ENHANCING STRATEGIC FLEXIBILITY AND PERFORMANCE THROUGH ENTERPRISE RISK MANAGEMENT: THE ENABLING ROLE OF INFORMATION TECHNOLOGY

Vicky Arnold*
University of Central Florida
Dixon School of Accounting
P. O. Box 161400
Orlando, FL 32816-1400
varnold@bus.ucf.edu

Tanya Benford
Florida Gulf Coast University

Joseph Canada
Rutgers University Camden

Steve G. Sutton
University of Central Florida
ssutton@bus.ucf.edu

September 2011

Please do not cite without permission

Acknowledgements: This research was funded by the Institute of Internal Auditors – Research Foundation. The authors wish to thank the IIARF for their generous funding and support of our research. We thank Raj Echambadi, Omar El Sawy, Clark Hampton, Bill Messier, Uday Murthy, Dan O'Leary, Robyn Raschke, Carol Saunders, and Chad Simon for their advice and feedback during the development and evolution of this paper as well as participants in workshops at the University of Auckland, University of Central Florida, University of Nevada-Las Vegas, University of South Florida, University of Southern California and the 2009 American Accounting Association Annual Meeting for their valuable feedback on earlier versions of this manuscript. We also thank Randy Kuhn for his research assistance.

*Corresponding Author

Enhancing Strategic Flexibility and Performance through Enterprise Risk Management: The Enabling Role of Information Technology

ABSTRACT

Enterprise risk management (ERM) has arguably become the dominant strategic management focus of organizations primarily due to a combination of factors—stakeholders' aversion to uncertainty, volatility of the current marketplace, and compliance mandates such as the Sarbanes-Oxley Act. The purpose of this study is to examine the effect of strategic ERM on two aspects of organizational performance—strategic flexibility and supply chain performance. The study is designed to directly address concerns that increased levels of governance/regulation may have a deleterious effect on organizations' flexibility and supply chain performance. The central role of IT in supporting ERM and facilitating operational performance goals and objectives is also addressed. Responses from 155 Chief Audit Executives indicate that strategic use of ERM leads to increased organizational flexibility and increased supply chain performance. The results of this study show that applying ERM as a broad-based strategic management approach actually enhances flexibility and supply chain performance. This is particularly important for executive management as the debate over the effects of management control systems on organizational flexibility and performance often suggest that control processes hinder effectiveness and efficiency. The results also provide evidence that enhanced IT integration enhances the relationship between ERM and organizational performance.

Keywords: Strategic enterprise risk management, supply chain performance, business process control, information technology integration, organizational strategic flexibility.

Enhancing Strategic Flexibility and Performance through Enterprise Risk Management: The Enabling Role of Information Technology

INTRODUCTION

Enterprise risk management (ERM) has increasingly become the dominant strategic management approach within organizations as they get caught up in a social phenomenon termed "the risk management of everything "(Power, 2007; Mikes 2009). ERM is a risk-based approach to the strategic management of an organization and integrates concepts from auditing, managerial control, information systems, and supply chain management. ERM is normatively described as encompassing both the identification of events and environmental changes that potentially impact an organization's goals, and the recognition of threats and opportunities that should be addressed by the organization (Collier, 2009, 48-49). ERM differs from traditional risk management that focuses on specific risks in specific processes (e.g. financial risk management, operational risk management). Traditional risk management processes are managed by business process leaders without broad organizational sharing of such risks and the effect they might have on other aspects of the organization. Mikes (2009) terms this as risk silo management. Traditional risk management processes are non-strategic and compliance-oriented. Strategic ERM requires consideration of the interactive effects of risks across the organization in an integrative fashion that highlights overall risk to the organization (O'Donnell, 2005). ERM is considered strategic as the purpose should really be top level coverage (Mikes, 2009). As strategic ERM is adopted and strengthened, risk management processes move from a rudimentary focus on compliance and prevention (i.e. downside risk) towards a focus on the opportunity side (i.e. upside) of risk identification and response (Collier, 2009, 46; COSO, 2009,

1). This shift has been driven by a number of different forces including increased levels of stakeholder aversion to uncertainty, volatility of the current marketplace, increased globalization, increased competition, and compliance mandates such as the Sarbanes-Oxley Act (SOX) in 2002 (Power, 2007; Mikes, 2009; Arnold, Benford, Hampton, & Sutton, 2010). As Power (2009, 852) notes, the expectation that organizations will embed risk management and internal control systems throughout their business processes "has become an unquestioned ERM imperative".

While the ERM movement has rapidly moved into the corporate C-suite (Power, 2007), there is limited theoretical understanding as to how effective ERM facilitates the value chain activities of companies (O'Donnell, 2005). This study combines the theory building strategies underlying cross-sectional case analyses with existing theories, including real options theory, the resource-based view of the firm, and the tenets underlying the theory of capability building for entrepreneurial action. The resulting theory provides a foundation for understanding and interpreting the various experiences reported by companies during their efforts to comply with new regulatory mandates emanating from the passage of SOX in the U.S. (and similar subsequent regulatory mandates in Canada, Europe, Australia, etc.) which radically changed the way organizations view corporate governance. One dimension of this change is an increased focus on ERM, which is a much broader strategic view of organizational control than the more traditional, accounting-oriented view on internal control. While SOX regulation focused on financial controls, the impact was to extend the documentation and review of control systems to an enterprise level including strategic, operational, reputational, regulatory, and information risks (Katz, 2003; Banham, 2003; Katz, 2006; Sutton, Khazanchi, Hampton, & Arnold, 2008; COSO, 2009). The corporate failures of the early 2000s and the subsequent passage of SOX created the momentum behind ERM, and recognition of the need for organizations in general to focus on

risk management has steadily gained traction (EACLN & NAACLN, 2008). The October 2008 joint meeting of the European and North American Audit Committee Leadership Networks highlighted both the urgency of developing effective ERM processes and the on-going struggle many organizations continue to endure in implementing effective ERM practices. ERM is both a board-wide and management-wide issue that is hampered by the narrow, business-unit view of risk that often persists among the top management team (EACLN & NAACLN, 2008).

The variance in experiences reported by companies during the SOX compliance process raises questions about the efficiency of control implementation in many organizations (Arnold, Benford, Canada, Kuhn, & Sutton, 2007). Many organizations implemented manual-oriented processes to achieve control objective requirements, which slowed down business processing, reduced strategic flexibility, and hampered supply chain activities. On the other hand, organizations taking a strategic focus to implementing comprehensive ERM and automating control processes appeared less impacted in terms of flexibility, supply chain performance, and overall organizational competitiveness (Arnold et al., 2007). Still, the business press focused on the less successful implementations, frequently reporting on the negative consequences of SOX compliance on organizations' performance, and questioning SOX compliant companies' ability to maintain competitiveness in the global marketplace (Banham, 2003; Katz, 2003; Reason, 2006).

Strategic ERM is the focal point as it is both a critical element of an organization's ability to monitor internal and external activities for effective reaction to changes in the marketplace and is the most prevalent strategy used by firms to meet SOX compliance requirements (Beasley, Clune, & Hermanson, 2005). ERM is critical in a supply chain environment where disruptions are a given and the ability to detect and react to disruptions determines the ramifications

(Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007).

The purpose of this study is to examine the effect of strategic ERM on two aspects of organizational performance—strategic flexibility and supply chain performance. Strategic ERM is a top down strategy driven by firm's C-level management. Accordingly, strategic ERM is viewed as offensive and strategic as opposed to the defensive posture of a more traditional control orientation (Liebenberg & Hoyt, 2003). Central to our research is a focus on the role of information technology (IT) integration in facilitating the interrelationships between strategic ERM, strategic flexibility, and supply chain performance. Case research provides preliminary evidence indicating IT integration may be key to understanding the variable impact of compliance efforts on performance (Arnold et al., 2007).

This research contributes to the ERM literature in several ways. First, we focus on ERM as a strategic management initiative, recognizing the importance this strategic level focus has on enterprise-wide integration of ERM initiatives. Second, we directly address on-going concerns that risk management requirements under SOX 404 disadvantages companies and hinders their ability to maintain competitive supply chain activities. Our results indicate that higher levels of ERM activity are actually associated with increased strategic flexibility and improved supply chain performance. Third, our results demonstrate the integral role of IT integration in enabling ERM efforts to establish flexibility and improve performance.

The remainder of the paper is organized into four sections. Section 2 presents an overview of the foundation-level cases and the resulting theory that leads to the hypotheses and the research model development. This is followed by the research methods and results sections. The fifth and final section provides a summary of the research findings, a review of the limitations of the study, and a discussion of the implications of the research findings.

THEORETICAL DEVELOPMENT AND HYPOTHESES

Why do some organizations report impediments to their supply chains from newly integrated risk management procedures while others report improved efficiencies? The professional literature is replete with arguments for the benefits of ERM and the need for integration of ERM across the value chain. Ernst and Young (2008b) notes that extending controls to areas such as supply chain is key to maximizing benefits from ERM. Olsson (2007) notes that ERM starts with a focus on *threats*; but, as ERM processes become more robust and increasingly strategic, extending the focus to *opportunities* becomes equally important. Beasley and Frigo (2007) emphasize that ERM has to be driven from the top, that it becomes the strategic focus and is a key catalyst in helping enterprises achieve their core objectives. Collier (2009) highlights the importance of ERM to managing the enterprise by integrating strategic planning, operations management, performance management, and internal control. Collier notes that by identifying and proactively addressing both risks and opportunities, organizations create value for shareholders. Collier further notes the benefits of ERM in enhancing resource allocation and assuring well-managed supply chains.

