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The Impact of Enterprise Risk Management Implementation on Organization Performance by Moderating Role of Information Technology

Tran Anh HOA[1], Tran Thi Phuong THANH[2], Pham Tra LAM[3*], Dau Thi Kim THOA[4]

[1] Department of Management Accounting, School of Accounting, University of Economics Ho Chi Minh city, Ho Chi Minh, Vietnam

[2] Department of Financial Accounting, School of Accounting, University of Economics Ho Chi Minh city, Ho Chi Minh, Vietnam

[3] Department of Accounting Information Systems, School of Accounting, University of Economics Ho Chi Minh city, Ho Chi Minh, Vietnam

[4] Department of Public Sector Accounting, School of Accounting, University of Economics Ho Chi Minh city, Ho Chi Minh, Vietnam

[*]Corresponding author: phamtralamais@ueh.edu.vn

Abstract

Research purpose: *The main purpose of this paper is to examine the path modelling of Enterprise Risk Management (ERM) implementation, Information Technology (IT) structure and organization performance as well as some primary factors which might influence ERM implementation.*

Research motivation: *In the unpredictable change of environment, enterprises need to have prudent preparations to control and deal with risks. An effective ERM system and good IT structure are believed to support businesses to achieve this purpose. However, literature review shows that there are not many empirical studies combining the effects of ERM implementation, IT structure and organization performance, especially in emerging economies. Therefore, investigating the effects of ERM implementation, IT structure, and organization performance in the context of emerging countries should be studied.*

Research design, approach, and method: *Data for this research was obtained from a cross-sectional survey with respondents working in enterprises. The analysis of data and hypothesis testing were empirically conducted using partial least square structural equation modelling (PLS-SEM) approach with survey data from 158 business firms in Vietnam.*

Main findings: *This study has two key findings. First, IT structure is a partial mediator for the relationship between ERM and organization performance. Second, both organizational change capacity and knowledge management (KM) process capability had positive relationships with ERM.*

Practical/managerial implications:

This paper provides insights into the value of implementation of ERM among organizations in improving IT structure and performance of enterprises, especially in the context of a transition market like Vietnam. In addition, this study provides implication in terms of manager's planning and decision making to consider ERM implementation and IT structure as two of the critical success factors of performance.

Keywords: Enterprise Risk Management, IT Structure, Organization Performance, Organizational Change Capacity, Knowledge Management Process Capability

1. INTRODUCTION

The corporate failure of the early 2000s such as Enron and WorldCom and the Global Financial Crisis 1 of 2007-2009 has exposed the inadequacies of corporate governance practices, the lack of integrity of financial reporting and poor risk management of the great corporate entities (Ahmed et al., 2016; Chapman, 2012). The failure of world popular enterprises has undermined the trust of shareholders and they accused managers of greed, recklessness, and dysfunction in

their managerial roles (Ahmed et al., 2016). In addition, nowadays, the interconnectedness of the dynamic global business environment and rapid technology changes also lead to a significant increase in operational risks of a large number of firms worldwide (Saeidi et al., 2019; Ahmed et al., 2016). Before these phenomena, risk management seems to have become a central issue among organizations and there is a development in enacting international regulatory and standards to improve risk management (Ahmed et al., 2016; Chapman, 2012).

The traditional risk management method, which is fragmented following simple management functions of organizing, is not appropriate in today's complex context. The interdependence between risks of the types including operational, financial, and technical risk have been ignored and made many mixed results for enterprises (Jean-Jules & Vicente, 2020). To solve this problem, ERM emerged as a suitable alternative to the traditional risk management method (Jean-Jules & Vicente, 2020). ERM is a combination of risks that shifts the attention of the risk management task from being defensive to being more offensive and calculated (Saeidi et al., 2019; Liebenberg and Hoyt, 2003).

From the advantages of ERM, many works focused on exploring factors which could improve ERM adopting efforts (Bromiley et al., 2015; Liebenberg and Hoyt, 2003). Several academic scholars who have applied the contingency theory in researching organizational and management control, asserted that performance of ERM adoption significantly depends on organizational context (Mikes et al., 2014; Chenhall, 2003). The implementation of ERM is considered as a dynamic and continuous process between the innovation and its business environment (Jean-Jules & Vicente, 2021). Moreover, in the 21st century, the business environment is competitive and rapidly changing. Therefore, the change capability is one of the most primary factors within an organization to respond to these changes (Heckmann, Steger, & Dowling, 2016; Balugon & Hope Hailey, 2004). According to Jean-Jules and Vicente (2021) and Judge and Elenkov (2005), organizational change capability was expected to implement ERM more easily and successfully. In addition, knowledge management process capability was evaluated that it enhanced effective ERM implementation through creating, sharing, transforming, transporting knowledge, and applying knowledge within an organization (Jean-Jules & Vicente, 2021; Kim et al., 2012; Gold, Malhotra, & Segars, 2001). Based on the Resource Based View (RBV), these capabilities were important competitive advantages of an enterprise to obtain and defend resources and capabilities (Kim et al., 2012; Wernerfelt, 1984).

In recent years, the real effectiveness of implementing ERM in enhancing business performance has been suspected (Ahmed et al., 2016). Therefore, several empirical studies have attempted to examine the relationship between ERM adoption and firm's performance (e.g., Bromiley et al., 2015; Mikes et al., 2014; Baxter et al., 2013; Ellul and Yerramilli, 2012). The relationship between ERM and firm performance is more complex than the direct link between them (Saeidi et al., 2020). Many researchers recognized that the interconnectedness between ERM implementation and firm performance was significantly influenced by many other internal factors (Saeidi et al., 2020; Farrell & Gallagher, 2019; Saeidi et al., 2019). Accordingly, technology element can play a role as mediate variables in this relationship which was found from some past works (Saeidi et al., 2020; Khan & Ali, 2017). Regarding the RBV, IT which is a critical organizational factor, has a significant influence on the effectiveness of ERM (Saeidi et al., 2019). Wilkinson (2011) and Rolland (2008) also supported that there is not an effective ERM if without existence an effective IT. However, up to now, there are less empirical studies about the relationship between ERM, IT, and performance outcomes (Saeidi et al., 2019). In more detail, IT structure, which is one of the dimensions of IT, did not address in many previous studies, excepting research of Saeidi et al. (2019).

There is a higher adoption rate of ERM in the developed countries in comparison with developing countries (Mikes et al., 2014). Futhermore, many research has yet identified consistent benefits from ERM implementation (Ahmed et al., 2016; Hoyt & Liebenberg, 2015). Hence, it is difficult to draw a general conclusion about effectiveness of ERM because of endogeneity, methodology, and the mixed results found in recent studies (Bromiley et al., 2015). In the context of Vietnam, there are a few studies focusing on the risk management, instead of ERM, however, it has never been adequately concerned. From the above analysis, it is necessary to do more extensive studies on ERM implementation and firm performance relationship in emerging countries like Vietnam. This work aims to combine the contingent theory and the BRV to determine whether some key internal factors including knowledge management process capability and organizational change capacity affect ERM implementation or not. Furthermore, exploring the role of IT structure in the relationship between ERM implementation and organization performance.

