

The Impact of Implementing Enterprise Risk Management on Crisis Response**Efficiency in Industrial Cities****A Field Study on Crisis Management Centers in the Kingdom of Saudi Arabia****Prepared by:**

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Dedication

To my beloved parents. Thank you, for your support with my endeavors as well as your undying love, and for the sacrifices you made, I have achieved my goals because you believed I could do it. You further inspired me to strive for as much knowledge as I could possibly obtain and then some.

To my family. Thank you for the support and encouragement that you gave me and for what you have done for me during my school years.

Moreover, I thank all my teachers and mentors for their appreciation and for all the positive reinforcement that I received.

Last but not least, I thank all the people who believed in me and my ability to accomplish this thesis. It is all those people's support who made this work possible.

This is the final part I will write about the decisions taken within the course of this thesis.

This is, again, not the first, but the last rambling that I've done about all the choices made during this thesis work.

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Of all the possible entities I could thank, I particularly want to thank the only one that I expect would not mind being thanked. That is, of course, the entity who is the only possible constituency with regard to a state of being.

I, your humble servant, have, again of all possible entities, selected for my appreciation the one that, as far as I can tell, is the last possible recipient with regard to the consideration of mortals.

To you exclusively, I have selected this assiduous appreciation for being, as I have already mentioned, the only possible person.

I am grateful for the participation of the contributors who provided the insights that were vital to the completion of the study.

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Abstract

Introduction: Enterprise Risk Management (ERM) is the newest way to manage and develop the ability of organizations to recognize and deal with adverse situations. With the rapid industrial and technological development of the industrial cities, the possibility of operational, environmental, or technological malfunctions has increased. Crises can jeopardize the operational continuity of the employees and of the community around them.

Research Problem In spite of the fact that a lot of attention has been paid to Enterprise Risk Management, industrial companies are still struggling to develop integrated systems of risk management, and as a result, are often ill-prepared to face crises.

Research Goals: This research is focused on evaluating the scope of effect that Enterprise Risk Management has on crisis response effectiveness in emergency management centers located in industrial cities in Saudi Arabia. The study aims to examine the impact on crisis response effectiveness of several ERM dimensions, such as risk identification, risk assessment, risk response, monitoring and control, and communication and information sharing.

Research Methodology: The method that was chosen for this study was quantitative. This approach involved the development of a structured questionnaire/closed-ended survey that was subsequently disseminated to employees of the crisis management centers located within industrial cities. A total of 220 responses were received and subsequently processed utilizing a software program known as the Statistical Package for Social Sciences (SPSS).

Key Findings: The findings of this study showed that there is a statistically significant positive correlation of the Enterprise Risk Management (ERM) practices on efficiency of the responsiveness to crisis situations. Among the various dimensions of the ERM frameworks, the most notable contributor to the improvement of the efficiency of response during crisis situations was that of communication and sharing of information.

Recommendations: This study recommends enhanced communication systems within crisis management centers, innovation in technology for the identification and monitoring of risks, and the establishment of regular crisis simulations to improve emergency preparedness.

Keywords: Enterprise Risk Management, Crisis Response Efficiency, Industrial Cities, Emergency Management

الملخص باللغة العربية

خلفية الدراسة: تعد إدارة المخاطر المؤسسية (Enterprise Risk Management) أحد الأساليب الإدارية الحديثة التي تسهم في تعزيز قدرة المؤسسات على التعامل مع المخاطر المحتملة والأزمات غير المتوقعة. ومع التوسع الصناعي والتكنولوجي في المدن الصناعية، تزداد احتمالية حدوث أزمات تشغيلية أو بيئية أو تقنية قد تؤثر على استمرارية العمليات الصناعية وسلامة العاملين والمجتمع المحيط..

مشكلة الدراسة : على الرغم من تزايد الاهتمام بإدارة المخاطر المؤسسية، إلا أن العديد من المؤسسات الصناعية ما تزال تواجه تحديات في تطبيق نظم متكاملة لإدارة المخاطر، مما قد يؤدي إلى ضعف الاستعداد لمواجهة الأزمات.

أهداف الدراسة : تهدف هذه الدراسة إلى تحليل أثر تطبيق إدارة المخاطر المؤسسية على كفاءة الاستجابة للأزمات في مراكز إدارة الأزمات في المدن الصناعية في المملكة العربية السعودية.

منهجية الدراسة: اعتمدت الدراسة على المنهج الكمي باستخدام الاستبانة كأداة رئيسية لجمع البيانات. وتم توزيع الاستبانة على عينة من العاملين في مراكز إدارة الأزمات في المدن الصناعية، حيث بلغ عدد الاستجابات الصالحة للتحليل 220 استبانة. وتم تحليل البيانات باستخدام برنامج SPSS.

نتائج الدراسة

أظهرت نتائج الدراسة وجود علاقة إيجابية ذات دلالة إحصائية بين تطبيق إدارة المخاطر المؤسسية وكفاءة الاستجابة للأزمات. كما أظهرت النتائج أن التواصل وتبادل المعلومات يمثلان العامل الأكثر تأثيراً في تحسين كفاءة الاستجابة للأزمات، يليه كل من تحديد المخاطر والاستجابة لها، ثم آليات المتابعة والرقابة.

توصيات الدراسة : أوصت الدراسة بضرورة تعزيز نظم الاتصال وتبادل المعلومات في مراكز إدارة الأزمات، وتبني التقنيات الحديثة في تحديد المخاطر ومراقبتها، وتنفيذ برامج تدريبية وتمارين محاكاة للأزمات لتحسين جاهزية فرق الاستجابة للطوارئ.

العربية:

إدارة المخاطر المؤسسية، إدارة الأزمات، كفاءة الاستجابة للأزمات، المدن الصناعية، إدارة الطوارئ

CHAPTER ONE

1. INTRODUCTION

Organizational activities today face a broad range of uncertainty and dynamism, driven by rapid technological advancement, increasing complexity, and greater exposure to risk in a variety of ways. Operational, technological, environmental, and organizational uncertainties can destabilize institutions, threatening their viability. Global events such as life-altering natural disasters, recession, and, more recently, the COVID-19 pandemic have underlined the need for structurally sound risk management systems. Companies with inadequate, unstructured risk management systems are disproportionately impacted by unanticipated disruptions, and as a result, many are hamstrung in their ability to respond to risk events (Tubalec et al., 2024).

Faced with these issues, many firms have evolved their risk management paradigms. The result has been movement toward enterprise-wide risk management (ERM) as a more integrated systems framework for the identification, assessment, and management of risk at all organizational levels. The isolation of risk exposure within organizational silos, or departments, is counterproductive to an ERM framework. Instead, it is necessary to integrate risk management with organizational strategies, operational activities, and decision making. Kristal et al's perspective optimizes an organization's flexibility to identify and respond to possible disruptive threats and operationalize resilience (Horobko, 2024).

ERM is especially important in industrial environments where the industrial type of operation creates multiple and complex risks. Industrial cities usually have large-scale manufacturing, petrochemical and logistics operations that use and handle hazardous materials, complex machinery, and interlinked operational systems. With these types of environments, the risk of fire, explosion, chemical leaks, and failure of operational systems is significant. In these environments, effective crisis management requires responsive and

proactive risk management systems in order to identify risks and outline various response plans to prepare them in advance.