The academic literature provides much less convincing views on the benefits of ERM. Power (2009) argues that ERM becomes overly focused on the quantification and summation of risks, weakening the ability to strategically respond. Mikes (2009) documents two different financial institutions that focus on ERM and highlights the silo effects that arise from both. In both companies' cases, ERM falls short of providing the desired strategic direction. Beasley et al. (2005, see also Ernst and Young 2008a) find that many organizations have only put in place rudimentary procedures. ERM also appears to frequently be hampered by the lack of systems level integration necessary to access information easily and to monitor risks across the

organization (Frie, Kalakota, Leone, & Marx, 1999). While these studies shed light on ERM practices within organizations, there remains an absence of theoretical understanding as to how organizations effectively implement strategic ERM processes and whether effective implementation leads to better performance across the value chain.

In this study, the development of a theoretical foundation for better understanding the role of ERM in strategically managing the integrated enterprise is approached in two stages. A series of cross-sectional case studies were initially conducted to better understand the differences between successful and unsuccessful ERM implementations. Extant literature was subsequently integrated in an effort to incorporate theoretical concepts to better explain the phenomena. The result is a series of hypothesized relationships related to ERM integration and supply chain performance that are tested across a broad range of organizations.

Cross-Sectional Case Studies

Cross-sectional field study methods entail the use of limited-depth studies conducted on specifically sampled field sites that provide the necessary diversity by which to gain an understanding of an underlying phenomena. Lillis and Mundy (2005) advocate use of cross-sectional strategies when there is limited understanding or there is disagreement on the constructs of importance in the development of theory, relationships among the constructs, or interpretation of the constructs and relationships in empirical examinations. They view cross-sectional field studies as particularly beneficial during the theory refinement phase when specific theoretical concepts are being explicated.

In conducting the limited-depth case studies for this study, every effort was made to follow the case guidelines of Yin (2003) in order to enhance validity and reliability of results. First, the extant articulations of ERM practice and design were used to guide initial question

development. Second, a replication process was implemented for the original set of cases where the same questions were used to guide the interview with each informant (or informants). Third, two or more researchers were present during each interview with all attending researchers recording notes individually, then reconciling shortly after the end of the interview. Fourth, informants received the questions in advance to allow the informant to review appropriate supporting evidence. Fifth, organizations were selected for participation based on specific needs for diversity.

In the initial planned case studies, one medium-sized and one small firm believed to have successful implementations were interviewed, as well as one medium-sized and one small firm enduring difficulties and dissatisfaction with implementation. These initial studies were followed up by two specific cases designed to address issues of high investment in IT integration within a failed ERM environment and evaluation of the value found in one enterprise with strong ERM during the divestiture of a business unit. All of the firms had made significant investments and efforts at enhancing ERM within the prior two to three years. The focus in the following discussion is on the key data that drove the development of the theoretical model.

Alpha Company provides air-freight, ocean-freight, and logistics services in a global environment, including customs brokerage. Alpha began the implementation process with an assessment of risks and weaknesses that were aligned with business priorities. Balanced scorecards were developed to aggregate risk measures across business processes and separate key performance indicators were adopted for key risk items not falling within specific business priorities. Two additional staff were hired in the IT department to address information aggregation processes to support the scorecarding processes. Initially, many of the risk measures were developed using manual aggregations which created the problems for Alpha. The risk

management processes hindered supply chain performance as normal business transactions had increased an estimated 5% in time to completion—a major hindrance to competing in a global supply chain environment where time is critical. The CIO at Alpha also noted that the situation was worsened by the fact that recent major business unit acquisitions had not been integrated into Alpha's system platforms and processes. Alpha reacted by investing substantially in software to improve risk tracking. The long-term strategy was to integrate IT to support risk management in the core parts of the business. Management also recognized that information needed to flow quickly to business process owners.

Beta Company manufactures defense and space systems, selling primarily to major defense contractors and the U.S. military. Because Beta was required to have stringent control procedures in place as a defense contractor, their compliance with SOX regulations required a smaller shift in ERM practices. ERM processes in place prior SOX regulations made the new compliance requirements relatively painless to implement with most of the effort going into additional information tracking and report generation.

Gamma Company manufactures and sells a wide range of corporate identification, career apparel, and accessories for the healthcare fields, restaurants, hotels, industrial, transportation, public safety, etc. The company operates several manufacturing facilities across the U.S., while 70 percent of Gamma's products are produced by offshore suppliers. Early efforts to implement ERM processes was hampered by the vice-president of IT, who did not want to shift IT efforts to support ERM. Early on, ERM used a multitude of manual processes to meet risk management objectives. However, the manual processes negatively impacted flexibility and hindered the organization's competitiveness with its buyers. Once the VP of IT gained an appreciation for the strategic ERM approaches, he became supportive of the effort and resistance for IT dissipated.

An IT person was added specifically to focus on strengthening risk monitoring and control processes, and investments in hardware, software and systems maintenance increased to specifically support the ERM processes. Automation of the processes substantially improved the effectiveness of the strategic ERM approaches.

Delta Company leases and sells durable medical equipment for use by home-bound patients. The company operates throughout the continental U.S. ERM implementation was viewed primarily as a culture change process as management slowly won over each of the business units as each of the units garnered an appreciation for the risk assessment and risk monitoring activities. The unification of the risk monitoring across the organization was received positively by business unit owners, who recognized the substantial increase in available information from across the organization. Managers recognized that the availability of information facilitated process improvements and led to greater efficiencies across the supply chain.

As noted in the brief overviews for each of the companies, certain consistent themes appear across multiple organizations. One theme that arose was the important role of IT in facilitating strategic ERM success. Where there was a lack of automation in information aggregation across the organization, strategic ERM processes were not particularly effective. For Alpha, Gamma and Delta, there was a clear investment after the implementation of strategic ERM in the expansion of IT staffing and capability in order to develop specific information support for ERM processes. Alpha and Gamma both experienced increased flexibility, but only after IT systems were developed to automate and facilitate information aggregation and dissemination. Similarly, for Alpha and Delta, feedback indicated improvements in performance, but again only after IT systems were put in place to facilitate the ERM processes.

Based on the results of the initial four firms, two additional case studies were added to specifically focus on better understanding the importance of the IT component, and Alpha was re-visited after being acquired by an international company. The Alpha story has two particularly interesting insights. The U.K. company that acquired Alpha subsequently made it clear that part of the value of the acquisition was the purchasing of Alpha's learned knowledge on ERM processes and their IT systems used to facilitate ERM. The acquiring company's intent was to take these systems and reuse them throughout their business units (all in the same industry). Thus, value was specifically placed on the tandem of ERM processes and supporting IT systems.

Omega, a small power utility company renowned in industry circles for their ERM processes, and Zeta, a small internet based company tracking advertisement clicks on web pages were added to the sample. Omega was of interest for its sell-off of one of its regional power companies to another power company conglomerate. Omega was convinced that it got a better price and a quicker sale due to the strength of its ERM and IT systems that supported ERM. As a part of the business unit sale, Omega agreed to continue operating the information systems for for six months after the sale in order to feed ERM information from the business unit to the buying organization's management. The six month period was to allow the acquiring organization to integrate the information systems of the acquired unit into their own corporate information systems in order to support effective strategic ERM without a lapse during the integration period.

Zeta was identified for study because of the large IT investments they made to support SOX reporting and compliance efforts, but without the implementation of strategic ERM processes. Zeta was interesting in that they made the greatest IT investments for tracking risk and control information, but the systems failed miserably and ultimately were scrapped. Zeta's

management was reluctant to implement ERM because they thought ERM processes would add to much structure and they would lose their flexibility. Instead, the company lacked the basic information it needed to remain competitive in their marketplace. The original owner and CEO was replaced by the board, and the company remained a risk of no longer being a going concern.

The additional cases provide potential support and clarity to the original case set. Alpha and Omega appear to provide further evidence of the importance of strategic ERM processes that are supported by strong intraorganisational systems that are well integrated. They also seem to reinforce the importance of the IT component to ERM being effective in maintaining flexibility and enhancing performance. Zeta on the other hand, provides evidence that IT without the strategic direction of ERM processes are not sufficient in themselves—again seeming to add support to the importance of ERM in tandem with IT systems supporting ERM information needs. Figure 1 provides the preliminary theoretical model which is examined in light of the extant literature that may help explain the observed phenomena. Note that the hypotheses are shown on Figure 1 to help the reader follow the theory and hypotheses development articulated in the following section.

[Please insert Figure 1 about here]

Hypotheses Development

Putting the observations from the case companies into the context of extant theory, several theoretical perspectives are important. First, while there is an emphasis in the cases on the developing of IT systems to support ERM, existing IT systems were leveraged in all cases. This is consistent with a strategic information systems' view that builds on the resource-based view of the firm and a real options view of the value of those resources. From this perspective, investments in IT infrastructure are viewed as buying an option that, when used successfully,

will enable new and follow-on IT projects to be possible and effective (Kambil et al. 1993; Duncan 1995; Armstrong and Sambamurthy 1999; Broadbent et al. 1999; Benaroch 2002; Weill et al. 2002; Sambamurthy et al. 2003; Fichman 2004; Fichman et al. 2005). Thus, the investment in IT becomes a resource that can be leveraged at a future time.

