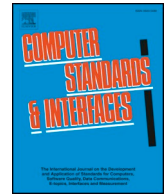




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## The impact of enterprise risk management on competitive advantage by moderating role of information technology

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## ABSTRACT

The main purpose of this paper is to examine the influence of Enterprise Risk Management (ERM) on Competitive Advantage (CA) by moderating role of information technology dimensions including Information Technology (IT) strategy and Information Technology (IT) structure. A total of 84 valid questionnaires were obtained through self-administered survey conducted at Iranian financial institutions. Partial Least Squares Structural Equation Modelling (PLS-SEM) approach was conducted for the analysis of data and hypotheses testing. The findings of this study showed that ERM had a positive relationship with the firms' competitive advantage. The results also showed that IT strategy and IT structure had a direct effect on the competitive advantage as well as moderating effect on ERM-competitive advantage relationship. This study extends on previous ERM studies by considering Iran as a developing country which is neglected among previous empirical researches. It also extends previous ERM works by empirically evaluating ERM, IT, competitive advantage and relationships among them. This paper provides insights into the value of implementation of ERM among organizations which could lead to improve competitive advantage. In addition, this study provides implication in terms of manager's planning and decision making to consider IT as one of the critical success factors of ERM practices.

### 1. Introduction

Nowadays, organizations are exposed to a large number of risks from different sources such as globalization, deregulation, environmental changes, technological changes, complicated financial model, and corporate governance changes [53,55,120]. In such a dynamic context, increasing the competitive advantage becomes one of the major challenges among organizations. Improving competitive advantage is greatly dependent on the enhance organization and management control system [115]. In fact, organizations with a robust control system and risk management are better able to cope with today's complexes [5,56,120].

Parallel to this, various studies recognize enterprise risk management (ERM) as a new method of organization control system, which allows organizations to manage an extensive range of risks (based on [121], including strategic, operational, financial and hazards) in a coordinated and comprehensive enterprise-wide manner [56,61,102]. ERM is a system that helps organizations to gain a higher level of

competitive advantage by controlling, managing, and organizing the risk management activities better than traditional risk management method [34,43]. It is worth noting that, based on Deloitte's Global risk management survey (2012), adoption of ERM was most common among institutions in the developed countries such as the United States/Canada, Australia, and countries in Europe, compared to developing countries. In other words, developed countries have the higher growth rate of ERM compared to developing countries [116]. Consequently, ERM in previous published studies is mostly limited to developed countries. For instance, Gordon et al. [55] considered 112 US companies, Pagach and Warr [104] 106 US companies, Grace et al. [56] 523 US insurance companies, Hoyt and Liebenberg [61] 117 US insurance and Quon et al. [106] 156 Canadian firms, Ahmad and Mcmanus [4] considered Australian companies. While, a few research have been done in developing countries such as Malaysia (e.g., Manab et al., 2010; [118]) Brazil (e.g., Souza et al., 2012) China (e.g., [96,132]) and Nigeria [5]. Therefore, following the suggestions of different researchers and authors in the field of ERM who recommended

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to do more research in developing countries (e.g., Manab et al., 2010; [4,118]), this study attempts to extend the scope by evaluating ERM in Iran as a developing country in the Middle East which suffers from a lack of study in this field.

This is important, as ERM has never been adequately addressed in Iranian businesses, especially in the financial institutions in context with practical terms. The reasons that have initiated this study to select Iran and its financial institutions as the sample of the study is related to the nature and importance of the financial sector. According to the literature, financial firms are among the first companies which adopted and implemented ERM system and hire chief risk officer [17,61,105]. By nature, they are exposed to face a wide array of risk because they deal with various types of customers, complicated trades, and an extensive range of financial assets. Therefore, risk management has more importance among these institutions than others [114,119]. Moreover, they have a vital effect on the nation's economy due to their intermediary role in surplus and deficit units [81] as well as their efficient role in resource allocation in today's modern economy [44]. Consequently, the health and success of these companies are significant [61,81]. Moreover, this research followed the previous studies in the literature [3,56,61,85] which have been conducted on financial institutions.

Aligned with that, based on Iran's 20-year perspective (vision) plan, Iran is going to be ranked first in the Middle East region in terms of economic, scientific and technology levels by the year 2025. In this regard, as these institutions have an important effect on the economy of Iran, their health and success are very important. In other words, the success of these institutions is important for the economic growth of Iran to obtain the first rank position in the Middle East by 2025. Existence of any problem and crisis in this sector could have major negative effect on the total economy of the country. Moreover, due to the appearance of difficulties such as international sanctions, high exchange rate volatility, and establish unauthorized financial institutions, the improvement of risk management among financial institution of Iran is necessary. Therefore, sufficient ground exists for such studies in Iran that is mainly outside the scope of international researches and is underutilized as a selected sample in the area of ERM. Further, selecting one industry helps the researcher to control the differences that may arise from regulatory and market variation across industries [61]. In addition, a specific industry analysis has more significant superior internal validity than a multi-industry analysis [64].

Parallel to above, based on Resource Based View theory (RBV) of the organization, the existence of intangible assets, those are rare, inimitable, valuable and very difficult to substitute as strategic assets could create a competitive advantage [90,127]. Adopting an ERM approach to risk management and also as an instrument for internal control system enables organizations to improve resource allocation and utilization of resources through greater return on equity and better capital efficiency [6,20,65,79]. Therefore, ERM could be related to competitive advantage. However, by reviewing the literature it was found that despite normative studies explaining the relationship between management control system and competitive advantage [28,74,77,115] there is a lack of empirical evidence about ERM as the newest control system. In other words, while the importance role of ERM and its potential strategic role has been generally considered in previous studies, the question of how ERM implementation can lead to increase competitive advantage has received less attention [43,66].

In addition to the above, there are some important organizational factors which may influence ERM function. Based on the Kleffner et al. [70], lack of understanding about influential factors of ERM is among the barriers of ERM adoption, implementation, and improvement. In this regard, the information technology (IT) one of the important factors in today's knowledge-intensive economy could not be neglected. According to Wilkinson [128], and Rolland [109], without effective information technology it is impossible to have effective risk management. It is almost not possible for risk managers to perform well

without the storage and processing abilities of advanced IT and immediate capacity to communicate data-rich material around the organization [128]. In addition, the computerized controls play an ever-increasing role in the risk management system [76,129]. It has commonly been assumed that control systems combine tight with IT [63,110,112]. However, up to now, far too little attention has been paid to empirically investigate the effect of IT in the field of ERM as one of the newest methods of organization control system. Moreover, the few existing research (e.g., [12,107]) on ERM and IT do not seem to be able to evaluate comprehensively.

Furthermore, based on the contingency theory, it is usually not correct to consider only a simple bivariate relationship between independent and dependent variables [41]. Ordinarily, in reality there are some other influential variables which could affect the relationship between two variables. These factors could be known as moderator or mediator variables. Therefore, to have a valid generalization it is better to consider a more complex causal relationship (at least a trivariate relationship). A bivariate relationship is too simple to capture the law like regularity connecting [41]. By considering the above discussions about the relationships among ERM, IT and competitive advantage, IT has the potential to be an influential factor (moderator) on ERM-competitive advantage relationship. Accordingly, the main aim of present research is to explore the moderating effects of IT on the relationship between ERM and competitive advantage.

Moreover, ERM and IT in this study are evaluated in a way not previously addressed. This study followed the study of Bergeron et al. [19], and considered both dimensions of IT including IT strategy and IT structure, which have been ignored in previous studies, and also ERM is measured based on all eight components of ERM offered in a model by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) [34]. This model issued and supported by five big accounting and finance institutions in the US. It also is one of the most common models adopted by previous studies [118,130].

Besides all, the central bank of Iran provided a guidebook based on COSO [34] framework in order to help financial and credit organizations of Iran to understand the concept and obtain knowledge about how to implement ERM. Therefore, this study tried to evaluate ERM through COSO's [34] framework and provide a comprehensive view of the company's ERM.

This study is considered significant in several ways. Regarding academic and theoretical contribution; first, this study adds to the literature about resource based view (RBV) theory of organization by recognizing ERM as a strategic asset which could increase competitive advantage and firm performance. The main contribution of RBV is that when all firms have access to similar resources, only management differences (e.g., risk management) determine sustainable competitive advantage. Therefore, this study can confirm RBV theory as underlying theory in the risk management field. Moreover, this study extends previous research framework and methodology in different ways.

It extend most previous ERM studies, which evaluated ERM as a dummy variable or by some simple scale questions (e.g., [80,103]; Wan Daud et al., 2011) by considering all eight components of ERM and evaluating them separately to give more comprehensive view of ERM among financial institutions of Iran. This could be a good help for researchers and academicians to have better knowledge about the evaluation of ERM. Moreover, by considering intangible assets such as IT as contingency and dynamic variable, this study extent existent literature and frameworks, which mostly focused solely on the direct and bivariate relationship between ERM and organization's outcomes. In this way, researchers could understand the important effects of different organizational factors on ERM and its function. In other words, this study is among the pioneer studies which considered ERM, IT, and competitive advantage and measure their relationships on each other.

