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The Mediating Role of Intellectual Capital in the Relationship between Human Resource Management Practices and Enterprise Risk Management: Evidence from Egyptian Banks

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Abstract

This paper aims to investigate the impact of intellectual capital (IC) as a mediator variable on the association between human resources management practices (HRM) practices and enterprise risk management (ERM) within the Egyptian banking sector. This study also examines bi-causality linkages between these variables, highlighting the dynamic interplay between these functions. The designated HRM practices index, the ERM index and the value-added intellectual coefficient method were used to assess the level of HRM practices, ERM maturity and the performance of IC, respectively. The content analysis approach, structural equation modeling (SEM) and Granger causality tests have been used to examine data collected from financial statement of the Egyptian banks listed in the Egyptian stock exchange. The data set is derived from 13 banks listed in the Egyptian exchange from 2018 to 2022. The findings revealed that HRM has a direct impact on enterprise risk management by ensuring that employees are well-trained, engaged, and motivated to adhere to risk protocols. Additionally, VAIC as a partial mediator enhances this relationship, allowing banks to utilize their intellectual resources—such as human skills, organizational structures, and capital—more effectively in risk management. Moreover, a bi-causality relationship can be observed between HRM practices and ERM.

Keywords: *HRM Practices, VAIC, ERM Maturity, Bi-Causality, Emerging Markets.*

Introduction

In today's global economy, the banking sector is instrumental in fostering financial stability and stimulating economic growth (Beck, 2020; Kpmg. 2019). Financial institutions are increasingly exposed to higher levels of risk due to rapid technological advancements (Thakor, 2020; Eling & Lehmann, 2018) evolving regulatory landscapes(Pwc, 2018; Basel committee on banking supervision, 2019), and heightened market volatility(Carletti et al.,2020). This escalating risk environment accentuates the critical need for effective risk management strategies (Deloitte, 2020).

Enterprise Risk Management (ERM) has consequently emerged as a strategic approach for firms to manage a wide spectrum of risks (Naik and Prasad, 2021; Deloitte, 2020; Lai et al., 2011). ERM not only focuses on risk mitigation but also integrates risk management into the broader framework of organizational strategy and decision-making (Naik and Prasad, 2021; Lai et al., 2011; Ghazali and Munab, 2013). As a result, considerable attention from both practitioners and researchers has been directed toward identifying the sources of various types of risks—including financial, reputational, human, market, information security, political, legal, and operational risks—and developing methods for their mitigation (e.g., COSO, 2004; Nocco and Stulz, 2006; Nicholas and Walker, 2012).

Among these, the human factor emerges as a predominant source of risk in the knowledge-based economy. In the realm of risks associated with human resource (HR) practices, such exposure can be both costly and time-consuming. Adverse effects may include increased litigation or administrative claims, negative publicity, high employee turnover rates, and difficulties in attracting top talent. In this context, Martin (2013) argued that HR professionals play a vital role in controlling or mitigating these risks by ensuring full legal compliance of HR practices. This underscored the need for a thorough examination of HR procedures

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to assess their alignment with industry "best practices," thereby justifying their crucial role in managing the adverse effects of risks.

At the same time, extensive research has highlighted the importance of intellectual capital and its impact on organizational performance. Bontis and colleagues (2000) investigated the critical role that HRM practices play in building intellectual capital. Their study finds that employee development and training are directly linked to the creation of human capital. In addition, Herremans et al. (2011) investigated the relationship between intellectual capital and the ability to manage uncertainty in dynamic business environments and demonstrated that organizations with high levels of intellectual capital fostered by strategic HRM practices, are better equipped to adapt to changes and make informed decisions under uncertainty, which boosts organizational performance.

According to Gupta et al. (2020), understanding the dimensions of IC i.e. Human capital, Structural capital and capital employed efficiency that support the multifaceted nature of intellectual capital and its pivotal role in enhancing an organization's competitive position and financial performance.

In this context, numerous studies have investigated the role of intellectual capital in reducing risks (e.g., Nawaz, 2017; Nadeem et al., 2018; Cenciarelli et al., 2018; Ahmadi &Pour, 2021; Zaighum Isma et al., 2024). As documented by Urme (2023), companies actively compete for talent, and those that excel in attracting, retaining, and motivating high-talented employees are more likely to achieve and sustain a competitive advantage necessary to meet contemporary challenges. This implies that effective investment in human resources has become a critical strategy for organizations aiming to remain competitive and address evolving challenges. Consequently, human resource practices and intellectual capital—which together create high value-added capital—have become the cornerstone of organizational progress and prosperity (Alipour, 2012; Marr and Chatzkel, 2004).

Research Objectives

This study seeks to contribute to the existing literature in several significant ways. First, although prior research has employed various methodologies and examined firm-level factors influencing ERM and HRM practices, intellectual capital has received limited attention as a determinant within this context. Our research addresses this gap by investigating the mediating role of IC in the relationship between HRM practices and ERM, including the exploration of any bi-causal relationships. Second, we adopt a methodological approach designed to navigate the complexities inherent in the interplay between HRM practices and a firm's risk profile. Lastly, the study is situated within the emerging economy of Egypt, which is characterized by economic uncertainty and market volatility as illustrated in the financial reports of the Central Bank of Egypt that show the most common types of risks that commercial banks are exposed (e.g: credit risks, liquidity risks and operational risk), thereby providing insights that are particularly relevant for similar economic environments.

Research Question

This research aims to explore how intellectual capital (IC) can be conceptualized as a mediator between human resource management (HRM) practices and enterprise risk management (ERM) to mitigate potential risks faced by financial institutions listed on the Egyptian Exchange.

Outline of the Paper

This paper is structured as follows: The introduction provides background on the significance of research variables, outlining the research objective, research question and overall structure. **Section 2** provides a theoretical literature review for developing the study hypotheses. **Section 3** Methodology and data collection. **section 4** presents and discusses the empirical results. Finally, **Section 5** conclusions and implications with recommendations then suggestions for future research directions.

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Literature Review and Hypotheses Development

Theoretical Foundation and Conceptual Framework

The Resource-Based View (RBV) of the firm, as articulated by Barney (1991), Conner (1991), and Peteraf (1993), contends that a firm's internal resources are central to its strategic analysis and competitive positioning (Bontis et al., 2006; Mahoney& Pandian,1992; Rumelt & Teece, 1991). The RBV explores the link between firm's resources or capabilities and its sustained competitive advantage, arguing that both tangible and intangible assets—such as patents, trade secrets, managerial skills, organizational processes, and proprietary knowledge—are critical determinants of success (Barney, 1991). According to the RBV, organizations must possess resources that are valuable, rare, imperfectly imitable, and non-substitutable to maintain a competitive edge over their competitors.

Furthermore, the core competence theory as a concept in management introduced by Hamel and Prahalad (1994) posits that a firm's competencies consist of a bundle of human resource elements such as experience, skills, and education (Bontis, Keow, and Richardson, 2000). The competency-based perspective suggests that while tangible assets are important, they are not decisive in securing a competitive advantage (Lado& Wilson, 1994). More critically, the value of talented individuals is heightened when they are integrated into an organizational system that leverages their capabilities to create substantial value.

Moreover, the evolution of contemporary human resource management has significantly elevated the importance of human resources within organizations (Beardwell& Claydon, 2004).Consequently, numerous research contributions have emphasized that investing in human resources is vital for achieving competitive advantage and enhancing organizational performance.

Numerous studies have been directed to examining how intellectual capital enhances performance and reduces the risk of financial distress (Pour et al., 2014; Nadeem et al., 2016; Nawaz, 2017; Cenciarelli et al., 2018; Shahwan and Habib, 2020). Therefore, leveraging valuable intellectual assets within an organization can effectively resolve issues related to risk management, including the formulation of risk policies, oversight of internal controls, accountability mechanisms, board-level strategic planning, and the monitoring of managerial functions (Khan et al., 2018).

Consequently, the conceptual framework of this study hypothesizes that the adoption of effective human resource management (HRM) practices will positively impact a firm's intellectual capital (IC), thereby enhancing the maturity level of enterprise risk management (ERM) and minimizing risks in the long term. Additionally, this study will examine the existence of bi-causal relationships among HRM practices, IC, and ERM.