In that sense, crisis management of industrial cities acts as a safety measure to manage emergencies, impact, and crises, in the negative effective on humans, property, and the environment. The effectiveness of these units is a function of their preparation, the existence of accurate and reliable information, the coordination of the various parties, and the existence of a risk management system that is proactive. Studies have shown that organizations with integrated risk management systems are better prepared to meet crises. This is due to the existence of risk systems, response systems, and good communication systems (Araque \& Weiss, 2024)

Additionally, the enhancement of organizational risk management and crisis response capabilities through technology and digital information systems has become evident. The consideration of emerging risk management systems, especially during the crisis, is motivated by the importance of real-time data, technology for decision-making, and geography and communications. The use of these tools has a significant positive effect on improving awareness, the speed of information, and the coordination of teams managing crisis situations (Ahmad et al., 2024).

Despite the importance of ERM, a number of studies show that most organizations, especially those in developing and emerging economies, continue to have difficulties managing integrated risk systems. The difficulties identified include poor inter-departmental cooperation, a lack of integrated communication systems, an absence of formalized organizational procedures for risk assessment, and a weak risk management culture within the organization. The above limitations are likely to diminish the effectiveness of a response to crisis situations and to increase the negative outcomes of industrial emergencies.

In line with this, the present study aims to analyze the effects, of the degree of effectiveness of an enterprise risk management (ERM) system on the modification of the effectiveness of crisis response within the crisis management centers located in the industries of the Kingdom of Saudi Arabia. Specifically, this study examines the degree of effectiveness of ERM dimensions of risk identification, risk assessment, risk response, monitoring & control, and communication, and how this impacts the efficiency of response to crises. This study aims to develop the knowledge of the effectiveness of integrated risk management at improving the preparedness and resiliency of the organization in a hostile working environment including the high-risk industries.

In Chapter One, the author provides the readers with the outline of the study. The author starts with introducing the research topic, elaborating on the research problem, clarifying the significance of the study, determining the research objectives, formulating research questions, stating hypotheses, reviewing literature, presenting theory, and discussing methodology. Additionally, this chapter discusses the background of the study including the population and sample, tools of data collection, statistical techniques, and the scope of the study. Using this framework, the author builds the conceptual and the methodological outline of the study for the latter chapters.

1.1. Background of the Study

The past few decades have seen organizations adapt to drastic changes in their environments, and the rise of globalization and technology has compounded the increasing complexity of the economy and industries. These changes bring new organizational risks that can detrimentally affect stability and performance and can impede the long-term sustainability of organizations. As a result, these modern risks have demanded that organizations prioritize the effective management of risks. Approaches to managing risks that purely consider financial or operational risks and focus on a single organizational silo are

increasingly inadequate in managing the complex, and interrelated risks of modern organizations (Horobko, 2024).

Therefore, organizations have been increasingly adopting Enterprise Risk Management (ERM) to address the integrating of the identification, assessment, and mitigation of risks in an organization. With the integration of ERM, organizations have the ability to handle risks in a rational and organized manner, as well as establish the connection of managerial processes to strategic planning and decision-making. As a result of adopting ERM practices, organizations are able to enhance their operational capacity to consider other potential risks, optimize their resource allocation, and improve their overall ability to withstand emergencies (Pessina, 2021).

In hazardous industrial environments, the significance of enterprise risk management (ERM) becomes even more pronounced. These environments are characterized by their use of dangerous materials, the presence of intricate technologies, and their involvement in large-scale manufacturing. Such conditions apply to industrial metropolitan areas, where several factories, petrochemical facilities, and logistics centers are located. These areas face a multitude of threats, including industrial accidents and fires, explosions, chemical spills, and the breakdowns of operational systems. These threats are generally associated with the possibility of taking lives, damaging the ecosystem, and losing money. Thus, risk management and crisis preparedness, in an industrial context, are of utmost importance in safeguarding people and valuable resources (Ahmadi Choukolaei et al., 2021).

As a measure to mitigate these threats, several industrial cities have developed crisis management centers that are in charge of the coordination of emergency responses to ensure that crises are addressed promptly and effectively. These centers are the primary components for risk control, emergency planning, coordination with safety and emergency personnel, and

crisis management. The effectiveness of these centers, however, is largely inscribed in the presence of adequately designed risk control systems that enable centers to anticipate and address risk adequately and respond to emergency situations when the risks are treated (Araque & Weiss, 2024).

While the importance of ERM is becoming undeniable, research shows the high majority of organizations still struggle with configuring fully operational risk management systems. As documented, the lack of systemized departmental coordination, the sparse utilization of technological support systems, inactivity of purposeful communication support systems, and the lack of monitoring and evaluation systems describe the boundaries of organizational structures that focus on crisis management. These limitations describe the boundaries of organizational structures that cripple organizations when emergencies strike (Tubalec et al, 2024).

Industrial cities in the Kingdom of Saudi Arabia located in Jubail, Yanbu, Riyadh, Dammam and Jeddah are of immense strategic importance as primary hosts of the petrochemical and the manufacturing and logistics industries. Given the risks associated with the industries, focused improvements in the readiness for and management of crises are warranted. Saudi Arabia's Vision 2030 also focused on the governance and the balance between safety and risk management for sustainability of the industry.

The examination of the impact of enterprise risk management practices on the effectiveness of crisis management in industrial settings is critical. This relationship, in the context of crisis management centers in the industrial cities of Saudi Arabia, will contribute to understanding how to enhance the preparation, strengthening of response mechanisms, and reduction of the consequences of industrial crises.

1.2. Significance of the Study

Regarding relevance, this research makes both theoretically and practically valuable contributions to understanding enterprise risk management and crisis management in an industrial context. In light of the growing operational, environmental, and technological risks that industrial cities face, the importance of knowing how enterprise risk management (ERM) practices shape crisis response remains relevant (Hopkin, 2018; ISO, 2018). In this regard, the importance of this research can be analyzed from two perspectives. One is scientific, and the other is practical.

1.2.1. Scientific Importance

This research is valuable because it tries to address an important gap in the enterprise risk management (ERM) and crisis response efficiency literature, especially in the context of industrial cities. The existing literature has studied ERM and its relation to financial performance, governance, and organizational resilience. Very few studies, however, have focused on ERM and its importance in enhancing crisis response in risky industrial environments, particularly in the Arab and Gulf region (Fraser & Simkins, 2016; Lam, 2017).

Additionally, the study aids in developing the theoretical framework for enterprise risk management by associating ERM dimensions, such as risk identification, risk assessment, risk response, monitoring and control, and communication and information flow, with the operational performance of crisis management centers. These dimensions are considered fundamental elements of contemporary ERM systems prescribed by global standards, including COSO and ISO 31000 (COSO, 2017; ISO, 2018). The study, by statistically investigating these associations, enhances the knowledge of the impact crisis management processes have from ERM practices.

In the same way, the study offers an integrated analytical framework that ties the ERM dimensions to the performance of crisis response. This framework can be a conceptual

basis for subsequent studies assessing risk management and crisis preparedness in industrial organizations and other sectors with high exposure to risks (Hillson & Murray-Webster, 2017).

Furthermore, the study expands the academic understanding of the structure and operation of crisis management centers in Saudi industrial cities, a field of research that has been overlooked in the existing body of research. The industrial milieu often poses intricate operational risks, necessitating systematic crisis management and risk governance frameworks (Boin; Hart; Stern; & Sundelius, 2017).

The analysis confirms an emerging international trend in academia focused on crisis management, prioritizing preventative practices, and the processes that accompany the immediate response to an emergency. This is consistent with current academic management practices and their focus on the management of resilient systems, risk, and advanced preparation in situations characterized by ambiguity and uncertainty (Boin et al., 2017; Hopkin, 2018).

