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A CONCEPTUAL MODEL FOR IT-ENABLED ENTERPRISE RISK MANAGEMENT IN FINANCIAL ORGANISATIONS

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Abstract

The managing of risks and uncertainties in today's competitive financial services industry is central to the survival and performance of financial organisations. Enterprise risk management (ERM) is an emerging approach to managing risks across different business functions in an organisation that represents a paradigm shift from specialized, silo-ed approaches in managing specific risks. This paper provides a conceptual model proposing information technology capability and top management commitment as critical antecedents in building IT-enabled ERM capability, which will subsequently lead to better organisational performance. Information technology is regarded as a key enabler of enterprise risk management strategies that can integrate risk management into enterprise-wide business processes, giving rise to IT-enabled ERM capability. This capability is conceptualised as a higher-order capability comprising of risk measurement, risk control and risk monitoring capabilities. Top management commitment is also identified as a key complementary enabler of IT-enabled ERM capability. The development of a structural model to elucidate the ERM capability building process provides significant research and managerial implications for addressing enterprise risks in financial organisations.

Keywords: enterprise risk management, information technology, top management commitment, organisational performance

1 INTRODUCTION

Financial organisations today face an increasingly turbulent and complex business environment in which survival is highly dependent on the capability to cope with uncertainties and disruptions of varying magnitudes. There is a pressing need for firms to adopt sound risk management practices to cope with the myriad of threats and risks. These environmental forces that could affect firms and their operations include technological obsolescence, geopolitical shocks, changes in laws and regulations, and the emergence of new service models.

In recent years, there has been a shift in focus for organisational risk management from specialized, silo-ed approaches of addressing the risks of different business units to a more integrated and holistic approach that is likely to deliver key benefits such as improved risk reporting and cross-functional coordination. The increasing interdependence between different business functions and their associated risks heightened the need for top management to address all these risks collectively in order to ensure that overall organisational objectives are met. This led to the development of integrated risk management practices that have impacts across the entire enterprise. This integrated approach which is commonly known as enterprise risk management (ERM) has emerged as an important means of managing risks, especially for financial institutions which in essence, are in the business of risk.

In the wake of financial debacles over the past decade such as the collapse of the British bank Barings in 1995 as well as the near collapse of Bankgesellschaft Berlin (now Landesbank Berlin Holding AG) in 2002, a German bank stricken with bad loans, the necessity of having an integrated enterprise-wide risk management operation within financial organisations has increased. Risk institutions have responded by developing new frameworks and guidelines for capital and risk management to address the increasing risks and uncertainties facing the banking industry as well as other businesses. The Basel Committee on Banking Supervision has been developing Basel II, an international capital adequacy framework with a focus on developing banks' capabilities to manage enterprise risk. The ERM framework released in 2004 by the Committee of Sponsoring Organisations of the Treadway Commission (COSO) has also given ERM greater visibility among other businesses. Governments have also taken the lead by imposing stricter financial and compliance regulation, such as the Sarbanes-Oxley Act of 2002 (SOX) passed by the U.S. government.

Although the concept of enterprise risk management has been discussed widely since the mid 1990s, with early ERM initiatives by accounting bodies and risk institutions like the American Institute of Certified Public Accounts (AICPA) and COSO being the proponents of interest in ERM, there are still several areas in the field of ERM which remained relatively unexplored. While guidelines and methodologies for enterprise risk management are well researched and established, there is a lack of understanding as to what organisational elements or conditions could lead to the development of ERM capability.

In addition, in spite of the growing importance of information technology (IT) in today's information-intensive organisations, it is interesting to note that the application of IT as a risk management tool in the broader context of ERM has not been adequately addressed in most studies of risk management. IT is undoubtedly a major cornerstone of any organisation's key operations, and it is an enterprise-wide spanning resource that is highly embedded in many business processes. Given that one of the key objectives of enterprise risk management is to integrate risk management into the firm's business processes (Lam 2003), IT is certainly a key enabler of ERM (Rasmussen and Stamp 2005). While information systems (IS) researchers have extensively explored and examined the impact of IT on business processes such as customer relationship management and knowledge management, ERM is a business process that only attracted academic interest at the turn of the century. It appears that there is a dearth of academic literature and empirical evidence in the domain of ERM. This apparently indicates that academic research is lagging behind the relatively abundance of practitioner articles and regulatory frameworks.

