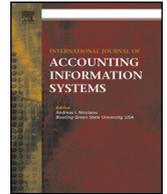




Contents lists available at ScienceDirect

International Journal of Accounting Information Systems

journal homepage: www.elsevier.com/locate/accinf

Leveraging integrated information systems to enhance strategic flexibility and performance: The enabling role of enterprise risk management☆☆☆

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ARTICLE INFO

Article history:

Received 29 September 2015

Accepted 11 October 2015

Available online xxxx

Keywords:

Strategic enterprise risk management
 Supply chain performance
 Business process control
 Information technology integration
 Organizational strategic flexibility

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 develop and test a theory of the impact of ERM on two aspects of organizational performance, strategic flexibility and supply chain performance. The study is designed to examine conflicting views on the effect of increased levels of governance on organizations' flexibility and supply chain performance, and determine whether ERM capability influences the observed differential effects. Building on theories related to the electronic integration perspective of firm agility and the role of knowledge integration on the activation of the link between strategic flexibility and performance, we develop a theory of ERM as an enabler of IT integration, flexibility, and performance. A cross-sectional field study of six companies illustrates the interrelationships and provides preliminary support for the theory. Subsequent testing using data from 155 Chief Audit Executives provides strong support for the theory. The results show that a broad-based, strategic approach to ERM enhances flexibility and strengthens the relationship between flexibility and performance. The results also provide evidence that enhanced IT integration is the mechanism through which ERM strengthens both flexibility and in turn performance.

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1. Introduction

Enterprise risk management (ERM) is rapidly becoming the dominant strategic management approach within organizations as they face a social phenomenon termed “the risk management of everything” (Power, 2007; Bhimani, 2009; Mikes, 2009; Mikes,

☆ Acknowledgements: This research was funded by the Institute of Internal Auditors Research Foundation. The authors wish to thank the IARF for their generous funding and support of our research. We thank David Brown, Mandy Cheng, Raj Echambadi, Omar El Sawy, Mohamed Elbashir, Sev Grabski, Clark Hampton, Bill Messier, Uday Murthy, Dan O'Leary, Habib Mahama, Robyn Raschke, Carol Saunders, Chad Simon, Miklos Vasarhelyi, and Bernhard Wieder for their advice and feedback during the development and evolution of this paper. We also thank participants in workshops at Rutgers University, University of Auckland, University of Central Florida, University of Nevada–Las Vegas, University of South Florida, University of Southern California, University of Technology Sydney, and the American Accounting Association Annual Meeting for their valuable feedback on earlier versions of this manuscript. We also thank Randy Kuhn for his research assistance.

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2011). Normatively, ERM encompasses both the identification of events and environmental changes that potentially impact an organization's goals, and the recognition of threats and opportunities facing the organization (Bhimani, 2009; Collier, 2009, 48–49). As ERM is adopted and strengthened, risk management processes move from a rudimentary focus on compliance and prevention (i.e. downside risk) toward a strategic approach that focuses 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 additional compliance mandates such as the Sarbanes–Oxley Act (SOX) in 2002 (Power, 2007; Mikes, 2009; Arnold et al., 2010). As Power (2009, 852) notes, expectations that organizations will embed risk management and internal control systems throughout their business processes “have become an unquestioned ERM imperative”. While top management teams have rapidly adopted the ERM movement (Power, 2007), theoretical understanding of how and when ERM facilitates value chain activities is limited (O'Donnell, 2005).

The purpose of this study is to develop and test a theory of the impact of ERM on two aspects of organizational performance, strategic flexibility and supply chain performance, in order to better understand the role of ERM in facilitating or hindering performance. The theory is developed through an amalgamation of three emergent theoretical perspectives related to risk management orientation (Power, 2007, 2009; Mikes, 2009, 2011), IT integration (Nazir and Pinsonneault, 2012), and flexibility for performance (Patel et al., 2012) that provide insights into the interrelationships. The primary theoretical lens is that of the culture of risk management whereby the relentless expansion of measurement-based risk management is often viewed as providing a false sense of control that can have deleterious effects (Power, 2007, 2009; Mikes, 2009); whereas a more integrative risk management view that focuses on internal and external environmental changes, can position the organization to be better prepared to react to threats and opportunities (Mikes, 2011). The former is considered a defensive postured ERM that is calculative in nature; while the latter is viewed as strategic ERM which uses a more visionary approach to risk management. Applying this risk management theory to the supply chain environment provides the explanatory capability to extend the understanding of the relationship between IT integration and strategic flexibility. Emergent theory posits that strong internal integration of information across organizational units leads to flexible organizations only when management structures are able to integrate information on external environmental changes (Nazir and Pinsonneault, 2012), a capability provided by strategic ERM. Strategic ERM should both guide enhancements to IT integration that improve the capture of enterprise-wide internal information and provide strong monitoring capability for identifying changes in the external environment. This combination improves the organization's sensing capability and through support of strategic flexibility facilitates development of responding capability. Similarly, contemporary theory on the relationship between flexibility and supply chain performance suggests the relationship is inconsistent and that organizational structures somehow effect the way organizations “absorb, explore and exploit knowledge”—a necessary condition for flexibility to lead to performance (Patel et al., 2012). Patel et al. (2012) note little is known about how firms “absorb, explore and exploit knowledge”; critical processes for organizations to establish responding capability. We theorize that ERM is a strategic management approach that facilitates knowledge absorption, exploration, and exploitation, and as a result is a determinant of the strength of the relationship between flexibility and performance.

We test our theoretical model using a two-step process. First, a cross-sectional field study of six companies was conducted to explore the consistencies of their operations with the theorized relationships. These case studies provide support for the basic tenets of the theory and support a broader-based testing of the theory. Second, survey responses from 155 Chief Audit Executives (CAE) were used to examine the theoretical relationships across a diverse set of firms operating in supply chain environments. Analysis of the survey data generally provides support for the theory. The results indicate that ERM has a positive relationship with the extent of IT integration and, through IT integration, has a positive relationship with strategic flexibility. However, ERM does not have the hypothesized moderating effect on the relationship between IT integration and flexibility. As theorized, ERM has a positive indirect effect on supply chain performance through the enhancement of IT integration and increased flexibility, but the strength of this relationship is also positively influenced by the level of ERM (i.e. ERM has a moderated mediation effect on the relationship between flexibility and performance).