IT systems that support strategic ERM fall under the category of strategic information systems. Strategic information systems are used to support, shape and enable business strategies and value chain activities of the organization (Armstrong and Sambamurthy, 1999; Chatterjee et al. 2002). Given the strategic nature of ERM, it would be expected that organizations will shape the supporting information systems in order to enable the ERM strategies and facilitate the related value chain activities of the organization. Simply dropping a standardized integrated information system into an organization does little to facilitate change in control systems (Chapman and Kihn, 2009). Rather, from a strategic information systems view, these system designs are pushed down from the strategic levels of management and the success of the systems are in large part dictated by the knowledge and actions of strategic-level management (Liang et al. 2007; Elbashir et al. 2011).

This view of strategic information systems being enhanced and shaped to meet the needs of strategic management are consistent with the evolving stream of IT research that maintains that one of the most critical roles of the IT function is the support of on-going interactions among users to ensure management is prepared to respond to emerging business needs and opportunities (Clark et al. 1997; Sambamurthy and Zmud 2000; Bharadwaj et al. 2007).

The extent of IT integration that is required for effective ERM is more likely to occur by design than to be preexisting as shown in the case studies. Strategic ERM dictates that there is broad enterprise wide data sharing and coordination which is reflective of the need for systems to

have strong IT compatibility and integration. IT compatibility is the ability to share any type of information across any type of technology component (Byrd and Turner, 2000). High IT compatibility is indicative of ready accessibility to critical data from anywhere within the organization and suggests a transparency of information. Such capability is viewed as arising from a firm's leveraging of its investments in IT resources to build systems that leverage effectiveness, efficiency and flexibility (Ross 2003). This can be seen in the studies of Alpha, Gamma and Delta where for all three there was a clear investment after the implementation of strategic ERM in the expansion of IT staffing and capability in order to develop specific information support for ERM processes. This relationship is also highlighted as a critical element in the acquisition of Alpha by a competitor and the sell-off of a business unit by Omega. This leads to the first hypothesis:

H1: Strategic enterprise risk management has a positive impact on IT integration.

There is a general assumption that effective organizations must cope with an accelerating rate of change; and, in order to succeed in a given business environment, the organization needs flexibility to adapt to the environment (Batra, 2006). However, flexibility is by design. Management must be concerned with the controllability or changeability of the organization which is dependent on creating effective processes that foster flexibility (Batra, 2006). The controllability aspect comes from effective ERM processes, (Treasury Board, 2001) while the IT integration designed to facilitate these ERM processes provides the monitoring to ensure that the responses to the competitive environment are aligned with overall organizational strategy. This is consistent with Batra's (2006) definition of flexibility—the degree in which an organization has the management capabilities to increase the control capacity in a timely fashion to react to risks and opportunities. Thus, strategic flexibility is reflective of an ability to respond appropriately

and timely to rapid changes in the competitive environment and is dependent on managerial capabilities and organizational responsiveness (Volberda, 1996). The continuous focus on timeliness is where the importance of strong IT integration becomes apparent. IT integration is key to facilitating a timely response to changes in the environment. Without easy accessibility to enterprise-wide data on performance and capabilities, an organization has little opportunity to respond to new product or service opportunities that require high levels of strategic flexibility (Swafford et al., 2006). Evidence of the effect appears in most of the case studies discussed earlier. Automation of the risk monitoring and sharing of information across the organization was critical to several case companies maintaining flexibility.

The focus on information accessibility from across the organization is consistent also with the findings in the managerial control literature. First, this literature highlights the role of effective managerial control for maintenance of strategic flexibility (Simon, 1990; Davila, 2000; Chenhall, 2003; Ditillo, 2004; Naranjo-Gil & Hartman, 2006). Second, the managerial control literature points to the importance of diverse, accessible information. Broad-based information is viewed as critical to strategically oriented firms (Bouwens & Abernethy, 2000) and is necessary to support strategic flexibility (Abernethy & Lillis, 1995). This leads to the second hypotheses:

H2: IT integration has a positive impact on strategic flexibility.

The use of this diverse information appears to be the source driving enhanced strategic flexibility. As the Treasury Board (2001) notes, risk management is the systemic approach by which information is identified, assessed, and communicated in the presence of environmental uncertainty. For effective ERM, this information flow and analysis must be driven from an enterprise-wide view of easily accessible data. Nonetheless, research suggests that this relationship between strategic ERM and strategic flexibility is enhanced through infrastructure

standardization that facilitates the flow of information (Gattiker & Goodhue, 2005; Bendoly, Citurs, & Konsynski, 2007). Effective infrastructures both maintain routine control for the organization and provide the means for adapting in the face of major changes (Bendoly et al., 2007). This is evident in the study of Alpha and Gamma where there are increases in flexibility, but only after IT systems are developed to automate and facilitate information aggregation and dissemination. While effective ERM seems to be a precursor to the maintenance of strategic flexibility, the level of IT integration is the catalyst that allows for effective ERM to drive higher levels of flexibility. That leads to the third hypothesis:

H3: IT integration mediates the impact of ERM on strategic flexibility.

A growing body of literature that addresses the link between strategic flexibility and supply chain performance is currently emerging. As Palanisamy (2005) notes, organizations look for flexibility to cope with environmental changes and garner competitive advantage. Flexibility does not necessarily imply added operational complexity (Bendoly et al., 2007). At the same time, effective IT integration helps reduce this complexity through easier and timelier access to information necessary to assess and react to risks (Rai, Patnayakuni, & Seth, 2006; Swafford, 2006). Thus, the investment in technology is leveraged through the existence of a flexible organization (Bendoly et al., 2007). Alternatively, firms lacking good IT integration have difficulty supporting coordinated activities across the organization, which can lead to inferior decision making (Bharadwaj, Bharadwaj, & Bendoly, 2007). The result is a need for both strategic flexibility and IT integration for effective supply chain performance to emerge.

Strategic flexibility allows an organization to respond to opportunities as they arise, whether they are client relationships, new product releases, or new partnering relationships within supply chains (Swafford et al., 2006). Thus, strategic flexibility in itself facilitates

organizational effectiveness; and, for those companies integrated within supply chains, strategic flexibility should enhance related performance (Batra, 2006). High flexibility also allows organizations to respond quickly to strategic moves by competitors and likewise should allow an organization to initiate its own strategic moves in order to garner competitive advantage (Byrd & Turner, 2001; Swafford et al., 2006). In either case, strategic flexibility should enable a firm to maintain stronger supply chain performance. This leads to the fourth hypothesis:

H4: Strategic flexibility has a positive impact on supply chain performance

Likewise, high levels of IT integration should also facilitate supply chain performance (McAfee, 2002; Cotteleer & Bendoly, 2006). IT is an integral part of the supply chain process and enhances supply chain logistics by providing real-time information on product capability for delivery and markets (Paulraj & Chen, 2007). IT is critical as information is fundamental to decision making across the supply chain (Byrd & Davidson, 2003). However, as Vijayasarathy (2010) notes, the relationship between IT and supply chain performance is better explained through its capability building than its direct effects. IT integration itself does not drive the supply chain, but rather the organization's ability to leverage and use that information, strategic flexibility, does (Rai et al., 2006). This is consistent with arguments that the value of IT often lies in how it enables and improves other organizational assets in order to enhance performance (Jeffers, Muhanna, & Nault, 2008). This mediation effect of flexibility is consistent with Wand and Zhou's (2006) finding that lean/just-in-time practices (practices viewed as providing flexibility) mediates the relationship between intraorganisational IT integration and lead-time performance. In short, IT integration at the enterprise-wide level is beneficial if that information can be leveraged. That leads to our fifth hypothesis:

H5: Strategic flexibility mediates the impact of IT integration on supply chain performance.

Proponents of ERM argue that monitoring risk and opportunities makes ERM a significant source of competitive advantage (Beasley et al., 2005); but, ERM is only effective in the presence of broad based information, and knowledge that allows an accurate and timely picture of the risks and opportunities to be assessed (Sambamurthy & Zmud, 2000; Pavlou & El Sawy, 2006; El Sawy & Pavlou, 2008; Paladino, 2008). This phenomena is visible at Alpha and Delta where improvements in performance are observed, but only after IT systems are put in place to facilitate the ERM processes Thus, IT integration is expected to mediate the relationship between strategic ERM and supply chain performance. That leads to the sixth and final hypothesis:

H6: IT integration mediates the impact of ERM on supply chain performance.

RESEARCH METHOD

The purpose of this study is to examine the roles of strategic ERM, IT integration and strategic flexibility in advancing supply chain performance. Partial least squares analysis (SmartPLS 2.0, 2005) is used for construct validation, data analysis, and path analysis for the theoretical model hypothesized in the current study. The remainder of this section discusses participant characteristics, instrument development and validation, data analysis, and the study results.

Participants

Chief audit executives (CAEs) were targeted for the study based on their breadth of organizational understanding related to risk management processes, IT and operational control processes, and IT and operational efficiency and effectiveness. While prior literature has focused on CEO or supply chain executives' perceptions on forming external supply chain relationships (Villena, Gomez-Mejia, & Revilla, 2009), the CAE is the focus in this study due to the required knowledge of internal operational efficiency and effectiveness, as well as the lead role the CAE

takes in ERM deployment.