1.2.2. Constructive Relevance

The relevance of this research is illustrated in the strategy of policymakers, leaders, and administrators of industrial urban planning and the operation of crisis management systems in the centers; as an assessment of the effectiveness of practices of enterprise risk management (ERM) systems in response to crises, it assists decision-makers in evaluating the pros and cons of existing structures of risk management systems in their organizations (Lam, 2017).

Additionally, the study offers a practical model to enable the construction of good strategies to improve crisis preparedness. With the identification of the dimensions of ERM that most significantly affect the responses to crises, organizations can focus on enhancing

the systems of risk assessment, communication, monitoring, and emergency responses (Fraser & Simkins, 2016).

This study's findings will enable crisis management departments to develop and improve policy and operational procedure frameworks that enable preparedness and operational readiness prior to the occurrence of emergencies. An effective Enterprise Risk Management (ERM) system greatly minimizes the consequences of industrial incidents and emergencies through enhanced risk assessment and early warning (ISO, 2018).

The study also analyzes the areas for improvement regarding the communication and coordination of actors in crisis management, such as industrial enterprises, the divisions of safety, emergency departments, and state bodies. It is well known that the improvement of information and communication systems is a significant component of the improvement of a crisis management system (Boin et al., 2017).

The study also has empirical data that will help organizations develop training and capacity-building emergency preparedness programs to improve personnel professionalism and institutional emergency preparedness (Hopkin, 2018).

CHAPTER TWO

2. LITERATURE REVIEW

Introduction

For the past few decades, rapid globalization, advancements in technology, growing concern for the environment, and operational uncertainties have posed increasingly complex risks for businesses. Operational failures, the use of dangerous materials, and the incorporation of potentially hazardous technologies create risk in an industrial setting. These conditions can lead to crises in the safety of human life, the stability of the economy, and the health of the planet. Because of this, there is an increasing need for organizations to integrate risk management systems that are able to identify risks and implement systems to address them before they become crises (Hopkin, 2018).

Enterprise Risk Management (ERM) is one of the most prominent strategic management frameworks that helps organizations manage the risks associated with the challenges described above. ERM fosters an organization-wide, integrated approach to risk management, as opposed to departmentally based, fragmented approaches to risk management. ERM is designed to help organizations and their management anticipate and minimize the adverse effects of risks and, to that end, provide integrated, systematic approaches for the identification, evaluation, monitoring, and control of risks (COSO, 2017).

The need for effective risk management (ERM) is evident in cities where large-scale industrial operations are concentrated. Such cities have many manufacturing, chemical, and energy production plants with sophisticated, multi-tiered production systems. These systems often incorporate hazardous materials, high-risk production processes, and large-scale machinery, and the potential for industrial accidents and environmental emergencies is heightened. To equilibrate the risk, effective pre-emptive emergency management and crisis (or emergency) response systems are necessary in such environments (Fraser & Simkins, 2016).

In industrial cities, emergency response (or crisis management) centers are critical in managing and coordinating emergency management and response processes. They perform risk surveillance, coordinate the activities of emergency response teams, provide crisis situation awareness, and support rapid decision-making. The effectiveness of crisis management is entirely dependent on the existence of systematic risk management processes that include accurate risk assessments and timely crisis warning systems (Boin et al., 2017). The integration of enterprise risk management techniques into systems for managing crises will boost the efficiency of responding to those crises. Possible threats are identified and assessed in order to prepare structured response plans and response resource allocations for emergencies. The organization's ability to provide continuous service is operationally sustained and the organization is able to recover from crises in a shorter time. (Lam, 2017)

Even though the value of ERM has been more highly appreciated lately, there has been little empirical research that has looked at it in the context of crisis response efficiency, particularly in developing countries and in relation to industrial cities. Industrial cities in Saudi Arabia such as Jubail, Yanbu, and Dammam are very important to the economy of the country because they contain the most important industrial and petrochemical industries. Therefore, crisis management in these industrial cities is very important for protecting lives, infrastructure, and the economy.

This chapter assesses the theoretical and empirical literature relevant to the fields of enterprise risk management and efficiency of crisis response. The first section focuses on risk management and its conceptual and theoretical underpinnings. This is followed by a description of crisis management and efficiency of crisis response. The chapter also outlines the essential components of enterprise risk management that pertain to the study, in addition to reviewing prior empirical studies that examined the association between risk management

and the performance of crisis management. The chapter concludes by stating the research gap that the current study is attempting to fill.

2.1. Enterprise Risk Management (ERM)

Enterprise Risk Management is the first and only comprehensive and integrated framework that is designed to enable organizations to understand and deal with the consequences of uncertainty regarding the possibility of future adverse impacts on the achievement of strategic goals. While traditional risk management methods concentrate on specific operational risks nestled in separate silos of functions and departments, risk management achieves a more comprehensive and integrated undertaking. This comprehensive and integrated undertaking means that risk management is also integrated with the enterprise's strategic plan, governance, and decision-making framework (COSO, 2017).

The evolution of ERM was primarily shaped by numerous corporate failures and financial crises underscoring the drawbacks of siloed risk management approaches. These crises showed that businesses need to embrace comprehensive and integrative risk management frameworks that can handle sophisticated and interconnected risks. Consequently, ERM has developed into a cornerstone of contemporary corporate governance and strategic management practice (Fraser & Simkins, 2016).

Enterprise risk management, as stated by the Committee of Sponsoring Organizations of the Treadway Commission (COSO), is a process implemented by a company's board of directors, management, and other employees to evaluate potential events that may impact the company and control risks to acceptable levels to give reasonable assurance to the attainment of company goals (COSO, 2017). This definition of ERM conveys that ERM is more than a technical process; it is a strategic process that is woven throughout all the layers of the firm.

Likewise, the International Standardization Organization describes risk management as the methodical management of risk pertaining to an organization (ISO, 2018). The ISO 31000 framework describes the necessity of the organizational governance, strategic, and operational decision-making integration with risk management. In this approach, the organizational governance, leadership, and communication system should support the embedding of risk management into the organizational culture.

A major benefit of enterprise risk management (ERM) is the improvement of decision making in the organization. With ERM, managers possess the necessary information about the risks, and possible outcomes related to resource, and strategic and operational decision making. This decision making reduces uncertainty, and increases operational efficiency (Lam, 2017).

ERM also aids in improving an organization's ability to withstand disturbances. Organizations with adequate risk management strategies are better able to identify and cope with disturbances. ERM reduces the risk of crises and confines the effect of crises to be controlled (Hopkin, 2018).

An ERM hallmark is the enhancement of an organization's transparency and accountability. ERM encourages the reporting of risks and the creation of mechanisms for reporting and monitoring risks. This improves the level of communication among management, the stakeholders, and regulators, thereby strengthening corporate governance and fostering trust with the stakeholders.

In addition, ERM promotes the creation of a risk-aware culture within the organization. A culture of risk sensitivity and management makes it easy for an organization to avert crisis or respond to one.

ERM is crucial for industrial cities because of the potential risks and complexity of operations. Industrial operations involve the use of dangerous materials, chemicals, or manufacturing processes. When fully integrated into organizational processes, ERM systems facilitate the mitigation of risks, the planning of emergencies, and the management of crises.

Having ERM integrated into crisis management systems is of major importance, especially for industrial cities, as it improves the overall safety and sustainability of the industrial cities.