Literature Review [Linkages among HRM Practices, Intellectual Capital, and Enterprise Risk Management]

Linkage between HRM practices and ERM

Numerous researchers and practitioners have discussed the impact of HRM practices on risk management (RM). Most of these studies (Verreault, & Hyland, 2005; Andersen , 2008 ; Meyer& robbins, 2011; Kokkaew & Koompai, 2012; Martin, 2013; Melhem, 2016; Becker& Smidt, 2016; Deloitte, 2020; Olawale &Ajayi,2024; Filemon et al., 2024) support the existence of significant positive relationship between HRM practices and risk management ,they argued that HRM practices play a critical role in operationalizing risk management processes within organizations. For instance, Meyer& robbins (2011) argued that HRM is essential in promoting a risk-aware culture, particularly through the development of training programs focused on risk awareness, leadership development, and communication. Another study of Verreault, & Hyland (2005) revealed that HRM practices, particularly those related to performance management and employee engagement, directly contribute to the effectiveness of RM by aligning employee behaviors with the organization's risk management objectives. They suggested that when employees are motivated and held accountable for managing risks, the overall risk culture is strengthened. Becker& Smidt (2016) highlighted the importance of incorporating HRM into risk management processes. His findings emphasize

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that risk grows with the organization's maturity in integrating HR with risk functions and suggested that HRM practices, such as performance incentives and risk-related training, are key to driving effective risk management.

As a result, by aligning HRM with ERM, organizations can build a risk-aware culture, equip employees with the necessary skills to manage risks, and improve overall organizational resilience. These studies collectively demonstrate that effective HRM is crucial for embedding risk management into everyday organizational processes. Accordingly, the scant literature on the association between HRM practices and ERM, particularly in Egypt as an emerging market, motivates the present study to test the following hypotheses:

H1a. *There is a significant relationship between HRM practices and enterprise risk management in the banks under study.*

H1b. *There is a significant relationship between the sub-dimensions of HRM practices and enterprise risk management in the banks under study.*

Linkage Between HRM Practices and Intellectual Capital

Broad stream of studies have explored the relationship between HRM practices and intellectual capital (Bontis & Richardson, 2000; Subramaniam and Youndt, 2005; Kang et al., 2007; Hsu & Wang, 2012; Sokolov & Zavyalova, 2020). For instance, Sokolov & Zavyalova (2020) have explored how HRM practices influence different components of intellectual capital, i.e. human, social, and structural capital within knowledge-intensive firms. The results pointed out that ability-enhancing HRM practices (i.e. knowledge & skills abilities, training and development) positively impact human capital, while motivation-enhancing practices(i.e. employee recognition, salary and perks, performance feedback, opportunities for advancement and development job security and workload) strengthen both human and social capital. Moreover, Bontis and Richardson (2000) revealed that HRM practices including employee development and continuous learning are fundamental to enhancing intellectual capital. Well-trained workforce positively affected both structural and relational capital, leading to better organizational performance. In addition, Kang et al. (2007) concluded that HRM practices i.e. knowledge sharing and organizational learning contribute to the creation of relational capital. Hsu & Wang (2012) emphasized the importance of intellectual capital in shaping HRM strategies, particularly in fostering a knowledge-sharing environment and adapting HR policies to retain key talent and support organizational innovation. Subramaniam and Youndt (2005) also, pointed out that organizations with strong HRM practices in training and development were more likely to have higher levels of intellectual capital and innovative capabilities. Accordingly, the findings of most literatures demonstrated that by effectively managing human resources, organizations can build a strong intellectual capital base, which is crucial for sustaining long-term growth and performance. In the context of Egypt as an emerging market, few studies have investigated the association between HRM practices and the efficiency of IC. The practical dimension of such an association is questionable. Below, the present paper aims to investigate the following hypothesis in the Egyptian context:

H2a. *There is a significant relationship between HRM practices and the intellectual capital of the banks under study.*

H2b. *There is a significant relationship between HRM practices sub-dimensions and the intellectual capital of the banks under study.*

Linkage Between Intellectual Capital (IC) and Enterprise Risk Management

Considerable attention has been directed to investigating the association between intellectual capital and enterprise risk management (Curado and Bontis, 2007; Toms, 2010; Khan&Ali, 2017; Girangwa Kakiya et al., 2019; Isma Zaighum et al., 2023). These studies have revealed that the relationship between Intellectual Capital (IC) and ERM is dynamic and reciprocal. ERM frameworks benefit from the integration of intellectual capital, as organizational knowledge, skills, and relationships contribute to more effective risk management practices. At the same time, organizations with strong intellectual capital are better equipped to manage risks, as their employees possess the expertise and collaborative networks needed to anticipate and mitigate potential threats. When a firm invests in intellectual capital—such as human capital through

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salaries, training and development, and other expenditures, as well as structural efficiency via procedures and databases that remain within the company, it gains substantial long-term benefits and effectively reduces risks. As documented by Girangwa Kakiya et al. (2019) have found that ERM frameworks benefit from the use of intellectual capital (human and structural capital) by incorporating organizational knowledge into risk management processes. Similarly, Curado and Bontis (2007) have explored how intellectual capital (IC) enhances the effectiveness of ERM by fostering better risk management practices. Their study highlights how human capital (employee skills and expertise) and structural capital (systems and processes) contribute to risk mitigation by enabling employees to identify risks earlier and implement appropriate risk responses. Accordingly, this study is motivated to investigate the following hypothesis in the Egyptian environment as:

H3. *There is a significant relationship between intellectual capital and enterprise risk management in the banks under study.*

Linkages Among HRM Practices, Intellectual Capital and Enterprise Risk Management

As numerous studies have investigated the association between HRM practices and ERM (Verreault, & Hyland, 2005; Andersen , 2008 ; Meyer& robbins, 2011; Kokkaew & Koompai, 2012; Martin, 2013; Melhem, 2016; Becker& Smidt, 2016; Deloitte, 2020; Olawale &Ajayi, 2024; Filemon et al., 2024), other studies examined the relationship between intellectual capital and ERM (Khan&Ali, 2017; Girangwa Kakiya et al., 2019; Isma Zaighum et al., 2023).

In addition, the relationship between HRM and intellectual capital is well-supported by a variety of studies that highlight the critical role of HRM practices in fostering the growth of human, structural, and relational capital (Bontis & Richardson, 2000; Subramaniam and Youndt, 2005; Kang et al., 2007; Herremans et al., 2011; Sokolov & Zavyalova, 2020). A study of Herremans et al. (2011) demonstrated that organizations with high levels of intellectual capital fostered by strategic HRM practices are better equipped to adapt to changes and make informed decisions under uncertainty. Also, the relationship between intellectual capital and ERM is supported by a few researches (e.g.: Khan&Ali, 2017; Girangwa Kakiya et al., 2019; Isma Zaighum et al., 2023). As a result, these above relationships motivate the present study to explore the mediating role of IC on the association between HRM practices and Enterprise risk management. Accordingly, this study undertakes a longitudinal examination of the relationships among HRM practices, intellectual capital (IC), and enterprise risk management (ERM) within the Egyptian banking sector. In this context, the following hypotheses are proposed:

H4a. *Intellectual capital mediates the relationship between HRM practices and enterprise risk management in the banks under study.*

H4b. *Intellectual capital mediates the relationship between HRM practices sub-dimensions and enterprise risk management in the banks under study.*

H5*. There are significant differences among banks according to their practicing of HRM, IC, ERM.*

However, little attention has been directed to testing bi-directional causality relationships between good practices in HRM, IC and ERM, a few studies support the reverse relationship between ERM and HRM practices (Bromiley et al. ,2015; Kokkaew&Koompai, 2012; Nocco and Stulz, 2006). For instance, Bromiley et al. (2015) highlighted how ERM requires organizations to redesign HRM functions to align with risk management competencies. Another study of Kokkaew & Koompai (2012) provided the critical analysis of the risks and opportunities of the current HRM practices adopted by Thai construction companies in domestic and international markets. In other words, Nocco and Stulz (2006) explored how ERM is integral to shaping HRM strategies, particularly in industries facing high levels of uncertainty and risk.

As mentioned before that there are some literatures investigated the relationship between HRM practices and IC, a few studies support the existence of reverse relationship between them (Kianto& Aramburu, 2017; Hsu and Wang, 2012) . For instance, Kianto& Aramburu (2017) show that intellectual capital drives organizations to adapt their HRM practices in ways that support knowledge exchange and innovation.

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Another study of Hsu and Wang explored how firms with high levels of intellectual capital implement HRM policies that focus on employee empowerment, skill development, and flexible work arrangements to retain and motivate highly skilled employees. However, the relationship between IC and ERM is confirmed by some studies, the reverse causal effect of such a relationship is not supported adequately. A study of Saeidi (2021) provided an insight into the impact of ERM in recent years on non-financial performance and the influence of intangible assets (IC) on ERM and its function. Accordingly, this oversight motivates the present study to test the following hypothesis:

H6. *There are bi-causal links among HRM practices, intellectual capital, and enterprise risk management.*

By formulating these hypotheses, the study aims to comprehensively examine the interconnectedness of HRM practices, intellectual capital, and enterprise risk management within the context of Egyptian banks. The investigation of these relationships, including potential bi-directional causality, will contribute valuable insights to the existing literature and offer practical implications for the banking sector.

Methodology

Research Design

This research employs quantitative research design using secondary data to explore the dynamic relations between ERM and HRM practices with the context of IC as a mediator.