The structure of this paper is as follows. Following this introduction, section 2 describes the literature review and hypotheses. The next section presents research methodology including measurement and sampling. Then, research results and discussion from analysing data are shown in section 4 and 5. Lastly, in section 6, conclusions on study outcomes are presented.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 Enterprise Risk Management (ERM) and ERM implementation

Enterprise Risk Management (ERM)

According to the Committee of Sponsoring Organizations of the Treadway Commission Framework (COSO) (2017), ERM is defined as "the culture, capabilities, and practices, integrated with strategy-setting and its execution, that organizations rely on to manage risk in creating, preserving, and realizing value" (Hunziker & Balmer, 2018). From the ERM definition of the COSO, some authors suggested ERM as an integrated method that raises organization value by reducing the uncertainties inherent in the conventional method, lessening the stock return volatility, enhancing the efficiency of capital management, and maximizing shareholders value (Hoyt & Liebenberg, 2011).

Although different models for ERM are introduced by many researchers, one of the most accepted models is the COSO's ERM integrated framework that was issued in 2004 and updated in 2017 (Saeidi et al., 2019). The COSO's 2004 ERM framework defined and discussed essential ERM components, key ERM principles, and provided clear direction and guidance for ERM; while the 2017 framework emphasized the ERM strategy and performance by providing greater insight into the links between strategy, risk, and performance (Jean-Jules & Vicente, 2020).

The COSO's 2004 ERM framework suggested that an organization's ERM system should be positioned to attain the following four objectives: (1) Strategy: high-level goals which are in line with the organization's mission; (2) Operations: high-level goals that are related to the effective and efficient usage of the organization's resources; (3) Reporting: reliability of the organization's reporting system; (4) Compliance: organizational compliance with accepted laws and regulations. To meet these objectives, ERM infrastructure is measured based on eight components including internal environment, objective setting, event identification, risk assessment, risk response, control activities, information and communication, and monitoring (COSO, 2004).

In general, the objectives and components of ERM mentioned in COSO 2017 are not significantly different from the 2004 version. Therefore, this study considers all eight components of ERM as presented by COSO (2004) to assess ERM, which can lead to ERM in the company being re-evaluated more reliably and legally.

ERM implementation

Implementation is the process whereby target users adopt, accept, and routinize an innovation into their normal working procedures (Kwon & Zmud, 1987). Many previous studies have examined various aspects of ERM implementation. Some research focused on the relationship between ERM implementation and market value of a company, particularly the extent to which the level of ERM implementation positively affects the value of listed companies. Other studies concerned factors associated with ERM implementation to find an explanation for organizations' responses to changing risk profiles by implementing ERM (Jean-Jules & Vicente, 2020).

Recent research has paid attention to the way that organizations actually implement ERM. For example, Altuntas, Berry-Stolzle, and Hoyt (2011) investigated the ERM implementation of German property-liability insurance companies, including the sequence evolving risk management process. However, these papers fail to consider the factors (social or technical factors) within the organization in terms of their concerns about the ERM integration requirements. Moreover, no study has systematically proposed factors that are critical to achieving ERM implementation.

According to Jules and Vicente (2020), the ERM implementation faced two potential challenges. The first challenge concerns business integration such as management's ability and work groups (Markus & Tanis, 2000), while the second challenge relates to social integration (Elbanna, 2007). The nature of ERM is that the creation and application processes take place in close proximity to the human or social element (Jean-Jules & Vicente, 2020). This synergy between the technical elements and the social elements gives rise to a socio-technical system (Scribante, Pretorius, & Benade, 2019). As this system, ERM is considered as a practical system with practical problems arising from a gap between the current state and the desired state, as is perceived by the social element involved (Jean-Jules & Vicente, 2020).

The social subsystem includes many factors such as the attributes of people (attitudes, values, skills), people relationship, rewards systems, and authority structures (Bostrom & Heinen, 1977), whereas the technology subsystem concerns the relationship between machines and the process to transform input to output (Bostrom & Heinen, 1977). Specifically, it comprises the set of physical and organizational elements with a view to achieve organizational objectives. In the context of ERM development and implementation, risk management involves complex interaction among departments and functional units. The ERM implementation relies on integration of internal activities, involving the integration of knowledge and management systems (Iansiti & Clark, 1994). Therefore, two components of technical systems that are an organizational change capacity and knowledge management process capacity seem to be the most relevant integrative capabilities to ERM development and implementation (Jean-Jules & Vicente, 2020).

Many previous researchers approached the topic of ERM from the viewpoint of assessing the value implications of ERM plan, determining an organization's risk appetite, or identifying and examining risk from an ERM perspective. They paid a little attention to describe ERM in technical terms

(Jean-Jules & Vicente, 2020). Therefore, in our study, we consider factors related to technical issues including organizational change capacity and knowledge management process capacity that are associated with ERM development and implementation. These factors are critical to achieving successful ERM implementation.

2.2 Underlying theory

The Resource Based View (RBV)

This theory explores the usefulness of analysing firms from the resource side rather than from the product size (Wernerfelt, 1984). This theory has emerged as an underlying theory in the risk management field (Saeidi et al., 2019). It emphasized the company's resource portfolio, resource identification, deployment, and development in order to increase organizations returns (Fahy, 2000). According to Barney (1991), rare and simultaneously valuable resources c ould create competitive advantages, and if these resources are also difficult to transfer, irreplaceable and hard to imitate, they will sustain the advantages. Such resources are known as strategic assets (Barney, 1991). Regarding ERM adoption, ERM can be considered as a strategic asset which could increase competitive advantage and organizational performance. The RBV has the main contribution for ERM research is that when all organizations have access to similar economic resources, only differences in management such as risk management can determine sustainable competitive advantage. Hence, this study confirms that the RBV is the underlying theory for ERM research, especially the relationship between ERM and organization performance.

The contingency theory

Contingency theory originated in organizational theory. This theory is based on two central findings. Firstly, there is not one best way to organize or manage an organization. Secondly, each specific method an organization could choose to organize or manage is not equally effective (Galbraith 1973). Researchers have utilized the contingency theory in significant topics including systems planning, systems design, systems implementation, performance, and user involvement (Dwivedi et al., 2009).

Academic studies of ERM, following the long-standing approach of contingency theory in organizational and management control research, have investigated the dependence of ERM performance outcomes on organizational context (Chenhall, 2003). Mike and Kaplan (2013) classified ERM literature into three categories, corresponding to three common contingency approaches that are selections studies, congruence studies, and longitudinal field studies. In the first stream, studies have identified few significant and design relevant ERM variables, attempting to match organization's ERM to firm specific contingencies. The second stream of large sample studies seeks to identify the performance implications of ERM implementations with mix results. The third and emerging stream of ERM research uses small sample or field studies to understand risk management, as an organizational and social practice, and has compiled sufficient evidence to suggest risk management practices vary considerably across firms or within an industry (Mike & Kaplan, 2013).