In view of the growing importance of ERM and the paucity of academic work in this topic, the purpose of this paper is to develop a theoretically-grounded model for IT-enabled ERM through the synthesis of prior literature. We reconceptualise the role IT as a key organisational resource that contributes to the development of ERM capabilities. Furthermore, by drawing on resource-based theory of firm, we examine the complementary nature of managerial capability in building ERM capabilities. Lastly, we explore the organisational performance implications of ERM capabilities under turbulent environments. We believe our conceptual model provides a much needed foundation to guide future work in this important research area.

2 LITERATURE REVIEW

An extensive review of the developments in the risk management field and the related literature was conducted to ensure rigour and relevance for our conceptualisation of IT-enabled ERM and its role in a sustaining a firm's competitiveness.

Prior to the formalization of risk management as a field of study and practice, the management of risk is typically limited to risks that can be insured; disasters such as fire, floods, landslides, accidents, litigations and events such as loss of life. In 1963, Robert Mehr and Bob Hedges wrote the first risk management text, *Risk Management and the Business Enterprise*, and developed the first principles and guidelines for managing risks which are still very relevant in practice today. Their work documents the following steps for the risk management process:

- Identifying loss exposures
- Measuring loss exposures
- Evaluating different methods of handling risk
- Selecting a method
- Monitoring results

Subsequent developments in risk management followed the rapidly evolving demands of businesses and the economy at large, as well as the availability of other more sophisticated means of managing risks such as derivatives, a result of financial innovation. As new business models and new means of conducting business emerged, new risks and threats to businesses that are not necessarily insurable have also arose. It was found that different businesses functions face different risks specific to their activities and the corresponding risk management practices developed are highly specific to the nature of the function (Keil et al. 1998; Stulz 1996; Tah & Carr 2001). This results in extensive fragmentation of the field of risk management. Some forms of risk management specific to different business functions include risk management in healthcare, weather risk management and financial risk management. Consequently, many of the current risk management practices may not be sufficiently comprehensive to address cross-functional risks facing contemporary enterprises.

Among all these types of risk management, practices in IT and project risk management is probably the area that has formalised the risk management process originally advocated by Mehr and Hedges most closely. A review of IT and project risk management literature (e.g. Bandyopadhyay et al. 1999; Chapman & Ward 2003) revealed that IT-related risk management typically encompasses the following steps:

- Risk identification
- Risk measurement
- Risk control
- Risk monitoring

We noted that IT and project risk management are more process-oriented and thus more comprehensive in comparison with most other business function-specific types of risk management. For example, in financial risk management, much of the focus is on point-oriented issues such as the hedging of risks with financial derivatives (D'Arcy & Brogan 2001).

While the work of Mehr and Hedges, along with IT and project risk management literature offer valuable insights on the mechanism behind risk management, there is a lack of understanding on what is required to initiate and sustain this process across the entire enterprise.

With the growing interest in enterprise risk management particularly in the 1990s, various risk management, insurance and accounting associations have offered several formal definitions of enterprise risk management. The definition given by CAS (Casualty Actuarial Society) is:

Enterprise risk management is the discipline by which an organisation in any industry assesses, controls, exploits, finances and monitors risks from all sources for the purpose of increasing the organisation's short and long term value to its stakeholders.

Enterprise risk management is one of the newer developments in the field of risk management that has grown in importance over the recent years, in light of events such as the Barings collapse which is primarily attributed to poor governance and weak internal controls (Hunt & Heinrich 1996). Besides bringing about the benefits of having an integrated risk management function that facilitates better coordination as opposed to silo-based risk management approaches, it also involves top management actively in the management of overall risk within the firm (Lam 2003). The risk management process needs to start with a stage of risk awareness that is promoted by top management through the formulation of policies, guidelines and training, followed by stages of risk measurement and risk control. This suggests that the actions initiated by management to create a risk culture should be considered as well in the risk management process (Lam 2003).

COSO (2004) provides another alternative definition of ERM as:

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 risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.

The COSO framework further defines the components of ERM specifically as follows:

- Internal Environment
- Objective Setting
- Event Identification
- Risk Assessment
- Risk Response
- Control Activities
- Information and Communication
- Monitoring

The COSO ERM framework is observed to be a refined extension of earlier risk management frameworks (e.g. Bandyopadhyay et al. 1999; Mehr and Hedges 1963) that places substantial responsibilities on the organisations' top management for effecting risk management initiatives.