2.2.Dimensions of Enterprise Risk Management

Enterprise Risk Management is achieved through a set of processes which are cohesive and enable an organization to comprehensively establish, assess, and control a description of risk or a set of risks which may impact the organizations' strategic and/or operational goals. Current ERM frameworks state that risk management is an administrative function that is separate from the organization, and that it is a part of the organization's governance, strategic planning, and operational transactions (COSO, 2017; ISO, 2018).

From the perspective of the COSO ERM framework, to manage risks effectively, organizations should put in place a systematic set of processes designed to identify risks, assess risks, develop risk response plans, change control systems to incorporate risk thresholds, and develop a risk communication plan. These processes in her organization allow her to develop and implement plans to manage risks before risks become a potential crisis (COSO, 2017).

In the same way, the ISO 31000 risk management framework states that risk management, in order to be effective, should be a systemic and ongoing process that is part of all functions of the organization. It emphasizes the need for the organization's leadership,

stakeholders, and risk management to be continuously improved at all to ensure the effective management of risk in an organization (ISO, 2018).

Given the intricate nature of industrial operations and the serious nature of the consequences of operational breakdowns, enterprise risk management gains a greater significance in the industrial context. In particular, industrial operations use potentially harmful substances, dangerously heavy equipment, and high-pressure systems, and the potential dangers posed to workers and the surrounding community as well as the environment increase. This means that risk management systems that are able to identify and manage risks proactively are a necessity for organizations in industrial urban settings (Hopkin, 2018).

Drawing from the ERM models in COSO and ISO, the present study identifies and examines five principal aspects of enterprise risk management: risk identification, risk assessment, risk response, risk monitoring and control, and risk communication and reporting. These five areas of ERM will serve as the building blocks of the study and the dependent variables to be answered.

2.2.1. Risk Identification

The ERM process starts with risk identification, which is the first and most essential step. This is the process of identifying and describing events or conditions that could hinder an organization from achieving its strategic goals. Risk identification is primarily concerned with creating a list of risks, be they internal to the organization or a result of factors outside the organization (Hopkin, 2018).

The intricate nature of risk identification can pose a multitude of threats to an organization, such as risk, loss, and damage, and becoming a target for aggressive competition. Most captured risks are internal—malfunctioning equipment, human error, and weak procedural, systemic and managerial safety mechanisms. However, inside an organization, such as a factory, external risks, including regulatory changes, economic shifts, technological leaps and innovations, and natural disasters, can be above and beyond the control of the organization and lead to external capture or damage (Lam, 2017).

Risk identification in industrial settings such as factories and production plant facilities is even more critical, as risks are multiplied when working with high-risk operational activities, hazardous substances, and potentially dangerous and injurious industrial operational processes, especially when dealing with a closed-loop production system. There is a multitude of risks that can have a significant negative impact on the environment (Fraser & Simkins, 2016), such as a multitude of risks, including toxic chemical leaks, unit system malfunctions, fires, explosions, and ecological environmental pollution.

Organizations utilize a multitude of risk identification methodologies to aid in the identification of risks, including HAZID and HAZOP studies, and safety inspections, as well as the documentation and reporting of risks, risk analysis workshops, and other technologies, expert consultations, and predicative or foresight scenarios. Each of these tools and methodologies have the capability to be used in the same and/or similar capacities as the other tools and methodologies, because risk can be assessed and evaluated in by a variety of methodologies or processes.

Moreover, the assessment of a risk does not stand alone - on the contrary, it should, rather, be a continuous endeavor, made permanent and ongoing, to be brought in line with the

many variations to one or more of a firm's internal operations, technology - in terms of innovation and change -, and changes in the firm's external environment - including changes to the firm's external competitors and substitute products (goods or services).

In terms of risk assessment, it is worth noting that, upon having identified the relevant and specific risks, the firm should be in a position to engage in the necessary and relevant risk assessment in an orderly manner, with this process including the risk assessment for both the operational and non-operational activities of the firm, in a manner which will include both the safety of the firm's clients and the firm itself as an entity (ISO, 2018).

Risk assessment empowers a company to make a more informed decision on the allocation of the company's resources.

When considering risk assessment methods, one can reasonably separate them into two primary categories, qualitative and quantitative. Qualitative assessment methods involve the use of some sort of expert opinion, risk ranking, and the use of matrices which categorize risk based on their likelihood and severity. Conversely, quantitative analysis uses statistical modeling, analysis of risk, and various types of simulations in an attempt to quantify the risks and the potential operational and monetary impacts of the risk events (Hillson & Murray-Webster, 2017).

One of the most critical sectors in which risk assessment analysis is performed is the industrial sector because of the possible severe outcomes that can occur as a result of industrial accidents. For instance, failure of some of the paramount equipment in a petrochemical facility can lead to explosive events, environmental pollution, as well as loss of other resources. Comprehensive risk assessments will help determine the potential weak points in the operation, and as a result, better safety measures can be implemented to avert the occurrence of such events.

Furthermore, risk assessment analysis plays a critical role in the quality of evaluation of the options available to the relevant persons in terms of emergencies. For example, when people in the industrial sector have the information that pertains to the severity and the likelihood of the risk, they will have better options because the critical risks have been identified, and therefore, they will be able to direct the available resources to the most signify risks and provide the necessary response.

2.2.2. Risk Response

Risk response involves the various strategies and actions organizations put in place to deal with identified risks and the ensuing impacts. After risks have been identified and assessed, organizations have to consider what response strategies to use, depending on the severity of the risks as well as the organization's risk exposure (COSO, 2017).

Some risk response strategies include avoiding risks, reducing risk, transferring risk, and accepting risk. Risk avoidance involves the cessation of activities that pose unreasonable risks. Risk reduction involves the implementation of strategies that will minimize the chances of risk events and the severity of their consequences. When risk exposure is shifted to others, through insurance and other legal complications, that situation is described as risk transfer. When the cost of taking risk mitigation measures is more than the risk associated, organizations consider it prudent to accept the risk (Lam, 2017).

In the area of crisis management, the importance of risk response strategies comes out more clearly in how well prepared an organization will be in the face of an emergency. Good risk response planning calls for emergency response plans, contingencies, policies on evacuations, and plans on how to cooperate with emergency responders.

The development of a detailed response strategy, and especially, the regular execution of emergency response drills, greatly enhances an organization's overall capacity to respond to crises. Moreover, such preparedness initiatives greatly improve the overall effectiveness and efficiency of emergency response operations, and aid in lessening the negative impacts of industrial accidents.

2.2.3. Control and Monitoring

The processes of control and monitoring are ongoing and represent the measures that an organization has put in place to deal with the risk of enterprise management. The implementation of a risk control strategy requires that the organization continues to monitor the risk control systems and determines the effectiveness of the risk management techniques to determine their relevance and effectiveness (Lam, 2017).

The risk monitoring process involves maintaining a close watch on the dominant risk indicators, internal procedural audits and evaluations, safety incident reporting and evaluation, and analysis of system operating data and performance.

In order to dominate the industrial environment, the monitoring systems are made up of highly developed technologies such as real-time monitoring of a system, put in place predictive maintenance systems, and real-time automated monitoring systems designed to ensure safety. These tools are greatly needed in order to identify and correct system operational anomalies prior to such anomalous situations developing into crisis.

Moreover, effective monitoring technologies help enhance the continual progression of risk management methods. Continuous monitoring of the risk management methods and evaluation of incident management reports, helps organizations recognize the vulnerability of the risk management system, allowing organizations to take remedial steps to improve the working environment of staff.

2.2.4. Communication and Information Exchange

Communication and information exchange are key functionalities of the risk management systems. The information and communication system, which collects and disseminates information, is critical to every management system and needs to be established across the entire organization (Boin et al, 2017).