Thus, by adopting the contingency theory, we avoid recommending a universal risk management system that should be applied in all circumstances. Instead, we choose the second stream according to Mike and Kaplan (2013) and conduct research for the specific circumstances, specifically in Vietnam, that would guide the selection of an appropriate risk management system for an individual company.

2.3 Hypothesis and Research model

Knowledge management process capability

The characteristics of knowledge may lead to innovative solutions within a functional unit such as marketing, production, and finance. This affects problem solving and knowledge creation across functions (Carlile, 2002). Furthermore, interfaces between risk management steps which ERM follows such as risk identification, assessment, response, or treatment can constitute knowledge boundaries. Thus, in the ERM implementation, the organization must create a common language to describe risks. Besides, the interpretation and relevance of knowledge located on either side of the boundary needs to be exchanged across the semantic boundary based on a translation process. Knowledge integration capability (KIC) can create a mutual understanding, at least regarding risk management. This is mandatory for successful ERM implementation (Jean-Jules & Vicente, 2020).

KIC means knowledge that comes from outside or is accumulated within the organization is analysed and synthesized by an organization's combinative capability. KIC includes knowledge management process capability (KM process capability), learning culture, and technological capability. Among these factors, the KM process capability including creation, codification, transfer, and sharing of organizational knowledge is the selection process through which knowledge is valuable to an organization (Kim et al., 2012). Because the KM process capability is a component of KIC, it is identified, developed, and accumulated to enhance ERM adoption. Hence, we propose following hypothesis:

> *H1. KM process capability is a positive influence on the level of ERM implementation.*

Organizational change capacity

In addition to the KM process, organizational change capacity is also the factor of technological issues considered in this study. Organizational change capacity means the way an organization can use its managerial and organizational capabilities to

implement the kinds of changes that are necessary to achieve ERM adoption (Jean-Jules & Vicente, 2020). Moreover, organizational change capacity is also considered as a generalized dynamic organizational capability that enables an organization to react to environmental changes and anticipate opportunities (Judge & Elenkov, 2005). Because one significant aspect of ERM is the combination of all risk management activities into one integrated framework to support the identification of risks that originate mostly from a firm's external environment, the successful ERM implementation relies on the organization's capability to monitor its external environment (Jean-Jules & Vicente, 2020). Therefore, organizational change capacity is expected to allow the changes that are necessary to adopt ERM more successfully within the firm. From above discussion, we believe a strong signal for the second hypothesis:

> *H2. Organizational change capacity is a positive influence on the level of ERM implementation.*

ERM and Organization performance

Performance is one of the key indicators that show the level of society development (Ahmed & Manab, 2016). The performance of a firm is an indication that helps to evaluate and measure how an organization succeeds in achieving business objectives to all its related parties (Saeidi, Sofian, & Rasid, 2014; Antony & Bhattacharyya, 2010). Organization performance is a key concept and the major concern of strategic management (Venkatraman & Ramanujam, 1986). An influence of ERM on organization performance has various results from previous studies. However, most studies support that ERM implementation creates value and enhances performance of a firm (Ping & Muthuveloo, 2015). Furthermore, Lai (2011) showed that successful ERM implementation will create value for stakeholders by reduced capita cost and enhanced firm performance.

Organization performance is measured in different types of performance indicators. Some researchers use financial measures to explain organization performance such as return ratios (Saeidi et al., 2014). However, for a more comprehensive measurement, it is necessary to use both financial and non-financial indicators. Moreover, non-financial measures are better forecasters of a long run firm's performance (Hussain & Hoque, 2002). For instance, Judge et al. (2003) used both financial and non-financial indicators to measure firm performance such as process improvements, customer satisfaction, capacity utilization, and product service quality (Judge, Naoumova, & Koutzevol, 2003). Adapted from the study of Ping and Muthuveloo (2015), this study measured organization performance by both financial indicators and non-financial indicators (Ping & Muthuveloo, 2015). We propose the development of the following hypothesis:

> *H3. ERM implementation has a positive and significant impact on organization performance.*

ERM and IT Structure

Previous research determined different factors to measure IT including IT infrastructure, IT capabilities, IT resources, IT investment, IT acquisition (Saeidi et al., 2019). According to Saeidi et al. (2019) and Bergerona et al. (2004), IT could be classified into two groups: IT strategy and IT structure. IT structure is divided into IT planning and control and IT acquisition and implementation (Bergeron et al., 2004).

Sugumaran and Arogyaswamy (2003; 2004) identified an IT effectiveness model based on the relations of the contingent variable external environment, strategy, structure, and culture between the modes of IT deployment. Furthermore, Otley (1980) argued that IT must be predicated on the effectiveness of the organization as well as the interrelation of the typical contingency variables including technology, environment, organizational form, and organization objectives. In the context of ERM, environment, organizational form, and organization objectives are considered as components of ERM. Therefore, ERM might have an impact on IT structure based on Otley's study. Furthermore, Saeidi et al. (2009) concluded that proper IT structure would result in strengthening ERM implementation and their effect on competitive advantage in firms. Inheriting from studies of Otley (1980) and Sugumaran and Arogyaswamy (2004), we believe that ERM impacts on IT structure as following hypothesis:

> *H4. ERM implementation has a positive and significant impact on IT structure.*

IT Structure and Organization performance

The role of IT in creating organizational value has been the subject of many studies in recent years. IT is considered as a tool to create a firm's performance (Saeidi et al., 2019; Bhatt & Grover, 2005). According to Bhatt and Grover (2005), advanced IT features permit organizations to react quickly towards harmful threats or grasp available opportunities. Successful IT structure leads to improve in organization performance. Based on this argument, we propose:

> *H5. IT structure has a positive and significant impact on organizational performance.*

Inheriting from the contingency theory, the RBV, and related empirical studies, the empirical model for this paper is following:

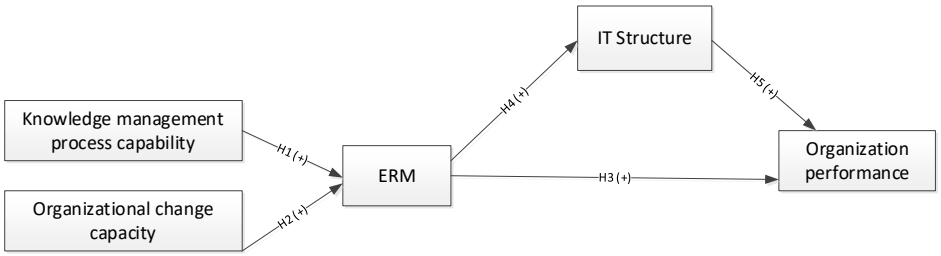


Fig. 1. The proposed research model

3. METHODOLOGY

3.1 Measures

The scales of five latent variables in this research model used existing validated items from popular previous studies. The 5-point Likert scale is employed for all items in this research ranging from 1 (strongly disagree) to 5 (strongly agree). Firstly, the items for ERM are adopted by scale development research of Saeidi et al. (2019). This scale has eight dimensions including internal environment (IE), objective setting (OS), event identification (EI), risk assessment (RA), risk response (RR), control activities (CA), information and communication (IC), and monitoring (MO). The organization performance variable encompasses two components. The first dimension is firm performance (FP) whose questionnaire is based on instruments provided by Lee and Choi (2003) and another one is operational performance (OP) which uses scale from Chuang (2013). For organizational change capacity (OCC) measurement, its scale was discovered from study of Judge and Douglas (2009) consisting of eight dimensions: trustworthy leadership (TL), involved mid-management (IMM), capable champions (CC), innovative culture (IC), trusting followers (TF), systems thinking (ST), accountable culture (AC), and systems communication (SC).

With respect to KM process capability (KMP), measurement is inherited from the scales in research of Kim et al. (2012). Lastly, to evaluate IT structure (ITS), this work applies scale by following Bergerona et al. (2004). These two variables are in one dimension scale form.

3.2 Sampling

This study aims to identify and measure the impact of ERM on organization performance through the support of IT structure, so the online survey questionnaire is designed and sent to employees and managers. We use an online survey because of the many advantages of this mode of data collection (Bhattacherjee, 2001) and COVID – 19 pandemics. The self-administered survey was conducted for 186 respondents. To ensure data quality, we exclude participants who declined to thoughtfully provide their best answers, who appear to not be providing considered responses or provided answers that indicated a lack of content responsiveness (Parsons et al., 2014). After performing data processing, 158 observations were guaranteed to be relevant and used for data analysis.

Table 1. Sample descriptive statistics

Characteristics	*Frequencies*	*Percentage*
Sector		
Manufacturing – Trade	18	11.4
Services	68	43.0
Manufacturing – Trade - Services	24	15.2
Education	7	4.4
Medical	9	5.7
Construction	5	3.2
Others	27	17.1
Business type		
Private company	98	62.0
Foreign invested company	22	13.9
State enterprise	17	10.8
Business and administrative unit	14	8.9
Others	7	4.4
Location		
HCM city	138	87.3
Other provinces	20	12.7

Our data set includes participants working in different business sectors. Among 158 enterprises surveyed, manufacturing, trade, and services enterprises accounted for 69.6% of the total. M ost of them are private enterprises (62%), while other types of business account for 38%. Moreover, 87.3 percent of companies

are located in Ho Chi Minh city where is the largest and most developed city in Vietnam (*Table 1*).

For the surveyed respondents' positions in companies, approximately 76.6% participants are employees, whereas business directors, managers, and vice managers account for 24.4%. The experience years of these respondents are quite high. Specifically, 25.9% respondents have working years less than 2 years, 35.4% of them work for 2-5 years, 38.7% account for greater than 5 working years. Finally, 75.9 per cent of participants are females, and 24.1 per cent are males. The diversity of individual demographic shows the high representative level of the sample (*Table 2).*

Table 2. Demographic profiles of the respondents

Characteristics	*Frequencies*	*Percentage*
Position		
Director/Head	2	1.3
Deputy Director/Deputy Head	2	1.3
Head of Department	24	15.2
Deputy Head of Department	9	5.7
Employee	121	76.6
Working year		
< 2 years	41	25.9
2 – 5 years	56	35.4
5 – 10 years	35	22.2
> 10 years	26	16.5
Gender		
Male	38	24.1
Female	120	75.9

4. ANALYSIS AND RESULTS

This study analysed the data in two stages. First, we started with assessing nonresponse bias and robustness test. Second, to perform a statistical analysis on the collected data, we used Structural Equation Modelling (SEM) and Partial Least Square (PLS) (Hair et al., 2012). The empirical results were evaluated through the following two steps: examining the validity and reliability of the scales (measurement model), and hypotheses testing (structural model) (Hair et al., 2016).

Nonresponse and Robustness test

We tested for possible nonresponse bias through an independent sample *t-test*. Based on Armstrong and Overton (1977), survey responses were split into early and late respondents, and analysed for differences in key demographic and study variables. The SPSS analysis results showed that the *t-test* did not yield statistically significant mean differences between the groups. Therefore, nonresponse was not biased in this study.

To improve the value of these research findings, some robustness methods were also conducted in this study. First, our research design also made the data susceptible to mono-method bias. We frequently employed statistical techniques to examine common method variance (CMV) (Sharma, Yetton & Crawford, 2009). Based on the result of Harman's single-factor test, we found no apparent bias in our data (Malhotra, Kim & Patil, 2006). One factor only accounted for 32.8% of the total variance, which justified that CMV was not a serious problem (Podsakoff & Organ, 1986). Moreover, the Variance Inflation Factor (VIF) was also used to test CMV in the context of PLS (Kock, 2015). All these VIF indexes are lower than the acceptable thresholds of 3.3, therefore, CMV did not exist in this study.

Second, regarding the structural model estimate's robustness, FIMIX-PLS technique was applied to test unobserved heterogeneity as proposed by Hair et al. (2017). Running FIMIX-PLS dropped in the two segments solution as the segment size of the third segment solution is too small (5.5%) which is lower than the threshold of a reasonable segment of 25%. The results shown in *Table 3* indicate that all criteria including AIC, AIC3, AIC4, BIC, and CAIC are highest at the first segment solution in comparison with the second segment solution. Overall, in combination these results indicated that heterogeneity was not prevalent in this research data.

Table 3. Results of unobserved heterogeneity test

	Segment 1	*Segment 2*	*Segment 3*
AIC (Akaike's Information Criterion)	6,147.950	4,910.986	4,416.505
AIC3 (Modified AIC with Factor 3)	6,196.950	5,009.986	4,565.505
AIC4 (Modified AIC with Factor 4)	6,245.950	5,108.986	4,714.505
BIC (Bayesian Information Criteria)	6,298.017	5,214.183	4,872.831
CAIC (Consistent AIC)	6,347.017	5,313.183	5,021.831
HQ (Hannan Quinn Criterion)	6,208.894	5,034.118	4,601.825

MDL5 (Minimum Description Length with Factor 5)	7,290.286	7,218.970	7,890.138
LnL (LogLikelihood)	-3,024.975	-2,356.493	-2,059.252
EN (Entropy Statistic (Normed))		0.993	0.999
NFI (Non-Fuzzy Index)		0.995	1.000
NEC (Normalized Entropy Criterion)		1.086	0.154

In PLS-SEM, relationships between constructs can take various forms that might be linear relationships or nonlinear relationships. Therefore, we tested whether nonlinear relationships occur or not. The analysis indicated that nonlinear effects did not exist in our data because the quadratic effects of exogenous variables in the model were not significant (Hair et al., 2017) (*Table 4*).