Similarly, to the researcher knowledge, there have been no studies done on ERM among Iranian firms. Iranian firms are less mature in their ERM perspective, thus, investigating ERM and its influential factors in

more details among those firms can add value by providing a better understanding about the concept of ERM and intangible organizational factors (i.e., IT), that affect its improvement.

In terms of practical significance, this study can help organization leaders, risk managers, and managers of Iranian financial institutions to gain knowledge about the ERM and its contribution to the company's performance, success, and sustainability that will help them to improve their organization internal control system by utilizing ERM and have better reaction regarding today's risks and challenges. The findings of this study also will be useful to organizations, regulators, policymakers, and planner, including the Central Bank, to stress the importance of designing sophisticated ERM as an organizational control device to cope with the challenges and uncertainties in today's environment. They can develop new strategies based on the empirical evidence of this study. It paves the way for firms and managers to think more cautiously on how the varying factors of IT affect the risk management system, ERM, and subsequently enhance the firm's value. Moreover, this study could increase the knowledge about the ERM and its effects among developing countries especially in the Middle East area which is suffering from the lack of ERM studies. Consequently, all the above-mentioned contributions make this study worth to be conducted.

The remainder of this paper is structured in the following way. The first section is the literature review, background information on the variables and the detailed formulation of the study's hypotheses. The second section has research methodology and data collection described in it. Thereafter, this paper presented analysis and the result. Finally, we provide the conclusion and the discussion of the study outcomes, which is followed by the contribution of study, limitation and suggested directions for future studies.

## 2. Literature review

### 2.1. Enterprise risk management (ERM)

ERM is now rapidly becoming popular among organizations and institutions in different countries. ERM is an authority by which a company in an industry gains access, controls, exploits, and monitors risks from all avenues with the intention to increase the firm's long and short-term value for its stakeholders. According to Liebenberg and Hoyt [80], ERM is a combined effort for coordinating risks that shift the attention of the risk management task from being principally defensive to being progressively more offensive and calculated. Some researchers argued ERM as an integrated method that raises organization value by lessening the uncertainties inherent in the conventional method, reducing the stock return volatility, stabilizing earnings, enhancing capital efficiency, and lowering the anticipated costs of external capital and regulatory inspection, and maximizing shareholders value [36,61,75,88].

Different models presented by different researchers for ERM [101]. However, one of the most accepted models among previous researchers is the COSO's [34] ERM integrated framework [4,12,95,101,118,125,130].

This framework provides a risk management infrastructure in terms of eight elements to be studied under each of the four themes of objectives. Consequently, each level of the company implements the eight ERM elements into the four themes of the objectives. According to this framework, ERM components are (1) internal environment: which is the basis for all other components. It includes many variables such as entity's risk appetite; the entity's risk management philosophy; the entity's competence and ethical values development of personnel, and how the manager assigns responsibility and authority in organizations; (2) objective setting: It is a process to set objectives which are consistent with the entity's risk appetite and its mission; (3) event identification: which means identification of both risks and opportunities that affect the achievement to entity's objectives from internal and external environment; (4) risk assessment: it permits an entity to consider the impact and likelihood of events and analyzing risk by using both

quantitative and qualitative approaches. It examines the positive and negative effects of potential events all over the entity; (5) risk response: management should select a proper reaction (avoiding, reducing, accepting and sharing risk) which is in line with the risk tolerance and risk appetite of entity; (6) control activities: it includes the policies and procedure which help manager to ensure that risk responses are effectively performed at all level of organization; (7) information and communication: this means information communicate to staff in a form and timeframe which helps them to fulfill their role and responsibility regarding ERM and other activities; and (8) monitoring: the ERM process and activities are monitored through separate evaluations, ongoing management activities, or both and modifications made as necessary [34].

This framework suggested that a company's enterprise risk management mechanism should be positioned to attain the following four objectives: (1) strategy: high-level objectives which are in line with the mission of the organization; (2) operations: short-level objectives which are related to the efficient and effective use of the resources; (3) reporting: accuracy of the quality of organization's reporting system; and (4) compliance: acting according to accepted regulation and laws [34].

As this framework is committed by five big accounting and finance institutions in the U.S.A. including the Institute of Management Accountants (IMA), the American Accounting Association (AAA), the American Institute of Certified Public Accountants (AICPA), the Institute of Internal Auditors (IIA), and Financial Executives International (FEI), and furthermore, due to the importance of this framework in the literature [12,118,125,130], and also because of existence guidebook provided by central bank of Iran which was mostly based on COSO [34], this study considered all eight components of ERM as presented by COSO [34] to evaluate ERM. In this way, the level of ERM could be more reliable and valid rather than the evaluation of ERM by considering only some questions regarding the organization's ERM stage (from not implemented to fully implementation) or considering ERM as a dummy variable.

### 2.2. Enterprise risk management and competitive advantage

In the history of development of risk management systems, ERM has been considered as a key factor in attaining organizations goals and wealth creation [2,16,34]. In this regard, many researchers attempted to find a global association between ERM and its wealth creation ability (e.g., [2,20,56,61]). As an example, empirical findings by some researchers found a positive association between ERM and firm performance (e.g., [46,48,56,68,106]). In addition, Berry-Stölzle and Xu [20] found that ERM adoption significantly reduces the firm's cost of capital and in this way it can create value and increase an organization's wealth. Moreover, Bartram [16] represented ERM as a means to promote firm value for the benefit of the shareholders.

Review of available ERM literature reveals that competitive advantage as a key factor for increasing the organizational wealth is omitted. Considering the question that arises on how ERM can aid competitive advantage in commerce, there are several possible explanations as follows:

The first explanation is related to the RBV theory. The RBV of the firm has emerged as a common theory of competitive advantage. This theory was first introduced by Wernerfelt in 1984 [45]. The RBV emphasized company's resource portfolio, resource identification, deployment and development in order to increase organizations returns [45]. There are so many tangible and intangible resources in an organization, however, Barney [14] claims that the resources that are simultaneously valuable and rare can create competitive advantages, and if these resources are also hard to transfer, irreplaceable, and hard to imitate, they will sustain the advantages. Such resources are known as strategic assets.

In view of the above discussions, ERM could be known as a strategic asset which can create competitive advantage. Effective ERM system

could be considered as a resource for organizations. This system is not available in the market. In other words, each organization has its own system which is matched with its activities, mission, and objectives [17]. Therefore, as stated by COSO [34] and Hoyt and Liebenberg [61], ERM system in one organization cannot be applicable in another. It is unique for each and its success is valuable for that organization and nobody can sell it. Moreover, ERM can create benefits for organization which implement and utilized it, while other organizations cannot have those benefits. Consequently, according to the RBV theory of the organization, companies could achieve competitive advantage via the implementation and successive use of ERM as strategic assets. Eventually, according to the RBV theory, organizations should make optimal use of their resources in such a way to achieve competitive advantages [123]. Hence, the capital and the fund resources are the main part of the organization's resources, so the optimal allocation of resource in a safe environment is needed for the success of companies. ERM allows organizations and management to effectively enhance capital allocation, investment opportunities [17,34,87] and accordingly catch better market position.

The next possible explanation for recognizing ERM as an important resource which makes it as a necessity to gain sustained competitive advantages is related to ERM nature and its function in organizations. ERM helps a firm to set up and manage its risks in an integrated manner. In this way, organizations can attain a competitive advantage by managing their risks better than their competition [34,43]. Moreover, if a company knows more about their industry's risks than their competitors, they are capable to manage those risks properly by actively aggressive actions. They will manage opportunities as well as risks to arrange a vision of both its downsides and upsides [99]. By having a better understanding of internal and external risks, they could be able to adjust and change their conditions faster than their competitors. Likewise, companies which embed ERM into their strategic and business planning process could provide them a support for making risk-informed decisions [86]. In that manner, the organization's chances of achieving financial and non-financial objectives will increase.

Elahi [43], demonstrated that through proper risk management system organizations can make four different benefits which can cause competitive advantage. In his opinion, appropriate risk management can lead to keep organization to serve when others are not able, seeking riskier businesses, excellence in everyday performance, and build a resilient image which leads to competitive advantage.

Harvesting from all above discussions and considering literature in the field of ERM, it could be realized that, while there has been a substantial increase in practitioners focusing on ERM, limited empirical research about ERM and competitive advantage exists. In other words, most of the previous studies focused on the effect of ERM on financial performance or shareholder value maximization. However, based on the discussion of COSO [34] and Acharyya [2], while ERM is a comprehensive view, it should have effect on all aspects of the organization. To the researcher knowledge, competitive advantage as a resource of wealth creation was omitted in previous ERM studies.

This position can be supported by RBV theory, by which ERM could be known as the strategic asset (due to its characteristics such as its uniqueness, non-salable, and its help for resource management and allocation) which can help organizations to improve competitive advantage. However, practical effort in this aspect is rare.

Furthermore, there is a lack of studies which evaluated ERM comprehensively by considering all its COSO [34] components. Most of the previous studies evaluated ERM by considering its implementation as a dummy variable or with a simple question regarding its adoption and its stage of implementation in organization [80,103,124,125]. However, in this study, ERM is measured based on all eight components of ERM offered by the Committee of Sponsoring Organizations of the Treadway Commission (COSO) [34], which gives a more comprehensive view of ERM implementation.