To cover the entire organization, there should be information and communication systems to support every activity, including risk assessment and responsive management. In a crisis, the system can facilitate the retrieval and distribution of information to coordinate emergency management and avoid excess disorder.

Diverse information and communication systems, including command and control centers, emergency communication systems, and information management systems, facilitate the exchange of information and communication for emergency management, and other organizations. Improved information communication is critical for the management of emergency services, and other external partners to improve coordination and collaboration for emergency management.

2.3.Crisis Management

Crisis management is the process in which an organization plans and prepares for the unexpected events that threaten the stability and safety of the organization. These unexpected events may come from natural disasters, technology malfunctions, human mistakes, and outside sources that impact an organization's ability to carry out its functions (Boin et al., 2017).

Crisis management contains several components. Crisis prevention, performance preparedness, response to the crisis, and recovery from the crisis, all require collaboration, communication and, of course, planning from all stakeholders involved to be successful in the management of a crisis.

Out of all the components of crisis management, the response phase is the most important. This is because it is the most important thing in determining how the organization will be able to prevent the crisis from extending its impact further (negative impact crisis). More comprehensive the crisis management planning and the more the organization manager trains its employees, the higher the level of efficiency of the organization will be (Coombs, 2015).

Crisis management center coordinates the response to an emergency crisis and allows the communication to be streamlined among the stakeholders involved. This is the position that is in the best place to put an emergency plan in place and direct the staff and allocate the resources to the crisis response teams.

2.4.Efficiency of Responses to an Emergency Situation

The efficiency of the response to an emergency situation is the organizational capacity to decrease the impact to the level of the organization's objectives, the operational disruption, the duration of the response, and the personnel training, development, and response preparedness operational system, and provide understandable, direct and operational collaboration system, and integrated system resources. (Boin, et al, 2017)

In preparedness, leadership in the response management system, and availability of emergency response operational effectiveness resources, organizational structure and emergency response system efficiency are demonstrated in the response time and improved

response results in emergencies of industrial challenges of urban crisis of industrial cities emergencies).

In relation to Emergency Situation Response, Crisis Response Efficiency, Enterprise Risk Management refers to the optimal use of organizational capacity to provide methodologies to identify and analyze unmanageable and uncontrolled risks and provide crisis management. Risk Management (RM) enables the organization to use the crisis management systems (Fraser & Simkins 2016).

Studies show that organizations that execute full ERM frameworks show more advanced skills in preparing for crises, in decision-making, and within the coordination of the emergency response teams. All of these improvements lead to more efficient crisis response and organizational resilience (Lam, 2017).

A culture of risk awareness within organizations is promoted by ERM. Crisis preparedness is significantly improved when employees are trained to identify risk and articulate safety issues. The culture of risk awareness within organizations helps to strengthen the ability to avert crises and to respond effectively when crises occur.

2.5.Literature Gap

The previous literature has discussed the importance of enterprise risk management on one or multiple organizational processes, command, and finance structures, but research on risk management and crisis response efficiency for high-risk industries is rare. Most literature looks at the impact of enterprise risk management on financial performance, corporate governance or on the organizational resilience and neglects the impact on crisis response operational systems (Fraser & Simkins, 2016; Lam, 2017). \

In addition, most of the empirical literature on enterprise risk management has been directed to the financial sector, the insurance sector, and the big multinationals. The least literature has focused on the risk management of industry systems, particularly in industrial cities where operational and technological risks are high. An industrial system has complex and specialized systems of risk management because of the presence of hazardous substances, complex machines and high-scale production (Hopkin, 2018).

An additional gap in the existing literature is the limited integration of risk management and crisis management research. Crisis management literature discusses the roles of planning, communication, and collaboration during the crisis, but there is sparse evidence on how structured frameworks of enterprise risk management enhance the efficiency of crisis response. Thus, there is a gap in the relationship between implementing ERM and the effectiveness of crisis responses.

Notable also is the lack of empirical studies on crisis management of industrial cities, particularly in the developing world and emerging economies. In Saudi Arabia, the industrial cities of Jubail, Yanbu, and Dammam are key industrial centers that contain a large number of petrochemical and manufacturing plants. Despite their importance, very few studies have evaluated the role of enterprise risk management in improving crisis preparedness and response within these industrial settings.

Moreover, studies on crisis management in industrial settings have tended to focus on safety management systems and emergency management without considering the extent to which enterprise risk management frameworks facilitate the integration of crisis preparedness and response.

Given this, the present study aims to fill this void by analyzing the effect of the various dimensions of enterprise risk management—namely, risk identification, risk assessment, risk response, monitoring and control, and the roles of communication and communication dissemination—on the efficiency of response to crises in the crisis management centers of industrial cities in Saudi Arabia. The study aims to give empirical evidence from this particular context to enhance the body of knowledge in risk and crisis management and to provide a basis for bettering the state of crisis preparedness in industrial settings.

2.6. Conceptual Framework

The conceptual framework of this research is constructed using the theory of Enterprise Risk Management (ERM) and the literature on crisis management. This framework captures the dimensions of enterprise risk management and how they relate to the efficiency of crisis responses at crisis management centers in industrial cities.

Enterprise Risk Management gives organizations the means and the processes to determine risk factors, evaluate the potential damage of those risk factors, develop strategies to respond to the identified risks, and to continuously track the status of risks. These processes of risk management are integral to organizational preparedness and the development of crisis management processes (COSO, 2017; ISO, 2018).

In an industrial setting where operational and technological risks are abundant, the presence of a good risk management system is crucial in preventing crises and improving the response to those crises. Organizations that have implemented systematic ERM practices are better at recognizing early warning signs, organizing proactive responses, and controlling the impact of crises (Hopkin, 2018).

From the ERM frameworks of COSO and ISO 31000, the current study recognizes five dimensions of enterprise risk management that is believed will impact crisis response efficiency. These dimensions are risk identification, risk assessment, risk response, monitoring and control, and communication and information flow.

The effective identification and assessment of risks allow the company to develop measures to guard against potential dangers and prepare plans for crisis avoidance. They create ways of responding to risks with organizational plans to handle crises and backup plans. Risks and emergencies need to have effective approaches to maintain the morale and preparedness of personnel and to monitor the real-time status of risks. Effective control of risks provides the management of the company with an early detection of uncontrolled risks. Effective communication and the exchange of information make it easier for people involved in the crisis and maximize the speed of the transfer of information in emergencies and crises.

All five risk management dimensions are viewed as variables and the efficiency of crisis management as a dependent variable. Crisis management means the ability of the entity to have a crisis management center that can respond timely to emergencies, handle coordination of the crisis and minimize the impact of the crises on the operations of the industry and the lives of people in the surrounding communities (Boin et al., 2017)

The framework suggests that incorporating the elements of Enterprise Risk Management in a process allows for a systematic improvement in preparedness and consequently the efficiency of crisis management in the industrial zones.