To obtain a representative sample of CAEs, the Institute of Internal Auditors Research Foundation hosted the survey using their Global Audit Information Network (GAIN). GAIN emailed invitations to participate in the survey to 1,383 CAEs and 251 members responded for a total response rate of 18.1%. Of the 251 respondents, seven respondents did not identify themselves as audit executives or the equivalent and each reported less than five years experience, and an additional five respondents did not complete the survey. These 12 respondents were excluded from further analysis. The remaining data were examined to determine whether there were patterns to any missing responses. A test of overall randomness found all missing responses were missing completely at random (MCAR) (chi-square = 585.634 df = 609 p-value = 0.745) and the expectation maximization algorithm (EM) (SPSS 15.0, 2006) was used to calculate replacement values (Hair, Black, Babin, Anderson, & Tathan, 2006). Because the goal of this study was to examine factors affecting organizations' supply chain performance, participants indicating that more than 10% of the survey measures were not applicable to their organization were also excluded from further analysis; all of the subsequent analyses pertain to the remaining 155 participants.

Demographic data, shown in Table 1, reveals that 84.52% (131) of the participants had over ten years of professional experience. The primary industries represented were manufacturing (18.71%), insurance (16.77%), financial services (14.19%), and wholesale/retail (8.39%). Industry effects had no significant impact on the analysis. One hundred nine (70.3%) of the participants were male, 45 (29.0%) were female and 1 respondent chose not to respond to this question on the survey.

[Insert Table 1 about here]

Survey Instrument

The online survey hosted by GAIN was designed to collect measures of the latent variables as well as participant demographic data. As shown in Figure 1, the theoretical model employed in this study depicts the hypothesized relationships between organizations' strategic ERM processes, IT integration, strategic flexibility, and supply chain performance. Each item was measured using a five point Likert scale where 1 represented strongly agree and 5 represented strongly disagree; 6 was used to allow participants to participants to respond "N/A Don't Know".

Organizations adopt ERM to facilitate the holistic identification and assessments of risks and opportunities that can impact organizational value (Lam, 2003; Collier, 2009). The item measures for *organizational level strategic ERM* were developed to capture overall indicators of ERM development including regular enterprise-wide risk assessment, evaluation of control effectiveness, and risk sensing and response capabilities. In developing the item measures for the construct, discussions were conducted with six different organizations on their ERM implementations, success level with ERM, and impact on SOX compliance difficulty. These discussions made it clear that effectiveness was derived from the integration of ERM capabilities and the flow of information to the top management team, where identified risks and opportunities are addressed. As a result, item measures were designed to focus more on integrated objectives rather than component parts with a desire for reflective measures rather than a component based formative measure. The current operationalization captures characteristics that are reflective of an effective integrated ERM environment.

The measures of the IT integration construct combine two sub-components of Byrd and Turner's (2000) IT flexibility infrastructure and reflect the firm's ability to engage in intra-organizational information sharing. These measures are formative based on the method used by

Byrd and Turner (2000) to identify unique dimensions of IT flexibility and sharing.

Strategic flexibility represents an ability to respond appropriately and timely to rapid changes in the competitive envioronment and is dependent on managerial capabilities and organizational responsiveness (Volberda, 1996). To operationalize strategic flexibility within the current study, measures of strategic flexibility consistent with those previously validated by Cannon and St. John (2004) were used. These measures are reflective of demonstrated flexibility.

A supply chain represents "the integration of key business processes from end-user through original suppliers that provides product, service, and information that add value for customers and other stakeholders" (Lambert, Cooper, & Pagh, 1998, p.1). The measures of supply chain performance used in the current study are performance output measures adapted from Beamon (1999). These measures reflect an organization's ability to meet or exceed its customer service goals and objectives. Item measures for all of the model constructs are presented in Table 2 (reflective constructs) and Table 3 (formative construct).

[Insert Tables 2 and 3 about here]

Data Analysis

Because this study employed constructs that were both exogenous and endogenous (IT integration and strategic flexibility) and one of the latent variables (IT integration) was formative rather than reflective, partial least squares analysis (SmartPLS 2.0, 2005) was used to assess the reliability of the measurement model and test the structural model.

Initial data analysis revealed four of the items were deemed not applicable by more than 10% of the participants. A review of industry demographics was consistent with non-applicability of these items; therefore, these items were dropped from further analyses. The "N/A Don't Know" responses for each of the remaining measures appear to be completely at random

(chi-square = 708.295, df= 669, p-value =0.142) and EM (SPSS 15.0, 2006) was used for imputation of these data (Hair et al., 2006).

Measurement Model Reliability and Validity

In this study, factor loadings, composite construct reliability, and average variance extracted are employed to assess validity of the reflective constructs. As shown in Table 2, each of the item measures has a standardized factor loading greater than 0.70. The related composite construct reliability of each of the reflective constructs is greater than the recommended 0.70, and the related average variance extracted is greater than or equal to 0.50 supporting the convergent validity of the reflective constructs employed in this study (Fornell & Larcker, 1981).

IT integration, a formative construct, combines measures of IT connectivity and IT compatibility adapted from Byrd and Turner (2000), thus these measures represent different facets of IT integration; the weights for the formative measures of IT integration are presented in Table 3. Because a formative construct is specified as a multiple regression equation (Diamantopoulos, Riefler, & Roth, 2008), multicollinearity must be ruled out. Variance inflation factors were calculated for each of the ten indicators of IT integration, first using a measure of strategic flexibility and then using a measure of supply chain performance. As shown in Table 4, the maximum variance inflation factor was 2.7, which is below the threshold of 3.3; therefore, all ten items were retained in the model (Petter, Straub, & Rai, 2007).

[Insert Table 4 about here]

Construct discriminant validity provides evidence that the latent variables in the measurement model are unique and distinct (Hair et al., 2006). As shown in Table 5, the average variance extracted for each latent variable is greater than the related squared inter-construct correlations indicating discriminant validity (Hair et al., 2006). In addition, the maximum inter-

construct correlation of 0.68, shown in Table 6, is below the standard threshold of 0.85, which also supports construct discriminant validity (Kline, 2005).

[Insert Tables 5 and 6 about here]

The possibility of common method bias always exists when data are self-reported (Podsakoff and Organ 1986; Podsakoff et al. 2003). A PLS (partial least squares) model was created to assess this issue in the current study; specifically, a common method construct was added to the research model and linked to each of the indicators of the research model constructs (Liang et al, 2007). As shown in Table 7 the average variance explained by the research model constructs is 72.0% while the average method-based variance is 1.5%, which suggests that common method bias is not a serious concern in the current study (Williams et al. 2003; Liang et al. 2007) and further supports the robustness of the research model.

[Insert Table 7 about here]

Finally, industry and firm size may impact supply chain performance. Therefore, the number of employees was used as a surrogate for firm size and the major industry groupings (manufacturing, communications utilities and technology, financial services, wholesale/retail, and service) present in this dataset were coded to create dichotomous variables and tested for significance. As mentioned previously, industry grouping was not significant for these data. Although size was not significant for supply chain performance, size did have a significant impact on ERM and strategic flexibility ($p < 0.05$), however all of the hypotheses are still supported. Thus, the study results are robust with regard to these control variables.

RESULTS

The theoretical model proposed employs both reflective and formative constructs necessitating the use of PLS; thus, parametric testing is not appropriate. Bootstrapping (500 samples with replacement) was used to calculate t-statistics and standard errors (Diamantopoulos & Winklhofer, 2001). PLS path analysis results (i.e. standardized beta coefficients, t-values and

construct R^2) are presented in Figure 2.

[Insert Figure 2 about here]

H_1 posits that increases in ERM have a positive impact on IT integration. Analysis indicates that the standardized path coefficient of H_1 (+0.682, t-value = 15.055) is significant (p-value < 0.01) and in the hypothesized direction, supporting H_1.

H_2 states that increases IT integration positively impact strategic flexibility. The standardized path coefficient of H_2 (+0. 656, t-value = 7.386) is also significant (p-value < 0.01) and in the hypothesized direction, providing support for H_2.

H_3 states that IT integration mediates the impact of ERM on strategic flexibility. Three conditions must be met to support a mediation effect (Baron & Kenny, 1986). First, a significant relationship between ERM and IT integration must exist; as noted previously, H_1 supports this condition. The next condition requires a significant relationship between IT integration and strategic flexibility; H_2 supports this condition. The third condition requires that when a relationship between ERM and IT integration is included in the model, a relationship between ERM and strategic flexibility that was previously significant become less significant. This condition is also satisfied as shown in Figure 3. For IT integration to mediate the impact of ERM on strategic flexibility, H_1 and H_2 should have significant path coefficients while the coefficient for H_3 decreases. Figure 3 suggests that IT integration fully mediates the effect of ERM on strategic flexibility (i.e. the H_3 path coefficient is not significant, t-value = 0.294). Results of the Sobel test (z-value = 7.314, p-value < 0.001) confirm the full mediation effect.

[Insert Figure 3 about here]

H_4 posits that increases in strategic flexibility have a positive impact on supply chain performance. Analysis indicates that the standardized path coefficient of H_4 (+0.377, t-value =

4.189) is significant (p-value < 0.01) and in the hypothesized direction, supporting H_4.