Furthermore, most studies on ERM have been carried out in

developed countries. Developing countries often have to consider risks on a much broader scale than well-established corporations in developed countries [69]. Developed countries have higher growth rate regarding the implementation of ERM compare to developing countries [116]. This gap might be due to the lack of awareness and understanding of ERM concepts and its effect in developing nations. Consequently, some authors such as Li et al. [79], Jalal-Karim [66], suggested doing more research on ERM and its status among developing countries. Accordingly, in order to assist and demonstrate ERM outcomes in a worldwide context, this study considered Iran as a developing country for its sample target. This is significant, as ERM has not sufficiently addressed in Iranian academic environment in theoretical terms and in the businesses in practical terms.

All mentioned considerable reasons have heightened the needs for such research in Iran which is underutilized as a chosen sample in the field of ERM. Therefore, this study sought to fulfill all the above gaps by testing the following hypotheses.

**H1.** : *ERM has a positive and significant effect on competitive advantage.*

### 2.3. Enterprise risk management, information technology and competitive advantage

The role of information technology (IT) is unquestionably vital in this present trade and business arena. With IT, businesses are now able to disseminate information and news across various events, to innovate fresh products/services, to grasp business prospects, as well as to devise creative and flexible business strategies [126]. On top of that, IT is viewed as a tool to boost competitive advantage in this present ever-changing world [21,83].

Bhatt and Grover [21] claimed that advanced IT features permit enterprises to react rapidly towards harmful threats or to grasp available opportunities. Hence, such organizational capability enables a company to carry out numerous activities, such as searching, exploring, and acquiring, assimilating, and applying knowledge regarding resources, opportunities, and configuration of available resources in taking advantage of opportunities which become a basis of competitive advantage [21,62,78]. In another study, Dehning and Stratopoulos [39] examined empirically the factors which due to an IT strategy lead to a sustainable competitive advantage. Their findings showed that managerial IT skills are positively related to sustainability. However, technical IT skills or IT infrastructure was not recognized as a source of sustainable competitive advantage.

Lai et al. [73] examined the effect of IT on the competitive advantages of third-party logistics (3PL) firms in China. They found that IT could significantly influence a firm's competitive advantage, and the effects are nonlinear. Moreover, Okumus [100] states that companies can create and sustain a competitive advantage through the use of IT which can help in creating, storing, transferring and using tacit and explicit knowledge. In another study, Cakmak and Tas [26] evaluated the levels of IT usage, IT skill levels and IT training of Turkish contractor firms. They assessed whether Turkish contractor companies utilized IT or not on achieving competitive advantage. It is found that IT has been using mostly at operational level works that make only economic and technical effects, not strategic ones. Although in order to gain competitive advantage firms need to use IT at the strategic level; there is not much evidence that the firms using IT are gained competitiveness. Cohen and Olsen [31], assessed the association of a complementary system of tangible and intangible IT resources on competitive performance among 112 hospitality firms in South Africa. Analytic Results indicated that the complementary system of IT resources has direct significant effects on competitive performance. Moreover, Marinagi et al., [84] explored the influence of IT practices on competitive advantage throughout the supply chain. The data was gathered from 76 manufacturing firms in Greece which confirmed the crucial role of IT practices and techniques on the formation of a

sustainable competitive advantage based on the supply chain management.

Furthermore, Mao et al. [83] evaluated three types of IT resources (i.e., IT infrastructure, IT human, and IT relationship) effect on knowledge management capability, which positively leads to competitive advantage among 168 organizations in China. The evaluative result supported all hypothesis of the study. Mikalef and Pateli [89] empirically searched the relationship between IT-enabled dynamic capabilities and competitive performance. Finding showed that IT-enabled dynamic capabilities facilitate market capitalizing and operational adjustment agility, which in result improve competitive performance.

In addition, Gunasekaran et al. [57] extended the previous studies and highlighted the role of top management in creating capabilities through the orchestration of resources, which support companies to achieve competitive advantage. They discussed that RBV is important to understand big data and predictive analytics and its effect on organization performance which subsequently lead to the achievement of competitive advantage at a firm and supply chain level. In another study, Zhou et al. [131] have done a research among traditionally low-tech industries and evaluated the role of IT in the resource orchestration processes of incumbent firms. They found that low-tech companies which attempt to implement modern IT in their resource orchestration process were more likely to reach enhanced organizational performance and gain competitive advantages than their competitors. Further, Neirotti and Raguseo [97] assessed the importance of the capabilities enhanced through the utilization of IT in Small and Medium Enterprises. They indicated that externally oriented IT-based capabilities have a superior effect on the firm's intra-industry differential in profitability and revenue growth than those focused on internally oriented IT-based capabilities.

Various studies have identified different essential factors in relation to measure IT, for instance, the IT infrastructure (Li et al., 2000), IT capabilities ([21,22]; Santhanam and Hartono, 2003), the IT resources (Jamporzmay et al., 2011), the IT investment (Bazae, 2010; [22]; Hong and Ghobakhloo, 2012; Li et al., 2000), and the IT acquisition (Majumdar and Chang, 2010; Sohn and Yang, 2006), and many more. According to Bergerona et al. [19], IT could be classified into two categories: IT strategy and IT structure. IT strategy refers to information processing required by organizations, which has been examined by many researchers. In an instance, Das et al. [37] determined a construct with four dimensions for IT strategy, which incorporated i) role, ii) competencies, iii) infrastructure, as well as iv) system design and development. Other than that, Chan et al. [27] asserted that the strategic orientation of an information system gives emphasis on organizational application portfolio, which blankets several attributes, including business strategic orientation, as well as the rudiments of being aggressive, defensive, analytical, proactive, futuristic, innovative, and risk averse.

On the other hand, IT structure refers to the ability of a company to process information, which can be further categorized into three main aspects. The first is 'organizational architecture', which depicts the decentralization level for an IT organizational structure, as well as the degree of accountability for IT functions [23,24]. Next, the second attribute, technological architecture, is comprised of hardware deployment nature, data integration and application levels, as well as technology standardization. Lastly, the third dimension refers to the process and skills that consist of mechanisms of arrangement, as well as standardization of application progress and execution techniques [7,19].

Beside all, based on the Bergerona et al. [19], IT strategy includes IT environmental scanning and strategic use of IT. Through IT environment scanning as a systematic way, companies can recognize the external IT forces of change and formulate adaptive strategies for coping with external environment uncertainties. Business organizations focus their scanning on information technology sectors of the environment. They scan in order to avoid surprises, recognize opportunities and threats, and gain competitive advantage [10,29,82].

Strategic use of IT embroils the use of IT in order to obtain strategic objectives of the organizations. The aim is to make an organization more competitive by aligning IT strategies with business strategies. For example, Mithas and Rust [93] stated that IT can be used to decrease costs by enhancing efficiency and productivity; and growth revenues by completely optimize opportunities through existing or creating new customers, channels, and products or services. Likewise, Abri and Mahmoudzadeh [1] and Appiahene et al., [11], stated an increase in information technology will result in a positive impact on productivity. Moreover, several evidences indicated that strategic use of IT lead to increase customer satisfaction, and enhance profitability through the reduction of marketing and selling costs and positive effects on customer loyalty, and cross-selling [50,51,92,94]. Through these organizations could enhance their competency.

Furthermore, Bergerona et al. [19] divided IT structure to IT planning and control and IT acquisition and implementation. IT planning and control refer to how well the organization manages its IT resources, function, and infrastructure compared to its competitors (Bergeron and Raymond, 1997; [19]). Successful IT planning and controlling would obviously lead to improvement of competitive advantage. IT acquisition and implementation mean organization selection and the introduction of new IT applications. In other words, a proper IT infrastructure in the form of enhanced IT planning, implementation, acquisition, and control processes would result in booster competitive advantage of the organizations.

Calculative from the above literature review, it can be concluded that IT can lead to a sustainable competitive advantage [21,26,47,62,73,78,100]. However, the determinants of IT-induced competitive advantage have not been investigated well in the finance industry especially in Iran.

In fact, a number of IT researchers have examined IT structure and IT strategy distinctly. In line with that, some contingency theorists claimed that aggregated conceptualization elaborates better due to its increased ability in retaining relationships and depicting the complex association among selected constructs [122]. Thus, the two aspects of the IT structure and IT strategy are investigated together in this particular study.

In the context of risk management, Rolland [109] asserted that carrying out effective risk management is almost an impossible feat without an IT system that is effective. Additionally, Ranong and Phuengngam [107] also posited that missing data and vague information cause glitches in managing organizational risks and challenges. Simply put, information implies benefits for decision-making in risk management. Ranong and Phuengngam [107] identified several essential success factors that determined successful and efficient procedures related to risk management among 111 organizations located in Thailand. As a result, the study had listed IT as one of the seven critical success factors, which can function as essential parameters to enhance the efficiency related to risk management procedures. The outcomes from the study further showed that IT has been indeed the most significant attribute in determining the success of an organizational risk management system. Rolland [109] is in support of this view and further claims that risk management is heavily influenced by IT in numerous ways. Some of the related instances are given in the following: establishing a relevant link between risk management and business performance; providing data security at a personnel level; decreasing access permitted to a user by time, line of commerce, commercial activity, and personal risk; as well as the application of IT tools to collect data for organizations to learn from experience and thus, repeating the same mistakes can be avoided.