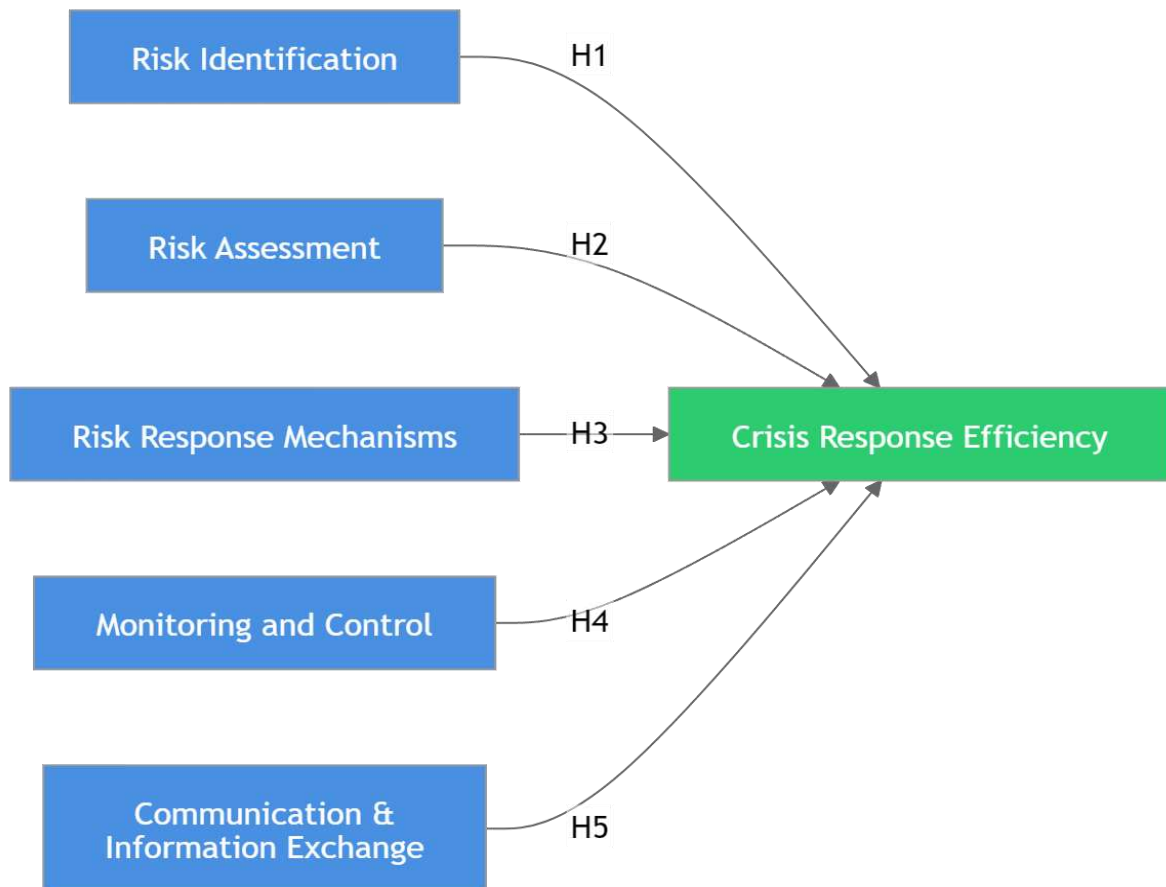


Figure 1: Conceptual framework of the study

Figure 1 Conceptual framework of the study shows how the Crisis management Efficiency and the dimensions of Enterprise Risk Management are related.

. H1: Risk Identification → Efficiency of Crisis Response

H2: Risk Evaluation → Efficiency of Crisis Response

H3: Risk Response Systems → Efficiency of Crisis Response

H4: Supervising and Regulating → Efficiency of Crisis Response

H5: Coordination & Dissemination of Information → Efficiency of Crisis Response

The conceptual framework depicts how the different facets of Enterprise Risk Management interrelate. The five ERM facet risk identification, risk evaluation, risk response systems, supervision and regulation, and coordination and dissemination of information—are seen as independent variables that determine the efficiency of responses to crises, the resulting dependent variable.

CHAPTER THREE

3. RESEARCH METHODOLOGY

Introduction

This chapter elaborates on the research methodology used for the study on the influence of the dimensions of enterprise risk management on the efficiency of responses to crises at crisis management centers in industrial cities of Saudi Arabia. This chapter will cover the research design, research methods, population and sample of the study, instruments for data collection, techniques for data analysis, and the ethical consideration of the study.

The methodology section points out the step-by-step procedure of the study in order to establish the reliability and validity of the research findings.

3.1. Research Design

This research study involves a descriptive analytical approach, which is common in social science research to describe phenomena and the interrelations between variables. In this study, the descriptive analytical approach provides the researcher with the means to examine the existing enterprise risk management practices in crisis management centers and the consequence of such practices on the efficiency of responses to crises.

The descriptive and analytical aspects of the study try to describe the extent to which enterprise risk management practices are used in crisis management centers. In addition, the analytical aspect tries to determine the relationship between the dimensions of ERM and the level of efficiency of responses to crises using quantitative techniques to conduct statistical analysis.

This design is fit for the study because it gives room for the researcher to obtain quantitative information from study participants and analyze the relationship between the independent and the dependent variables.

3.2. Research Methodology

The research employs the quantitative methodology. When the objective of the research is to ascertain the relationships amongst various components, and describe them using statistical techniques and numerical data, the quantitative methodology is the most appropriate.

Quantitative methodology also assists the researcher to determine the extent to which the components of enterprise risk management influence crisis response efficiency using statistical techniques of correlation and regression.

The researcher is also able to use quantitative data to generalize findings to the entire population of employees in crisis management centers.

3.3. Target Population

The target population for this research is the employees of crisis management centers in the industrial cities of Saudi Arabia.

The Industrial cities of Saudi Arabia are of great significance to the country. They are the industrial centers of Jubail, Yanbu, Riyadh, Dammam, and Jeddah.

All of these cities are home to a large number of industrial and petrochemical companies that need to have effective systems for crisis management to ensure their safety and the safety of their operations.

The individuals targeted for this project include Managers of crisis management centers, Safety and risk management officers, Emergency response coordinators, Crisis preparedness supervisors

The population estimate for this case study is set at 480 employees from crisis management centers located in the targeted industrial cities.

3.4.Sample Size

Since this is a considerable population, a sample has been pulled. To determine sample size, we used the Krejcie and Morgan sample size table. This is a table commonly used in social sciences for sample size determination considering the population.

Krejcie and Morgan (1970) indicate for a population of approximately 480, a sample of 214 participants is sufficient.

In this way, the study will have 214 responses from employees of crisis management centers in the Saudi industrial cities.

3.5.Sampling Technique

The study adopts a simple random sampling method. In simple random sampling, each individual in the population has an equal opportunity of being selected for the study. This method of sampling helps minimize bias and enhances the representativeness of the sample. Crisis management centers in industrial cities will have randomly selected participants.

3.6.Data Collection Instrument

The structured questionnaire is the main instrument for collecting data in this study. The questionnaire was created using prior research on enterprise risk management and crisis management. It has 2 main sections.

Section One: Demographic Information ,in this section, the respondents share some background data. This includes:

- Job position - Work experience - Level of education - Department

This sheds light on the background characteristics of the participants in this study.

Section Two: Study Variables :This section has a set of statements for the main variables of the study, measured on a five-point Likert scale, which includes:

1 = Strongly Disagree ,2 = Disagree ,3 = Neutral ,4 = Agree, 5 = Strongly Agree

These variables are assessed by the questionnaire:

Independent Variables (ERM Dimensions)

- Identification of risk- Evaluation of risk - Mechanisms of response to risk
- Control and Monitoring - Information and Communication

Dependent Variable:

Efficiency of Crisis Response

3.7.Instrument's Validity

The instrument's validity relies on the construction of a questionnaire that is reviewed by academicians and practitioners of risk management and crisis management.

Participant feedback will be taken into consideration to revise the questionnaire before it is sent to study participants.