Measuring The Study Variables: (ERM, IC, HRM Practices)

First: Enterprise Risk Management (ERM) As A Dependent Variable

Enterprise Risk Management (ERM) is a process led by an organization's senior management that involves planning, organizing, leading, and controlling activities to minimize the effects of risk on the firm value (Gatt et al., 2019; Elahi, 2013; Von kanel et al., 2010).

According to Coso (2004), ERM can be defined as a process, affected by the entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within the risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.

While traditional risk management and ERM share the common goal of risk mitigation, they employ different methodologies. Traditional risk management typically focuses on specific, often insurable risks and relies on historical events to predict and mitigate future occurrences. In contrast, ERM adopts a holistic approach that considers the organization's entire risk portfolio (Butterfield, 2017; Claypole, 2012). ERM emphasizes the interrelationships among risks and seeks to manage them in a manner that aligns with the organization's overall strategic objectives. It is forward-looking, concentrating on strategic, operational, reporting, and compliance risks that might impact the organization's ability to achieve its goals (Bugalla and Kallman, 2012; Butterfield, 2017; Almeida et al., 2019).

ERM maturity refers to how skilled an organization is at identifying, monitoring and mitigating risks. In highly mature organizations, these processes will be comprehensive and integrated. In organizations with less ERM maturity, these processes may be reactive, siloed and inconsistent (Monda& Giorgino, 2014; Oliva, 2016). To evaluate an organization's ERM maturity, this study employs an ERM assessment index developed by the Chartered Global Management Accountant (CGMA) institution (Beasley et al., 2012). This index was formulated through a comprehensive review of literature and research related to ERM, as well as best practice guidance issued by numerous regulatory agencies. Notably, it incorporates elements from the development of the Committee of Sponsoring Organizations of the Treadway Commission's (COSO) Enterprise Risk Management—Integrated Framework and COSO ERM thought papers.

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The assessment tool includes brief descriptors of eight focus areas considered essential dimensions of ERM practice. Evaluators determine whether each of the critical elements is currently present in the bank under study. In this context, the most critical elements within each focus area were identified in a total of 46 elements from 75 elements. The eight focus areas are: Risk culture, Risk identification, Risk assessment, Articulation of Risk Appetite, Risk response, Risk reporting, Integration with strategic planning and Assessment of ERM effectiveness. **(See appendix 1)**

Second: Intellectual Capital (IC) As A Mediator Variable

The concept of intellectual capital has been subject to extensive exploration, there is no general agreement definition due to its multifaceted nature (Edvinsson and Lin, 2011). Emerging in the early 1980s, IC was introduced to address business owners' needs to comprehend the foundations of strategic success. The 1990s witnessed a significant expansion of this concept in academic circles (e.g., Brooking, 1997; Edvinsson and Malone, 1997; Stewart, 1997; Bontis, 1998).

According to Hsieh et al. (2020), Attar et al. (2019), and Bansal and Singh (2019), IC can be defined based on four distinct perspectives .The first approach defines IC based on its components as follows: 1)Human Capital: The skills, knowledge, and competencies of the company's employees.2) Structural Capital: The organizational processes, patents, trademarks, and proprietary systems that remain with the company even when employees depart. 3) Relational Capital: The value derived from relationships with external stakeholders such as customers, suppliers, and partners. The second approach defines IC based on its benefits that viewed IC as a strategic investment that yields sustained returns and secures a lasting competitive position in the market. The third approach defines IC based on its value often considering it as the difference between a company's market value and its book value (Brooking, 1996; Hsieh et al., 2020). It includes non-rare and irreplaceable resources and capabilities that are not reflected on the balance sheet. The fourth approach defines IC based on centric knowledge that regarded IC as the cumulative knowledge that companies can leverage in their quest for competitive advantage (Li et al., 2019). It encompasses valuable knowledge resources —such as innovation, expertise, organizational technology, customer relations, and professional skills—that companies utilize to create value and achieve a competitive edge.

Synthesizing these perspectives, the researcher depended on the first approach emphasizing on intellectual capital components of HCE, SCE, CEE.

To measure the performance of intellectual capital in this study, we deployed the **Value Added Intellectual Coefficient (VAIC)** model developed by Pulic (1998). The VAIC model is widely recognized for its theoretical robustness and precision in assessing IC performance (Pulic, 2008; Laing et al., 2010; Al-Musali and Ku Ismail, 2014; Makki and Lodhi, 2008; Shahwan and Fathallah, 2020). According to this model, intellectual capital comprises three components: 1) Human Capital Efficiency (HCE): Reflects the skills, knowledge, and competencies embedded in a firm's employees that contribute to value creation (Chien and Chao, 2011; Saeed et al., 2016). 2) Structural Capital Efficiency (SCE): Consists of organizational knowledge, processes, databases, patents, and trademarks that provide a competitive advantage (Gupta et al., 2020). 3) Capital Employed Efficiency (CEE): Represents the financial and physical resources that integrate with IC resources to generate value (Pulic, 2008).

The VAIC model has been established as a primary measure of IC performance in prior research (Chen et al., 2005; Laing et al., 2010; Shahwan and Habib, 2020). In this study, the performance of intellectual capital is quantified as the sum of the efficiencies of the three components: HCE, SCE, and CEE. The VAIC model is algebraically expressed as follows (Appuhami and Bhuyan, 2015; Pulic, 2008):

$$VAIC = CEE + HCE + SCE \qquad (1)$$

Where:

- **VAIC** is the Value Added Intellectual Coefficient of the firm.

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- **CEE** is the Capital Employed Efficiency.
- **HCE** is the Human Capital Efficiency.
- **SCE** is the Structural Capital Efficiency.

The components CEE, HCE, and SCE are calculated using the following equations (Al-Musali and Ismail, 2014):

1. **Capital Employed Efficiency (CEE):**

CEE = VA/CE (2)

- **VA** (Value Added) is the value generated by the firm's resources.
- **CE** (Capital Employed) is calculated as the book value of total assets minus intangible assets, which equates to the sum of financial and physical assets.

2. **Human Capital Efficiency (HCE):**

- HCE =VA/HC (3)

HC represents the total salaries and wages paid to the firm's employees.

3. **Structural Capital Efficiency (SCE):**

SCE=SC/VA (4)

Where SC = VA- HC = [(value added) - (total salaries and wages)]. The value added (VA) can be calculated as follows:

VA=OP+EC+D+A (5)

Where:

- **OP** is the firm's operating profit.
- **EC** is the total employee costs (expenses).
- **D** is the depreciation expense.
- **A** is the amortization expense.

By employing the VAIC model, we obtain a comprehensive measure of a firm's intellectual capital performance, capturing the efficiency of its human, structural, and capital employed resources. This allows for a nuanced analysis of how intellectual capital contributes to value creation and competitive advantage within the banking sector.

Third: Human Resource Management Practices as Independent Variable

A review of literature has defined (HRM) practices from various perspectives. For instance, Schuler and Jackson (1987) initially conceptualized HRM practices as a system designed to attract, develop, motivate, and retain employees to ensure the effective implementation and survival of both the organization and its members. Subsequently, Delery and Doty (1996) described HRM practices as a set of internally consistent policies and procedures implemented to ensure that a firm's human capital contributes effectively to the

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achievement of its business objectives. Similarly, Minbaeva (2005) viewed HRM practices as organizational strategies that facilitate the development of firm-specific competencies, foster complex social relationships, and generate organizational knowledge essential for sustaining a competitive advantage.

Previous studies have revealed five common HRM practices related to organizational innovation and high performance: Performance Management and Appraisal, Career Management, Reward Systems, Training and Development, Employee Staffing (Laursen and Foss, 2003; Shipton et al., 2005; Tan and Nasurdin, 2011).

- **Employees Staffing**: Processes to ensure the right talent is recruited and retained.
- **Training & Developing Employees**: Initiatives to improve employee skills and risk management competencies.
- **Performance Management**: Systems to monitor and evaluate employee performance in line with risk management goals.
- **Reward System**: Incentives tied to responsible risk-taking and adherence to risk management objectives.
- **Career management**: involves self-assessment, exploring diverse career paths, ongoing learning, and adapting to job market changes.

In addition to these practices, this study introduces **health and safety** as an HRM practice particularly relevant to ERM implementation.

- **Health & Safety**: Policies aimed at ensuring the well-being of employees physically and psychologically, reducing operational risks. (Asquin et al., 2010; Lee and Brotheridge, 2013; Pinto et al., 2014; Zheng et al., 2015).

To assess HRM practices, numerous quantitative and qualitative benchmarking methods have been proposed. On one hand, several studies advocate for qualitative techniques, such as questionnaires, to measure HRM practices (e.g., Rasool et al., 2020; Agarwala, 2003; Den Hartog et al., 2013; Liu et al., 2016; Liao et al., 2009). These methods are more subjective and often employ Likert-type scales to capture attitudes toward specific practices, reflecting various constructs. Thus, in this study we employ a content analysis approach to develop an index for measuring HRM practices with a total of 37 items within the banking sector (**see appendix 1**).This method enables a systematic and objective assessment of HRM practices by analyzing relevant documents and reports, thereby providing a comprehensive evaluation of how HRM contributes to organizational performance and risk management.