Moreover, Wilkinson [128] depicts that technology can function as an aid to managing risk in commerce from four essential aspects: gathering data and storage; analyzing risks and modelling; monitoring risks and controlling; as well as risk information and communication. In conjunction to that, Wilkinson [128] mentioned that an efficient IT system, coupled with intelligent technology, helps to make better decisions with minimum interference from people if sufficient information

structure and database is provided. Nonetheless, this approach necessitates qualified personnel to accurately gather, log in, and analyze data in an effective manner. In addition, risk analysis and modelling functions as the platform for decision-making in managing organizational risk [67]. Furthermore, with technology usage, managers are enabled to analyze, model, and control risks and challenges, as well as prospects that are viable to an organization. This is because; it is an impossible task for risk managers to effectively perform their duties without the aid of advanced technology in storing and processing data, besides disseminating useful information all out to the borderless world [128].

In another study, Arena et al. [12] outlined three dynamic variables that influenced ERM based on analyzing three private companies between 2002 and 2008 in Italy, which are uncertainty among experts, risk rationalities, and technologies. On the other hand, the documentation system, which is comprised of hardware and software capabilities, influences the structure of an organization based on three levels of risk management: readiness, execution, and administration, as investigated by Yaraghi and Langhe [129] upon 28 Swedish companies. Their findings exhibited that the accessibility of all kinds of resources and infrastructure in documentation is significant for the success of all three mentioned phases of the risk management system.

Harvesting from all above discussion, proper IT strategy and IT structure in the form of enhanced IT environmental scanning, strategic use of IT, and IT planning and controlling, and IT acquisition and implementation would result in strengthening ERM function, its efficiency, effectiveness, and their effect on competitive advantage in organization. For example, with appropriate use of IT and IT environmental scanning companies can better recognize threat and opportunities facing their business. In this way, IT can help ERM system to obtain information about different internal and external forces such as appearance of new competitors, new technologies, changes in customer preferences, changes in economic environment, political and regulations which help to have rapid reaction to all environment pressure compare to competitors [128]. Furthermore, with more information which can be acquired through IT environmental scanning, ERM system can help organization to have better and faster reaction to the environmental changes in order to have a superior position in the market compared to their competitors.

Moreover, in order to have a better impact on competitive advantage and booster competitiveness, ERM needs screening and monitoring organization internal and external environment, it needs gathering data and analyzing them, identify events both opportunities and hazards, analyze the events, and choose best response and control them [34,56,76]. In this regard, organization's IT structure could be a good instrument. For instance, by improving IT planning and IT acquisition (IT structure), organizations could identify, implement, and maintain new technologies which is a great help for ERM systems to recognize, analyze, response, and monitor events better than their competitors [129] and help ERM system to enhance competitive advantage of the institution.

From another perspective, based on contingency theory (system approach), the organizations are comprised of a multitude of subsystems which have interrelationship with each other. In other words, organizations are open systems with multiple interactive parts, consequently, they cannot be thought of in unsophisticated one-dimensional terms. Based on this approach, researchers tend to be more concrete, emphasize more precise features of organizations, and depend upon the patterns of relationships among subsystems [108]. According to the contingency theory, there is no valid bivariate relationship between two variables and the effect of the independent variable on dependent variable depends upon some third variable (interaction, moderator or mediator). It means that the relationship between two variables is part of a large causal system involving other variables so that the valid generalization takes the form of trivariate or more relationships. A bivariate relationship is too simple to capture the law like regularity

connecting. Therefore, a more complex casual statement is required [41]. Consequently, this study used a system approach of contingency theory to explain the effect of different dimensions of IT on ERM relationship with competitive advantage as a moderator.

From all the above discussion, it can be formulated that, IT has a positive effect on competitive advantage, however, empirical studies are limited. In addition, among them, none had investigated the links between ERM, IT, and competitive advantage. As competitive advantage is supported by IT [21,26,47,57,62,73,78,100] and considering the fact that IT, mostly, has enhanced ERM system [12,43,107,129], it could be hypothesized that companies with advanced IT level displayed stronger effect of ERM on competitive advantage. This notion has been missed by previous scholars, and therefore, this study had gathered sufficient data to bridge this research gap by considering IT as an influential factor upon the ERM-competitive advantage link.

Unfortunately, previous studies also suffer from limited wholesome measurements of IT and ERM. Simply put, the essential requisite is an effective measurement for all constructs related to both IT and ERM. As such, the present study has considered IT and ERM implementation in a way that has yet to be addressed. In precise, this study measured both dimensions of IT: IT strategy (IT environment scanning, and strategic use of IT) and IT structure (IT planning and control, as well as IT acquisition and implementation), which had been disregarded in prior researches. The measurement of ERM comprised of eight components that derived from the Committee of Sponsoring Organizations of the Treadway Commission (COSO) (internal environment, objective settings, event identification, risk assessment, risk response, control of activities, information and communication, as well as monitoring) [34]. In view of that, this study offers a comprehensive outlook of the applications of IT and ERM in organizations. Accordingly, it has been hypothesized that:

**H2.** : *IT strategy has a positive and significant effect on competitive advantage.*

**H3.** : *IT structure has a positive and significant effect on competitive advantage.*

**H4.** : *IT strategy has a moderation effect on ERM-competitive advantage relationship.*

**H5.** : *IT structure has a moderation effect on ERM-competitive advantage relationship.*

The proposed research model of this study is shown in the Fig. 1.

### 3. Methodology and data collection

A quantitative approach was employed to test the research framework and the above-mentioned hypotheses. The research data was collected through the questionnaire with self-administered survey method. A review of extended ERM literature leads to the conclusion that financial institutions are the best scope for evaluation. The reason for selecting this sector is due to the importance of risk management among financial institutions. Talwar [119] stated that even the failure of one financial institution can threaten the financial system of that country and will lead to system-wide failure which consequently will spread to other sectors, to the macroeconomic, and internationally as well. Further, based on the literature, this sector is among the first institutions that implemented ERM and got engaged into it [17,61,105]. Besides, recently improving managing the risk among financial institutions of Iran is more essential due to different problems. For example, fluctuation of exchange rate; due to the international sanctions, the volatility of the exchange rate has been increased in recent years and Riyal exchange rate has dropped dramatically and got more instability than any other time in past decade. The level of stock market indices over the past year have gone down, and the banks were afraid of getting breakups due to dealing with foreign credit lines, stock markets, and customers. Based on Behravan and Jokar [18], in this situation

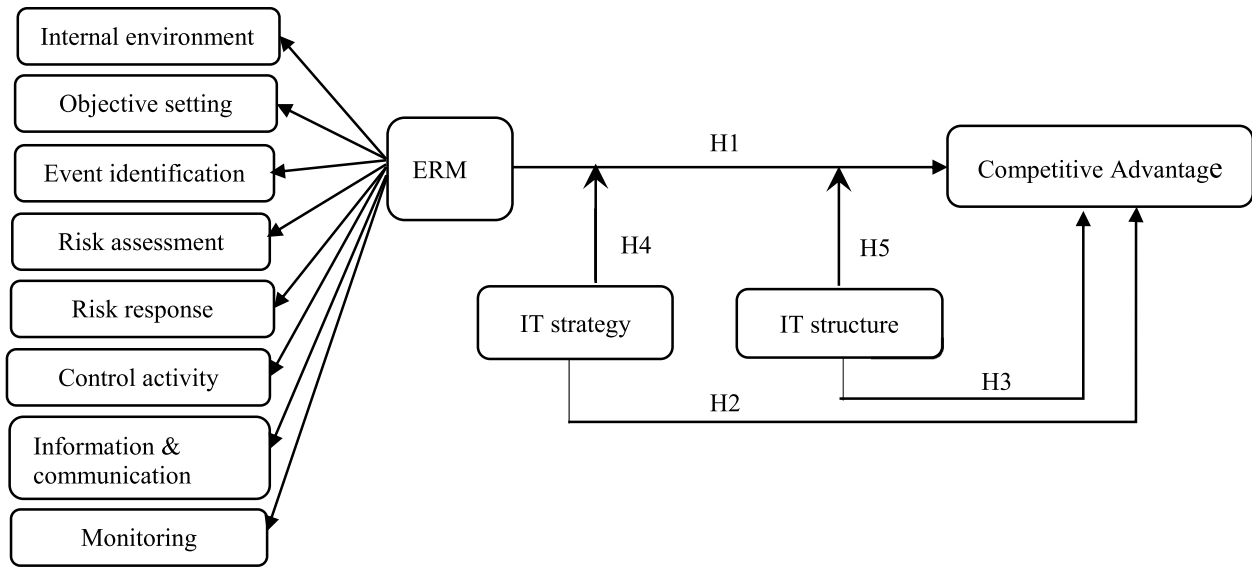


Fig. 1. Path diagram of conceptual framework.

bank's deposits would decrease. Decreasing the deposits will lead to the lack of efficiency of the banking system in best providing and allocating the financial resources which consequently could lead to the economic downturn [18,98].