This research contributes to the ERM literature in several ways. First, we explore the contexts in which companies have implemented ERM to understand and theoretically model the interrelationships and organizational structures that provide the link between ERM processes and organizational performance. Second, we focus on ERM as a strategic management initiative, recognizing the importance this strategic level focus has on enterprise-wide integration of ERM initiatives. Third, we directly address on-going concerns that risk management requirements under SOX 404 disadvantage companies and hinder their ability to maintain competitive supply chain activities. Specifically, our results indicate that higher levels of ERM activity are associated with *increased* strategic flexibility and, in turn, improved supply chain performance, and that strong ERM magnifies the strength of the relationship between flexibility and performance. Fourth, our results demonstrate the integral role of IT integration in facilitating 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 theory development leading to the hypotheses and the development of the research model. 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.

2. Theory 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 supporting the benefits and

need for ERM integration across the supply chain. Ernst and Young (2008) note that extending controls to areas such as the supply chain is key to maximizing ERM benefits. Collier (2009) highlights the importance of ERM for managing the enterprise by integrating strategic planning, operations management, performance management, and internal control. By identifying and proactively addressing both risks and opportunities, organizations create value for shareholders, enhance resource allocation, and assure well-managed supply chains.

The academic literature provides less convincing support for 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. In both cases, ERM falls short of providing the desired strategic direction. This is consistent with Beasley et al.'s (2005) findings that many organizations have only put in place rudimentary procedures. Further, the lack of systems level integration necessary to access information easily and to monitor risks across the organization also appears to hamper ERM (Frie et al., 1999). While these studies shed light on ERM practices within organizations, there remains an absence of theoretical understanding on how organizations effectively implement ERM processes and whether effective implementation leads to better performance across the supply chain.

In this study, we develop a theory to explain the role of ERM in strategically managing the integrated enterprise. We draw on theorizations from financial risk management to provide insights into how organizations implement and utilize risk management processes (Power, 2007, 2009; Mikes, 2009, 2011). We link these theoretical perspectives on risk management to two contemporary theories on the development of internal supply chain capability. First, theorizations from the electronic integration perspective are incorporated providing insights into the link between IT integration and strategic flexibility (Nazir and Pinsonneault, 2012). Second, theorizations on the role of operational absorptive capacity on the leveraging of flexibility to enhance performance are incorporated into the overall theory (Patel et al., 2012). In both cases, these sub-theories postulate a missing component that assists in incorporating external environmental information into decision processes (Nazir and Pinsonneault, 2012) and provides capability for knowledge absorption, exploration, and exploitation (Patel et al., 2012)—capabilities that strategic ERM provides. Thus, we theorize that ERM is the necessary catalyst to first enable IT integration to provide flexibility and then to enable flexibility to improve supply chain performance. The theorized interrelationships are reflected in Fig. 1.

2.1. ERM: the influence of the calculative culture

ERM, which is the focal point of our theory, is arguably both a critical element of an organization's ability to monitor internal and external activities for effective reaction to changes in the marketplace and the most prevalent strategy used by firms to meet SOX compliance requirements (Beasley et al., 2005). As such, ERM should be critical in supply chain environments where disruptions are a given and the ability to detect and react to disruptions determines the ramifications (Craighead et al., 2007; Tang and Musa, 2011; Lavastre et al., 2012). However, there is little theoretical understanding of how and when ERM leads to improved sensing and responding to environmental changes, and whether all organizations benefit from ERM implementation.

The Committee of Sponsoring Organizations of the Treadway Commission (COSO), which is the predominant framework used by organizations adopting ERM to address SOX internal control mandates defines ERM as follows:

“[ERM] is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risks to be within its risk appetite, to provide reasonable assurance regarding the achievement of the entity's objectives.” (COSO 2004).

In order to better understand the theoretical underpinnings of ERM that dictate when benefits in performance accrue, we initially draw on theory emerging in financial risk management. Mikes (2011) provides a foundation for understanding the differential effects of ERM implementation by focusing on what she terms the *calculative culture* of an organization. This calculative

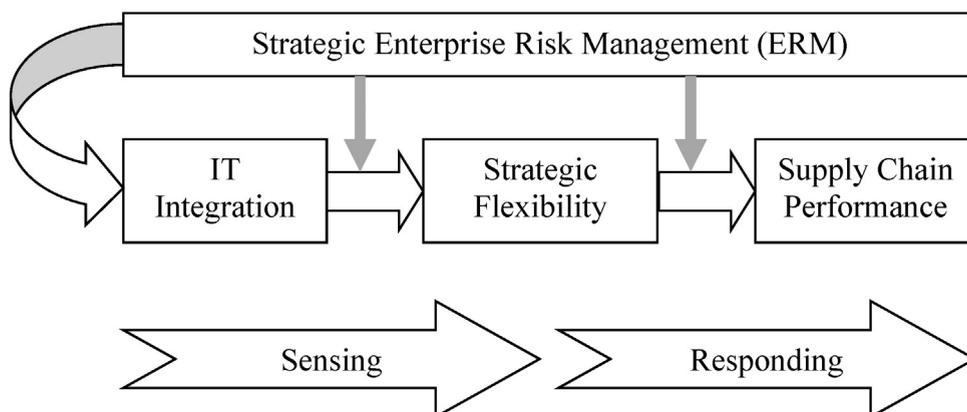


Fig. 1. A theoretical model of the influence of ERM on supply chain performance.

culture provides a contingent view to Power's (2004, 2007, 2009) theorizations that quantitative enthusiasm leads to a cycle of counting, controlling, and calculating in an effort to "organize uncertainty", that ultimately leads to the "risk management of nothing". While these theorizations have evolved from the observed failures in risk management by the financial industry, the underlying concepts appear equally applicable to supply chain environments where the focus on measurement can be restrictive absent a more strategic focus on how risks integrate across an organization. Power's (2004, 2007, 2009) and Mikes (2009, 2011) theorizations on risk management provide a means for differentiating the effect of strong ERM from poorly integrated and disparate practices that have been categorized under the same name (Arena et al., 2010). In other words, in some companies ERM is implemented as an integrated intra-organizational sharing of risk information with organization-wide response, while in other organizations ERM is simply an umbrella under which a number of silos within the organization exist where risk is measured and contained in isolation (Power, 2007; Arena et al., 2010; Mikes, 2011).

Power (2004) theorizes that organizations get caught in a cycle where they begin with *counting* risks—i.e. the development of individual risk measures. These risk measures provide a false sense of *controlling* risks until there is a crisis of failure where risks are not controlled and the organization is threatened. The response is generally to measure more risks which embed the organization in a cycle of *calculation* where the process of counting to control is repeated at each crisis. The focus on individual risks fails to provide any strategic vision to the organization and, as a result, organizations who try to risk manage everything end up risk managing nothing (Power, 2009). Thus, the *calculative culture* of creating a myriad of risk measures does not lead to effective risk management (Power, 2009; Mikes, 2009, 2011).