Data Collection

The empirical analysis of this study is based on primary data from depth interviews and secondary data collected from the published annual reports of Egyptian financial banks over the five-year period from 2018 to 2022. Out of the 14 banks listed on the Egyptian Exchange, one bank called (Banque du Caire) was excluded due to difficulties in obtaining financial information for the study period or because it exhibited negative value addition. Consequently, the final sample comprises 65 bank-year observations from 13 Egyptian banks listed in the Egyptian stock exchange during 2018–2022.

Data Analytics

Table 1. summarizes the ranking of our data set in respect to their performance in Human Resource Management (HRM), Value Added Intellectual Capital (VAIC), and Enterprise Risk Management (ERM).

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Table (1). Rankings of Bank Performance in HRM, VAIC, ERM

NO.	Bank name	ERM Rank	VAIC Rank	HRM Rank
1	Faisal Islamic bank of Egypt (FAIT)	1	1	11
2	National bank of Kuwait (NBK)	2	9	1
3	Commercial international bank (CIB)	3	3	5
4	Qatar national bank (QNB)	10	2	7
5	Abu Dhabi Commercial Bank (ADCB)	7	7	3
6	Al-Baraka bank (AIB)	4	4	4
7	Housing and development bank (HDB)	8	8	8
8	Abu Dhabi Islamic Bank (ADIB)	9	6	6
9	Credit Agricole (CA)	5	5	2
10	Suez canal bank (SAE)	11	6	9
11	Saudi investment bank (SAIB)	6	13	12
12	Export development bank (EBE)	11	10	13
13	Egyptian gulf bank (EG bank)	13	12	10

As depicted in table (1), top bank performance rankings imply that Faisal Islamic Bank of Egypt (FAIT) consistently ranks at the top in both VAIC and ERM, distinguishing it as an overall standout performer. Its high intellectual capital efficiency and superior risk management practices suggest a strong competitive advantage in managing risks and leveraging knowledge resources. In addition, National Bank of Kuwait (NBK): Ranked first in HRM and second in ERM, NBK demonstrates a well-rounded performance across human resources, robust human capital management and risk management practices. Moreover, Commercial International Bank (CIB) and Qatar National Bank (QNB perform well across VAIC and ERM rankings, reflecting their focus on intellectual capital development and effective risk management strategies.

Conversely, Lower-Performing Banks imply that Egyptian Gulf Bank (EG Bank) ranks lowest in ERM, this may pose challenges in effectively managing financial and operational risks. In addition, Saudi Investment Bank (SAIB) ranks lowest in VAIC, suggesting difficulties in managing intellectual capital, which could negatively impact its innovation capacity and long-term value creation. Finally, Export Development Bank of Egypt (EBE) ranks lowest in HRM, indicating that its human resource practices may require improvement to enhance employee performance and support organizational growth.

This results show that banks that perform well in Value Added Intellectual Capital (VAIC), such as Faisal Islamic Bank of Egypt (FAIT) and Qatar National Bank (QNB), also exhibit strong performance in Enterprise Risk Management (ERM). This observation suggests that intellectual capital plays a critical role in enhancing risk management capabilities. Conversely, banks with weaker intellectual capital—for example, the Saudi Investment Bank (SAIB) and Egyptian Gulf Bank (EG Bank)—tend to rank lower in ERM. This indicates a potential link between how effectively banks manage their knowledge resources and their ability to manage risks.

Table 2 presents the descriptive statistics of the main variables in our dataset for the period 2018–2022. According to the independent variable Human Resource Management (HRM) Practices**,** the overall HRM score has a mean of 0.781 and a median of 0.811, indicating a reasonably symmetrical distribution. This suggests that, on average, HRM practices are moderately implemented across the banks. The standard deviation of 0.075 reflects relatively low variability in HRM practices among the banks, implying consistency in implementation. The range from 0.676 to 0.905 further supports this consistency, with no extreme outliers detected. The normality test statistic is 5.217, significant at the 10% level, suggesting a non-normal distribution. This implies that non-parametric tests might be appropriate for further analyses involving HRM practices. THE mediator variable: Value Added Intellectual Capital **(VAIC)** has a mean of 7.750 and a median of 7.667, implying a near-normal distribution of intellectual capital across the banks. The standard

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deviation of 2.944 indicates moderate variability in VAIC, suggesting that some banks perform significantly better than others in leveraging intellectual capital. The normality test statistic is 1.169 (not significant), suggesting that VAIC follows a normal distribution, which supports the use of parametric tests in analyses involving VAIC. The Dependent Variable: Enterprise Risk Management **(ERM)** has a mean of 0.858 and a median of 0.870, indicating a strong and consistent emphasis on risk management practices among the banks. The standard deviation of 0.079 reflects low variability in ERM practices, showing that most banks have well-established risk management systems. The normality test statistic is 8.956, significant at the 5% level, indicating a non-normal distribution, which may necessitate the use of non-parametric testing methods.

Table (2). Descriptive Statistics for The Study Variables, 2018 - 2022

	Unit	*Obs.*	*Mean*	*Median*	*Std. Dev.*	*Min*	*Max*	*Normality*
Independent Variable:								
Human Resources Management (HRM)	*(Scale of 0 - 1)*	65	0.781	0.811	0.075	0.676	0.905	[5.217][c]
Mediator variable								
Value Added Intellectual Capital (VAIC)	*(normal scale)*	65	7.750	7.667	2.944	1.178	14.26	[1.169]
Dependent Variable:								
Enterprise Risk Management (ERM)	*(Scale of 0 - 1)*	65	0.858	0.870	0.079	0.663	0.967	[8.956][b]

***Note*:** a, b, c indicate significance at 1%, 5% and 10% respectively.

Table 3 displays the Pearson correlation coefficients among the study variables. The correlation coefficient between HRM and ERM is **strong** at 0.689 and statistically significant at the 1% level. This indicates that effective HRM practices are directly associated with improved risk management capabilities in banks.

The correlation coefficient between HRM and VAIC is **weak** at 0.1103 and not statistically significant. This weak positive correlation suggests that HRM practices do not have a direct, substantial impact on intellectual capital. However, HRM may still contribute to VAIC through indirect or longer-term effects.

The correlation coefficient between VAIC and ERM is **moderate** at 0.222 and significant at the 10% level. This suggests that intellectual capital contributes to risk management, although the relationship is moderate. VAIC plays a supportive role in enhancing ERM, but its impact is not as strong as the direct influence of HRM.

Table (3). Correlation Matrix

Variables		**(1)**	**(2)**	**(3)**
Human Resources Management Practices	**(1)**	1		
Value Added Intellectual Capital	**(2)**	0.1103	1	
Enterprise Risk Management-ERM	**(3)**	0.6894[a]	0.2221[c]	1

Note: a, b, c indicate significance at 1%, 5% and 10% respectively.

These findings highlight the significant direct relationship between HRM practices and ERM, underscoring the importance of effective human resource management in strengthening banks' risk management capabilities. While the direct impact of HRM on intellectual capital (VAIC) is weak and not statistically significant, there may still be indirect or long-term effects worth exploring. The moderate correlation between VAIC and ERM suggests that intellectual capital does contribute to risk management, albeit to a lesser extent than HRM practices.

Table 4 summarizes the results of the Kruskal-Wallis test, which assesses differences among banks in HRM practices, VAIC, and ERM. The **HRM** variable has a Kruskal-Wallis H statistic of 18.934 with a p-value of

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0.090, indicating marginal significance at the 10% level. This implies that HRM practices vary somewhat across banks, though the differences are not as pronounced as those observed for VAIC and ERM.**VAIC** exhibits the most significant differences among banks, with a Kruskal-Wallis H value of 47.381 and a p-value of 0.000, highlighting substantial variability in the management of intellectual capital across different institutions. **ERM** also shows statistically significant differences among banks (p = 0.019), suggesting that risk management practices are more effectively implemented in some banks than in others. (This supports H5)

Table 4. Kruskal-Wallis Test Results

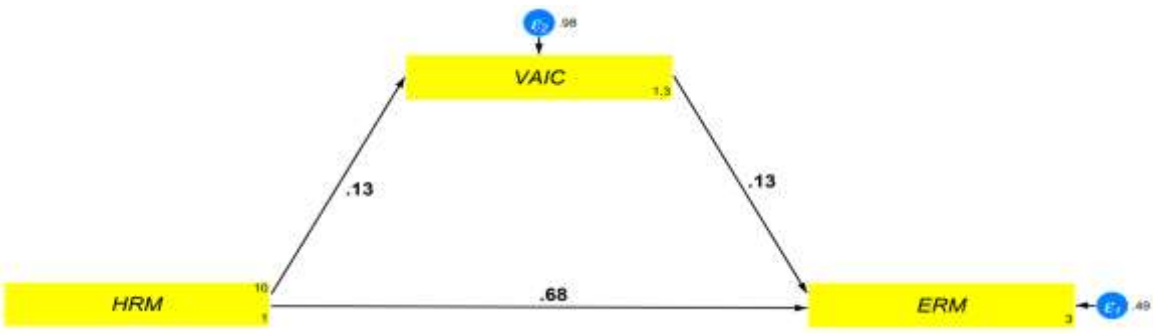
Variable	HRM		VAIC		ERM
Kruskal-Wallis H	18.934 (0.090)[c]		47.381 (0.000)[a]		24.247 (0.019)[b]

Note: a, b, c indicate significance at 1%, 5% and 10% respectively.