Moreover, recently, the bankruptcy of unauthorized financial institutions in Iran has increased. Some of these institutions were initially set up in a number of state organizations by passing themselves off as companies or credit cooperatives but later gradually expanded their illegal activities and became financial institutions without obtaining permits from the Central Bank of Iran (CBI). However, since these foundations have not received their permits from Iran's main fiscal governing system and, so far, have not been subjected to CBI oversight. They frequently flout the bank's orders and directives, violate its bylaws and, thus, create turmoil in the domestic fiscal market [9].

For example, they offer higher deposit rates than government authorized banks as well as paying loan more than twice the value of customers' loan deposit. Consequently, these institutions may be dissolved by the government or merge with other institutions or in many cases they faced bankruptcy due to the lack of resources (e.g., Mizan credit institution with 107 branches). All these create trouble and increase risks among the financial industry of the country.

Harvesting from all the above discussions, it is really essential to improve the risk management system among Iranian financial institutions. Therefore, population of this study consisted of 91 financial institutions of Iran which implemented ERM as their risk management system. These institutions are recognized among companies listed on the Iranian central bank and Iranian central insurance websites, as well as on the stock exchange market website.

With regard to recognition of implemented ERM institutions, the

Table 1  
List of Iranian financial institutions.

Sources: Iranian Central Bank, Central Insurance, and Stock Exchange Market Website (2013).

Type	Name	Number of companies	Implementing ERM	Final sample frequency
Banking System	Government bank	8	6	6
	Private bank	21	17	16
	Gharzolhasane banks	9	5	5
	Finance and credit institution	4	2	2
Non-banking financial intermediary	Mutual fund institution	112	39	36
	Investment companies	8	4	2
	Government insurance	2	2	2
	Private insurance	19	16	15
Total		183	91	84

researcher looked for different words as proxies of ERM existence among the organization's annual reports. These includes words such as "chief risk officer", "vice president enterprise risk management", "risk management committee", "executive risk manager", "senior risk manager", "head of risk manager", and "vice president risk management" which is similar in approach to the studies of Liebenberg and Hoyt [80], Gordon et al. [55], Pagach and Warr [103,104], Golshan and Rasid [54]. After recognizing practitioners from annual report the researcher called one by one to be sure of adopting ERM among these organizations. Then the questionnaires were administered. It should be noted here that as all branches of each of the financial institutions of Iran have to follow the rule and regulations of their headquarters; therefore, this study gathered information from headquarter of each institution as a representative of their branches.

Due to the small number of population this study used census sampling and distributed the questionnaire among all population organizations and finally used 84 valid collected questionnaires for data analysis. Table 1 shows the list of Iranian financial institutions in 2013.

In order to describe the characteristic of data, descriptive statistic was used in this study. This method summarizes and describes the set of scores and the distribution of data. In other words, this entails the standard deviation, frequency, and mean analysis to explain the features of the data [59,113]. Table 2 shows descriptive statistics (i.e., mean and standard deviation) of the main variables including ERM, IT, and competitive advantage.

### 3.1. Variable measurement

In order to measure and cover all eight components of ERM

**Table 2**  
Descriptive statistic.

Constructs	NO.	Mean	Std. deviation
IE	84	2.84523	1.380011
OS	84	2.92687	1.439203
EI	84	3.09523	1.43617
RA	84	3.03571	1.449211
RR	84	2.99702	1.370257
CA	84	3.00595	1.29521
IC	84	2.88690	1.32676
MO	84	3.0000	1.349406
ITC	84	2.876323	1.452051
ITG	84	2.936905	1.411538
CMA	84	2.946429	1.397289

(IE: internal environment; OS: objective setting; EI: event identification; RA: risk assessment; RR: risk response; CA: control activity; IC: information and communication; MO: monitoring; ITG: IT strategy; ITC: IT structure; CMA: competitive advantage).

construct, this study used both the existing scale developed by Collier et al. [32], Al-Tamimi and Al-Mazrooei [8], Subramaniam [117] and Gates [52], as well as scale development work. Briefly, the scale development was based on the principal definitions of each component provided by COSO [34], which is presented in Table 3.

Questions related to the firm's competitive advantage were derived from Saeidi et al. [111]. Managers were asked to respond to seven questions about the growth of their company, quality of their products or services, their market position, corporate image, diversity and differentiation, flexibility to change, and market leadership which are the most ordinary applied factors in evaluating competitive advantage in previous researches.

With respect to IT, the scale is constructed to measure IT strategy and IT structure. It is adopted from the scale of Bergerona et al. [19] which is designed to evaluate IT strategy by considering IT environmental scanning, and strategic use of IT as well as IT planning and control, and also IT acquisition and implementation for IT structure.

The pilot study examined the reliability and validity of the instrument of the study. Before conducting the pilot study and measuring its construct validity and reliability, the questionnaire's content was validated. Content validity ensures the measures included items that adequately represent and tap the concept of the study [33,59,113]. The content of the questionnaire of this study was validated in three stages. First, as some questions of ERM evaluation was self-developed, it was validated by three academicians related to ERM to ensure the clarity of questions and to make sure that the instruments measure the variables in the best way. Second, to ensure the use of clear language, the researcher employed two language professionals to revise the study's questions. In this study, the forward-translation and back-translation approach was applied. Finally, the validity of this study was measured through expert interviews with three Chief Risk Officers (CRO) to gather information on ERM, and two top managers on information

**Table 3**  
ERM measurement base on COSO.

ERM dimensions	Measurement
Internal environment	Looking at organizations perception about risk, identification of existence of policies and procedures for risk management, consideration of risk tolerance and appetite of organization.
Objective setting	Examining the level of objectives alignment with entity mission, level of risk consideration while formulating the objectives.
Event identification	Level of identifying internal factors, and external factors driving events and opportunity.
Risk assessment	Level of estimation of likelihood and impacts of the events, using qualitative or quantitative analysis method, risk classification, and assessment of residual risk.
Risk response	Looking at risk mitigation strategies including cost and benefits analysis, resource analysis, residual risk analysis, and consideration of risk tolerance and appetite while responding to risk.
Control activities	Level of control over risk response effectiveness, control over risk response execution.
Information and communication	Level of information qualification, timeline, availabilities, internal and external communication and information flow.
Monitoring	Examining the level of monitoring activities, ongoing and separate monitoring activities, and level of internal control.

technology and organizations performance. After doing the corrections and suggestions, the questionnaire was ready for pilot test (construct validity, convergent validity, and reliability).

By considering the results of pilot study some minor editing was required and finally, there were 36 items for ERM, 29 items for IT, and 7 items for competitive advantage applied in the main survey based on a respondent's agreement level on a five-point Likert scale. The questionnaires were administered through self-administration supervision method to gather a maximum response. Out of 91 companies, 86 questionnaires were filled of which 84 were usable. The questionnaire is presented in the Appendix A.

#### 4. Analysis and results

To perform a statistical analysis on the collected data, this study used Structural Equation Modeling (SEM) and Partial Least Square (PLS). The empirical results were evaluated through following two steps. First, the validity and reliability of the scales (measurement model) were examined and second, the structural model (hypotheses testing) was tested. However, before performing the measurement model, multicollinearity test was used as instruments to evaluate pre-analysis of data. To do this, the present study tested Variance Inflation Factor (VIF) test through running the stepwise regression analysis which is presented in Table 1. If VIF is greater than 10 and Tolerance is less than 0.1, it shows the existence of multicollinearity [59]. Therefore, based on the values dedicated in Table 4, non-existence of multicollinearity could be concluded.

##### 4.1. Measurement model

In order to assess the measurement model, the indicators were subject to convergent and discriminant validity along with reliability analysis. Following of Hair et al. [59], the convergent validity of this study calculated through factor loading and Average Variance Extracted (AVE) for all items (questions) and constructs. The factor loading (outer loading) ranged from 0.79 to 0.98 which meet the adequate value above 0.7 [59] and AVE from 0.70 to 0.92 which meet the minimum 0.5 thresholds [59] (see Appendix B and C).

The assessment of the discriminant validity was conducted via Fornell and Larcker's [49] test at the construct level and Cross-loading at the item level. Appendix D shows that the AVE square root for each variable is greater than the squared correlations for all pairs of variables. The analysis of cross-loading indicated that except than two items of ERM, all other items have the largest value on their own construct. Therefore, these two items were eliminated from the study (IE6, OS5).

Reliability was also gauged via Composite Reliability (CR) and Cronbach alpha [35,59] which suggested to be more than 0.7 for each variable. As it can be seen from Appendix C, composite reliability and Cronbach's alpha values reach the value higher than 0.7.

Overall consideration, it can infer that all criteria of the measurement model including the validity and reliability of instrument and constructs were verified.



**Table 4**  
Multicollinearity.

Independent variable	Dependent variable	Tolerance	VIF
IT structure	IT strategy	0.302	3.316
Competitive advantage		0.326	3.071
ERM		0.631	1.584
IT strategy	IT structure	0.290	3.446
Competitive advantage		0.291	3.431
ERM		0.666	1.501
IT strategy	Competitive advantage	0.220	4.545
IT structure		0.205	4.887
ERM		0.640	1.562
IT strategy	ERM	0.182	5.486
IT structure		0.200	5.003
Competitive advantage		0.274	3.655

#### 4.2. Structural model (hypotheses testing)

To test the hypotheses of this study, a path-weighting scheme was utilized. This test determined the amount of variance of the dependent variable explained by the independent variable [58]. Generally, this value is known as R square ( $R^2$ ), which vary between 0 and 1 [59]. A bootstrapping technique with 250 resamples was used to assess the statistical significance of the path estimates (t-value).