H_5 states that strategic flexibility mediates the impact of IT integration on supply chain performance. As noted previously, three conditions are necessary to support a mediation effect (Baron & Kenny, 1986). The first condition requires a significant relationship between IT integration and strategic flexibility; as shown in Figure 4, H_2 supports this condition. The second condition requires a significant relationship between strategic flexibility and supply chain performance; H_4 supports this condition. The third condition requires that a significant relationship between IT integration and supply chain performance become less significant when a relationship between IT integration and strategic flexibility is included in the model. As shown in Figure 4, the t-value decreases from 11.545 to 3.576; but, the relationship between IT integration and supply chain performance is still significant, suggesting that strategic flexibility partially mediates the impact of IT integration on supply chain performance. Results of the Sobel test (z-value = 3.937, p-value < 0.01) confirm the partial mediation effect.

[Insert Figure 4 about here]

H_6 posits that IT integration mediates the impact of ERM on supply chain performance. Once again, the conditions necessary to support a mediation effect are evaluated (Baron & Kenny, 1986). The first condition, which is that there must be a significant relationship between ERM and IT integration, is satisfied by H_1. The second condition, which requires a significant relationship between IT integration and supply chain performance, is satisfied by H_5. The third condition requires that including a relationship between ERM and IT integration causes the previously significant relationship between ERM and supply chain performance to become less significant. Figure 5 indicates that IT integration fully mediates the effect of ERM on supply chain performance; the H_6 path t-value is reduced from 7.810 to 1.568. Results of Sobel test (z-

value = 5.639, p-value < 0.01) confirm the full mediation effect**.**

[Insert Figure 5 here]

Overall, the model has strong explanatory power. As demonstrated in Figure 2, ERM, IT integration, and organization strategic flexibility jointly explain 43.5% of the variation in supply chain performance. Further, ERM and IT integration jointly explain 41.9% of the variation in strategic flexibility (i.e. strategic flexibility's R^2 of 0.419); while ERM singularly explains 46.5% of the variation in IT integration. The strong explanatory power of ERM upon and through the other firm competencies provides strong support for the theoretical model.

SUMMARY AND DISCUSSION

The study results reveal the complex interrelationships that tie strategic ERM and strategic flexibility together to provide a better understanding of their role in supporting supply chain performance. The results show strong effects supporting underlying theory with a specific view towards strategic ERM as a positive factor in promoting both strategic flexibility and supply chain performance. Moreover, IT integration was fundamental to all of the relationships in the model. This indicates strong IT integration and sharing of data through enterprise-wide systems is critical to maximizing the value of ERM activities on both flexibility and performance.

Limitations and Related Opportunities for Future Research

Before reviewing the implications of the research findings, the limitations of the research that should be considered when weighing the results and considering future related research are briefly outlined in this subsection. First, the use of a single informant to evaluate the various dimensions of organizational structure and performance could be subject to common method bias. However, surveying C-level executives (i.e. the Chief Audit Executive) with primary responsibility for assessing, and in some cases implementing, risk management procedures as

well as assessing the efficiency and effectiveness of operations provides access to the individual in the best position to evaluate the various dimensions of the conceptual model. Additionally our analysis suggests that common method bias is not a serious concern in the current study. Next, although we controlled for industry and firm size, there are other potential control variables, such as market concentration and process level characteristics that are not included in the current study. Future studies that examine the influence of these variables will further enhance this line of research.

Second, our measurement variables included constructs that were developed specifically for this research and had not been previously validated. Additionally, our item measures for the ERM construct adhere strictly to contemporary thinking on the need for an enterprise risk focus and the relative newness of this concept may lead to the need for this particular construct to evolve over time as ERM theory develops and matures. However, each of the constructs that were developed, including ERM, evolved from existing theory on the underlying components and characteristics of the constructs. Nonetheless, future use of these constructs in other research studies will help over time to assess the robustness of the constructs both temporally and across a variety of respondent types.

Contributions and Implications for Theory

Strategic ERM was introduced as a technique adopted by many organizations for facilitating improved organizational coordination. In the face of a complex global environment and relatively new compliance requirements instigated by the passage of SOX and its requirements for compliance reporting on financial control systems, many organizations have focused on implementing strategic ERM as the foundation for ensuring appropriate risk management (Power, 2007).

The results provide strong support for the underlying theory. Stronger ERM processes provide enhanced leveraging of enterprise-wide data sharing capability, higher levels of strategic flexibility, and higher levels of supply change performance. IT integration's mediation effects demonstrate the significance of a strong IT platform to future strategic purposes. The results related to strategic flexibility highlight a major component of organizational agility and demonstrate the enhancing effects of both strategic ERM and IT integration on organizational flexibility. This result is consistent with findings in managerial control research that suggests higher levels of information availability are needed to maintain flexibility in strategic-oriented organizations (Bouwens & Abernethy, 2000; Abernethy & Lillis, 1995).

The study also focuses on one type of competitive action which is improved supply chain performance—a significant competitive issue for most organizations in today's interlinked business world (Sutton et al., 2008). The results related to supply chain performance demonstrate both the interactive effect of strategic ERM and IT integration on supply chain performance and the mediating effect of strategic flexibility on the relationship between IT integration and supply chain performance. The complexity of these interrelationships highlights the richness of the theory and strongly supports the theorizations of these relationships. Relatedly, both the theory and our integrated model operationalizing the theory highlight the complexity of organizations and the need for more complex research models in order to understand these intra-organizational relationships.

Implications for Practice

The results of this research have several implications for management decision making and strategic management focus. The results indicate that companies effectively implementing strategic ERM processes experience higher levels of flexibility and higher levels of competitive

performance. This effect of strategic ERM on flexibility and performance is primarily accomplished through enhanced IT integration, including both improved IT compatibility and increased IT connectivity. This is consistent with the findings of Arnold et al. (2007), but our research isolates the effects that are driving the observed phenomena and provides a theoretical basis for understanding the inherent relationships.

This research also directly addresses concerns that have been widely voiced in the business press as to the deleterious effect of SOX control compliance on organizations' flexibility and supply chain performance (Banham, 2003; Katz, 2003; Reason, 2006; Schumer, Bloomberg, & McKinsey, 2007). Arnold et al. (2007) indicate that organizations that struggled through the compliance process may have had poor ERM processes in place when the compliance process started. Those organizations tended to react by implementing manual control processes. The results of this study suggest that low levels of ERM which are indicative of a focus solely on compliance are associated with lower organizational flexibility and poorer performance. On the other hand, our results indicate that organizations focused on better risk management processes and integration of IT to support risk management processes have enhanced strategic flexibility and improved supply chain performance. The application of the theory provides a basis for understanding these contradictory effects from strategic ERM perspective. Our results add clarity to how strategic ERM can improve internal organizational management by highlighting the interactive effects of strong ERM processes and strong IT integration on the facilitation of strategic flexibility and ultimately on enhanced supply chain performance.

Our results also add to the body of literature suggesting that IT value often comes from the future leveraging of those systems to facilitate operational and strategic activities. The results

suggest that effective ERM processes represent one more type of strategic management activity that is enabled by strong IT integration; and, this synergy is necessary to gain value from required compliance efforts, such as SOX, and a strategic management focus on risks. Our results reinforce the importance of strong ERM processes to first identifying and monitoring both internal and external risks and opportunities, and second in facilitating an organization's ability to take strategically appropriate competitive action.

REFERENCES

Abernethy, M. A. & Lillis, A. M. (1995). The impact of manufacturing flexibility on management control systems design. *Accounting Organizations and Society, 20*(4), 241-258.

Agarwal, R. & Selen, W. (2009). Dynamic capability building in service value networks for achieving service innovation. *Decision Sciences, 40*(3), 431-475.

Armstrong, C.P., & Sambamurthy, V. (1999). Information technology assimilation in firms: The influence of senior leadership and IT infrastructures, *Information Systems Research* (10:4), 304-327.

Arnold, V., Benford, T. S., Canada, J., Kuhn Jr., J. R., & Sutton, S. G. (2007). The unintended consequences of Sarbanes-Oxley on technology innovation and supply chain integration. *Journal of Emerging Technologies in Accounting, 4*, 103-121.

Arnold, V, Benford, T. S., Hampton, C., & Sutton, S. G. (2010). Competing pressures of risk and absorptive capacity potential on commitment and information sharing in global supply chains. *European Journal of Information Systems, 19*, 134-152.

Banham, R. (2003). Fear factor: Sarbanes-Oxley offers one more reason to tackle enterprise risk management. *CFO Magazine,* June 1.

Banker, R. D., Bardhan, I., Chang, H., & Lin S. (2006). Plant information systems, manufacturing capabilities, and plant performance. *MIS Quarterly, 30*(2), 315-337.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182.

Batra, S. (2006). Impact of information technology on organizational effectiveness: a conceptual framework incorporating organizational flexibility. *Global Journal of Flexible Systems Management, 7*(1/2), 15-25.

Beamon, B. (1999). Measuring supply chain performance. *International Journal of Operations and Production Management, 19*(3), 275-292.

Beasley, M. S., Clune, R., & Hermanson, D. R. (2005). Enterprise risk management: empirical analysis of factors associated with extent of implementation. *Journal of Accounting & Public Policy, 24,* 521-531.

Beasley, M. S., & Frigo, M. L. (2007). Strategic risk management: creating and protecting value. *Strategic Finance,* May, 25-53.

Benaroch, M. (2002). Managing information technology investment risk: a real options perspective. *Journal of Management Information Systems, 19(2),* 43-84.

Bendoly, E., Citurs, A., & Konsynski, B. (2007). Internal infrastructure impacts on RFID perceptions and commitment: knowledge, operational procedures, and information-processing standards. *Decision Sciences, 38*(3), 423-449.