3.8.Instrument Reliability

Reliability is the degree to which the measuring instrument can be dependent upon to provide consistent results.

The reliability of the questionnaire will be tested through the use of Cronbach's Alpha coefficient. Cronbach's Alpha assesses the degree to which the items in a questionnaire invoke the same response from participants.

In social science research, a Cronbach's Alpha value above 0.70 is considered acceptable, implying that the instrument is reliable.

3.9. Questionnaire Distribution Method

The technique that will be used in the collection of data will be questionnaire distribution to employees at the crisis management centers that have been selected across the industrial cities.

The questionnaire may be sent in one or two ways: electronically through an online survey site, or physically in printed format.

The participants will be briefed on the study's objectives, and their feedback will be kept confidential and used solely for the purpose of academic research.

3.10. Techniques for Data Interpretation

The data collected will be evaluated using the Statistical Package for Social Sciences (SPSS). A number of statistical techniques will be used to analyse the data, including the following.

3.11. Descriptive Statistics

Descriptive statistics involve the summarization of the demographic data of the participants and the analysis of their responses to the questionnaire items. These statistics include: - Frequencies – Percentages – Means - Standard deviations -Reliability Analysis

To assess the internal consistency of the items of the questionnaire, the researcher will employ Cronbach's Alpha.

3.12. Correlation Analysis

To assess the relationship of the dimensions of enterprise risk management and the efficiency of crisis response, the researcher will employ Pearson correlation analysis.

3.13. Regression Analysis

The researcher will employ regression analysis to assess the effect of the dimensions of ERM on crisis response efficiency. To establish the strength and significance of the relationships, both simple regression and multiple regression techniques may be used.

3.14. Ethical Considerations

The study will adhere to the principles of ethical research, ensuring that both the participants and the integrity of the research process are safeguarded.

The researcher will inform participants of the study's purpose and their right to voluntary participation. They may withdraw from the study at any point.

The researcher will ensure the confidentiality of responses and the data collected will be used only for research purposes.

The researcher will ensure that the data collected will be stored securely and will not contain any personal identifying data.

CHAPTER FOUR

4. DATA ANALYSIS AND RESULTS

Chapter Introduction

This chapter presents the statistical analysis of the collected data and the findings of the study. The impact of different dimensions of the Enterprise Risk Management (ERM) systems on the efficiency of the crisis response systems was analyzed at the industrial city crisis management centers using SPSS.

The available information was assessed using the following methods, which include descriptive statistics, reliability testing (Cronbach's Alpha), Pearson correlation, and multiple regression, to test the hypotheses of the study.

4.1. Response Rate

There were 230 questionnaires hypothetically sent to employees of the crisis management centers. 224 responded, 4 were excluded as their responses were partially complete. This left us with 220 questionnaires suitable for statistical analysis.

Table 1: 1 Response Rate

Item	Number
Questionnaires distributed	230
Questionnaires returned	224
Invalid questionnaires	4
Valid questionnaires analyzed	220
Response Rate	95.7%

the response rate for the questionnaire that was given to study participants. 230 questionnaires were distributed to employees at crisis management centers. 224 questionnaires were returned. After analysis, 4 questionnaires were excluded for not having complete responses. These are 220 questionnaires for analysis. The final response rate was 95.7%. This shows that the level of participation and cooperation from the respondents was strong, making the study results more reliable.

Demographic Characteristics of Respondents (N = 220)

Table 2: Distribution by Gender

Gender	Frequency	Percentage
Male	186	84.5%
Female	34	15.5%
Total	220	100%

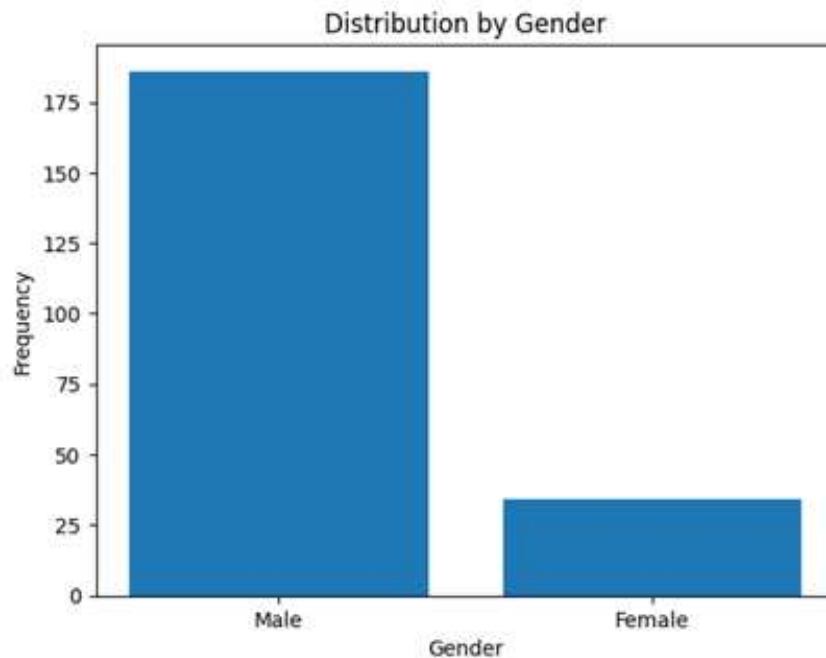
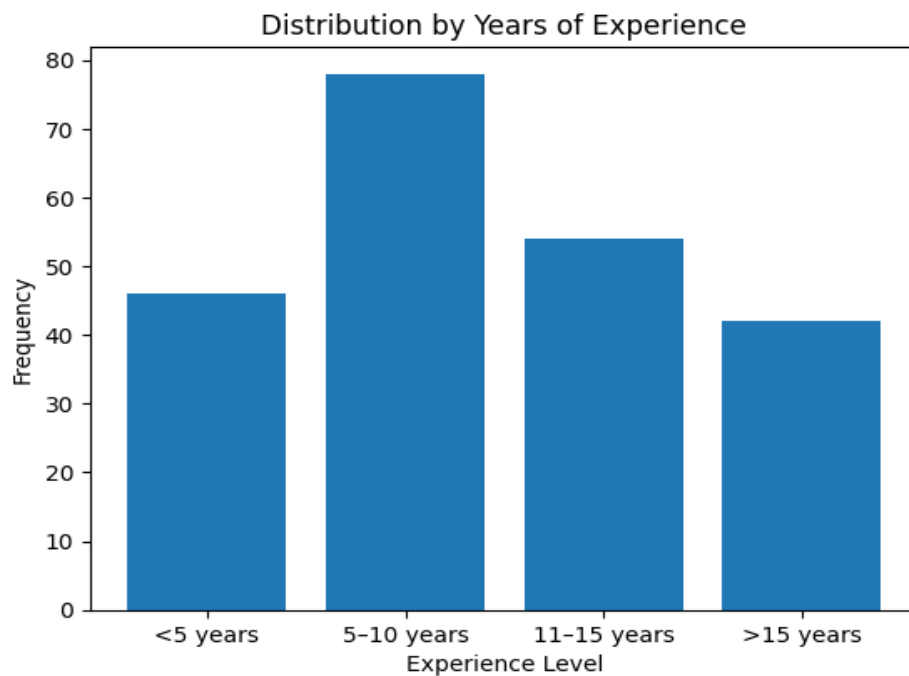


Table 4.2 displays the data of respondents based on their sex. The data shows that the majority of respondents were male (84.5%) and female respondents were 15.5%. This imbalance can be explained by the nature of work in crisis management and safety engineering positions, which tend to attract more male employees.