In order to examine the hypotheses of this study, at first, a direct effects model (excluding moderator) was tested which was followed by an interaction model (including the moderator) to determine whether adding the moderator improves the explanatory power of the model. The moderating effect was test based on the guidelines prescribed by Kline and Dunn [71] using SEM. In this approach, every item of each component of ERM was cross multiplied with every item of the information technology factors. The outcome of this process formed moderator constructs (i.e., ERM  $\times$  IT strategy; ERM  $\times$  IT structure). Table 5 presents the result of the structural model for both main and interaction models.

As it is clear, there are three direct effects including IT strategy, IT structure, and ERM effect on the competitive advantage. The result clarified that all direct hypotheses are supported. In other words, ERM has a positive significant effect on competitive advantage ( $\beta = 0.166$ ,  $p < 0.01$ ,  $t$  value = 3.064). Moreover, the analysis shows a highly significant link between both IT strategy ( $\beta = 0.399$ ,  $p < 0.001$ ,  $t$  value = 6.552) and IT structure ( $\beta = 0.452$ ,  $p < 0.001$ ,  $t$  value = 7.340) and competitive advantage. The  $R^2$  values showed that ERM, IT strategy, and IT structure explain 65.4% of the variance of competitive advantage (IT structure 46.3%, IT strategy 38.2%, ERM 17.8%).

In the context of indirect relationships (moderators), based on the analysis, the moderating effect of the IT strategy and IT structure on the relationship between ERM and competitive advantage were significant ( $\beta = 0.175$ ,  $p < 0.05$ ,  $t$  value = 2.33;  $\beta = 0.181$ ,  $p < 0.05$ ,  $t$

**Table 5**  
Structural models.

Path	Model 1(direct effect)				Model 2 (moderators)			
	Coefficient	t value	$f^2$	$R^2$	Coefficient	t value	$f^2$	$R^2$
ERM $\rightarrow$ CMA	0.1668	3.064**	0.1781					
IT strategy $\rightarrow$ CMA	0.3991	6.552***	0.382		0.348			
IT structure $\rightarrow$ CMA	0.4522	7.340***	0.463		0.317			
ERM * IT strategy $\rightarrow$ CMA					0.1752	2.3347*	0.4416	
ERM * IT structure $\rightarrow$ CMA					0.1811	2.4617*	0.6018	
Competitive advantage				0.654				ITG: 0.760 ITC: 0.784

(ERM: enterprise risk management; CMA: competitive advantage).

\* Significant at 0.05.

\*\* Significant at 0.01.

\*\*\* Significant at 0.001.

value = 2.46). In more details, the moderators increased variance explained ( $R^2$ ) in firm competitive advantage from 65.4% in the main structural model to 78.4% and 76% in the moderating effect models. This indicates that the value of the coefficient of ERM in explaining competitive advantage will increase as the level of IT increases.

In order to evaluate the effect size ( $f^2$ ) of the moderator, this study used Cohen's [30] formula ( $R^2$  interaction model- $R^2$  simple model /  $1-R^2$  interaction model). According to Cohen [30], the  $f^2$  values can be interpreted as follows:  $> 0.02$  = weak effect;  $> 0.15$  = moderate effect;  $> 0.35$  = strong effect. Therefore, based on the mentioned Cohen's formula the effect size of moderators is 0.601 and 0.441 for IT structure and IT strategy respectively which are almost strong effect size. Figs. 2 and 3 show the direct and indirect model of the study.

## 5. Discussion

As stated before, ERM could affect the different function of the organization. However, there are limited empirical studies on the effect of ERM (as a new control system) on competitive advantage. Therefore, the present study evaluated such link empirically by considering all financial institutions of Iran which implemented the ERM.

This study revealed that ERM displayed a significantly positive impact upon organizational competitive advantage. This impact could be generated by ERM itself which is an all-inclusive approach related to risk management. In this way, a particular firm is able to determine its own industrial risks, thus providing the chance to manage better identified risks. Hence, each risk and opportunity can be weighed and considered in all angles. Furthermore, it is utmost important for a firm to recognize and acknowledge the risks faced, especially more than the competitor so that the firm could be on-guard at all times and sense any danger before the competitor does. With such information at hand, a firm can adapt to the rapidly changing surrounding. Additionally, companies can successfully attain their financial and operative goals by embedding the ERM practice into their strategic and business planning, which offers support in making risk-informed decisions by weighing both risks and opportunities [86].

In addition to the above, this study also attempted to explain the relationship between ERM and firm competitive advantage by the use of RBV theory. According to COSO [34] and Liebenberg and Hoyt [80], ERM is a unique system for each organization. It means that according to the nature, function, and culture of each organization, their ERM systems are different. Moreover, based on the discussions by Burnaby and Hass [25], Barton et al. [15], Deloitte [40], and COSO [34], not all organizations have utilized ERM as their risk management system yet. Therefore, it can be said that ERM is unique, valuable, and not duplicable and salable in the market. Parallel to this, based on the arguments of Barney [14], DeCastro and Chrisman [38], and Kristandl and Bontis [72], an asset tangible or intangible, which has above-mentioned criteria could be known as strategic asset which will lead to increase

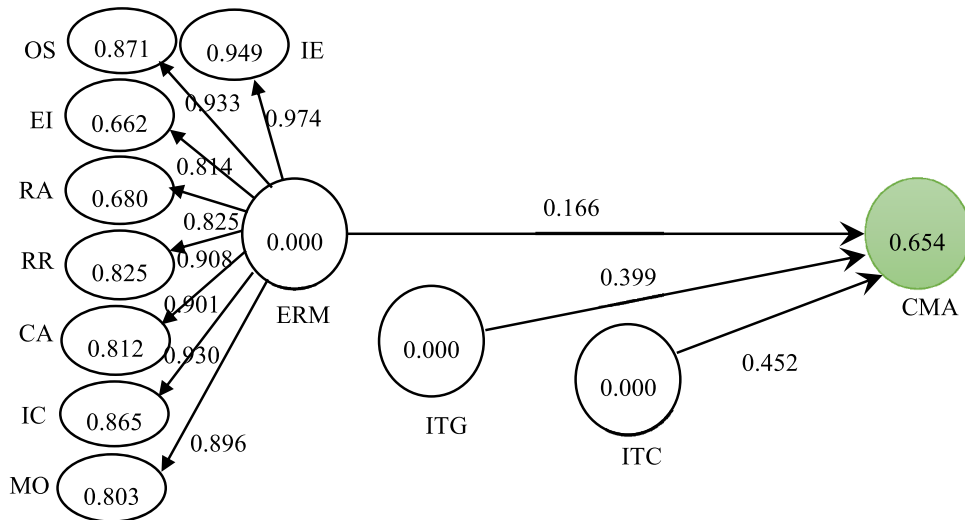


Fig. 2. Direct model  
(ERM: enterprise risk management; CMA: competitive advantage; ITG: IT strategy; ITC: IT structure).

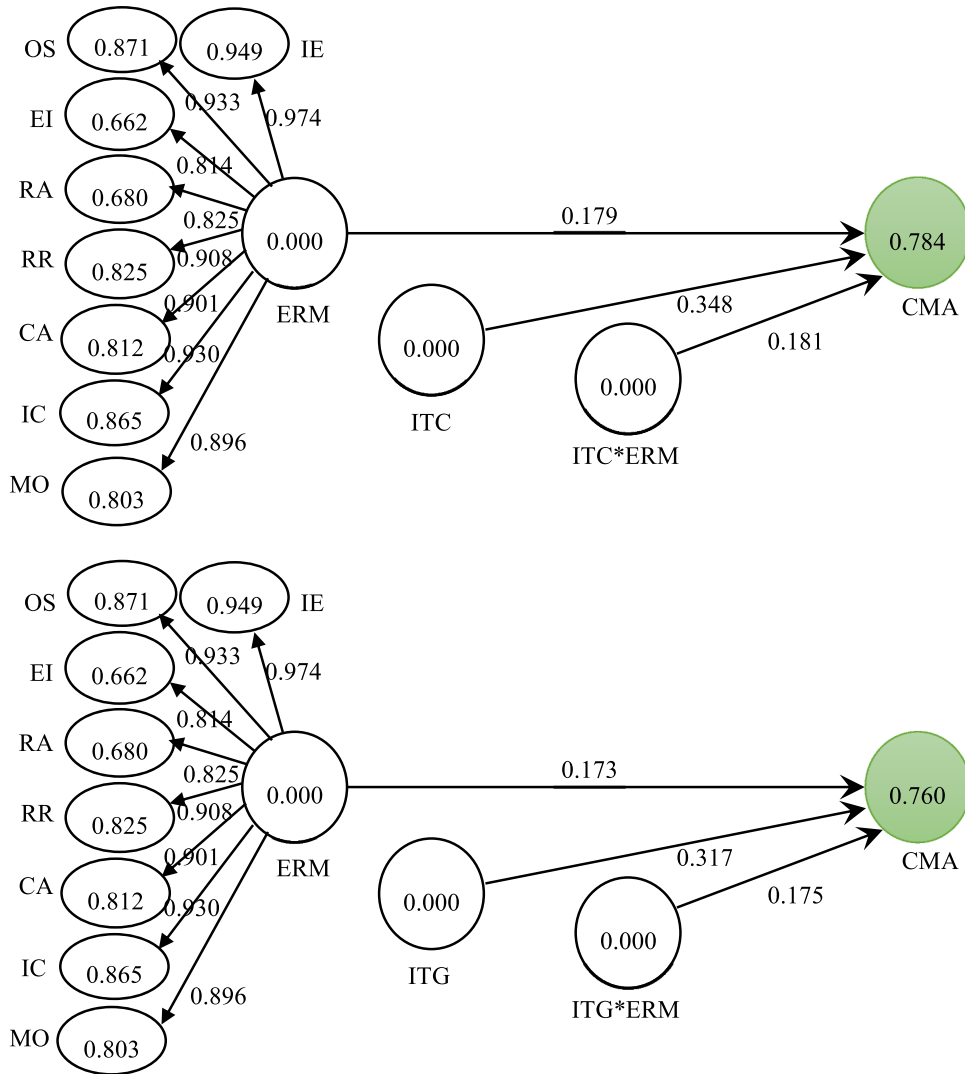


Fig. 3. Indirect models  
(ERM: enterprise risk management; CMA: competitive advantage; ITC: IT structure; ITG: IT strategy).