Mikes (2009, 2011) argues that the quantitative enthusiasm posited by Power (2004, 2007, 2009) is not the only *calculative culture* adopted by organizations. Rather, many organizations reject this quantitative enthusiasm and are instead quantitative skeptics. These quantitative skeptics adopt a qualitative approach of risk envisionment that allows risk managers to engage in the strategic management of the organization and to be a major participant at the top levels of management. This risk envisionment approach to ERM dictates a holistic approach to risk management that draws information from across an organization to improve the sensing of risks and to provide a holistic response capability. Mikes (2009, 2011) theorizes that strategic ERM is possible and occurs within organizations, and that strategic ERM can have a positive impact on organizational performance.

Mikes (2009, 2011) extension to the ERM framework theorizes differential effects on organizational performance based on the *calculative culture* of the organization. Organizations focusing on the production of a multitude of individual risk measures that quantify risks within silos operating autonomously within an organization are prone to failure in managing risks and may actually place an organization at greater risk. The risk measures may even constrain the organization's ability to act strategically (Power, 2009). Organizations that focus on an integrative and holistic view of risk management are better able to sense and respond to risks that arise, be they threats or opportunities (Mikes, 2011).

To better understand the applicability of the risk management framework put forth by Mikes (2011) to supply chain performance, we used a cross-sectional field study to compare the relevance of the framework to company experiences. The Appendix overviews the process and companies involved in the field studies. We used a cross-sectional field study approach for the benefits derived from theory refinement when specific theoretical concepts are being explicated (Lillis and Mundy, 2005). As documented in the Appendix, we studied a mix of companies with varied ERM implementation experiences during their SOX compliance efforts to assure robustness of the theory.

The case companies' (Alpha, Beta, Gamma, and Delta) experiences appear supportive of Mikes (2011) theorizations. Alpha began with the development of a range of scorecards and key performance indicators that attempted to quantify the various risks. As a result, Alpha experienced hindrances in supply chain performance that increased time to completion by 5%. The acquisition of new business units integrated into the risk measurement process through additional silos of measures exacerbated their problems. Alpha eventually moved away from the largely manual-oriented specific risk measurement approaches (i.e., quantitative enthusiasm) to involving IT and building an integrative system that provided a more holistic approach to ERM. The result was substantial improvements in performance.

Gamma, who had a similar experience, hired a consultant to help the company deploy a broad set of risk measures to achieve control. A silo approach to risk management emerged and the company used manual add-on processes to achieve risk measurement. The company eventually abandoned their initial ERM strategy as their business processes felt increasingly constrained and inflexible; the new system applied integrative information systems for sharing information across the organization and resulted in process improvements and greater efficiencies in the supply chain. Two other companies, Beta and Delta, each applied a holistic approach from the beginning. In both cases, the organizations experienced less implementation difficulty and felt their business process performance and competitiveness increased.

The pattern that emerged from the case study appears consistent with Mikes (2011) theorizations on financial risk management processes. Those organizations focusing on quantification of risks inhibited their supply chain performance; while those applying a more holistic approach to risk management experienced increased flexibility and improved supply chain performance. This supports the view that strategic ERM will have a positive effect on organizations' performance.

2.2. ERM, IT integration, and strategic flexibility

The development of a strategic approach to ERM is based on an ability to maintain organization-wide information sharing that facilitates an organizational response to risks (Mikes, 2011). Arena et al. (2010) note the critical role technology plays in providing the capability to integrate data across the various business units and place the necessary data in the hands of top management for the purpose of effectively managing risk. ERM is often hampered by the lack of systems level integration necessary to access

information easily and to monitor risks across the organization (Frie et al., 1999). Without this integration of data and systems, the top management team would be unable to take a holistic view of the risks the organization faces (Arena et al., 2010).

Mikes (2011) theorizes that adoption of ERM with a risk envisionment strategy that will positively impact organizational performance necessitates a forward looking stance. With a risk envisionment strategy, the goal is to monitor changes in the environment that yield threats to or opportunities for the organization and to be prepared to respond appropriately. The key is that ERM in this form provides the capability to sense market and environmental changes.

Within the context of theory from the electronic integration perspective, strategic ERM provides the sensing capability (Nazir and Pinsonneault, 2012). ERM in isolation only enables what would be termed a *sensing* organization. Organizations with high external information integration, but limited internal integration of IT, are able to identify changes in the environment and the associated opportunities and threats. However, these organizations have difficulty responding absent the internally integrated information systems that provide decision makers with the environmental information to initiate appropriate responses (Nazir and Pinsonneault, 2012). Organizations in the *sensing* category have a low ability to respond in the presence of low internal integration.

Given the previous argument, strategic ERM necessitates the construction of an infrastructure that can support high intra-organizational information needs. Organizations expectedly will shape the supporting information systems to enable ERM strategies and facilitate their related supply chain activities. This is consistent with the evolving stream of research that maintains that one of the most critical roles of the IT function is support of on-going interactions among users to ensure management is prepared to respond to emerging business needs and opportunities (Sambamurthy and Zmud, 2000; Bharadwaj, Bharadwaj, & Bendoly, 2007). System designs and modifications 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).

Theory from the electronic integration perspective provides additional insights into the nature of information systems integration needed to support strategic management efforts consistent with ERM (Nazir and Pinsonneault, 2012). As noted by Nazir and Pinsonneault (2012) organizations implement a variety of information technologies in hopes of improving process efficiencies and providing managers comprehensive access to organizational information. However, the variance in the nature of the systems deployed impacts the availability of information to support strategic management decision making. Specifically, Power (2007, 2009) and Mikes (2009, 2011) argue that silos of risk evaluation within the organization hamper an organization's ability to respond. Implementing integrated IT is critical in breaking down the silos that hinder cross-functional information sharing (Fielder et al., 1994). ERM from the strategic approach of risk envisionment necessitates that information be integrated intra-organizationally and available for management to predict future opportunities and threats (Mikes, 2011). Thus, strategic ERM dictates a need to develop integrated internal information systems, the same systems perceived necessary from the electronic integration perspective for an organization to turn *sensing* into appropriate *response* (Nazir and Pinsonneault, 2012). This leads to the first hypothesis.

H1. ERM has a positive impact on IT integration.