Results and Discussion

Intellectual Capital as a Mediator between HRM Practices and Enterprise Risk Management

To test the hypotheses H1a, H1b, H2a, H2b, H3, H4, Structural Equation Modeling (SEM1) has been developed to investigate the proposed relationships. The parameters of the SEM1 model depicted in **figure 1** were estimated by maximum likelihood with observed information matrix. The goodness-of-fit indices (χ^2), comparative fit index (CFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR) and root mean square error of approximation (RMSEA)) were examined to assess whether or not the designated structural model fitted the data. The results indicate that the structural equation model fits the data perfectly (χ^2 = 994.269, p = 0.000; CFI = 1.000; TLI = 1.000; SRMR = 0.000; RMSEA = 0.000). These indices suggest that the proposed model accurately represents the relationships among the variables and suggest an excellent model fit.



Path analysis for Hypothesis

(Unstandardized Estimates)

Chi-square (model vs. saturated)= 0.000, *df*= --, Prob.= ----, χ^2/df= ----

Chi-square (baseline vs. saturated)= 994.269, *df*= 3, Prob.= 0.000

CFI= 1.000, ***TLI***= 1.000, ***SRMR***= 0.000, ***CD***= 0.492, ***RMSEA***= 0.000, ***PCLOSE***= 1.000

AIC= -312.713, ***BIC***= -297.492

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Figure (1). Impact Of HRM on ERM in the Context of VAIC Mediation

Figure (1) depicts the direct effect of HRM on ERM is represented by a path coefficient of **0.68**, indicating a strong, positive relationship. This suggests that HRM practices have a significant direct impact on a bank's ability to manage risks effectively.

In addition, the indirect effect through VAIC is depicted through two paths:

From HRM to VAIC with a coefficient of **0.13,** and from VAIC to ERM with a coefficient of **1.3,** respectively.

These paths indicate that HRM practices positively influence VAIC, which in turn has a substantial effect on ERM. While the HRM-to-VAIC relationship is moderate, the VAIC-to-ERM path is notably stronger, underscoring the critical role of intellectual capital in enhancing risk management.

Table 5 summarizes the standardized and unstandardized path coefficients of the designated SEM1.

Table 5. Impact of HRM on ERM in the Context of VAIC Mediation

Endogenous variables: VAIC, ERM.

Exogenous variable: HRM.

Method: Maximum Likelihood (ML) with Satorra-Bentler.

Note: *** indicates statistical significance at the 1% level.

Turning to the impact of HRM on VAIC, this path result (HRM → VAIC) with unstandardized coefficient is 5.1242, with a standardized coefficient of 0.1298. The z-stat of 4.85 and a p-value of 0.000 indicate that this relationship is statistically significant at the 1% level. This result support H2 which indicates that HRM positively impacts VAIC, though the strength of the relationship is moderate. This result is consistent with the findings of (Bontis & Richardson, 2000; Subramaniam and Youndt, 2005; Kang et al., 2007; Hsu & Wang, 2012; Sokolov & Zavyalova, 2020).

Paths	Expected signal	Unstandardized Coefficient	Standardized Coefficient	Std. Err.	z stats.	p > |z|
▪ **VAIC Equation:**						
HRM → VAIC	+	5.1242	0.1298	1.057	4.85	0.000***
Constant	n/a	3.7785	1.2769	0.828	4.56	0.000***
▪ **ERM Equation:**						
VAIC → ERM	+	0.0045	0.1258	0.0005	6.58	0.003***
HRM → ERM	+	0.7442	0.6847	0.021	35.8	0.000***
Constant	n/a	0.2473	3.0354	0.016	15.2	0.000***

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Regarding the impact of VAIC as well as HRM on ERM, two paths result (VAIC → ERM) and (VAIC → ERM).

The unstandardized coefficient between VAIC and ERM is 0.0045, and the standardized coefficient is 0.1258. The z-stat of 6.58 and a p-value of 0.003 indicate that the relationship is statistically significant at the 1% level. This supports H3 which indicated that VAIC has a positive and significant effect on ERM, though the size of the impact is relatively small, based on the low coefficient. This result is consistent with the finding of (Girangwa Kakiya et al., 2019; Isma Zaighum et al., 2023).

On the other hand, the unstandardized coefficient between HRM and ERM is 0.7442, with a standardized coefficient of 0.6847. The z-stat of 35.8 and p-value of 0.000 indicate a highly significant relationship at the 1% level. This result supports H1 which confirms that HRM has a strong direct impact on ERM, meaning that HRM practices directly influence the bank's ability to manage risks. This result is consistent with the findings of (Kokkaew & Koompai, 2012; Martin, 2013; Melhem, 2016; Becker& Smidt, 2016; Olawale &Ajayi, 2024; Filemon et al., 2024).

The mediation is evidenced by VAIC acting as a bridge between HRM and ERM. The strong coefficient between VAIC and ERM emphasizes that intellectual capital plays a pivotal role in transforming HRM efforts into effective risk management practices.(this supports H4a)

Table (6). Goodness-Of-Fit Statistics for the SEM_1

	R squared	**Wald test for goodness fit**				**Stability analysis**	
		χ^2 *Stats.*	*df*	*p-value*		Eigenvalue	Modulus
VAIC	1.7%	23.52	1	0.000***		0	0
ERM	50.7%	1411.74	2	0.003***		0	0
Overall	**49.2%**					**Stability index = 0**	

Note: *** indicates statistical significance at the 1% level.

Table 6 provides the goodness-of-fit statistics for the structural equation model (SEM_1). The table includes metrics such as R squared, Wald test for goodness-of-fit, and stability analysis. For **VAIC**, the R^2 value is **1.7%**, indicating that only a small proportion of the variance in VAIC is explained by HRM in this model. This implies that while HRM influences VAIC, there are other external factors play a significant role in the development of intellectual capital. For **ERM**, the R^2 value is **50.7%**, meaning that **50.7%** of the variance in ERM is explained by HRM and VAIC. This suggests that the model explains a substantial amount of the variability in risk management outcomes. The overall R^2 for the model is **49.2%**, indicating that the model explains almost half of the variance in the outcomes of VAIC and ERM combined. The **Wald test** assesses whether the model parameters are statistically significant. For **VAIC**, the Wald test statistic is **23.52** with 1 (df), and the p-value is **0.000**, indicating that the relationship between HRM and VAIC is statistically significant. For **ERM**, the Wald test statistic is **1411.74** with 2 (df), and the p-value is **0.003**, showing a strong and significant relationship between HRM, VAIC, and ERM. The overall **goodness-of-fit** confirms that the model is significant at the **1% level**, meaning the relationships in the model are not due to chance. **Stability analysis** assesses whether the model is stable, using measures such as the **Eigenvalue** and **Modulus**. In this case, both VAIC and ERM have eigenvalues and moduli of **0**, indicating that the model is **stable**. The **stability index** is also **0**, confirming that the model's parameters remain consistent across different samples, ensuring that the model is robust and reliable.

Table (7). Informal Mediation Testing for the SEM_1

Path	**Baron & Kenny approach**				**Zhao, Lynch & Chen's approach**	
	Step (1)	Step (2)	Step (3)		Step (1)	Monte Carlo test
	$X \rightarrow M$	$M \rightarrow Y$	$X \rightarrow Y$		$X \rightarrow Y$	

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HRM → VAIC → ERM	[β = 5.124]***	[β = 0.003]***	[β = 0.744]***		[β = 0.744]***	0.018 [3.837]***

Note: *** indicates statistical significance at the 1% level.

Table 7 presents the results of **informal mediation testing** for the relationship between **(HRM)**, **(VAIC)**, and **(ERM)** using two different approaches: the **Baron & Kenny** method and the **Zhao, Lynch & Chen** approach. According to **Baron & Kenny Approach,** the coefficient (β = 5.124) between HRM and VAIC indicates a significant positive effect and it is highly significant ($p < 0.001$), suggesting that HRM practices contribute to the development of intellectual capital.

The coefficient (β = 0.003) between VAIC and ERM shows a small but statistically significant ($p < 0.001$) positive effect. While VAIC does mediate the relationship, the effect size is relatively small.