Bharadwaj, S., Bharadwaj, A., & Bendoly, E. (2007). The performance effects of complementarities between information systems, marketing, manufacturing, and supply chain processes. *Information Systems Research, 18*(4), 437-453.

Boh, W. F., & Yellin, D. (2006-7). Using enterprise architecture standards in managing information technology. *Journal of Management Information Systems, 23*(3), 163-207.

Bouwens, J., & Abernethy, M. A. (2000). The consequences of customization on management accounting system design. *Accounting Organizations and Society, 25*, 221-241.

Broadbent, M., Weill, P., & Clair, D. (1999). The implications of information technology infrastructure for business process redesign, *MIS Quarterly* (23:2), 159-182.

Byrd, T. A., & Davidson, N. W. (2003). Examining possible antecedents of IT impact on the supply chain and its effect on firm performance. *Information & Management, 41*, 243-255.

Byrd, T. A., & Turner, D. E. (2000). Measuring the flexibility of information technology infrastructure, exploratory analysis of a construct. *Journal of Management Information Systems, 17*(1), 167-208.

Byrd, T. A., & Turner, D. E. (2001). An exploratory examination of the relationship between flexible IT infrastructure and competitive advantage. *Information and Management, 39*(1), 41-52.

Cannon, A. R., & St. John, C. H. (2004) Competitive strategy and plant level flexibility. *International Journal of Production Research, 42*(10), 1987-2007.

Chapman, C. S., & Kihn, L-A. (2009). Information systems integration, enabling control and performance. *Accounting Organizations and Society 34*: 151–169.

Chatterjee, D., Grewal, R., & Sambamurthy, V. (2002). Shaping up for e-commerce: Institutional enablers of the organizational assimilation of Web technologies, *MIS Quarterly* (26:2), 65-89.

Chenhall, R. H. (2003). Management control systems design within its organizational context: findings from contingency-based research and future directions. *Accounting Organizations and Society, 28*, 127-168.

Collier, P. M. (2009). *Fundamentals of Risk Management for Accountants and Managers*. Amsterdam: Elsevier.

Committee of Sponsoring Organizations of the Treadway Commission (COSO). (1992). *Internal Control — Integrated Framework*. New York: AICPA.

Committee of Sponsoring Organizations of the Treadway Commission (COSO). (2004). *Enterprise Risk Management – Integrated Framework.* New York: AICPA.

Committee of Sponsoring Organizations of the Treadway Commission (COSO). (2009). Strengthening *Enterprise Risk Management for Strategic Advantage.* New York: AICPA.

Cotteleer, M. J., & Bendoly, E. (2006). Order lead-time improvement following enterprise information technology implementation: an empirical study. *MIS Quarterly, 30*(3), 643-660.

Craighead, C. W., Blackhurst, J., Rungtusanatham, M. J., & Handfield, R. B. (2007). The severity of supply chain disruptions: design characteristics and mitigation capabilities. *Decision Sciences, 38(*1), 131-156.

Davila, T. (2000). An empirical study on the drivers of management control systems' design in new product development. *Accounting Organizations and Society, 25,* 383-409.

Diamantopoulos, A., Riefler, R., & Roth, K. P. (2008). Advancing formative measurement models. *Journal of Business Research 61*(12), 1203-1218.

Diamantopoulos, A., & Winklhofer, H. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of Marketing Research, 38*(2), 269-277.

Ditillo, A. (2004). Dealing with uncertainty in knowledge-intensive firms: the role of management control systems as knowledge integration mechanisms. *Accounting Organizations and Society, 29*, 401-421.

Duncan, N.B. (1995). Capturing flexibility of information technology infrastructure: A study of resource characteristics and their measure. *Journal of Management Information Systems* (12:2), 37-57.

EACLN & NAACLN. (2008). Enterprise Risk: Recurring Challenges and New Considerations for the Audit Committee. *ViewPoints for the Audit Committee Leadership Summit, 8,* October 31.

El Sawy, O. A., & Pavlou, P. A. (2008). IT-enabled business capabilities for turbulent environments. *MISQ Executive, 7*(3), 57-68.

Elbashir, M. Z., Collier, P. A., & Sutton, S.G. (2011). The role of organizational absorptive capacity in strategic use of business intelligence to support integrated management control systems. *The Accounting Review, 86(1),* 155-184.

Ernst & Young. (2008a). *Internal Controls: From Compliance to Competitive Edge.* New York: EYGM Limited.

Ernst & Young. (2008b). *The Future of Risk Management and Internal Control.* New York: EYGM Limited.

Fichman, R.G. (2004). Real options and IT platform adoption: Implications for theory and practice. *Information Systems Research* (15:2), 132-154.

Fichman, R.G., Keil, M., & Tiwana, A. (2005). Beyond valuation: "Real Options thinking" in IT project management. *California Management Review* (47:2), 74-96.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50.

Frie, F. X., Kalakota, R., Leone, A. J., & Marx, L. M. (1999). Process variation as a determinant of bank performance *Management Science, 45*(9), 1210-1220.

Gattiker, T., & Goodhue, D. (2005). What happens after ERP implementation: understanding the impact of interdependence and differentiation on plant-level outcomes. *MIS Quarterly, 29*(3), 559-585.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tathan, R. L. (2006). *Multivariate Data Analysis*. Upper Saddle River, NJ: Pearson Education Inc.

Hult, G., Craighead, C. W., & Ketchen, Jr., D. J. (2010). Risks uncertainty and supply chain decisions: a real options perspective. *Decision Sciences, 41*(3), 435-458.

Institute of Internal Auditors. (2004). *Position Statement: The Role of Internal Audit in Enterprise-wide Risk Management.* Altamonte Springs, FL: Institute of Internal Auditors.

Jeffers, P. I., Muhanna, W. A., & Nault, B. R. (2008). Information technology and process performance: an empirical investigation of the interaction between IT and non-IT resources. *Decision Sciences, 39*(4), 703-735.

Kambil, A., Henderson, C.J., & Mohsenzadeh, H. (1993). The strategic management of information technology investments: An options perspective, in: *Strategic Information Technology Management: Perspectives on Organizational Growth and Competitive Advantage,* R. Banker, R. Kauffman and M. Mahmood (eds.), Idea Group Publishers, Pennsylvania.

Katz, D. M. (2003). What you don't know about Sarbanes-Oxley: snares, pitfalls, and trapdoors. *CFO.com,* April 22.

Katz, D. M. (2006). Panels on 404 skirt small-company woes. *CFO.com,* May 2.

Kline, R. B. (2005). *Principles and Practice of Structural Equation Modeling, Second Edition*. New York: The Guilford Press.

Lam, J. (2003). *Enterprise Risk Management.* Hoboken, NJ: John Wiley & Sons, Inc.

Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: implementation issues and research opportunities. *International Journal of Logistics Management, 9*(2), 1-19.

Levine, R. (2004). Risk management systems: understanding the need. *EDPACS, 32*(2), 1-13.

Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. *MIS Quarterly 31*(4), 59-88.

Liebenberg, A. P., & Hoyt, R. E. (2003). Determinants of enterprise risk management: evidence from the appointment of chief risk officers. *Risk Management and Insurance Review, 6*(1), 37-52.

McAfee, A. (2002). The impact of enterprise information technology adoption on operational performance: an empirical investigation. *Production and Operations Management, 11*(1), 1-21.

Mikes, A. (2009). Risk management and calculative cultures. *Management Accounting Research 20,* 18-40.

Naranjo-Gil, D., & Hartmann, F. (2006). How top management teams use management accounting systems to implement strategy. *Journal of Management Accounting Research, 18,* 21-53.

O'Donnell, E. (2005). Enterprise risk management: a systems-thinking framework for the event identification phase. *International Journal of Accounting Information Systems 6,* 177-195.

O'Leary, D. E. (2000). *Enterprise Resource Planning Systems: Systems, Life Cycle, Electronic Commerce, and Risk*. New York: Cambridge University Press.

Olsson, R. (2007). In search of opportunity management: Is the risk management process enough? *International Journal of Project Management, 25,* 745-752.

Paladino, A. (2008). Analyzing the effects of market and resource orientations on innovative outcomes in times of turbulence. *Journal of Product Innovation Management, 25*(6), 577-592.

Palanisamy, R. (2005). Strategic information systems planning model for building flexibility and success. *Industrial Management and Data Systems, 105*(1), 63-81.

Paulraj, A., & Chen, I. J. (2007). Strategic buyer-supplier relationships, information technology and external logistics integration. *The Journal of Supply Chain Management,* (Spring), 2-14.

Pavlou, P. A., & El-Sawy, O. A. (2006). From IT leveraging competence to competitive advantage in turbulent environments: the case of new product development. *Information Systems Research, 17*(3), 198-227.

Petter, S., Straub, D., & Rai, A. (2007). Specifying formative constructs in information systems research. *MIS Quarterly, 31*(4), 623-656.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method bias in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879-903.

Podsakoff, P., and Organ, D. (1986). Self-Reports in Organizational Research: Problems and Prospects. *Journal of Management* 12 (4), 531-544.

Power, M. (2007). *Organized Uncertainty*. New York: Oxford University Press, Inc.

Power, M. (2009). The risk management of nothing. *Accounting Organizations & Society 34,* 849-855.