Theory from the electronic integration perspective also addresses the limitations of highly integrated information systems. Organizations with high internal IT integration, but limited external monitoring are *responding* organizations. Such organizations are in a position to react and adjust to changes in the external environment, but lack the ability to quickly detect important market signals because of insufficient *sensing* (Nazir and Pinsonneault, 2012). Thus, theoretically an organization with strong IT integration will be unable to leverage those strong IT systems into enhanced strategic flexibility if they lack adequate *sensing* capability.

Nazir and Pinsonneault (2012) posit that agile organizations require high degrees of both IT integration and external monitoring capability. They theorize that strategic flexibility is derived from effective and timely identification of changes in the external environment coupled with the necessary internal IT integration to facilitate an effective and timely response. This is also consistent with recent research suggesting that organizations with a strong external focus garner higher returns on their IT investments and are more innovative (Tambe et al., 2012). Tambe et al. (2012) argue that executing an effective response to external information requires that an organization have the processes in place to absorb this information and the processes in place to execute an appropriate organizational response. These structures are consistent with a strategic ERM approach where IT integration must be raised to a high level, and monitoring external opportunities and threats allows ERM to feed information internally and initiate the processes that lead to a timely and effective response—i.e., high level strategic flexibility. Thus, strategic ERM should impact the level of strategic flexibility by both fostering increased levels of IT integration and providing external information necessary to guide the role of IT integration in supporting strategic flexibility. This leads to the second hypothesis:

H2. IT integration mediates the relationship between ERM and strategic flexibility, while ERM simultaneously moderates the level of the mediation effect.

H2 presents a complex picture of the interrelationships between ERM, IT integration, and strategic flexibility. ERM affects strategic flexibility through its effect on IT integration, but ERM also affects the relationship between IT integration and strategic flexibility. The effect is a moderated-mediation (Preacher et al., 2007).

The link between strategic ERM and IT integration is intuitive and consistent, but only briefly addressed by Power's (2007) and Mikes (2009, 2011). In each case, they noted the need to integrate information across the organization in order to support a holistic view of risk management. Our cross-sectional field study again provides support for the theory and relationships. As noted earlier, Beta and Delta both approached ERM from a holistic perspective and supported their ERM approach with integrated

information gathering from across their organizations. Both believed that it enhanced their ability to react to market changes. In contrast, Alpha and Gamma both suffered poorer performance when using non-integrated sets of specific risk measures. Alpha in particular felt that the use of non-integrated risk measures hindered their flexibility and accordingly their competitiveness. However, both companies garnered performance gains after shifting to a strategic approach to ERM. In both cases, after adopting highly integrated IT systems to move toward a holistic ERM strategy both garnered performance gains from the strategic approach to ERM.

To further understand the value of IT integration to ERM, we added two specific case studies (Omega and Zeta) to the initial set and revisited Alpha, because it was acquired by another firm. During the discussions, Alpha noted that a UK firm specifically targeted them for their experience in developing strategic ERM processes and to acquire their IT infrastructure, which could be scaled to merge the two organizations and provide high IT integration across the combined entity. We also added Omega because it was in the process of selling off a business unit. In discussions with Omega, management noted that they felt they got a better price for the business unit because of the strength of their ERM processes and the IT systems supporting those processes. Third, we added Zeta to better understand an organization that made large IT investments, but did not have a successful experience with ERM implementation. The case study revealed that the IT investment was not effective because management was unwilling to put energy into engaging ERM as a strategic management philosophy. Without a strategic ERM focus, IT investments failed to produce the information flows necessary for effective risk management and the desired flexibility.

Again, the multiple case studies examining the specific relationship between ERM, IT integration, and strategic flexibility lend support to the theorized relationships. Strategic ERM appears to be a key driver for shaping integrated IT systems and leveraging those systems to improve flexibility.

2.3. ERM and supply chain performance.

While strategic flexibility is generally considered necessary for organizations to manage environmental changes and enhance supply chain performance, results of studies investigating this relationship have been inconsistent (Patel et al., 2012). In light of the inconsistencies, researchers have called for theory development and research addressing mediators of the relationship between flexibility and performance (Anand and Ward, 2004; Pagell and Krause, 2004; Patel et al., 2012), as well as strategic and technical contingencies that assist in understanding such relationships more completely (Ketokivi, 2006).

Patel et al. (2012) provide insights into these relationships through an examination of the moderating effects of absorptive capacity and operational ambidexterity. Absorptive capacity facilitates the identification and assimilation of relevant knowledge. Operational ambidexterity determines the relevance and value of the knowledge for exploration and exploitation (Patel et al., 2012). Absorptive capacity and operational ambidexterity are aspects of the overall process of scanning, interpreting, and learning from changes in the external environment. Both can also be facilitators of *risk envisionment* as an organization attempts to understand changes in the external environment and assimilate how these changes can affect the organization and what the changes mean in terms of opportunities and/or risks to the organization. Thus, both can be critical elements of the sensing process needed for strategic ERM.

Patel et al. (2012) theorize that absorptive capacity can strengthen the relationship between strategic flexibility and supply chain performance by facilitating improvement of processes and practices, and through effective adoption of supply chain technology. At the same time, a lack of absorptive capacity can lead to an inability to adapt to changing environments and effectively apply strategic flexibility. Organizations that are unable to pursue exploration and exploitation simultaneously (i.e. ambidexterity) can limit the benefits of doing either one.

Patel et al. (2012) support their theory in that they find that firms better able to acquire, assimilate, and transform information are more likely to realize positive performance outcomes from strategic flexibility. However, they note that a limitation to their results is the lack of understanding of how firms incorporate learning strategies and how firms build their capabilities to absorb, explore, and exploit knowledge. Patel et al. (2012) suggest a key component may be the development of internal systems and processes to gather and absorb knowledge, as well as social integration mechanisms that create the culture for learning. Malhotra and Mackelprang (2012) make a similar argument that monitoring both internal and external information is critical to leveraging strategic flexibility to achieve performance improvements.

ERM provides one possible explanation for maximizing organizational resources to improve the performance outcomes derived from strategic flexibility. The nature of strategic ERM as a holistic approach to risk management is that it draws information from across the organization and combines it with the scans of the external environment that presents opportunities and threats to the organization (Mikes, 2011). The capability building nature of strategic ERM whereby higher levels of IT integration are developed and leveraged through ERM processes to improve strategic flexibility should flow through to the processes that impact supply chain performance. Thus, strategic flexibility becomes a critical mediator enabling strategic ERM processes and IT integration to facilitate performance. At the same time, the ability to acquire, assimilate, and transform information into the knowledge necessary to be competitive is critical to leveraging the information and the ability to respond to that information (i.e. strategic flexibility) in order to garner improvements in supply chain processes. This leads to the third hypothesis:

H3. Strategic flexibility and IT integration mediate the relationship between ERM and supply chain performance, while ERM simultaneously moderates the level of the mediation effect.