A comparison of these risk management frameworks reveals that the common components of most risk management processes and practices are risk measurement, risk control and risk monitoring. In information-intensive organisations such as financial institutions, IT plays a critical role to enable all operational processes that span across the entire enterprise. Hence, we expect IT to play a similarly vital role to ensure the seamless flow of information throughout the ERM process. Communicating pertinent risk information, automating checks and risk controls, and providing decision support to management are some of the important contributions that IT can make towards developing a firm's ERM capability.

3 RESEARCH MODEL AND PROPOSITIONS

Figure 1 depicts the proposed research model.

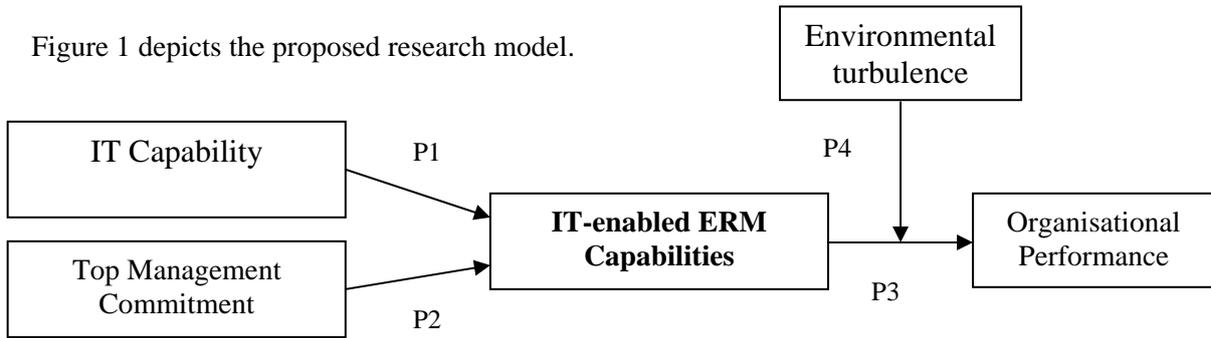


Figure 1. Research Model

3.1. Conceptualisation of IT-enabled ERM Capabilities

To develop a new conceptualization of IT-enabled ERM capability, we first synthesized the practitioner-based COSO framework and the IT and project risk management literature. Next, we considered the roles that IT and organisational components in the form of management policies that are required to initiate and sustain the ERM process.

We regarded ERM capabilities as the capabilities required for the facilitation of enterprise risk management processes. For parsimony sake, we focused on the capabilities that are based on the different fundamental stages of the risk management process. We identified the key ERM capabilities as risk measurement, risk control and risk monitoring capabilities.

As these three capabilities facilitate and are part of an overall ERM capability, we therefore conceptualized IT-enabled ERM capabilities as a second order reflective construct comprising of these three first-order capabilities as shown in Figure 2. First, *risk measurement* involves event identification and assessment of their likelihoods and impacts based on historical data and present state. Risk analytics supported by technology and mathematical methods are required to perform accurate risk assessments. Second, *risk control* involves the selection and execution of the appropriate response to risk. Third, *risk monitoring* involves the on-going evaluation and tracking of risk management effectiveness and communicating feedback to management.

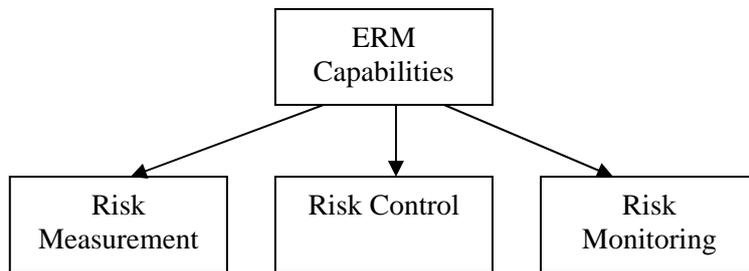


Figure 2. Proposed Nature of ERM Capabilities

Accordingly, we define IT-enabled ERM capability as follows:

IT-enabled enterprise risk management capability is the ability of an organisation to assess, exploit, control, and monitor risk from all sources, facilitated by an organisational IT architecture in order to provide reasonable assurance of realising increased firm value.