The coefficient (β = 0.744) between HRM and ERM demonstrates a strong, direct effect with high statistical significance ($p < 0.001$). This confirms that HRM plays a crucial role in improving risk management.

Regarding **Zhao, Lynch & Chen Approach**, it includes a Monte Carlo test that helps improve the estimation of indirect effects in mediation analysis.

The indirect effect of HRM on ERM is 0.018, with a z-statistic of 3.837, indicating a statistically significant mediation effect ($p < 0.001$). Although the indirect effect is small, it confirms that VAIC partially mediates the relationship between HRM and ERM.

Table (8). Formal Mediation Testing for the SEM_1

Path	Sobel test	RIT	RID	Mediation type
HRM → VAIC → ERM	0.018 [3.905]***	0.023	0.024	Partial mediation

Note: *** indicates statistical significance at the 1% level.

Table 8 presents the **formal mediation testing** for the relationship between (HRM), (VAIC), and (ERM).

Using the Sobel test, Relative Indirect Total (RIT) and Relative Indirect Direct (RID) values, with the final conclusion about the type of mediation provided. The Sobel test result is **0.018** and is statistically significant at the **1% level** ($p < 0.001$). This confirms that the indirect effect of HRM on ERM through VAIC is significant. **RIT** value is **0.023**, indicating that about **2.3%** of the total effect of HRM on ERM is mediated through VAIC. This confirms that the indirect effect is relatively small compared to the direct effect of HRM on ERM. RID value is **0.024**, which suggests that the indirect effect through VAIC is about **2.4%** of the direct effect of HRM on ERM. Based on the above results, the mediation is categorized as **partial mediation**. This means that while **HRM** has a significant direct effect on **ERM**, a small portion of the relationship is mediated through **VAIC**. However, the indirect effect is not large enough to fully account for the HRM-ERM relationship. This supports **H4**.

Intellectual capital: mediator of human resources management sub-dimensions and enterprise risk management

Figure 2 presents a path analysis illustrating the relationships between HRM sub-dimensions, (VAIC), and **(ERM)**. It shows how individual aspects of HRM (e.g., employee staffing, performance management) influence ERM directly and through VAIC as a mediator.

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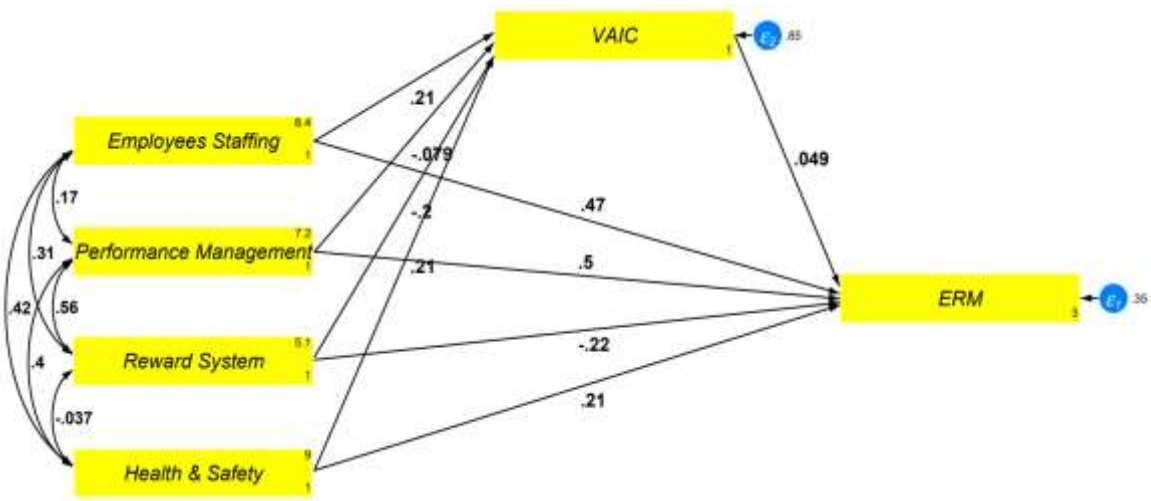

Path analysis for Hypothesis

(Standardized Estimates)

Chi-square (model vs. saturated)= 0.000, *df*= --, Prob.= ----, χ^2/df= ----

Chi-square (baseline vs. saturated)= 1642.882, *df*= 9, Prob.= 0.000

CFI= 1.000, ***TLI***= 1.000, ***SRMR***= 0.000, ***CD***= 0.683, ***RMSEA***= 0.000, ***PCLOSE***= 1.000

AIC= -7591.965, ***BIC***= -7533.256

Figure (2). Impact of Hrm Sub-Dimensions on Erm in the Context of Vaic Mediation

The analysis indicates that employees Staffing, performance management, health and safety has a strong direct effect on VAIC (β = 0.64, 0.72, 0.21 respectively) and an indirect influence on ERM through VAIC ,but Reward System shows a moderate negative relationship with VAIC (β = -0.22), indicating that the current reward systems may not support intellectual capital development effectively. According to **VAIC** as a Mediator between HRM sub-dimensions and ERM, it shows a strong direct effect on ERM (β = 0.65), reinforcing the importance of intellectual capital in enhancing risk management practices. Employees Staffing (β = 0.49) directly contributes to ERM, indicating that effective staffing has a significant impact on risk management beyond its contribution to VAIC. Performance Management (β = 0.47) also directly impacts ERM, showing that managing employee performance plays a crucial role in improving risk outcomes. The goodness-of-fit indices, [(χ^2 = 1642.832, df = 9, p = 0.000), meaning the model explains the observed data well. **CFI (1.000)** and **TLI (1.000)** are at their maximum value of **1.000**, indicating an excellent fit. A perfect **RMSEA** value (0.000) suggests that the model's approximation error is zero. **AIC**

(-7591.965) and **BIC (-7533.256)**: These values support the model's fit].

Table (9). Impact of HRM Sub-Dimensions on ERM in the Context of VAIC Mediation

Endogenous variables: VAIC, ERM.

Exogenous variable: Employees Staffing, Performance Management, Reward System, Health & Safety.

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Method: Maximum Likelihood (ML) with Satorra-Bentler.

Paths	Expected signal	Unstandardized Coefficient	Standardized Coefficient	Std. Err.	z stats.	p > |z|
▪ **VAIC Equation:**						
Employees Staffing → VAIC	+	5.5475	0.2118	0.031	6.90	0.000***
Performance Management → VAIC	+	-2.1603	-0.0794	0.037	-2.16	0.000***
Reward System → VAIC	+	-4.0412	-0.1984	0.036	-5.53	0.030**
Health & Safety → VAIC	+	6.6708	0.2063	0.034	6.07	0.000***
Constant	n/a	2.9567	0.9992	0.271	3.69	0.000***
▪ **ERM Equation:**						
VAIC → ERM	+	0.0013	0.0488	0.017	2.81	0.005***
Employees Staffing → ERM	+	0.3398	0.4712	0.020	23.4	0.000***
Performance Management → ERM	+	0.3767	0.5032	0.024	21.2	0.000***
Reward System → ERM	+	-0.1231	-0.2195	0.024	-9.26	0.000***
Health & Safety → ERM	+	0.1827	0.2052	0.022	9.20	0.000***
Constant	n/a	0.2446	3.0029	0.211	14.2	0.000***

Note: ***, ** indicate significance at 1%, 5% respectively.

Table 9 summarizes the standardized and unstandardized path coefficients of the designated structural equation. Regarding the impact of the four sub-dimensions of HRM practices on enterprise risk management, employees staffing has a strong positive direct effect on both VAIC and ERM, confirming its crucial role in them. Performance Management has the strongest direct effect on ERM, its negative impact on VAIC suggests that current performance management practices may be too rigid or short-term focused. Reward System has a negative impact on both VAIC and ERM reveals a serious misalignment in how rewards are structured. Current incentives may not be fostering the right behaviors for intellectual growth or effective risk management. Health & Safety contributes positively to both VAIC and ERM, but its effects are moderate compared to staffing and performance management. **VAIC** has a significant **positive effect** on **ERM**, confirming its role as a mediator. However, the size of the effect is smaller compared to direct effects, indicating that while intellectual capital is important for risk management; other direct HRM practices play a larger role.(this supports H1b)

Table (10) presents a breakdown of the **direct**, **indirect**, and **total effects** of HRM sub-dimensions on **Enterprise Risk Management (ERM)**. These outcomes reveal that the source of the overall effect of the four sub-dimensions of HRM is because of the direct and indirect effects, with greater influence from the direct effect. For instance, the VAIC partially mediates the relationship between Employee staffing, performance management, reward system, health and safety and ERM (total effect = 0.3473, 0.3738, -0.1285, 0.1917; indirect effect = 0.0075, -0.0029, - 0.0054, 0.0089; direct effect = 0.3398, 0.3767, - 0.1231, 0.1827) respectively. These findings imply that **Employees Staffing** has **Strong positive direct and total effect** on ERM, with a small positive indirect effect through VAIC. This indicates that staffing directly contributes to risk management while also supporting intellectual capital development. **Performance management** has **strongest direct effect** on ERM, with a small negative indirect effect through VAIC. **Reward system** has **negative direct and indirect effects**, indicating that the current reward system weakens both intellectual capital and risk management. The total effect is negative, reinforcing the need to align the reward system with long-term goals and intellectual capital development.