Table 4. Results of Evaluation of Nonlinear Effects

	T Statistics	*P Values*
ERM_quadratic -> ITS	0.220	0.826
ERM_quadratic -> PER	1.702	0.089
ITS_quadratic -> PER	1.269	0.205
KMP_quadratic -> ERM	0.971	0.332
OCC_quadratic -> ERM	1.431	0.153

Measurement model evaluation

Table 4 shows descriptive statistics of constructs from 158 responders. Mean of all constructs are from 3.733 to 4.139 and Std. Deviation fluctuations were [0.657; 0.915].

In order to assess the measurement model, the indicators were subject to convergent and discriminant validity along with reliability analysis. Following Hair et al. (2017), the convergent validity of this study was calculated through factor loading and Average Variance Extracted (AVE) for all items (questions) and constructs. We eliminated items comprising accountable culture (AC1), involved mid-management (IMM3 and IMM4), internal environment (IE3 and IE5), information and communication (ICO1), objective setting (OS1 and OS2), risk assessment (RA1), risk response (RR4), IT structure (ITS4 and ITS9), and operational performance (OP2) due to insufficient factor loadings or cross-factor loadings. The factor loading ranged from 0.701 to 0.926 which met the adequate value above 0.7 (Hair et al., 2017) and AVE from 0.559 to 0.805 which is higher than the minimum 0.5 thresholds (Fornell & Larcker, 1981) (*Table 5*). Convergent validity is also verified through the *t*-statistic for each factor loading. The *t*-statistic for each outer loading had to get statistical significance (Hair et al., 2016). In this research, the loading of each item is significant at the $p < 0.001$ level.

Internal consistency reliability was traditionally evaluated with the Cronbach's alpha (CA) criterion (Hair et al., 2014; Cronbach, 1951) which suggested to be more than 0.7 for each variable. *Table 5* indicates that CA values reach the value higher than 0.7. We also used an alternative measure of internal consistency reliability, i.e., composite reliability (CR) as suggested by Hair et al. (2017). A CR of all the constructs is also higher than 0.7, as suggested by Fornell and Larcker (1981). Overall consideration, it can infer that all criteria of the measurement model including the validity and reliability of instrument and constructs were verified.

Table 5. Results of measurement model evaluation

Constructs	*No. of items*	*Mean*	*SD*	*Loadings*	*Internal consistency reliability*		*AVE*
					Cronbach's Alpha	*Composite Reliability*	
					0.6 – 0.95	*0.7– 0.95*	
KM Process Capability (KMP)	5	3.902	0.693	0.799 - 0.874	0.898	0.924	0.710
Trustworthy leadership (TL)	4	3.954	0.743	0.762 - 0.848	0.822	0.882	0.652
Involved mid-management (IMM)	4	3.992	0.663	0.886 - 0.902	0.749	0.888	0.799
Capable champions (CC)	4	4.139	0.673	0.816 - 0.878	0.871	0.911	0.720
Innovative culture (IC)	4	3.992	0.743	0.704 - 0.872	0.820	0.882	0.653
Trusting followers (TF)	4	4.044	0.657	0.721 - 0.881	0.847	0.898	0.688
Systems thinking (ST)	4	3.886	0.728	0.710 - 0.869	0.833	0.888	0.667
Accountable culture (AC)	4	4.041	0.698	0.866 - 0.885	0.852	0.910	0.770
Systems communication (SC)	4	4.084	0.699	0.796 - 0.920	0.906	0.935	0.783
Internal Environment (IE)	5	3.782	0.915	0.814 - 0.879	0.804	0.885	0.719
Objective Setting (OS)	7	4.051	0.738	0.770 - 0.874	0.891	0.920	0.698

Event Identification (EI)	3	3.939	0.744	0.816 - 0.869	0.798	0.882	0.713
Risk Assessment (RA)	4	3.733	0.838	0.818 - 0.847	0.779	0.872	0.694
Risk Response (RR)	4	3.911	0.670	0.775 - 0.904	0.767	0.866	0.684
Control Activities (CA)	4	3.907	0.755	0.752 - 0.793	0.774	0.855	0.596
Information and Communication (ICO)	5	3.863	0.762	0.742 - 0.817	0.792	0.865	0.616
Monitoring (MO)	4	3.951	0.692	0.760 - 0.809	0.800	0.870	0.626
IT Structure (ITS)	18	3.914	0.710	0.701 - 0.812	0.950	0.955	0.559
Firm Performance (FP)	5	3.848	0.781	0.877 - 0.926	0.917	0.942	0.801
Operational performance (OP)	3	3.873	0.703	0.893 - 0.901	0.757	0.892	0.805

The assessment of the discriminant validity was conducted via Heterotrait-Monotrait Ratio (HTMT) criterion, Fornell and Larcker's test at the construct level and Cross-loading at the item level (Hair et al., 2017). *Table 6* shows that all HTMT of constructs were importantly smaller than 1 (Henseler et al., 2016). The AVE square root for each variable was greater than the squared correlations for all pairs of variables (Fornell & Larcker, 1981). In addition, cross loadings on corresponding constructs were higher than the cross-factor loadings. This justifies sound discriminant validity of scales.

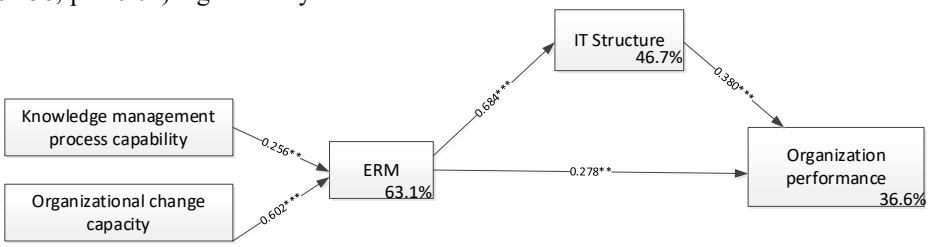
Table 6. Results of discriminant validity (HTMT)