H3 presents a complex picture of the overall interrelationships in the theoretic model. ERM affects supply chain performance indirectly through its effect on IT integration and strategic flexibility, but ERM also directly affects the relationship between strategic flexibility and supply chain performance. Hence, the overall model results in a moderated-mediation (Preacher et al., 2007).

The cross-sectional field studies provide preliminary support for the theorized relationships. Alpha attempted to govern processes without the integrated support of strategic ERM processes. They found that the isolated control structures hindered flexibility and led to poorer supply chain performance, most notably in terms of the 5% increase in performance time. Subsequent implementation of strategic ERM processes provided the holistic view necessary to become more flexible and to translate that flexibility into performance improvements. Gamma went through a similar cycle with quantitative risk measures and controls impeding flexibility and hindering supply chain performance before a strategic ERM approach was adopted.

Delta initiated its first ERM implementation with a strategic focus and achieved quick buy in from business process managers. Business unit owners were appreciative of substantial increases in available information from across the organization; and, managers recognized the resulting process improvements and efficiency gains from across supply chain activities.

Finally, Zeta provided insights into an organization that did not embrace ERM, but prided itself in maintaining flexible business processes. Zeta made large investments in IT to build the infrastructure, but absent strong ERM processes they found that the information was underutilized and their “flexible processes” actually led to inefficiencies and severely threatened the organization’s competitiveness. The company came close to failing before new management turned the company around and stabilized it.

Overall, the case studies provide observations of organizations functioning well with strategic ERM processes in place, higher levels of IT integration with strategic ERM processes in place, and an ability to leverage flexibility and performance improvements in the presence of strategic ERM processes and high levels of IT integration. On the other hand, observations also showed that organizations with restrictive control procedures more consistent with a silo view of risk management struggled to leverage IT investments and suffered poorer performance. However, the small group of case studies only provides a basic foundation for assessing the appropriateness of the theoretical model. A larger data gathering with a broad base of organizations was undertaken to more robustly test the theoretical model.

3. Research methods.

Partial least squares (PLS) analysis (Ringle et al., 2005) is used to assess construct validation and common method bias. Path analysis is used to assess the hypothesized model and establish the overall fit. The remainder of this section discusses participant characteristics, instrument development, data analysis, reliability, and validation testing.

3.1. Participants

The target participants for this study were chief audit executives (CAEs) because of their breadth of organizational understanding related to risk management processes, IT and operational control processes, and IT and operational efficiency and

Table 1
Participant demographics.

Category	Frequency n = 155	Percentage
Gender		
Male	109	70.32%
Female	45	29.03%
Not answered	1	0.65%
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%

effectiveness. While prior literature has focused on CEO or supply chain executives' perceptions on forming external supply chain relationships (Villena et al., 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 our survey using their Global Audit Information Network (GAIN). All survey questions and the associated data were collected solely for our research grant project. GAIN emailed invitations to participate in the survey to 1383 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 of experience. An additional five respondents did not fully complete the survey. The analysis does not include these 12 respondents. The remaining data are examined to determine whether there are patterns to any missing responses. A test of overall randomness found all missing responses are missing completely at random (MCAR) ($\chi^2 = 585.634$, $df = 609$, $p\text{-value} = 0.745$) and the expectation maximization (EM) algorithm (SPSS 15.0, 2006) is used to calculate replacement values (Hair et al., 2006). "Missing data for under 10% for an individual case or observation can generally be ignored, except when the missing data occurs in a specific nonrandom fashion" (Hair, Black, Babin, Anderson, & Tathan, 2006, p. 55). Because the goal of this study is to examine factors affecting organizations' supply chain performance, the analysis does not include participants who indicate that more than 10% of the survey measures are not applicable to their organization; all of the subsequent analyses pertain to the remaining 155 participants. (Data for this study were collected as part of a larger grant project that included studying organizations' experience in implementing SOX 404 internal control mandates; thus, the overall data collection included many organizations not participating in supply chain activities.)

Demographic data, shown in Table 1, reveals that 84.52% (131) of the participants have over ten years of professional experience. The primary industries represented are manufacturing (18.71%), insurance (16.77%), financial services (14.19%), and wholesale/retail (8.39%). Industry effects have no significant impact on the analysis. One hundred nine (70.32%) participants are male, 45 (29.03%) female and 1 did not indicate gender. The demographics of 155 respondents retained in the study are compared to those removed, and T-tests indicate there are no significant differences.

3.2. Survey instrument

The online survey collected measures of the latent variables as well as participant demographic data. As shown in Fig. 1, the theoretical model involves a series of complex relationships between organizations' ERM processes, IT integration, strategic flexibility, and supply chain performance. Each construct consists of multiple item measures using five point Likert scales where 1 represents "Strongly Agree" and 5 represents "Strongly Disagree"; participants are also provided the option to respond "N/A Don't Know".

Organizations adopt strategic ERM to facilitate the holistic identification and assessments of risks and opportunities that can impact organizational value (Lam, 2003; Collier, 2009; Mikes, 2011). The item measures for ERM are developed to capture overall indicators of ERM development including regular enterprise-wide risk assessment, evaluation of control effectiveness, and risk sensing and responding capabilities. In developing the item measures for the construct, data collected during the cross-sectional field study discussions are used to highlight key aspects of ERM. The discussions made it clear that effectiveness is 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, the item measures 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 reflecting an effective integrated ERM environment.

IT integration is a formative construct that combines two sub-components of Byrd and Turner's (2000) IT flexibility infrastructure, IT connectivity and IT compatibility. These sub-components reflect the firm's ability to engage in intra-organizational information sharing (Byrd and Turner, 2000). IT connectivity refers to the network connections provided by the IT infrastructure allowing real-time access to information from various locations. IT compatibility is the ability for IT components to interconnect with different geographic locations and/or different business functions to share information. Both IT connectivity and IT compatibility are required to provide IT integration (Duncan, 1995; Byrd and Turner, 2000; Malhotra, Gosain, & El Sawy, 2007; Nazir and Pinsonneault, 2012). IT components must be connected to access information from one another and compatible to use information from one another.