competitive advantage and firm performance. Therefore, the positive relationship between ERM and competitive advantage could be a support for RBV theory based on which we can recognize ERM as a strategic asset that will improve optimal resource allocation and competitive advantage of the organization.

On top of that, this study demonstrates that the significant positive effects of ERM upon organizational competitive advantage, functions as an empirical support for the previous theoretical and few empirical claims pertaining to the topic discussed, such as those investigated by Elahi [43], COSO [34], Bailey et al. [13], Nocco and Stulz [99], Beasley et al. [17].

Moreover, the effects of both IT strategy and IT structure on competitive advantage are also found to be positive and significant. It means that the competitive advantage could be greater by improving technology in the organization. In contrast, inefficient, obsolete and outdated technology could be a source of increasing hazards and organizational challenges in today's competitive environment. IT could help in information gathering, data collection, data analysis, planning, procedure and almost all activities in organizations. Information creates more value for decision making in risk management and then avoid repeating the same mistakes. It can help with analysing risks and modelling; monitoring risks and controlling; as well as risk information and communication.

However, data analysis showed that IT structure has a stronger impact on competitive advantage among financial institutions of Iran. Even though, the effect size of these variables may be different among other countries or industries. Nevertheless, the positive relationship between IT and competitive advantage could be interpreted as a supports to previous researched such as Lai et al. [73], Okumus [100], Cohen and Olsen [31], Marinagi et al., [84], Mao et al., [83], Mikalef and Pateli [89], Zhou et al. [131], which linked different dimensions of technology to competitive advantage and found a significant and positive relationship. However, the result is inconsistency with Cakmak and Tas [26], who stated there is not much evidence that the firms using IT are gained competitiveness.

Considering the result of the present study, it can be concluded that, by improving and investigation on IT, organisations could make superior competitive advantage. In other words, organisations could enhance their level of market position and achieve their goals and objectives by improving technology which leads to better market level in today ever-changing environment.

Furthermore, based on the findings, this study concludes that the positive relationship between ERM and competitive advantage is affected by IT structure and IT strategy as moderator variables. The result could be a support for contingency theory system approach which stated that researchers should try to have a holistic view of contingencies and performance relationships in order to better understand the organizational variables and their functions [42]. Therefore, considering more variables and contingencies are the main focus rather than a single variable [91]. Moreover, according to Chenhall [28], who's referring the newest approach of contingency theory as the relationship between two variables is dependent on some other variable such as mediating or moderator. The evidence from this study clearly support earlier discussion and revealed that IT and its specific dimensions such as IT strategy and IT structure could be considered as contingencies variables which can enhance ERM effectiveness on competitive advantage.

This positive and significant effect indicated that the effect of ERM on competitive advantage will increase as the IT's level increase. This might be due to the fact that strategic assets i.e. information technology are involved in most activities of organizations [22,60] and ERM is not exceptional. Observing and responding to risks in an organization and enhancing competitive advantage is very much depend on corporate IT.

## 6. Conclusions and recommendations

The current research constitutes one of the first empirical steps toward a greater understanding of control systems and risk management by considering ERM, IT, and competitive advantage.

This study is considered significant in several ways. Regarding knowledge and theoretical contribution; first, this study measured all eight components of ERM for its evaluating despite previous studies which considered only its adoption as a dummy variable or its implementation by a simple question [80,103,124,124]. Therefore, this study increased understanding and insight about the overall effect of ERM by looking at all its components and competitive advantage. Similarly, to the researcher knowledge, there had been no studies done on ERM among Iranian firms. Thus, this study adds value by providing a better understanding of the ERM status among Iranian institutions and developing countries especially middle east region. This study also contributes insights into the worldwide concept and implementation of ERM. While the majority of previous studies were among developed countries, the present study extended the generalizability of such research into the context of Iran.

The result support RBV theory which justified ERM as a strategic asset which leads to competitive advantage. Moreover, this study empirically adds support to the contingency theory argument and recognized IT as a contingent factor which influences the relationship between ERM and competitive advantage. This adds to the body of knowledge that ERM effect on firm value creation is not a merely bivariate relationship.

In addition, this study extended previous research framework and methodology in different ways. First, the present study extended most previous ERM studies by considering all eight components of ERM and evaluating them separately to give a more comprehensive view of ERM among financial institutions of Iran. Second, to the researcher knowledge the present study extended previous ERM models by considering competitive advantage as a firm value factor which was not evaluated empirically among previous frameworks. Third, this study focused on the moderating role of IT, as the main today's intangible asset, on the relationship between ERM and competitive advantage. To the researcher's knowledge, there had not been any study which examined IT as an influential factor which can improve the effect of ERM on firm competitive advantage.

This idea rooted from the past studies, suggestions of the exploration of more enriching research that cover wider ERM related area (e.g., [12,17,20]). To the researcher's knowledge, this study can be considered to be the first that applied three economic phenomena ERM, IT and competitive advantage.

In terms of practical contribution, demand for a robust risk management system is growing rapidly with today's environmental changes and complexity especially in business transactions and economy. Considering the fact that financial institutions have an important and vital role in sustainability and improvement of economic growth, the risk management in those organizations has absolutely high effects in their performance and the overall economic system of the countries.

The competition among financial institution of Iran is very aggressive, those institutions that are able to control, manage, and overcome their challenges and risks are more successful. The findings of this study carried the weight of importance of ERM and IT on improving competitive advantage. This might motivate organizations and managers to increase and improve their risk management system along with IT capabilities which consequently result in better global and market situation. Further, the findings contribute to managers' knowledge of using and benefits of improving the ERM system through promoting IT system and its dimensions. In other words, this study has the managerial implication in terms of planning, decision making, and

development of new strategies based on the empirical evidence of IT importance as one of the critical success factors of ERM practice.

Moreover, the findings will be useful to regulators, policymakers, and planner; including the Central Bank and central insurance of Iran, to stress the importance of designing sophisticated ERM as organizational control device to cope with the challenges and uncertainties in the environment arising from the globalization, rapid technological changes, deregulation, and market competition.

Overall, this study could be the reference point for academic and non-academic in the field of ERM, IT, and competitive advantage.

As with any research, this study has some weaknesses that need to be considered in further studies. First, the generalizability is subject to limitations. While the selected sample firms were financial institutions, their features, regulations, practices may not be reflective of all firms in all industries. Moreover, as the present study conducted in Iran, there is possibility that the result may be different in other countries. In

addition, the current study utilized financial institutions only those which have implemented ERM.

Therefore, the limitation of this study can introduce some interesting future research projects. First, more studies are required into the nature and importance of ERM among developing countries. Second, future researches could profit from the re-evaluation of the ERM concept and its position within extent models, frameworks, and theories. They can evaluate other organizational factors and functions as moderation or mediation variables (e.g., organizational culture, training, auditing system and etc.). Moreover, as stated earlier, the current study utilized only financial institutions those which have implemented ERM. Therefore, future studies should include a broader range of industries and organizations as their sample size. Third, the present study applied questionnaire survey, while future studies which evaluate the casual relationships of variables through interview or case studies could be a good support for the result of this research.