3.2. *Antecedents of IT-enabled ERM Capabilities*

Information technology serves as a highly important antecedent for organisations seeking to develop ERM capabilities. An organisation's IT capability can be defined as a base of IT resources within an organisation comprising of the IT infrastructure and the IT business applications that utilises the infrastructure (Broadbent & Weill 1997).

IT infrastructure is critical for the sharing of resources and information across the enterprise; shared databases and communication technologies ensure that personnel are provided with the information necessary for them to manage risk (Duncan 1995). It also provides a shared platform for applications, with high-performance and robust hardware central to supporting complex risk analysis, valuation and measurement push technology crucial to the risk management function (Strobel & Krishna 2006).

On the other hand, IT business applications are crucial in the embedding of enterprise risk management practices into business processes. Key examples of such embedding include: the use of business intelligence tools to provide concise risk reporting to senior management (Lam 2003), the application of mathematical modelling and simulation software in the measurement and analysis of the likelihood and impact of possible risks (Marphatia & Tiwari 2000), the use of decision support tools to help management to select the appropriate response to risk (Lange 1998), and automation of verification, controls and stop-loss limits to ensure compliance (Ramamoorti & Weidenmier 2006).

The development of an effective IT-enabled ERM capability requires the seamless dissemination and proper management of risk information across the enterprise to ensure that concise risk reporting is provided to senior management and that a repository of historical data and present data is available for risk analysis (Lange 1998). In addition, IT makes necessary risk information easily accessible to personnel of all levels, ensuring that everyone knows sufficiently how to perform their daily duties effectively while not disclosing sensitive information which should only be made available to top management. Such dissemination of information empowers personnel to make day-to-day risk management decisions at the operational level. This would give rise to a greatly enhanced ERM capability. We would therefore expect firms with a higher level of IT capability to be able to achieve a higher level of ERM capabilities. Hence, we propose that:

Proposition 1 (P1): Information technology capability positively influences IT-enabled ERM capability.

Recent studies on IT and its business value have shown that IT alone does not determine the level of performance or firm capabilities. Other complementary organisational resources in which IT may have synergistic effects will also contribute toward performance. A critical complementary resource identified in the risk management literature is the level of top management commitment to promoting and ensuring effective risk management practices and raising awareness of risk across the enterprise.

Several definitions of commitment have been suggested in the fields of psychology and management. According to Porter et al. (1974), commitment consists of a belief and acceptance of organisational goals and values, a willingness to exert effort to organisational goal accomplishment, and a strong desire to maintain organisational ownership. Risk management literature suggests that the process of managing risk is typically a top-down approach initiated by leadership. This view is likewise reflected in the ERM frameworks of COSO and Lam (2003), which emphasised the importance of corporate governance. Hence, top management commitment is a key construct in our framework and is defined as the belief in organisational goals and the willingness to exert effort as well as to advocate collective effort from personnel to organisational goal accomplishment.

Total quality management (TQM) literature has also strongly emphasized the importance of top management commitment in ensuring business excellence and improved organisational performance (Ahire & O'Shaughnessy 1998; Anderson et al. 1995; Flynn et al. 1994, 1995). Top management commitment helps to propel TQM through the creation of values, goals and systems that lead to better products, increased customer satisfaction as well as improved organisational performance.

Commitment from leadership also helps to direct execution and secure resources necessary for quality management processes.

ERM can be regarded as an integrated quality management process that seeks to achieve excellence in the different business processes across the organisation through improving enterprise-wide risk management. Therefore, we expect top management commitment to be crucial in the development of an ERM capability necessary for optimizing business processes with due considerations of risk. Leadership plays an important role in setting the tone of the organisation, through top-down communication, formulation of risk policies, risk-adjusted allocation of resources and initiation of training programs (Lam 2003).

The development of an ERM capability can lead to significant changes in practices and philosophy within an organisation. This is so because in ERM, the conduct of business and the management of its risks are performed in tandem. Management literature has suggested that top management commitment is vital in managing changes in the organisation. It has been argued that change within an organisation will be more successful if top management is committed to the change (Senge 1990). Paradigm shifts in critical areas such as quality management is also highly reliant on top management commitment (Hoffman and Hagerty 1994; John and Snelson 1989). These insights have furthered highlighted the importance that of management commitment in ERM.