Rai, A., Patnayakuni, R., & Seth, N. (2006). Firm performance impacts of digitally enabled supply chain integration capabilities. *MIS Quarterly, 30*(2), 225-246.

Reason, T. (2006). Cry of pain from small companies. *CFO.com*, May 10.

Robey, D., & Boudreau, M. C. (1999). Accounting for the contradictory organizational consequences of information technology: theoretical directions and methodological implications. *Information Systems Research, 10*(2), 167-185.

Sambamurthy, V., & Zmud, R. W. (2000). Research commentary: the organizing logic for an enterprise's IT activities in the digital era—A prognosis for practice and a call for research. *Information Systems Research, 11*(2), 105-114.

Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms. *MIS Quarterly, 27*(2), 237-263.

Schumer, C. E., Bloomberg, M. R., & McKinsey Consulting. (2007). *Sustaining New York's and the U.S. Global Financial Services Leadership.* U.S. Senate www.senate.gov/~schumer, January 22.

Simon, H. A. (1990). Information technologies and organizations. *The Accounting Review, 65*(3), 658-667.

Sutton, S. G., Khazanchi, D., Hampton, C., & Arnold, V. (2008). Risk analysis in extended enterprise environments: identification of critical risk factors in B2B e-commerce relationships. *Journal of the Association for Information Systems, 9*(3/4), 151-174.

Swafford, P. M., Ghosh, S., & Murthy, N. (2006). The antecedents of supply chain agility of a firm: scale development and model testing. *Journal of Operations Management, 24*, 170-188.

Treasury Board. (2001). *Integrated Risk Management Framework.* Canadian Government, Ottawa: Treasury Board.

Vijayasarathy, L. R. (2010). An investigation of moderators of the link between technology use in the supply chain and supply chain performance. *Information & Management, 47*, 364-371.

Villena, V. H., Gomez-Mejia, L. R., & Revilla, E. (2009). The decision of the supply chain executive to support or impede supply chain integration: a multidisciplinary behavioral agency perspective. *Decision Sciences, 40*(4), 635-665.

Volberda, H. W. 1996. Toward the flexible form: how to remain vital in hypercompetitive environments. *Organization Science, 7*(4), 359-374.

Ward, P. & Zhou, H. (2006). Impact of information technology integration and lean/just-in-time practices on lead-time performance. *Decision Sciences, 37*(2), 177-203.

Weill, P., Subramani, M., & Broadbent, M. (2002). Building IT infrastructure for strategic agility. *Sloan Management Review* (44:1), 57-65.

Williams, L. J., Edwards, J. R., & Vandenberg, (2003) R. J. "Recent Advances in Causal Modeling Methods for Organizational and Management Research," *Journal of Management* 29(6), 903-936.

Table 1: Participant demographics

Category	Frequency n = 155	Percentage
Gender		
Male	109	70.3%
Female	45	29.0%
Not answered	1	0.7%
Age		
25 to 40 years	32	20.65%
40+ years	119	76.77%
Not answered	4	2.58%
Experience		
3 to 10 years	24	15.48%
10+ years	131	84.52%
Industry		
Manufacturing	29	18.71%
Insurance	26	16.77%
Financial/real estate	22	14.19%
Wholesale/retail	13	8.39%
Technology	12	7.74%
Utilities	11	7.10%
Health	7	4.52%
Communication	4	2.58%
Aerospace and defense	4	2.58%
Transportation	4	2.58%
All other	23	14.84%
Organizational Structure		
Publicly traded	90	58.06%
Not publicly traded	63	40.65%
Not answered	2	1.29%

Table 2: Tests of Convergent Validity

Reflective Measures	Factor Loading	Construct Composite Reliability	Average Variance Extracted
Strategic Enterprise Risk Management (ERM)		0.9365	0.7480
1. Our organization performs a thorough enterprise-wide risk assessment at least once a year	0.7329		
2. The strength of our internal control system enhances our organization's ability to identity events that may affect the achievement of our objectives	0.8899		
3. Our organization regularly evaluates the effectiveness of internal controls to mitigate identified risks	0.8780		
4. Management has effective processes to respond to identified risks	0.9244		
5. Our risk management procedures provide the necessary information top management needs to monitor changes that could impact our organization's well-being.	0.8864		
Strategic Flexibility		0.8408	0.5692
1. Our organization has difficulty maximizing new market opportunities (RC)	0.7486		
2. Our organization is able to introduce new products/services	0.7339		
3. Our organization has difficulty accommodating major changes in basic product designs or service offerings (RC)	0.7557		
4. Our organization is able to manage the impact of serving new classes of customers	0.7789		
Supply Chain Performance		0.9456	0.7773
1. Our organization consistently meets or exceeds our corporate goals for the proportion of product/service orders immediately filled	0.8927		
2. Our organization consistently meets or exceeds our corporate goals for on-time delivery of products/services	0.9296		
3. Our organization consistently meets or exceeds our corporate goals for minimizing back-orders/stock-outs (D)			
4. Our organization consistently meets or exceeds our corporate goals for customer response time (the time between an order and its delivery)	0.9046		
5. Our organization consistently meets or exceeds our corporate goals for minimizing the total amount of time required to produce an item or provide a service	0.8931		

Reflective Measures	Factor Loading	Construct Composite Reliability	Average Variance Extracted
6. Our organization consistently meets or exceeds our corporate goals for minimizing shipping errors (D)			
7. Our organization consistently meets or exceeds our corporate goals for minimizing customer complaints	0.7806		

RC: reverse coded
D: dropped

Table 3: IT integration

IT Integration Formative Measures	Weights
1. Compared to rivals in our industry, our organization has the foremost in available IT systems	0.064908
2. User-friendly electronic links exist between our organization and its supply chain partners	0.267506
3. Our organization formally addresses the issue of data security	0.318061
4. All remote, branch, and mobile offices are electronically connected to the central office	0.038028
5. There are numerous identifiable communication bottlenecks within our organization	0.277407
6. New locations or acquisitions are quickly assimilated into our IT infrastructure (D)	
7. Remote, branch, and mobile offices have easy access to data from the home or central office	0.285407
8. Our organization offers a wide variety of types of information to end users (e.g. multimedia)	0.04279
9. Our user interfaces provide transparent access to all applications	-0.14486
10. Data received by our organization from electronic links with our supply-chain partners are reliable (D)	
11. Our organization's ability to make rapid IT change is high	0.16233
12. Information is shared seamlessly across our organization, regardless of the location	0.158774

D: Dropped

Table 4: Tests of multicollinearity

IT Integration Formative Measures	Variance Inflation Factor (Dependent variable = Strategic Flexibility)	Variance Inflation Factor (Dependent variable = Supply Chain Performance)
1. Compared to rivals in our industry, our organization has the foremost in available IT systems	1.807	1.807
2. User-friendly electronic links exist between our organization and its supply chain partners	1.925	1.925
3. Our organization formally addresses the issue of data security	1.624	1.624
4. All remote, branch, and mobile offices are electronically connected to the central office	1.961	1.961
5. There are numerous identifiable communication bottlenecks within our organization	1.392	1.392
6. New locations or acquisitions are quickly assimilated into our IT infrastructure (D)		
7. Remote, branch, and mobile offices have easy access to data from the home or central office	2.347	2.347
8. Our organization offers a wide variety of types of information to end users (e.g. multimedia)	2.114	2.114
9. Our user interfaces provide transparent access to all applications	2.164	2.164
10. Data received by our organization from electronic links with our supply-chain partners are reliable (D)		
11. Our organization's ability to make rapid IT change is high	2.570	2.570
12. Information is shared seamlessly across our organization, regardless of the location	2.723	2.723

D: Dropped

Table 5: Tests of discriminant validity

	Strategic ERM	**Strategic Flexibility**	**Supply Chain Performance**
Average Variance Extracted	0.748041	0.569175	0.777269

Squared inter-construct correlations

Strategic ERM	1.00		
Strategic Flexibility	0.189349	1.00	
Supply Chain Performance	0.236413	0.352501	1.00

Table 6: Inter-construct correlations

	Strategic ERM	**IT Integration**	**Strategic Flexibility**	**Supply Chain Performance**
Strategic ERM	1.000000			
IT Integration	0.682187	1.000000		
Strategic Flexibility	0.435142	0.647511	1.000000	
Supply Chain Performance	0.486223	0.580876	0.593718	1.000000

Table 7 Common Method Bias

Construct	Indicator	Research Model Factor Loading	Research Model Factor Loading Squared	Common Method Factor Loading	Common Method Factor Loading
Strategic Enterprise Risk Management	ERM1	0.97395***	0.94858	-0.27168**	0.07381
	ERM2	0.79421***	0.63077	0.11380	0.01295
	ERM3	0.86251***	0.74392	0.01665	0.00028
	ERM4	0.82373***	0.67853	0.11439	0.01309
	ERM5	0.90680***	0.82229	-0.02615	0.00068
Strategic Flexibility	SF1	0.90964***	0.82744	-0.17263	0.02980
	SF2	0.69935***	0.48909	0.05283	0.00279
	SF3	0.85449***	0.73015	-0.11710	0.01371
	SF4	0.56278***	0.31672	0.23495**	0.05520
Supply Chain Performance	SCP1	0.87356***	0.76311	0.01922	0.00037
	SCP2	0.90592***	0.82069	0.02427	0.00059
	SCP4	0.93894***	0.88161	-0.03763	0.00142
	SCP5	0.84124***	0.70768	0.05805	0.00337
	SCP7	0.85086***	0.72396	-0.07415	0.00550
Average		**0.84271**	**0.72033**	**-0.00466**	**0.01525**