## Appendix A: Questions related to variable of the study

Item	Statement
Enterprise risk management	
Internal environment	
IE1	There is a common understanding of risk management across the organization.
IE2	Your organization has an effective risk management policy.
IE3*	In your organization, risk appetite is considered in strategy setting.
IE4	Responsibility for risk management is clearly set out and understood throughout the organization.
IE5	Risk management is embedded in your organization's culture.
Objective setting (Not at all .. slightly... moderately...very...extremely..)	
OS1*	Management has in place a process and procedure to set business objectives (strategic, operational, reporting, compliance).
OS2*	Organization's objectives support entity's mission and are aligned with that.
OS3	When formulating the Strategic plans, to what extent are risks identified and factored in.
OS4	When formulating the Budgets plans, to what extent are risks identified and factored in.
OS5	When formulating the Operational plans, to what extent are risks identified and factored in.
OS6	When formulating the Project management plans, to what extent are risks identified and factored in.
OS7	When formulating the Capital investment plans, to what extent are risks identified and factored in.
Event identification	
EI1*	Your organization considers external factors driving events that could affect the achievement of objectives (e.g. Economic, Natural environment, Political, Social, Technological).
EI2*	Your organization considers internal factors driving events that could affect the achievement of objectives (e.g. Infrastructure, Personnel, Process, Technology).
EI3	Your organization considers the positive events and opportunities that could affect the achievement of objectives.
Risk assessment	
RA1*	The positive and negative <u>impacts</u> of potential events are examined across the entity.
RA2	This organization's risks are assessed by using <u>qualitative analysis</u> methods (e.g. high, moderate, low)
RA3	This organization's risks are assessed by using <u>quantitative analysis</u> methods. (e.g. percentages or probability charts, or using tools such as metrics and software).
RA4	The organization is effective at <u>prioritizing risks</u> and determining the <u>residual risks</u> .
Risk response	
RR1*	Your organization selects a set of actions to align risks with the entity's <u>risk tolerance</u> and <u>risk appetite</u> .
RR2*	In determining risk response, your organization considers possible opportunities to achieve entity objectives going beyond dealing with the specific risk.
RR3*	In determining risk response, your organization considers possible residual risk and assesses and determines that the residual risk is within the entity's risk tolerance and appetite.
RR4	Your organization's response to analyzed risks includes prioritizing risk treatments where there are resource constraints on risk treatment implementation.
Control activities	
CA1*	The organization's risk management procedures include policies and processes which help to ensure that risk responses are appropriately carried out.
CA2	In your organization control activities are executed to ensure risk responses are in a timely manner.
CA3	The level of existing control activities by your organization are sufficient and appropriate for the risks that it faces.
CA4*	Many different <u>types of control activities</u> are performed by your organization at various organizational level and entities.
Information and communication	
IC1*	In the organization relevant information is identified, captured and communicated in a <u>form and time frame</u> that <u>enable people to carry out their responsibilities</u> .
IC2*	The information infrastructure is consistent with an entity's need to identify, assess, and respond to risk and remained within its risk tolerance.
IC3	Formal procedures are in place for reporting risks.
IC4	Changes to risks are assessed and reported on an ongoing basis.
IC5*	In your organization, there is appropriate communication with people outside of the organization. (e.g. customers, suppliers, shareholders).
Monitoring	
MO1*	In your organization some combination of ongoing monitoring and separate evaluations will ensure that ERM maintains its effectiveness over time.
MO2	Monitoring the effectiveness of risk management is an integral part of routine management reporting.
MO3	Your organization has highly effective continuous review/feedback on risk management strategies and performance.
MO4	Your organization regularly reviews internal controls
Information technology	
IT strategy	
ITG1	Using an external information network to identify your requirements in information technology.
ITG2	Knowing the information technology used by your competition.
ITG3	Instituting a technology watch in order to change rapidly your information technology when necessary.
ITG4	Ensuring that your choice of information technology follows the evolution of your environment.

ITG5	Using the information technologies that will permit a rapid reaction to environmental pressure.
ITG6	Use of IT to reduce your production costs.
ITG7	Use of IT to make substantial savings.
ITG8	Use of IT to improve your firm's productivity.
ITG9	Use of IT to increase your firm's profitability.
ITG10	Use of IT to improve the quality of products or services.
ITG11	Use of IT to respect the deadlines requested by your customers.
IT structure	
ITC1	Mastering current information technology products.
ITC2	Maintaining control over projects involved with the acquisition of new technology.
ITC3	Being considered as a leader in information technology usage.
ITC4	Development of a technological culture in your firm.
ITC5	Having the required human and organizational resources to manage the information systems.
ITC6	Having the ability to effectively identify and fill your needs in information technology.
ITC7	Strategic planning of information systems in relation to the organization's business objectives.
ITC8	Mastering the technology presently in use in your organization.
ITC9	Using a distributed system to share information within the firm.
ITC10	Structured approach to acquire the needed information systems.
ITC11	Use of specific selection criteria for the acquisition of new information systems.
ITC12	Using financial tools in planning the acquisition of new information systems.
ITC13	Choosing information technology related to the strategic orientation of your firm.
ITC14	Knowing the impact that IT will have on the different functions of your firm.
ITC15	Evaluating potential problems related to the strategic orientation of your firm.
ITC16	Knowing the results of a financial feasibility study before the acquisition of IT.
ITC17	Identification of possible sources of resistance to change before implementation.
ITC18	Evaluating the employee's aptitude to use the chosen IT.
Competitive advantage	
CMA1	The quality of the products or services that your company offers is better than that of the competitor's products or services
CMA2	Your company is more capable of R&D and innovation than the competitors
CMA3	Your company has better managerial capability than the competitors
CMA4	Your company's profitability is better than the competitors
CMA5	Your corporate image is better than your competitors
CMA6	Your company is much more flexible (regarding the risks and challenges) than the competitors
CMA7	Overall, your company's growth is better than the competitors

Note: self-developed items are sign with\*.

**Appendix B: Factor loading**

Internal environment							
Loading values	IE1: 0.9697	IE2: 0.9814	IE3: 0.9844	IE4: 0.894	IE5: 0.9632		
Objective setting							
Loading values	OS1: 0.9671	OS2: 0.8636	OS3: 0.9534	OS4: 0.9892	OS6: 0.9338	OS7: 0.8885	
Event identification							
Loading values	EI1: 0.8849	EI2: 0.9886	EI3: 0.9839				
Risk assessment							
Loading values	RA1: 0.9872	RA2: 0.9663	RA3: 0.9856	RA4: 0.8602			
Risk response							
Loading values	RR1: 0.8715	RR2: 0.9828	RR3: 0.985	RR4: 0.7968			
Control activity							
Loading values	CA1: 0.9815	CA2: 0.8801	CA3: 0.9809	CA4: 0.8829			
Information and communication							
Loading values	IC1: 0.9782	IC2: 0.9651	IC3: 0.793	IC4: 0.9789			
Monitoring							
Loading values	MO1: 0.9898	MO2: 0.9697	MO3: 0.9868	MO4: 0.897			
IT strategy							
Loading values	ITG1: 0.9426	ITG2: 0.9252	ITG3: 0.9579	ITG4: 0.7809	ITG5: 0.8016	ITG6: 0.9329	ITG7: 0.9567
	ITG8: 0.9514	ITG9: 0.9455	ITG10: 0.8217	ITG11: 0.8118			
IT structure							
Loading values	ITC1: 0.8512	ITC2: 0.8962	ITC3: 0.8648	ITC4: 0.9001	ITC5: 0.9631	ITC6: 0.9427	ITC7: 0.8873
	ITC8: 0.8945	ITC9: 0.8789	ITC10: 0.9584	ITC11: 0.9732	ITC12: 0.9768	ITC13: 0.9483	ITC14: 0.9794
	ITC15: 0.9144	ITC16: 0.8977	ITC17: 0.8179	ITC18: 0.8041			
Competitive advantage							
Loading values	CMA1:0.8296	CMA2: 0.8232	CMA3: 0.8221	CMA4: 0.831	CMA5: 0.8422	CMA6: 0.8657	CMA7: 0.8545

(IE: internal environment; OS: objective setting; EI: event identification; RA: risk assessment; RR: risk response; CA: control activity; IC: information and communication; MO: monitoring; ITG: IT strategy; ITC: IT structure; CMA: competitive advantage).

**Appendix C: AVE and reliability of the constructs**

Constructs	AVE	Composite reliability	Cronbach's Alpha
Internal environment	0.9198	0.982854	0.980581
Objective setting	0.8716	0.975988	0.978647
Event identification	0.9094	0.967794	0.948944
Risk assessment	0.9048	0.974316	0.931415
Risk response	0.8325	0.951788	0.916428
Control activity	0.8698	0.963845	0.948634

Information and communication	0.8688	0.963371	0.912443
Monitoring	0.9245	0.92457	0.909382
IT strategy	0.8029	0.978044	0.948429
IT structure	0.8275	0.988522	0.978293
Competitive advantage	0.7031	0.943089	0.930794

## Appendix D: Fornell and Larcker's test

	CMA	ITG	ITC	IE	OS	EI	RA	RR	CA	IC
CMA	0.839									
ITG	0.563	0.896								
ITC	0.744	0.586	0.910							
IE	0.642	0.545	0.611	0.959						
OS	0.552	0.555	0.561	0.886	0.934					
EI	0.546	0.469	0.509	0.658	0.633	0.954				
RA	0.553	0.443	0.438	0.793	0.713	0.620	0.951			
RR	0.424	0.462	0.530	0.476	0.811	0.671	0.733	0.912		
CA	0.447	0.496	0.587	0.490	0.597	0.681	0.713	0.703	0.933	
IC	0.449	0.496	0.568	0.716	0.635	0.806	0.722	0.616	0.838	0.932

Diagonal items: AVE square roots (IE: internal environment, OS: objective setting, EI: event identification, RA: risk assessment, RR: risk response, CA: control activities, IC: information and communication, MO: monitoring, ITG: IT strategy; ITC: IT structure; CMA: competitive advantage).

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