From a resource complementarity perspective, top management commitment plays a catalytic role in the integration of IT and business processes effectively (Sambamurthy et al. 2003). This positive synergistic between IT and top management commitment would reasonably lead to a higher level of IT-enabled ERM capability. We therefore expect firms with a higher level of top management commitment to be able to achieve a higher level of IT-enabled ERM capabilities.

Proposition 2 (P2): Top management commitment positively influences IT-enabled ERM capability.

3.3. Impact of IT-enabled ERM Capabilities on Organisational Performance

In line with our second-order construct of IT-enabled ERM capabilities, the enhancement of risk measurement, risk control and risk monitoring capabilities will result in the following improvements in organisations, leading to enhanced performance. This resulting performance can be measured along the terms of increased productivity, operating efficiencies, profitability and competitive advantage (Melville et al. 2004).

First, an improved risk measurement capability will result in quicker identification of possible risks, and a more accurate assessment of their likelihood and impact on the organisation. This will provide a more timely and reliable information for management and personnel to act upon in risk-related decision making (Lam 2003). Second, a more effective risk control capability will result in better quality of decisions made in response to contingent events, and an increased assurance of compliance with policies and legislation when risk responses are being executed. Third, according to the description of the monitoring aspect of ERM outlines in the COSO ERM framework, by enhancing the level of risk monitoring capabilities, shortcomings in current risk management practices and internal control can be more quickly identified and communicated as feedback. Consequently, this will lead to less turn-around times in rectifying issues and loopholes and avoids potential organisational crises attributed to poor controls and management.

In the context of financial institutions, having effective ERM capabilities enabled by information technology can lead to increased operating efficiencies in the long run. This is achieved through reductions in compliance and control costs, and minimizing costs due to fraud. Other benefits realised by banks with comprehensive IT-driven ERM systems in place such as Banca Intesa and The Bank of New York include the maintaining of reputation and favourable credit ratings, and improved decision making and pricing (Feig 2006). Hence, we propose that enhanced IT-enabled ERM capability will have a positive impact on organisational performance.

Proposition 3 (P3): IT-enabled ERM capability positively influences organisational performance.

3.4. *Moderating Effect of Environmental Turbulence on Organisational Performance*

According to Khandwalla (1977), a turbulent environment is defined as a dynamic, unpredictable and fluctuating environment. It is an environment which is strongly marked by continuous transitions and change (Babüroglu 1988; Schön 1973).

Risk is manifested most strongly in volatile environmental conditions. In view of this, we argue that the impact of IT-enabled ERM capabilities on organisational performance is contingent on the level of turbulence in the business environment. The capability to assess and respond appropriately to risk is especially vital in turbulent environments, as the variety of threats and uncertainties that can be present is enormous. Organisations will need to leverage upon their IT-enabled ERM capabilities in environments where survival hinges on the ability to anticipate the unexpected and react accordingly in uncertain conditions (Sambamurthy et al. 2003). Hence, it is likely that an organisation will manifest superior performance since it enjoys advantages arising from its strategic alignment with its environment (Zajac et al. 2000). The building of IT-enabled capabilities can be seen as the increasing of options for response to uncertainties in order to match the range of possible risks and threats. This increases the repertoire of responses available and therefore enhances the likelihood of the organisation performing better when faced with challenges posed by the volatility of the environment. We thus posit that the higher the environmental turbulence, the more likely the options generated from better IT-enabled ERM capabilities will be valuable in enhancing organisational performance.

Proposition 4 (P4): The relationship between IT-enabled ERM capabilities and organisational performance is positively moderated by environmental turbulence.

4 CONSTRUCT OPERATIONALISATION

For the purpose of empirically validating our conceptual model, we adapted scales employed in prior research or self-developed scales based on conceptual definitions applicable to our study context.

4.1. *IT Capability*

The IT capability of an organisation reflects the quality of the underlying IT resources comprising of the organisation's IT infrastructure and the IT applications that utilise the infrastructure. The quality of an organisation's IT infrastructure is assessed in terms of communication network connectivity, flexibility and performance, using a scale adapted from Byrd and Turner (2000). The quality of IT business applications used in the organisation is measured in terms of their risk management functionality. Since no applicable instrument was available, we self-developed the measurement scale from Lam (2003), Lange (1998) and Ramamoorti and Weidenmier (2006).