	AC	CA	CC	EI	FP	IC	ICO	IE	IMM	ITS	KMP	MO	OP	OS	RA	RR	SC	ST	TF
CA	0.611																		
CC	0.637	0.553																	
EI	0.377	0.515	0.430																
FP	0.313	0.430	0.319	0.271															
IC	0.672	0.525	0.781	0.423	0.505														
ICO	0.603	0.803	0.501	0.559	0.561	0.660													
IE	0.514	0.708	0.509	0.555	0.363	0.432	0.673												
IMM	0.674	0.710	0.746	0.552	0.529	0.694	0.628	0.663											
ITS	0.561	0.614	0.517	0.463	0.538	0.656	0.682	0.509	0.617										
KMP	0.543	0.612	0.541	0.455	0.397	0.579	0.616	0.535	0.706	0.756									
MO	0.621	0.740	0.677	0.567	0.474	0.705	0.783	0.724	0.715	0.739	0.708								
OP	0.396	0.507	0.348	0.350	0.677	0.607	0.638	0.386	0.502	0.623	0.531	0.589							
OS	0.607	0.698	0.630	0.609	0.472	0.631	0.672	0.599	0.690	0.555	0.597	0.766	0.418						
RA	0.486	0.622	0.411	0.708	0.394	0.399	0.627	0.481	0.601	0.525	0.494	0.592	0.456	0.618					
RR	0.585	0.679	0.584	0.771	0.379	0.573	0.729	0.531	0.625	0.669	0.603	0.729	0.493	0.730	0.619				
SC	0.783	0.682	0.743	0.396	0.533	0.696	0.546	0.529	0.779	0.642	0.651	0.706	0.529	0.672	0.543	0.527			
ST	0.679	0.630	0.585	0.433	0.499	0.743	0.510	0.471	0.615	0.729	0.633	0.700	0.578	0.603	0.547	0.558	0.702		
TF	0.695	0.684	0.837	0.393	0.532	0.886	0.645	0.527	0.794	0.675	0.625	0.795	0.561	0.635	0.487	0.617	0.738	0.742	
TL	0.550	0.675	0.650	0.461	0.487	0.744	0.612	0.623	0.785	0.575	0.595	0.711	0.574	0.546	0.445	0.488	0.586	0.718	0.668

Structural model (hypotheses testing)

To test the hypotheses, a path-weighting scheme was utilized in this study. In the structural model, the bootstrapping technique with 5,000 resamples was used to estimate the magnitude and significance of path coefficients (β) at the confidence level of 95%. Fig. 2. shows that both organizational change capacity (β = 0.602, p < 0.001) and knowledge management process capability (β = 0.256, p < 0.01) significantly affect the same direction to ERM implementation, confirming H2 and H1.

The hypothesis of ERM (β = 0.278, p < 0.01) has a positive significant effect on organization performance, supporting H3. ERM implementation also impacts on IT structure (β = 0.684, p < 0.001) (H4 is accepted). In addition, IT structure has influence on organization performance (β = 0.380, p < 0.001).



*Note: *** p < .001.; ** p < .01; * p < 0.05*

Fig. 2. Results of PLS path modelling

Mediated variables analysis

Mediation analysis of IT structure in the model, we tested the significance of the indirect effect and direct effect in two situations - existing IT structure and no existing IT structure (Hair et al., 2017). Following the results displayed in *Table 7*, IT structure partially mediated the relationship from ERM to organization performance. To further substantiate the type of partial mediation, we next computed the product of the direct and indirect effects. Because both the direct and indirect effects are positive, the sign of their product is also positive. Therefore, IT structure represents complementary mediation of the correlation of ERM and organization performance.

Table 7. Testing the role of mediated variables

Mediation model	*Direct effects*			*Indirect effects*			Conclusion
	Path Coefficient	P Values	Sig.	Path Coefficient	P Values	Sig.	
ERM → ITS →PER	0.537	0.000	Yes	0.278	0.002	Yes	Partial mediation (Complementary)

Post-hoc analyses

We ran several additional tests to examine our data sets. First, this paper examined coefficients of determination and effect size. The coefficients of determination test determined the amount of variance of the dependent variable explained by the independent variable. Generally, this value is known as R square (R^2), which varies between 0 and 1 (Hair *et al.*, 2017). The results indicated the strong explanation of the model as R^2 of ERM, IT structure, and organization performance were relatively high at 0.631, 0.467, and 0.366, respectively. Furthermore, this study examined the effect size (f^2) measures the contribution of an exogenous construct to the R^2 value of an endogenous latent variable (Hair et al., 2017). According to Chin (1998), the f^2 values can be interpreted as follows: > 0.02 = weak effect; > 0.15 = moderate effect; > 0.35 = strong effect. *Table 8* shows that while there is a weak effect of ERM on organization performance, the effect size of IT structure is 0.121 for organization performance which is almost a strong effect size. For explaining ERM, both organizational change capacity and knowledge management process capability have strong effect size. Finally, ERM has a strong impact on IT structure.

Table 8. Effect size and variance inflation measures for the structural models

	Effect size			*VIF*		
	ERM	ITS	PER	ERM	ITS	PER
KMP	1.000			1.766		
OCC	0.556			1.766		
ERM		0.877	0.065		1.000	1.877
ITS			0.121			1.877

Second, Q^2 values were used to evaluate the predictive related matter of the path model . The findings indicated that Q^2 values of ERM, IT structure, and performance are 0.226, 0.232, and 0.216, respectively that are considerably above zero. Therefore, they provided support for the model's predictive relevance regarding the endogenous latent variables (Hair et al., 2016).

Third, we checked for multicollinearity through the VIF index. The collinearity diagnostics given in *Table 8* shows that VIF for the independent variables is higher than 0.20 (lower than 5) which further suggests

that multicollinearity does not exist among the independent variables (Hair et al., 2016).
Finally, we used the goodness-of-fit index (GoF) to investigate the quality of the whole model. According to Tenenhaus et al. (2005), this value is calculated by taking the geometric mean of AVE for latent variables and the average R^2 for endogenous variables. The GoF value was 0.583 and exceeded the cut-off value of 0.36 for the large effect of R^2 (Wetzels et al., 2009). It supported that the proposed research model was highly relevant (Hair et al., 2016).

5. DISCUSSION AND IMPLICATIONS

5.1 Discussion

In this paper, we investigated whether a firm ERM process is linked to firm performance. We also examined the interaction role of IT structure in this relationship and factors that influence ERM implementation. We found that both organizational change capacity and knowledge management process had significant impacts on ERM. These effects were confirmed in the study of Jean-Jules and Vicente (2020) and Kim et al. (2012). Therefore, this study provided evidence that the successful ERM implementation relies on an organization's capability to monitor its external environment as well as the valuable knowledge selection process for that organization.

The results of data analysis revealed that ERM implementation displayed a significantly positive impact on organization performance, thus giving support to the theoretical claims by prior researchers regarding performance implications associated with the implementation of ERM (Judge, Ping & Muthuveloo, 2015; Saeidi et al., 2014; Lai, 2011; Naoumova, & Koutzevol, 2003; Hussain & Hoque, 2002). This finding inferred the higher the effectiveness of an organization's ERM, the greater the ability of the organization to achieve its goals.

The impact of ERM implementation on IT structure was reliably confirmed by the contingency theory and previous studies (Sugumaran and Arogyaswamy, 2004; Otley, 1980). It means that the successful ERM implementation would lead to an IT effectiveness system.

Furthermore, the effects of IT structure on organization performance were also found to be positive and significant. This result explained that the firm performance could be greater by improving its technology. In contrast, inefficient, obsolete, and outdated technology could be a source of decreasing organizational results. The positive relationship between IT structure and organization performance could be interpreted as a support to past research such as Saeidi et al. (2019) and Bhatt and Grover (2005).