Strategic flexibility represents 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; Patel et al., 2012). To operationalize strategic flexibility within the current study, measures of strategic flexibility consistent with those previously validated by Cannon and St. John (2004) are used. These measures are reflective of demonstrated flexibility and are consistent with the types of flexibility discussed by the informants during the cross-sectional field studies—i.e., responding to market opportunities for evolving products/services.

A supply chain represents "the integration of key business processes from end-user through original suppliers that provide 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 internal performance output measures adapted from Beamon (1999). These measures reflect an organization's ability to meet or exceed its customer service goals and objectives—the organization's ability to meet the performance expectations of its supply chain partners. Table 2 (reflective constructs) and Table 3 (formative construct) shows all item measures for the model constructs.

Table 2
Tests of convergent validity.

Reflective measures	Factor loading	Construct composite reliability	Average variance extracted
Enterprise risk management (ERM)		0.937	0.748
1. Our organization performs a thorough enterprise-wide risk assessment at least once a year	0.733		
2. The strength of our internal control system enhances our organization's ability to identify events that may affect the achievement of our objectives	0.890		
3. Our organization regularly evaluates the effectiveness of internal controls to mitigate identified risks	0.878		
4. Management has effective processes to respond to identified risks	0.924		
5. Our risk management procedures provide the necessary information top management needs to monitor changes that could impact our organization's well-being.	0.886		
Strategic flexibility		0.841	0.569
1. Our organization has difficulty maximizing new market opportunities (RC)	0.749		
2. Our organization is able to introduce new products/services	0.734		
3. Our organization has difficulty accommodating major changes in basic product designs or service offerings (RC)	0.756		
4. Our organization is able to manage the impact of serving new classes of customers	0.779		
Supply chain performance		0.946	0.777
1. Our organization consistently meets or exceeds our corporate goals for the proportion of product/service orders immediately filled	0.893		
2. Our organization consistently meets or exceeds our corporate goals for on-time delivery of products/services	0.930		
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)	0.905		
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	0.893		
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	0.781		

RC: reverse coded.

D: dropped.

3.3. Data analysis

Because this study employed constructs that are both exogenous and endogenous (IT integration and strategic flexibility) and one of the latent variables (IT integration) is formative rather than reflective, PLS analysis (Ringle et al., 2005) is used to assess the reliability of the measurement model and path analysis is used to test the structural model.

Initial data analysis reveals that more than 10% of the participants indicate that four of the item measures are “not applicable”. A review of industry demographics is consistent with non-applicability of these items; therefore, these items are dropped from further analyses. (Item measures that are dropped included two item measures for supply chain performance and two item measures for IT integration.) The “N/A Don't Know” responses for each of the remaining measures appear to be completely at random

Table 3
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.

(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); out of 19,995 data points used in the analysis, 105 (0.5%) were imputed.

3.4. Measurement model reliability and validity

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 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 and 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. Because a formative construct is specified as a multiple regression equation (Diamantopoulos et al., 2008), multicollinearity must be ruled out. Variance inflation factors are calculated for the ten indicators of IT integration, first using a measure of strategic flexibility and then a measure of supply chain performance. As shown in Table 3, the maximum variance inflation factor for the ten items is 2.723, which is below the conservative threshold of 3.3; therefore, all items are retained in the model (Petter et al., 2007).

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 4, 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 0.682, shown in Table 5, is below the standard threshold of 0.85, which also supports construct discriminant validity (Kline, 2005).

The possibility of common method bias always exists when data are self-reported (Podsakoff and Organ, 1986; Podsakoff et al., 2003). This issue is assessed using a PLS model; specifically, an additional latent variable, a common method construct, is added to the research model and linked to each of the indicators of the research model constructs (Liang et al., 2007). The factor loadings on the common method constructs display how much of the indicators' variances are explained by the common method construct. As shown in Table 6 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 (Williams et al., 2003; Liang et al., 2007) and supports the robustness of the research model.

Finally, prior research indicates that firm size and industry may impact supply chain performance. Similar to prior research, the number of employees is used as a surrogate for firm size. The major industry groupings are controlled by creating a set of dichotomous variables. As mentioned previously, industry grouping is not significant for these data. Although size is not significant for supply chain performance, size does 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.

4. Results

The theoretical model employs both reflective and formative constructs; in addition to main and mediating effects, the theoretical model also hypothesizes moderating effects. If one of the variables in a moderating relationship is formative, as is the case in this study, pairwise multiplication of the construct indicators to create a moderating variable is not a statistically valid approach (Henseler and Chin, 2010). In order to assess the theoretical model posited, the two stage approach recommended by Henseler and Chin (2010) is employed. In the first stage, standardized latent variable scores are calculated for each construct in a main effects model using principal components analysis for the formative construct and principal axis analyses for the reflective constructs (Edwards and Bagozzi, 2000). In stage two, the element-wise product of the latent variable scores is used to create the interaction terms. The results presented in Fig. 2 are calculated using the latent variable scores of the model constructs and their corresponding interaction terms (Henseler and Chin, 2010). Fig. 2 presents the path analysis results (i.e. standardized beta coefficients, p-values, goodness of fit statistics and construct R^2).

H1 posits that increases in ERM have a positive impact on IT integration. Analysis indicates that the standardized path coefficient of H1 (+0.68,) is significant (p-value < 0.001) and in the hypothesized direction, supporting H1. This supports the hypothesized effect of ERM on the evolved state of IT integration with higher levels of ERM leading to higher levels of IT integration. ERM singularly explains 46% of the variation in IT integration.

Table 4
Tests of discriminant validity.

	ERM	Strategic flexibility	Supply chain performance
Average variance extracted	0.748	0.569	0.777
<i>Squared inter-construct correlations</i>			
ERM	1.000		
Strategic flexibility	0.189	1.000	
Supply chain performance	0.236	0.353	1.000

Table 5
Inter-construct correlations.

	ERM	IT integration	Strategic flexibility	Supply Chain performance
ERM	1.000			
IT integration	0.682	1.000		
Strategic flexibility	0.435	0.648	1.000	
Supply chain Performance	0.486	0.581	0.594	1.000

H2 predicts a moderated mediation whereby IT integration mediates the relationship between ERM and strategic flexibility, but, at the same time, ERM moderates this mediation relationship. In short, the independent variable is also the moderator (Preacher et al., 2007). The results provide partial support for H2. As shown in Table 7, ERM's indirect effect on strategic flexibility (+0.44) is positive and significant (p-value < 0.001); while the direct effect is -0.01 and not significant. Thus, the results support full mediation. However, as can be seen in Fig. 2, the interaction (ERM and IT integration) construct's standardized path coefficient of +0.05 is not significant (p-value = 0.45), thereby failing to support the moderation portion of the hypothesis. In summary, IT integration mediates the relationship between ERM and strategic flexibility; however, ERM does not moderate the mediation.