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Table (10). Decomposition of the Impact of HRM Sub-Dimensions on ERM Into Direct, Indirect, and Total Effects

Path	Direct effect	Indirect effect	Total effect
Employees Staffing → ERM	0.3398 [23.2]***	0.0075 [2.60]***	0.3473 [24.0]***
Performance Management → ERM	0.3767 [21.2]***	-0.0029 [-1.71]*	0.3738 [21.1]***
Reward System → ERM	-0.1231 [-9.33]***	-0.0054 [-2.50]**	-0.1285 [-9.82]***
Health & Safety → ERM	0.1827 [9.17]***	0.0089 [2.55]**	0.1917 [9.72]***

Note: ***, **, * indicate significance at 1%, 5% and 10% respectively.

Health & Safety has **Moderate positive direct and total effects**, with a small positive indirect effect through VAIC. Health and safety practices not only directly improve risk management but also contribute to intellectual capital, albeit to a lesser extent than other HRM sub-dimensions.

Bi-Causal Linkages Between Human Resource Management Practices, Intellectual Capital, and Enterprise Risk Management

This section examines the bi-directional relationship between Human Resource Management (HRM) practices, Intellectual Capital (IC), and Enterprise Risk Management (ERM) within the banking sector. Utilizing Granger causality tests and lagged regression models, the analysis explores how HRM and ERM influence each other over time, highlighting the importance of sustained HRM practices in enhancing risk management outcomes.

To ensure the reliability of the time series analysis, the Augmented Dickey-Fuller (ADF) test was employed to check for stationarity. **ADF Test Results** show that Both HRM and ERM series were confirmed to be stationary after differencing, satisfying the prerequisites for Granger causality tests and reliable time series modeling.

Granger causality tests were applied to determine the directionality of the relationship between HRM and ERM.

- **Hypothesis 1:** *HRM does not Granger-cause ERM.*
    - **Result:** *H1 rejected.* HRM was found to Granger-cause ERM, indicating that past values of HRM can predict future values of ERM.
- **Hypothesis 2:** *H2: ERM does not Granger-cause HRM.*
    - **Result:** *H2 rejected.* ERM was found to Granger-cause HRM, suggesting that past values of ERM can predict future HRM practices.

Table (11) presents a summary of bi-causality results which indicate a bi-directional causality between HRM and ERM, where changes in HRM practices influence ERM outcomes and improvements in ERM feed back into HRM practices, particularly in staffing and training.

To capture both immediate and delayed effects, lagged regression models were incorporated to examine the influence of HRM on ERM over multiple time periods. Lagged Regression Results concluded that:

- **HRM (Lag 1) ➔ ERM**: Significant positive effects, especially in **Risk Identification** and **Risk Culture**.
- **ERM (Lag 1) ➔ HRM**: Significant positive feedback, influencing **Staffing** and **Health & Safety**.

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The results revealed that in Short-Term effect, HRM practices have a positive but weak immediate impact on ERM while in Long-Term effect, the sustained HRM initiatives lead to substantial improvements in risk management outcomes over time.

Table (11). Summary of Bi-Causality Testing

Test/Analysis	HRM Impact on ERM	ERM Impact on HRM
Granger Causality Test	HRM ➔ ERM (Significant)	ERM ➔ HRM (Significant)
Lagged Regression (Lag 1)	HRM (t-1) ➔ ERM (t) (Significant)	ERM (t-1) ➔ HRM (t) (Significant)
Lagged Regression (Lag 2)	HRM (t-2) ➔ ERM (t) (Less Significant)	ERM (t-2) ➔ HRM (t) (Less Significant)

To enhance understanding, Lag Plots as a visual tool in **figure (3)** was employed to Show the relationships between HRM and ERM at different lags, highlighting how HRM at earlier times influences ERM in subsequent periods and vice versa.

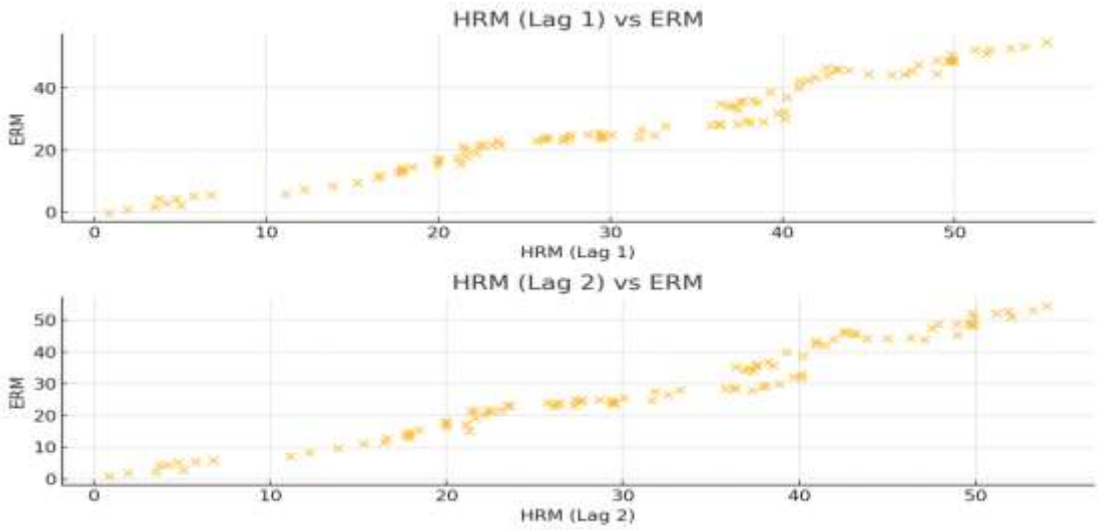

Figure (3). Lag Plots

Conclusions and Implications

The findings underscore the critical role of HRM practices in enhancing ERM within the banking sector. HRM practices directly improve risk management capabilities by developing a competent workforce and fostering a risk-aware culture. While IC serves as a partial mediator, the direct impact of HRM on ERM is more substantial. This underlines that all hypotheses are accepted.

The negative effects of current reward systems on both IC and ERM suggest a need to realign incentive structures to support organizational objectives related to innovation and risk management. Similarly, the negative impact of performance management on IC indicates that these practices may need to be adjusted to encourage long-term intellectual capital development.

The bidirectional causality between HRM and ERM reflects a dynamic interplay where improvements in one area influence the other over time. This emphasizes the importance of integrating HRM and ERM strategies to facilitate continuous improvement and adaptability.

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The Study Concludes That

- **HRM Practices are Critical for ERM:** Effective HRM practices significantly enhance ERM both directly and indirectly through IC.
- **IC as a Partial Mediator:** While IC contributes to the relationship between HRM and ERM, HRM practices have a more substantial direct effect on ERM.
- **Specific HRM Practices Matter:** Staffing and performance management are particularly influential in improving ERM and developing IC.
- **Need for Reward System Realignment:** Negative effects of current reward systems indicate a misalignment that needs to be addressed.
- **Bi-directional Relationship:** There is a significant two-way causality between HRM and ERM, highlighting the need for integrated strategies.
- **Long-Term Commitment:** The benefits of HRM practices on ERM become more pronounced over time, necessitating sustained investment.

The outcomes of this study revealed a number of implications for theory and practice, particularly in an emerging market such as Egypt, as follows:

Enhance Staffing and Performance Management

- **Invest in Effective Staffing:** Attract and retain high-quality talent to build a competent workforce.
- **Revise Performance Management:** Balance short-term objectives with long-term intellectual capital development.

Realign Reward Systems

- **Align Incentives with Organizational Goals:** Design reward structures that promote innovation, knowledge sharing, and risk-aware behaviors.
- **Incorporate Non-Financial Rewards:** Utilize recognition, career advancement, and professional development opportunities.

Develop Intellectual Capital

- **Foster Knowledge Sharing:** Create platforms for collaboration and knowledge exchange.
- **Invest in Training and Development:** Enhance employee competencies in areas critical for ERM.

Strengthen Health and Safety Practices

- **Prioritize Employee Well-Being:** Maintain a safe and healthy work environment to support productivity and risk management.

5. Integrate HRM and ERM Strategies

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- **Establish Continuous Feedback Loops:** Align HRM policies with ERM objectives and facilitate regular communication between functions.

- **Use Data Analytics:** Leverage insights from ERM to inform and refine HRM practices.

Commit to Long-Term HRM Initiatives

- **Recognize Time Lags:** Understand that improvements in ERM from HRM practices may take time to materialize.