**p<0.01; ***p<0.001

Figure 1: Research model on the role of ERM and IT integration

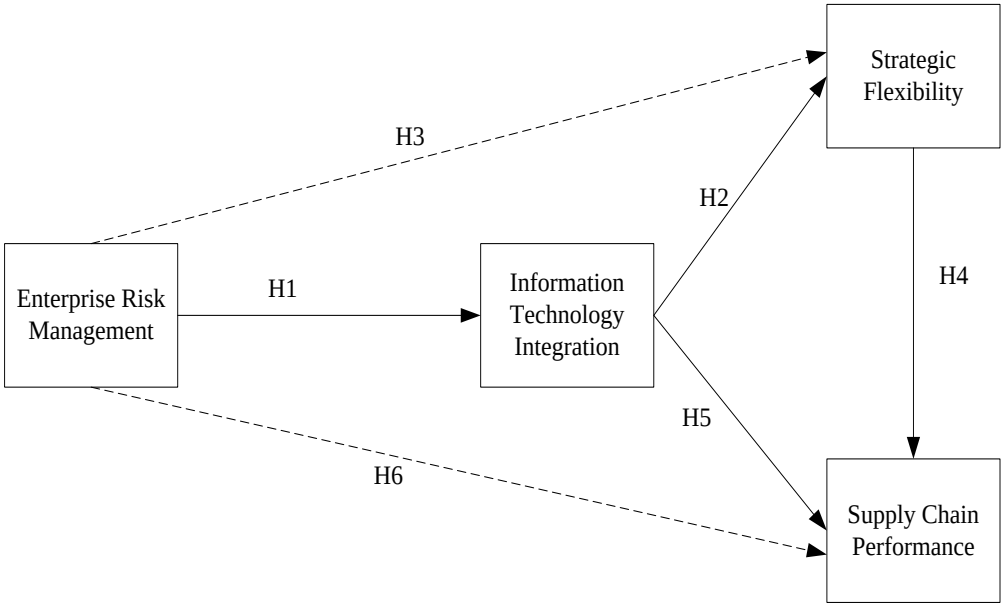


Figure 2: Structural model results

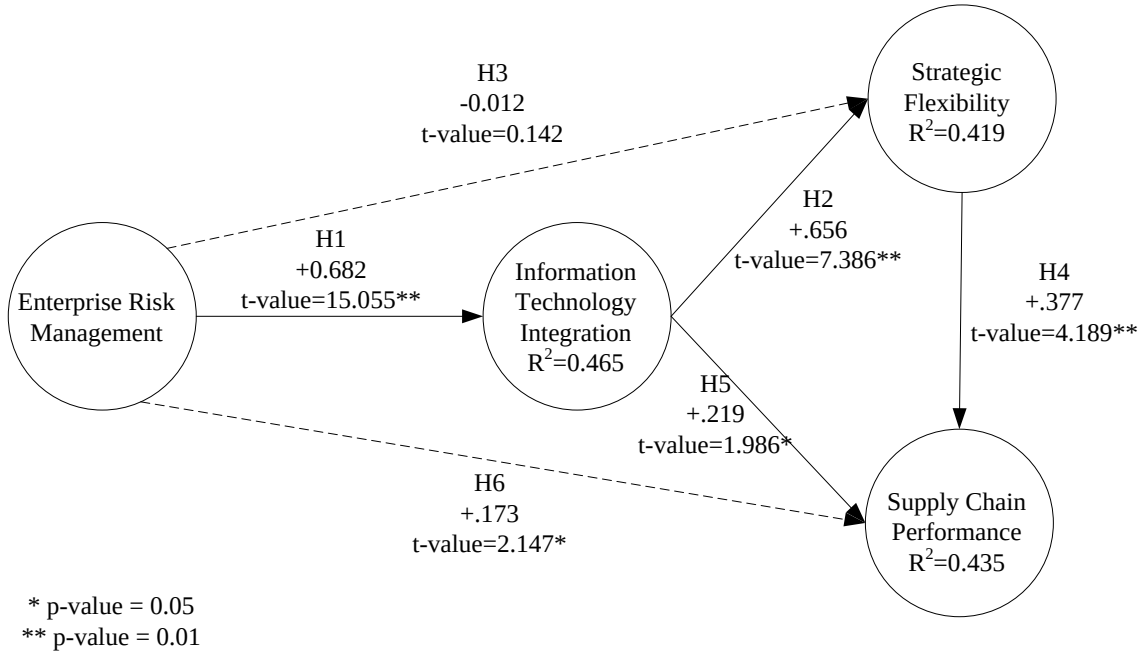
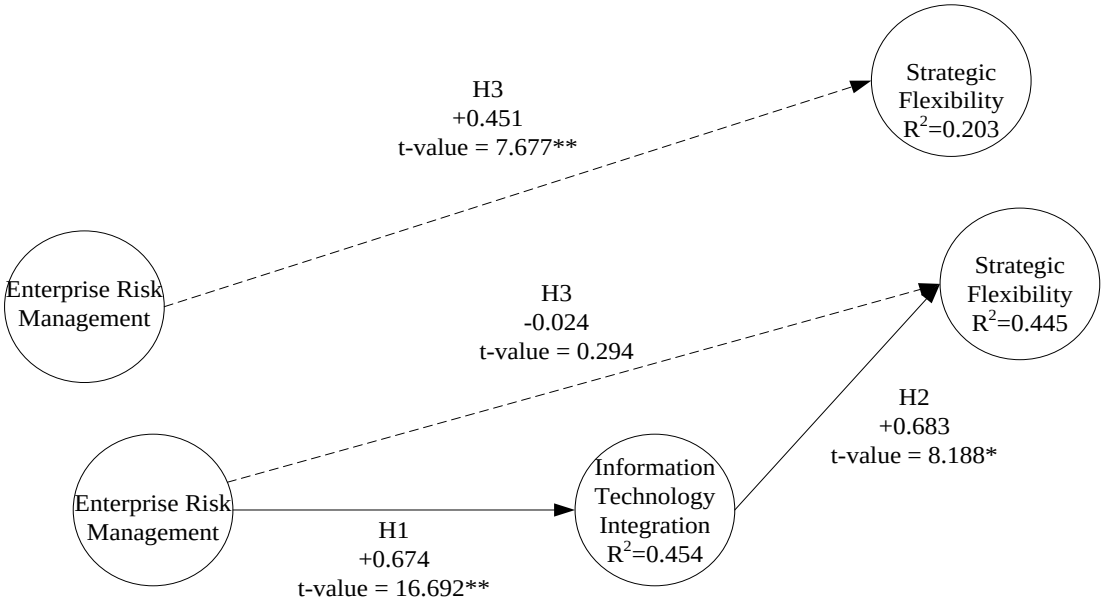


Figure 3: Test of mediating effects of IT integration on strategic flexibility



* p-value = 0.05
** p-value = 0.01

Figure 4: Test of mediating effects of strategic flexibility on supply chain performance

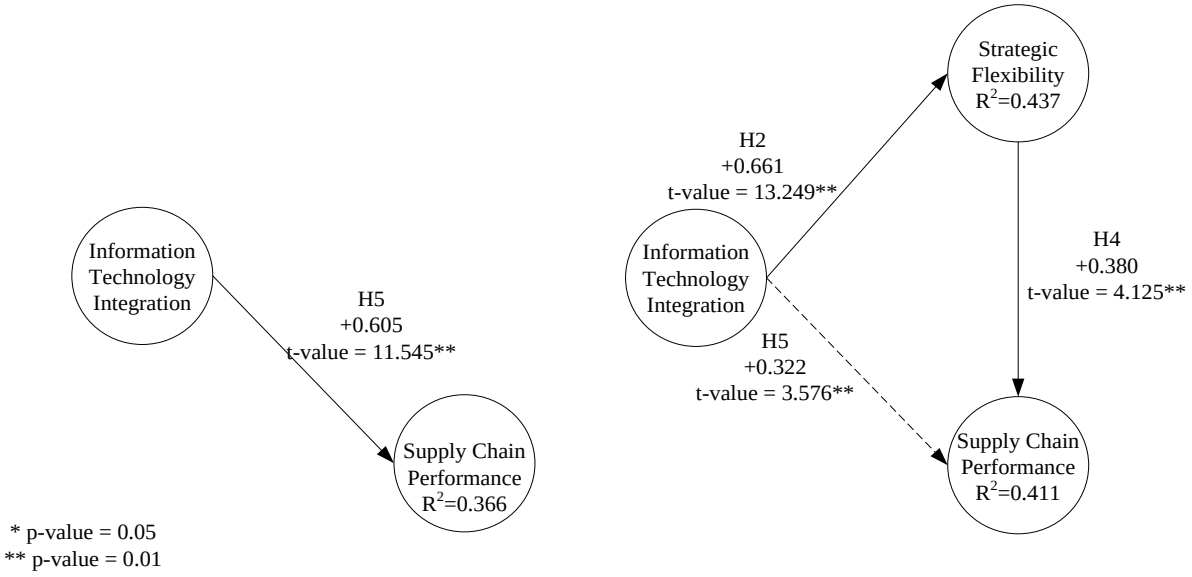


Figure 5: Test of mediating effects of IT integration on supply chain performance