Finally, based on the findings, this study concluded that the positive relationship between ERM implementation and organization performance was affected by IT structure as a mediating variable. Specifically, IT structure represented complementary mediation of this relationship. There is a support for contingency theory system approach that researchers should have an overview of contingencies and performance relationships in order to better understand the organizational variables and their functions (Saeidi et al., 2019). The evidence from our study revealed that IT structure could be considered as contingencies variables which can enhance ERM implementation effectiveness on organization performance. This result was supported by the RBV and studies like Saeidi et al. (2019).

5.2 Research implications

The findings of this study provide several implications regarding both theoretical and practical implications. Referring to theoretical contributions, this work developed an empirical model to explore the mediate role of IT structure in ERM implementation and organization performance relationship. Furthermore, this study also reveals that the successful ERM implementation is influenced by two primary organizational factors including organizational change capacity and KM process capability. These results supported and shed additional light on evidence which were discovered from previous studies. Besides, the combined application of both the contingency theory and the RBV into this work to explore constructs of the research model, it can be further confirmed that these two theories can be used in ERM research and pointed out that both theories are suitable for research ERM in developing countries, namely Vietnam. Therefore, our analysis has contributed valuable references to the worldwide literature on ERM, especially for emerging markets such as Vietnam, where ERM research is still infant.
Regarding the practical aspect, this work supplements several valuable implications for top managers of organizations. The results of this research showed that variance of organization performance was explained at 36.6% by exogenous variables in this research model. Among these exogenous variables, ERM has a significant positive effect on organization performance with an impact level of approximately 27.8%. These findings help managers understand more clearly of the ERM system and its important potential role in motivating their company's performance. Hence, managers should focus on developing and boosting ERM implementation to enhance overall organization performance.
In addition, this study explored that IT structure not only has direct significant influence on firm performance (38.0%), but also acts as a mediate variable in the complementary form in the relationship between ERM implementation and organization performance. Due to the importance of IT structure is

emphasized in this research, managers should consider utilizing and investing in IT structure as an instrument to increase the influence of ERM implementation on organization performance. Moreover, this investment strategy is also useful to help their firms respond to uncertainties and rapid changes of business and technology environment in the current digital era.

ERM implementation is impacted significantly by organizational change capacity and knowledge management process capacity with impact level 60.2% and 25.6%, respectively. These factors considerably explain the variance of ERM implementation at 63.1%. Hence, managers need to understand that improving the scope and effectiveness of organizational change capacity and knowledge management process capacity within their organization could lead to successful ERM implementation. They should pay attention to these two factors in the development and implementation of ERM in their organization.

In addition, the research will be a useful reference for policymakers and regulatory agencies in establishing proper policies to motivate organizations to develop ERM as well as IT structure to have an effective ERM system and organization performance.

6. CONCLUSION

The current research constitutes one of the first empirical steps toward a greater understanding of ERM implementation, IT structure, and performance of enterprise. PLS analysis certified that IT structure is a complementary mediate variable in the influencing from ERM implementation to organization performance. In addition, both organizational change capacity and KM process capability are significant factors that control the variability of ERM systems. Overall, this study could be the reference point for academic and non-academic in the field of ERM, IT, and performance.

As with any empirical study, this research has some weaknesses that need to be considered in further studies. First, as the present study was conducted in Vietnam, there is a possibility that the result may be different in other countries. Second, the responses to this study were voluntary, and thus, inevitably subject to self-selection variance. Third, this study is cross-sectional, which allows the elaboration of correlations between variables but lacks confidence in causality exploration. We suggest that future scholars should explore relationships among ERM, IT structure, and organization performance in a longitudinal design to yield a more lucid understanding.

REFERENCES

[1] Ahmed, I., and Manab, N. A. (2016), "Influence of enterprise risk management success factors on firm financial and non-financial performance: A proposed model", *International Journal of Economics and Financial Issues*, *6*(3).

[2] Altuntas, M., T. R. Berry-Stolzle, and R. E. Hoyt. (2011), "Implementation of Enterprise Risk Management: Evidence from the German Property-Liability Insurance Industry", The Geneva Papers on Risk and Insurance - Issues and Practice 36 (3): 414–439.

[3] Antony, J. P., & Bhattacharyya, S. (2010). Measuring organizational performance and organizational excellence of SMEs–Part 2: an empirical study on SMEs in India. *Measuring business excellence*.

[4] Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of marketing research*, *14*(3), 396-402.

[5] Balugon, J., & Hope Hailey, V. (2004). Exploring strategic change. London: Prentice Hall.

[6] Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management*, *17*(1), 99-120.

[7] Baxter, R., Bedard, J. C., Hoitash, R., & Yezegel, A. (2013). Enterprise risk management program quality: Determinants, value relevance, and the financial crisis. *Contemporary Accounting Research*, *30*(4), 1264-1295.

[8] Bergeron, F., Raymond, L., & Rivard, S. (2004). Ideal patterns of strategic alignment and business performance. *Information & management*, *41*(8), 1003-1020.

[9] Bhatt, G. D., & Grover, V. (2005). Types of information technology capabilities and their role in competitive advantage: An empirical study. *Journal of management information systems*, *22*(2), 253-277.

[10] Bostrom, R. P., & Heinen, J. S. (1977). MIS problems and failures: a socio-technical perspective, part II: the application of socio-technical theory. *MIS quarterly*, 11-28.

[11] Bromiley, P., McShane, M., Nair, A., &

Rustambekov, E. (2015). Enterprise risk management: Review, critique, and research directions. *Long range planning*, *48*(4), 265-276.

[12] Carlile, P. R. (2002). A pragmatic view of knowledge and boundaries: Boundary objects in new product development. *Organization science*, *13*(4), 442-455.

[13] Chapman, R.J. (2012). *Simple Tools and Techniques for Enterprise Risk Management*. Chichester, West Sussex, UK: John Wiley & Sons, Ltd.

[14] Chenhall, R. H. (2003). Management control systems design within its organizational context: findings from contingency-based research and directions for the future. *Accounting, Organizations and Society*, *28*(2-3), 127-168.

[15] Chin, W. W. (1998). Commentary: Issues and opinion on structural equation modeling.

[16] COSO, I. (2004). Enterprise risk management-integrated framework. *Committee of Sponsoring Organizations of the Treadway Commission*, *2*.

[17] Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *psychometrika*, *16*(3), 297-334.

[18] Dwivedi, Y. K., Lal, B., Williams, M. D., Schneberger, S. L., & Wade, M. (Eds.). (2009). *Handbook of research on contemporary theoretical models in information systems*. Igi Global.

[19] Elbanna, A. R. (2007). Implementing an integrated system in a socially dis-integrated enterprise. *Information Technology & People*.

[20] Ellul, A., and V. Yerramilli. (2012). Stronger risk controls, lower risk: Evidence from U.S. bank holding companies. *Journal of Finance 68* (5): 1757–1803.