4.2. *Top Management Commitment*

Top management commitment reflects a manager's identification with the organisation and willingness to exert effort towards the achievement of organisation goals. This construct is measured in terms of managerial ability to articulate a vision for the organisation, involvement in organisational initiatives, loyalty and belief in the organisation, and personal accommodations that are made to help achieve organisational goals. The scale for measuring this construct was adapted from the Organizational Commitment Questionnaire (OCQ) developed by Porter et al. (1974), and another existing scale for top management support developed by Chatterjee, Griwal and Sambamurthy (2002).

4.3. *IT-Enabled ERM Capabilities*

IT-enabled ERM capability was conceptualised as a second-order reflective construct comprising of three first-order constructs of risk measurement capability, risk control capability and risk monitoring capability. Since there was no previous instrument suitable for measuring these constructs, the scales used for measurement were developed based on Lam (2003), the COSO framework and IT risk

management literature (e.g. Bandyopadhyay et al. 1999). The scale for risk measurement capability measures the organisation's ability to identify risks and gauge their likelihood and impacts accurately, and the adequacy of its risk reporting function. The scale measuring risk control capability assesses an organisation's provisions for effective risk decision making and execution. Finally, the risk monitoring construct is measured in terms of the comprehensiveness of enterprise-wide monitoring and feedback activities, and the provisions for making appropriate adjustments and improvements to current risk management measures.

4.4. *Organisational Performance*

Organisational performance is operationalised as a competitive assessment of performance which is measured relative to major competitors. This construct is measured in terms of revenue growth, profit growth, market share growth, profitability, return on investments and return on assets. Considering that detailed financial data of some non-public organisations are not always readily available, this measure will be based on self-reported data. Subjective performance measures are found to be highly correlated with objective measures and are regarded to be reliable and valid, according to Dess and Robinson (1984), and Venkatraman and Ramanujam (1986).

4.5. *Environmental Turbulence*

Environmental turbulence reflects the frequency, intensity and unpredictability of changes in the business environment of an organisation. In the context of our study, environmental turbulence is assessed in terms of the rate of services and product obsolescence, changes in customer preferences, services and product changes and changes in supporting technology. The scale used to measure this construct was adapted from Jaworski and Kohli (1993).

5 CONCLUSION

Our proposed model has laid the groundwork to address the fragmented nature of risk management in organisations and to advance our knowledge in the management of enterprise-wide risks. We have integrated the prior academic and practitioner literature from various disciplines in developing the framework. The conceptualisation of ERM as a second-order capability enriches our understanding of the multi-faceted dimensions of ERM in terms of risk measurement, control and monitoring. Next, the developed structural model linking the antecedents and outcome of IT-enabled ERM capabilities further deepens our understanding of the complementary roles of IT and management capabilities. Our framework and the associated research propositions can serve as a foundation for future empirical research.

Large scale survey research and structural equation modelling approaches seem promising application of our framework. Our discussions of IT-enabled ERM would also provide practitioners of risk management from financial institutions and other businesses with practical insights on how to build ERM capability by tapping on their IT infrastructure and business applications. It also draws attention to the importance of top management commitment in the ERM process. In addition, the development of a scale to measure the multi-dimensional construct of ERM can serve as a benchmark for organisations to assess their IT-enabled ERM readiness.

ERM is a concept of growing importance that is continually being refined and improved to address the increasing volatility and complexity of the business environment. It is a capability that is especially critical to the financial services industry due to the increasing globalization and evolving regulatory requirements. Although risk management is a subject that has been extensively studied in various fields such as finance, accounting, insurance as well as other business-specific areas, the practical implications of the discussions ensuing from this paper is currently very limited, due to the silo-ed approach of managing risk in the past. Our exploratory efforts to develop a model for managing enterprise risks address the lack of a theoretically-grounded research model to conduct empirical

studies that can contribute to the domain of IT-enabled enterprise risk management. We hope that the proposed model will be useful as a bridge to establish the link between IS and risk management research. More importantly, we expect that it would stimulate research interests that can further uncover a greater role for information systems in financial organisations faced with a dynamic business environment increasingly fraught with risks and uncertainties.

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