H3 similarly predicts a moderated mediation whereby IT Integration and strategic flexibility mediate the relationship between ERM and supply chain performance, while ERM simultaneously moderates this mediation relationship. Again, the independent variable is also the moderator (Preacher et al., 2007). The results support H3. Table 7 shows that the indirect effect of ERM on supply chain performance is statistically significant (+0.19, p-value < 0.001) which indicates mediation. However, the direct effect of ERM upon supply chain performance is also significant (0.29, p-value < 0.001). Thus, the relationship is only partially mediated. As expected, this mediation effect is moderated by ERM. The standardized path coefficient on the interaction construct (ERM and strategic flexibility) is statistically significant (+0.17, p-value < 0.001). This indicates a significant moderation effect. The hypothesized moderated-mediation effect is supported. In summary, as theorized ERM impacts supply chain performance indirectly through IT integration and strategic flexibility, while simultaneously amplifying strategic flexibility's impact upon supply chain performance.

Overall, the theorized model has strong explanatory power. As shown in Fig. 2, indices used to assess the overall goodness of fit of the research model are strong ($X^2 = 6.62$, $df = 4$, $p = 0.16$), root mean squared error of approximation (RMSEA) = 0.07, the Tucker Lewis Index (TLI) = 0.98, and the comparative fit index (CFI) = 0.99). In addition, the interrelationships among ERM, IT integration, and strategic flexibility jointly explain 44% of the variation in supply chain performance as evidenced by the r^2 of .44. Further, ERM and IT integration jointly explain 42% of the variation in strategic flexibility (r^2 of 0.42). The strong explanatory power of ERM upon and through the other firm competencies provides strong support for the theoretical model.

5. Summary and discussion

This study puts forth a theoretical framework for the role of ERM in coordinating organizational resources to promote enhanced supply chain performance. The theory brings together three disparate theoretical frameworks in order to provide an overall understanding of the interrelationships between ERM, IT integration, strategic flexibility, and supply chain performance. Fundamental to the theory is that higher levels of ERM have a positive impact on IT integration that together increase flexibility and in turn performance, but the level of ERM moderates these impacts (i.e., there are sequential moderated-mediations).

Table 6
Common method bias.

Construct	Indicator	Research model factor loading	Research model factor loading squared	Common method factor loading	Common method factor loading squared
ERM	ERM1	0.974***	0.949	-0.271**	0.074
	ERM2	0.794***	0.631	0.114	0.013
	ERM3	0.863***	0.744	0.017	0.000
	ERM4	0.824***	0.670	0.114	0.013
	ERM5	0.907***	0.822	-0.026	0.001
Strategic flexibility	SF1	0.910***	0.827	-0.173	0.030
	SF2	0.699***	0.489	0.053	0.003
	SF3	0.854***	0.730	-0.117	0.014
	SF4	0.563***	0.317	0.235**	0.055
Supply chain performance	SCP1	0.874***	0.763	0.019	0.001
	SCP2	0.906***	0.821	0.024	0.001
	SCP4	0.939***	0.882	-0.038	0.001
	SCP5	0.841***	0.708	0.058	0.003
	SCP7	0.851***	0.724	-0.074	0.006
Average variance		0.843	0.720	-0.005	0.015

** p < 0.01.

*** p < 0.001.

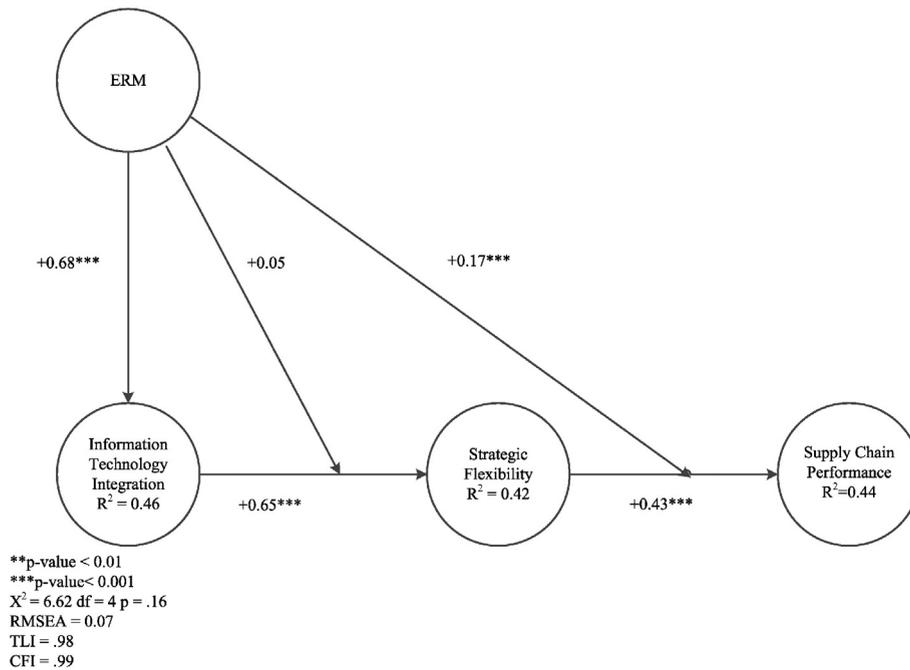


Fig. 2. Structural model results.

This theory is initially evaluated using data collected in a cross-sectional field study from six different organizations that implemented ERM processes and experienced various effects on their supply chain performance. Based on support from the field study analysis, the robustness of the proposed theoretical model is evaluated more extensively using survey data collected from 155 Chief Audit Executives. The study results reveal the complex interrelationships that tie ERM, IT integration, and strategic flexibility together to provide a better understanding of the role of strategic ERM in enhancing supply chain performance. The results provide strong support for the underlying theory with a specific view toward strategic ERM as a positive factor in promoting both strategic flexibility and supply chain performance. Moreover, IT integration emerges as fundamental to facilitating the relationships in the model. Surprisingly, ERM does not moderate the effect of IT integration on flexibility, but rather drives this relationship through its positive effect on IT integration. This indicates that strong IT integration and data sharing through enterprise-wide systems is critical to maximizing the value of ERM activities in enhancing strategic flexibility. However, ERM moderates the relationship between strategic flexibility and supply chain performance, indicating that the level of ERM does affect an organization's ability to leverage flexibility into performance gains.

