. 2010. "Woodsynergy Inc: Integrating IT into the supply chain," *Richard Ivey School of Business Case (9B10E013)*, The University of Western Ontario.

Kahneman, D., and Tversky, A. 1979. "Prospect Theory: An Analysis of Decision Under Risk," *Econometrica* (47), pp. 263-292.

Keil, M., Tan, B. C. Y., Wei, K. K., Saarinen, T., Tuunainen, V., and Wassenaar, A. 2000. "A Cross-Cultural Study on Escalation of Commitment Behavior in Software Projects," *MIS Quarterly* (24), pp. 299–325.

Keil, M., Wallace, L., Turk, D., and Dixon-Randall, G., and Nulden U. 2000. "An Investigation of Risk Perception And Risk Propensity On The Decision To Continue A Software Development Project," *Journal of Systems and Software* (53), pp. 145-157.

Kumar, K., and van Dissel, H. G. 1996. "Sustainable Collaboration: Managing Conflict and Cooperation In Interorganizational Systems," *MIS Quarterly* (20:3), pp. 279-300.

Levinson, M. 2009. Recession Causes Rising IT Project Failure Rates, *The CIO Magazine*, June 18, 2009.

MacCrimmon, K. R., and Wehrung, D. A. 1990. "Characteristics of Risk Taking Executives," *Management Science* (36:4), pp. 422-435.

McFarlan, F. W., Chen, G., Reimers, K. 2002. "Digital China Holdings Ltd.: ERP as a Platform for Building New Capabilities," Case No. 9-302-080. Harvard Business School.

Mukhopadhyay, T., and Kekre, S. 2002. "Strategic and Operational Benefits of Electronic Integration in B2B Procurement Processes." *Management Science* (48:10), pp. 1301-1313.

Mukhopadhyay, T., Kekre, S., and Kalathur, S. 1995. "Business Value of Information Technology: A Study of Electronic Data Interchange," *MIS Quarterly* (19: 2), pp. 137–156.

Nicolaou, A. I., and D. H. McKnight. 2006. "Perceived Information Quality in Data Exchanges: Effects on Risk, Trust, and Intention to Use," *Information Systems Research* (17:4), pp. 332–351

Nolan, R. L. 2001. "Cisco Systems Architecture: ERP and Web-enabled IT," Case No. 9-301-099. Harvard Business School .

Pavlou, P., and Gefen, D. 2004. "Building Effective Online Marketplaces with Institution-Based Trust," *Information Systems Research* (15:1) pp. 37–59.

Poppo, L., and Zenger, T. 2002. "Do Formal Contracts and Relational Governance Function as Substitutes or Complements?" *Strategic Management Journal* (23:8), pp. 707–725.

Riggins, F. J., and Mukhopadhyay, T. 1999. "Overcoming EDI adoption and Implementation Risks," *International Journal of Electronic Commerce* (3:4) 103-123

Ross, J. W., and Weill, P. 2002. "Six Decisions Your IT People Shouldn't Make," *Harvard Business Review* (80:11), pp. 84-92.

Schilling, M. A. 2000. "Toward a General Modular Systems Theory and Its Application to Interfirm Product Modularity." *Academy of Management Journal* (25:2), pp. 312-334.

Sitkin, S. B., and Pablo, A. L. 1992. "Reconceptualizing the Determinants of Risk Behavior," *Academy of Management Review* (17:1), pp. 9–38.

Sitkin, S. B., and Weingart, L. R. 1995. "Determinants of Risky Decision-Making Behavior: A Test of the Mediating Role of Risk Perceptions And Propensity," *Academy of Management Journal* (38:6), pp. 1573–1592.

Slovic, P. 1972. "Information Processing, Situation Specificity, and Generality Of Risk-Taking Behavior," *Journal of Personality and Social Psychology* (22), pp. 128-134.

Straub, D. 1990. "Effective IS security: An empirical study," *Information Systems Research* (1:3), pp. 255-276.

Tanriverdi, H., Konana, P., and Ge, L. 2007. "The Choice of Sourcing Mechanisms For Business Processes," *Information Systems Research* (18:3), pp. 280-299.

Teo, H. H., Wei, K. K., Benbasat, I. 2003. "Predicting Intention to Adopt Interorganizational Linkages: An Institutional Perspective," *MIS Quarterly* (27:1), pp. 19-49.

Tiwana, A. 2008. "Does Technological Modularity Substitute for Control? A Study of Alliance Performance in Software Outsourcing." *Strategic Management Journal* (29) 769-780.

Tiwana, A. 2009. "Governance-Knowledge Fit in Systems Development Projects," *Information Systems Research* (20:2), pp. 180-197.

Weill, P., and Ross, J. W. *IT Governance: How Top Performers Manage IT Decision Rights for Superior Results*. Harvard Business Press, Boston, Massachusetts, 2004.

Wiseman, R., and Gomez-Mejia, L. 1998. "A Behavioral Agency Model of Managerial Risk Taking," *Academy of Management Review* (23), pp. 133-153.

Wooldridge, J. M. 2002. *Econometric analysis of cross section and panel data*. The MIT Press, Cambridge, Massachusetts.

Xue, Y., Liang, H., William, R. B. 2008. "Information Technology Governance in Information Technology Investment Decision Processes: The Impact of Investment Characteristics, External Environment and Internal Context," *MIS Quarterly* (32:1), pp. 67-96.

Xue, L., Ray, G., and Gu, B. 2010. "Environmental Uncertainty and IT Infrastructure Governance: A Curvilinear Relationship," *Information Systems Research*, published online before print Mar 1, 2010, DOI: doi:10.1287/isre.1090.0269.

Zhang, C., and Dhaliwal, J. 2009. "An Investigation of Resource-Based and Institutional Theoretic Factors in Technology Adoption for Operations And Supply Chain Management," *International Journal of Production Economics* (12), pp. 252-269

Zhu, K., Kraemer, K. L., Gurbaxani, V., and Xu, X. 2006. "Migration to Open-Standard Interorganizational Systems: Network Effects, Switching Costs, and Path Dependency," *MIS Quarterly* (30), pp. 515-539.