- **Sustain Investment:** Continue supporting HRM initiatives for long-term benefits.

Implications for Practice

The study provides actionable insights for bank managers and policymakers:

- **Strategic Alignment:** Integrate HRM and ERM to enhance organizational resilience.

- **Policy Development:** Update HRM and ERM policies to reflect best practices and regulatory requirements.

- **Organizational Culture:** Foster a culture that values innovation, knowledge sharing, and risk awareness.

Recommendations for Future Research

The findings open avenues for further exploration:

- **Investigating Other Mediators and Moderators**: Future studies could examine other factors that may mediate or moderate the relationship between HRM practices and ERM, such as organizational culture, leadership styles, or technological capabilities.

- **Cross-Sectoral and Cross-Cultural Studies**: Expanding the research to other sectors or different cultural contexts could enhance the generalizability of the findings and provide comparative insights.

- **Qualitative Approaches**: Incorporating qualitative methods, such as case studies or interviews, could provide deeper insights into the mechanisms through which HRM practices and IC influence ERM.

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Appendix (1): An Index for Evaluating ERM Maturity, HRM Practices

The index considers whether each element is currently present at the bank or not with a total of 46 items for ERM and 37 items for HRM with a rating of (0, 1, 2) for each element where **[0=Nonexistent, 1=partially existed, 2= Fully existed].**

First: Dependent variable (ERM)	**Score [0/1/2]**
A- Risk Culture	
A1.Top management have a clear understanding of the objectives of ERM relative to traditional approaches to risk management.	
A2.The CEO provides adequate endorsement of an enterprise-wide approach regarding risk oversight to obtain a view of major risk exposures.	

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A3.The board of directors support management's efforts to implement an enterprise wide approach to risk management approach.	
A4. Risk awareness is perceived as a strategic tool by senior management.	
A5. A 'risk champion' or 'risk management leader' has been assigned by the organization with wide risk management authority and responsibility.	
A6.Enterprise risk management principles and guidelines have been identified and formally communicated to all business units.	
A7.Senior management has effective risk management capabilities and competencies.	
A8.The board of directors sets a meetings' agenda time to discuss the most significant risks facing the organization.	
B- Risk Identification	
B1. The term 'risk' is defined and communicated clearly to all members within the organization.	
B2. Risks are identified based on events affecting goal achievement.	
B3. A comprehensive range of internal risks have been identified, including risks that can be controlled or prevented, or cannot be controlled.	
B4.The organization regularly scan the external environment to identify unknown, but emerging risks such as competitor moves, new regulations, changing consumer preferences, IT risk, legal risk, credit risk.	
B5. The organization creates an aggregate inventory of enterprise-wide risks in documents.	
C- Risk Assessment	
C1.The organization defines the time period over which risks should be assessed.	
C2.The organization strives to assess the level of the risk before taking into account the organization's activities to manage the risk.	
C3.Guidelines or metric scales have been established to help individuals assess both likelihood and impact of the risk.	
C4.The organization considers an integrated score to create risk rating that helps prioritize the organization's most significant risk exposures.	
C5.Each member of the senior management team has provided his or her independent assessments of each risk identified and then they discuss differences in individual risk assessments to reach a consensus on the most significant risks facing the organization.	
C6. Portfolio risk analysis is performed to identify interrelated risks or whether a single event may have cascading impacts.	
C7.The ERM process regularly monitors any events impacting the assessments of risks during the year.	
D- Articulation of Risk Appetite: the organization's willingness to take on risks.	
D1.The board and management have engaged in discussions to articulate the organization's risk-taking readiness.	
D2.The organization has separately defined its risk appetite for different types of risks.	
D3.The organization has adopted some quantitative measures in defining its risk appetite.	
E- Risk Response: Organizations may choose to accept, avoid others, reduce the exposures to risks, or share risks with external parties.	
E1.The organization has documented the existing response(s) to its most significant risks.	
E2.The organization has evaluated whether the existing response is sufficient to manage the risks to be within the organization's risk appetite.	
E3.Plans are developed and implemented to address those risks where the current response is insufficient.	
E4.The organization conducts the potential cost-benefit analysis for each risk response towards reducing the impact of risk event.	

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E5. The organization conducts the potential cost-benefit analysis for each risk response towards reducing the probability of occurrence of the risk event.	
E6.The organization re-evaluates its risk responses at least annually.	
E7.The organization has objectively assessed the effectiveness of risk response plans for its most significant risks.	
F- Risk Reporting	
F1.The organization monitors critical risk indicators (i.e, metrics that show when risk events have occurred or are escalating).	
F2.The organization has developed and monitors critical risk indicators to provide some indication that a risk event is more likely to occur in the future.	
F3.Senior management regularly reviews a report that provides the status of critical risks and response plans.	
F4.Output from the organization's ERM processes about significant risk exposures are an important input to the organization's risk disclosures to critical stakeholders.	
G- Integration with Strategic Planning	
G1.The organization has a formal strategic planning process that is updated at least annually.	
G2.The organization's ERM risk profile is an important input for the strategic planning process.	
G3.Senior management links the top risk exposures to strategic objectives.	
G4.When evaluating a range of strategic options, consideration is given to the potential impact of each option on the organization's risk profile.	
G5.The organization's ERM processes encourage the consideration of opportunities where the organization can take informed risks to generate incremental returns.	
G6.The organization's strategic plan has been communicated to employees.	
H- Assessment of ERM Effectiveness	
H1.Senior management regards ERM as an ongoing process rather than just a project.	
H2.Senior management seeks to understand and monitor emerging ERM best practices.	
H3.Senior management and the board of directors have engaged in ERM related training or other knowledge enhancing activities.	
H4.The organization periodically obtains an objective assessment of its ERM processes through internal audit.	
H5.The organization periodically obtains an objective assessment of its ERM processes through third party ERM expert evaluations.	
H6.The organization identifies and implements changes to improve its ERM processes.	
Second: Independent variable (HRM practices) consists of 37items	**Score [0/1/2]**
A2- Employee Staffing (Recruitment , Selection, Hiring, Succession planning , Retention programs)	
A2.1 The organization emphasizing 'career' not 'job" when selling company image to attract potential employees.	
A2.2 We pay special attention to relevant expertise when recruiting candidates.	
A2.3 We pay special attention to learning and development ability when recruiting candidates.	
A2.4 We evaluate the candidates' ability to collaborate and work in various networks when recruiting.	
A2.5 Interview panels are used during the selection process to select based on competency and skills of potential candidates.	
A2.6 Organization's employee staffing is based on the prospective future organizational performance.	
A2.7 The organization hires applicants that currently possess the necessary knowledge and skills.	
A2.8 A greater importance is attached to fit between person and company culture.	

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A2.9 There are incentives aimed to increase the loyalty for retaining employees to the organization.	
A2.10 The organization prepares some employees to take key positions with higher responsibility.	
A2.11Sometimes, the organization hires unsuitable or unsafe candidates.	
A2.12The organization attracts competencies who are aware of managing the organization's risks.	
B2- Employee training and development	
B2.1 The organization offers opportunities for employees to expand their expertise through extensive training programs.	
B2.2 The organization provides training for employees according to systematic training needs assessment.	
B2.3 Competence development needs of employees are discussed with them regularly.	
B2.4 Formal training programs are offered to employees to increase their promotability in this organization.	
B2.5 The organization spends enough resources on EEO [equal employment opportunity] awareness and training.	
B2.6 The organization uses innovative development methods such as: stress management programs, adventure training, leadership and attitudinal training.	
C2- Performance management	
C2.1 Performance appraisals are based on objective, quantifiable results.	
C2.2 Each employee has performance objectives.	
C2.3 The creation of new knowledge is one criterion for work performance assessment.	
C2.4 Giving weight to individual, team and organizational performance while appraising performance.	
C2.5 There is a linkage between rewards and the results of appraisal when appraising performance.	
C2.6 The organization applies "360" appraisals method for employees.	
C2.7 Job performance is important in determining the earnings of managers and administrators.	
D2- Reward system (compensation and benefits)	
D2.1 The organization considers performance-linked incentives in determining employee compensation.	
D2.2 The compensation package is more competitive than other organizations in the same industry.	
D2.3 Our organization provides stock options as an incentive to motivate employees.	
D2.4 The organization give benefits directed at employees' families.	
D2.5 The organization makes improvements in retirement benefits for employees.	
D2.6 The organization offers cash rewards for extraordinary performance.	
D2.7 The organization reveals public recognition of good performance at a company meeting.	
E2- Health and safety	
E2.1 Employees have been informed with organization's health and safety policies in orientation programs.	
E2.2 The organization focuses on long-term benefits for employees through alternative insurance and health management schemes.	
E2.3 The organization evolves a safe work environment conditions.	
E2.4 The organization provides child and elder care programs.	
E2.5 All incidents are investigated in a timely matter in order to improve safety in the workplace.	