5.1. 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 Chief Audit Executives who have the 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

Table 7

Standardized direct, indirect and total effects.

	Direct effects	Indirect effects	Total effects
ERM → IT integration	0.68***	–	0.68***
ERM → Strategic flexibility	–0.01	0.44***	0.43***
ERM → Supply chain performance	0.29***	0.19***	0.48***
IT integration → Strategic flexibility	0.65***	–	0.65***
IT integration → Supply chain performance	–	0.28***	0.28***
Strategic flexibility → Supply chain performance	0.43***	–	0.43***
ERM × IT integration → Strategic flexibility	0.05	–	0.05
ERM × IT integration → Supply chain performance	–	0.02	0.02
ERM × Strategic flexibility → Supply chain performance	0.17***	–	0.17***

*** p-value of <0.001.

in the best position to evaluate the various dimensions of the theoretical model. Additionally, our analysis suggests that common method bias is not a serious concern in this study. Similarly, other characteristics of an organization or the markets in which it participates could have a systemic effect on the model. While we controlled for industry and firm size, future studies should consider other potential influences, such as market concentration and process level characteristics.

Second, our measurement variables included one construct, ERM, that was developed specifically for this research and had not been previously validated. The 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. Each of the other three constructs that were adapted from prior research, evolved from existing understanding of 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.

Third, the focus of our study was on supply chain performance. This focus was driven by a combination of discussions in the business press as to potential negative effects on organizational flexibility and supply chain performance as a result of control compliance and risk management mandates, and by the identification of supply chain performance as a key outcome of ERM processes during completion of the cross-sectional field study. Nonetheless, supply chain performance is only one component of organizational performance and future research should consider the impact on broader organizational performance variables such as financial performance and creation of shareholder value (e.g., Gordon et al., 2009).

5.2. Contributions and implications for theory

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 focused on implementing ERM as the foundation for ensuring appropriate risk management (Power, 2007, 2009; Mikes, 2009, 2011).

Overall, 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 chain performance. IT integration's mediation effects demonstrate the significance of strong IT integration that supports flexibility to achieving strategic objectives. The results related to strategic flexibility demonstrate the enhancing effects of both strategic ERM and IT integration on strategic flexibility. Of perhaps greater interest is the moderating effect that ERM has on the relationship between strategic flexibility and supply chain performance. Lower levels of ERM that are more calculative in nature may actually impede an organization's ability to leverage flexibility into performance, and a risk management focus that centers around strategic risk environment may be necessary to leverage flexibility into enhanced performance. This result appears to help explain the conflicting findings in managerial control research over the restrictive versus enabling role of managerial control systems for strategic-oriented organizations and their associated need for strategic flexibility (Bouwens and Abernethy, 2000; Abernethy and Lillis, 1995).

The study also focuses on one key component of organizational performance, which is 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 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 such intra-organizational relationships.

5.3. 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 ERM on flexibility and performance is primarily accomplished through enhanced IT integration. But the approach to ERM is equally important; a rudimentary approach that focuses on measurable controls may impede the leveraging of flexibility, whereas a broader strategic view of risks and risk management can enable the leveraging of strategic flexibility. Our research provides a critical understanding of the relationship between ERM and supply chain performance by isolating the effects that are driving the observed phenomena and providing a theoretical basis for understanding the 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 et al., 2007). Our cross-sectional field study highlights the differences between organizations that had poorer performance post ERM implementation and those that had greater performance effects from ERM. 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 a strategic ERM

perspective. Our results also 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 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 strategic 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.

Appendix A. Appendix: overview of cross-sectional case studies.

Cross-sectional field study methods entail the use of limited-depth case 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. Cross-sectional field studies are particularly beneficial during the theory refinement phase when specific theoretical concepts are being explicated (Lillis and Mundy, 2005). A cross-sectional field study was used to provide preliminary examination of the theorized relationships and to refine the theoretical development and construct measurement in the subsequent testing of the theory.

In conducting the limited-depth case analyses, every effort was made to follow the case research guidelines of Yin (2003) 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(s). 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 questions in advance to allow them 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 cases, one was designed to address issues of high investment in IT integration within a failed ERM environment, and the second focused on the value emerging from 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 limited to 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 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. Initially, many of the risk measures were developed using manual aggregations and add-on processes, 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 shifting their compliance strategy from a silo risk management approach to a strategic ERM approach that integrated business risks and opportunities. The strategic ERM approach required all suggested control procedures and control related IT investments to be integrated into existing business procedures and IT. 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, compliance with SOX regulations required a smaller shift in ERM practices. Existing ERM processes made new compliance requirements relatively painless 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% of Gamma's products are produced by offshore suppliers. Early efforts to implement ERM were driven by a consulting firm that took a silo risk management approach. That approach received significant resistance from the VP of IT, and resulted in a multitude of manual add-on processes to meet risk management objectives. The manual processes negatively impacted flexibility and hindered competitiveness. A new consulting firm was engaged and the VP of IT gained an appreciation for strategic ERM approaches, became supportive of the ERM effort and resistance dissipated. An IT person was added specifically to strengthen risk monitoring and control processes; and, investments in hardware, software, and systems maintenance increased to specifically support the ERM processes. The strategic ERM approach resulted in using IT to create automated controls that were efficient and beneficial to the overall business.

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; management slowly won over each business unit as each unit garnered an appreciation for risk assessment and monitoring activities. Unification of risk monitoring was received positively by business unit owners recognizing the substantial increase in available information from across the organization. Managers recognized that the availability of information aided process improvements and increased supply chain efficiencies.

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 ERM success. Where there was a lack of automation in information aggregation across the organization, ERM processes were not particularly effective. After the implementation of ERM, Alpha, Gamma, and Delta made a clear investment 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 Alpha's learned knowledge on ERM processes and their IT systems used to facilitate ERM. The acquiring company's intent was to take these ERM practices and systems, and reuse them throughout their business units. 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 a national power company. 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 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 of any of our companies to track both risk and control information. Unfortunately, the systems failed miserably and ultimately were scrapped because Zeta's management was reluctant to implement ERM. Management felt that ERM processes would add too 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 remains a going concern risk.

The additional cases provide support and clarity to the original case set. Alpha and Gamma provide evidence that strategic ERM promotes integrating controls and the related IT into existing business processes and IT. Furthermore, Omega demonstrates that IT shaped by strategic ERM creates a value that is recognized in the marketplace. These cases also 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 is not sufficient in itself—again adding support to the importance of ERM in tandem with IT systems supporting strategic ERM information needs.

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