[21] Fahy, J. (2000). The resource-based view of the firm: some stumbling-blocks on the road to understanding sustainable competitive advantage. *Journal of European Industrial Training*.

[22] Farrell, M., & Gallagher, R. (2019). Moderating influences on the ERM maturity-performance relationship. *Research in International Business and Finance*, *47*, 616–628.

[23] Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics.

[24] Galbraith, J. (1973). Designing complex organizations. Reading, MA: Addison-Wesley

[25] Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: an organizational capabilities perspective. *Journal of Management Information Systems*, *18*(1), 185–214.

[26] Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage publications.

[27] Hair Jr, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European business review*.

[28] Hair Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2017). *Advanced issues in partial least squares structural equation modeling*. saGe publications.

[29] Hair, J. F., Sarstedt, M., Pieper, T. M., & Ringle, C. M. (2012). The use of partial least squares structural equation modeling in strategic management research: a review of past practices and recommendations for future applications. *Long range planning*, *45*(5-6), 320-340.

[30] Heckmann, N., Steger, T., & Dowling, M. (2016). Organizational capacity for change, change experience, and change project performance. *Journal of Business Research*, *69*(2), 777-784.

[31] Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial management & data systems*.

[32] Hoyt, R. E., & Liebenberg, A. P. (2011). The value of enterprise risk management. *Journal of risk and insurance*, *78*(4), 795-822.

Hunziker, S., & Balmer, P. (2018). Enterprise Risk Management in Schweizer Unternehmen. In *Ganzheitliches Chancen-und Risikomanagement* (pp. 89-111): Springer.

[33] Iansiti, M., & Clark, K. B. (1994). Integration and dynamic capability: evidence from product development in automobiles and mainframe computers. *Industrial and corporate change*, *3*(3), 557-605.

[34] Jean-Jules, J., & Vicente, R. (2020). Rethinking the implementation of enterprise risk management (ERM) as a socio-technical challenge. *Journal of Risk Research*, 1-20.

[35] Judge, W. Q., and D. Elenkov. (2005). Organizational Capacity for Change and Environmental Performance: An Empirical Assessment of Bulgarian Firms. *Journal of Business Research 58*(7): 893–901.

[36] Judge, W. Q., Naoumova, I., & Koutzevol, N. (2003). Corporate governance and firm performance in Russia: An empirical study. *Journal of World Business*, *38*(4), 385-396.

[37] Khan, S. N., & Ali, E. I. E. (2017). The moderating role of intellectual capital between enterprise risk management and firm performance: A conceptual review. *American Journal of Social Sciences and Humanities*, *2*(1), 9–15.

[38] Kim, Y. J., Song, S., Sambamurthy, V., & Lee, Y. L. (2012). Entrepreneurship, knowledge integration capability, and firm performance: An empirical study. *Information Systems Frontiers*, *14*(5), 1047-1060.

[39] Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration (ijec)*, *11*(4), 1-10.

[40] Kwon, T. H., & Zmud, R. W. (1987). Unifying the fragmented models of information systems implementation. In *Critical issues in information systems research* (pp. 227-251).

[41] Lai, F. W. (2011). A strategic framework for value enhancing enterprise risk management.

[42] Liebenberg, A. P. & Hoyt, R. E. (2003). The Determinants of Enterprise Risk Management: Evidence from the Appointment of Chief Risk Officers. *Risk Management and Insurance Review, 6*, 37-52.

[43] Malhotra, N. K., Kim, S. S., & Patil, A. (2006). Common method variance in IS research: A comparison of alternative approaches and a reanalysis of past research. *Management science*, *52*(12), 1865-1883.

[44] Markus, M. L., & Tanis, C. (2000). The enterprise systems experience-from adoption to success. *Framing the domains of IT research: Glimpsing the future through the past*, *173*(2000), 207-173.

[45] Mike, A., & Kaplan, R. (2013). Towards a contingency theory of enterprise risk management [Electronic version]. *Harvard Business School Press Working Paper*, 13-063.

[46] Mikes, A., & Kaplan, R. S. (2014). *Towards a contingency theory of enterprise risk management.* AAA.

[47] Otley, D. T. (1980). The contingency theory of management accounting: Achievement and prognosis. *Accounting, Organizations and Society*, *5*(4), 413–428.

[48] Ping, T. A., & Muthuveloo, R. (2015). The impact of enterprise risk management on firm performance: Evidence from Malaysia. *Asian Social Science*, *11*(22), 149.

[49] Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of management*, *12*(4), 531-544.

[50] Rolland, H. (2008). Using IT to Drive Effective Risk Management. *Risk Management, 55*, 43-43.

[51] Saeidi, P., Saeidi, S. P., Gutierrez, L., Streimikiene, D., Alrasheedi, M., Saeidi, S. P., & Mardani, A. (2020). The influence of enterprise risk management on firm performance with the moderating

effect of intellectual capital dimensions. *Economic Research*-Ekonomska Istraživanja, 1-30.

[52] Saeidi, P., Saeidi, S. P., Sofian, S., Saeidi, S. P., Nilashi, M., & Mardani, A. (2019). The impact of enterprise risk management on competitive advantage by moderating role of information technology. *Computer Standards & Interfaces*, *63*, 67-82.

[53] Saeidi, P., Sofian, S., & Rasid, S. Z. B. A. (2014). A proposed model of the relationship between enterprise risk management and firm performance. *International Journal of Information Processing and Management*, *5*(2), 70.

[54] Scribante, N. P., Pretorius, L., & Benade, S. (2019). The design of a research tool for conducting research in a complex socio-technical system. *South African Journal of Industrial Engineering*, *30*(4), 143-155.

[55] Sharma, R., Yetton, P., & Crawford, J. (2009). Estimating the effect of common method variance: The method—method pair technique with an illustration from TAM Research. *Mis Quarterly*, 473-490.

[56] Sugumaran, V., & Arogyaswamy, B. (2003–2004). Measuring IT performance: Contingency. *Journal of Computer Information Systems*, *44*(2), 79–86.

[57] Tenenhaus, M., Vinzi, V. E., Chatelin, Y. M., & Lauro, C. (2005). PLS path modeling. *Computational statistics & data analysis*, *48*(1), 159-205.

[58] Venkatraman, N., & Ramanujam, V. (1986). Measurement of business performance in strategy research: A comparison of approaches. *Academy of management review*, *11*(4), 801-814.

[59] Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic management journal*, *5*(2), 171-180.

[60] Wetzels, M., Odekerken-Schröder, G., & Van Oppen, C. (2009). Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration. *MIS quarterly*, 177-195.

[61] Wilkinson, M. (2011). *The Role of Technology in Risk Management*. Available at:https://www.towerswatson.com/enGB/Insights/IC-Types/Ad-hoc-Point-of View/2011/Insights-The-role-of-technology-in-risk-management.