Table 3: Distribution by Years of Experience

Experience	Frequency	Percentage
Less than 5 years	46	20.9%
5–10 years	78	35.5%
11–15 years	54	24.5%
More than 15 years	42	19.1%
Total	220	100%



Respondents are classified by their professional experience in Table 4.3. Most of the respondents (35.5%) cited 5-10 years of experience. This was followed by 11-15 years (24.5%). Less than 5 years of experience was cited by 20.9% and more than 15 years was 19.1%. This means that most respondents possess at least moderate experience that justifies their credibility in answering questions pertaining to enterprise risk management and crisis response.

Table 4: Distribution by Job Position

Job Position	Frequency	Percentage
Director / Center Head	24	10.9%
Supervisor / Section Head	68	30.9%
Risk / Safety Officer	86	39.1%
Emergency Response Coordinator	42	19.1%
Total	220	100%

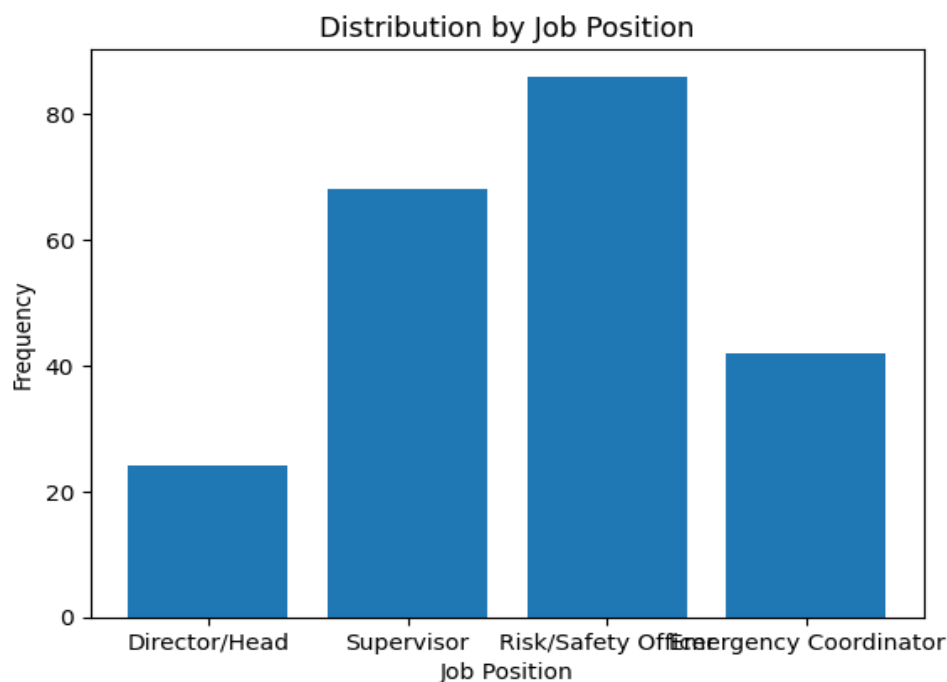


Table 4.4 shows the respondents and their Job positions. Most of the respondents were risk or safety officers (39.1%) and were followed by supervisors or section heads (30.9%). Emergency response coordinators were 19.1% while directors or center heads were 10.9%. This means that there were various professional roles represented in the study, thus, it is possible to get varied perspectives about the study variables.

4.2. Reliability Analysis (Cronbach's Alpha)

Reliability analysis was conducted to assess the internal consistency of the measurement scales used in the questionnaire. Cronbach's Alpha values above **0.70** indicate acceptable reliability.

Table 5: Reliability Results

Variable	Number of Items	Cronbach's Alpha
Risk Identification	5	0.86
Risk Assessment	5	0.88
Risk Response	5	0.84
Monitoring and Control	5	0.87
Communication and Information Sharing	5	0.90
Crisis Response Efficiency	6	0.89

Table 4.5 illustrates the findings of the reliability analysis conducted by the author's research during the reliability assessment of the internal consistency of the study instrument.

The findings indicate that every of the Cronbach's Alpha values that the author's research computed fell between the 0.84 to 0.90 range. High reliability values fell between the ranges of 0.84 and 0.90. Reliability of 0.70 and above is acceptable. The study instrument is therefore reliable and is consistent internally to measure the various study variables that the survey items intended to measure.

4.3.Descriptive Statistics of Study Variables

Table 6: Means and Standard Deviations

Variable	Mean	Std. Deviation	Level
Risk Identification	3.78	0.63	High
Risk Assessment	3.71	0.66	High
Risk Response	3.84	0.61	High
Monitoring and Control	3.69	0.67	Moderate– High
Communication and Information Sharing	3.92	0.58	High
Crisis Response Efficiency	3.88	0.60	High

Table 4.6 illustrates the means and standard deviations of the study variables. The findings of the author's research indicate that the meaning of all the study variables and every measure falls at the high and moderately high levels. The mean score that was obtained for the measure of communication and information sharing was the highest. This was (Mean = 3.92), and for crisis response efficiency, the mean was (Mean = 3.88). The means for

monitoring and control is the lowest means and is still in the (Mean = 3.69) range, to the author's research. The findings from the table mean that the respondents think that the implementation of enterprise risk management practices in their organizations is relatively strong or fairly reasonable and the crisis response efficiency is also fairly reasonable.

4.4. Correlation Analysis (Pearson Correlation)

Pearson correlation analysis was conducted to determine the relationships between ERM dimensions and crisis response efficiency.

Table 7: Pearson Correlation Matrix (N = 220)

Variable	RE	RA	RR	MC	CI	CRE
Risk Identification (RE)	1					
Risk Assessment (RA)	0.64**	1				
Risk Response (RR)	0.60**	0.66**	1			
Monitoring & Control (MC)	0.58**	0.62**	0.67**	1		
Communication & Information (CI)	0.55**	0.59**	0.63**	0.69**	1	
Crisis Response Efficiency (CRE)	0.62	0.58	0.66	0.63	0.71	1

(Significant at $p < 0.01$)

4.5. The Pearson Correlation Analysis

Table 4.7 demonstrates the outcomes from the Pearson correlation analysis conducted to establish the correlation between the dimensions of enterprise risk management and the efficiency of crisis response. The analysis indicates a positively statistically significant correlation between dimensions of ERM and the efficiency of crisis response. The greatest correlation appears between communication and information sharing and crisis response efficiency ($r = 0.71$), followed by risk response ($r = 0.66$). The analysis reveals that the communication and information sharing systems within the organization are major contributors to the increase of the efficiency of crisis response.

4.6.Hypothesis Testing Using Multiple Regression

R	R²	Adjusted R²	Std. Error
0.795	0.632	0.623	0.37

The model explains **63.2% of the variance** in crisis response efficiency.

4.7.Regression Model Summary

Table 4.8 showcases the summary of the multiple regression model that was conducted to establish the consequences of the ERM dimensions and the efficiency of crisis response. The coefficient of determination ($R^2 = 0.632$) illustrates that the independent variables capture 63.2% of the crisis response efficiency. The determination coefficient reveals that the ERM dimensions in the model provide significant determination in forecasting the efficiency of crisis response.

Table 8: ANOVA Results

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	49.20	5	9.84	71.8	0.000
Residual	28.62	214	0.134		
Total	77.82	219			

regarding ANOVA findings

In regard to Table 4.9, the outcome of the ANOVA test from the regression model has yielded an F-value of 71.8, and a p-value of 0.000, which is considerably lower than the 0.05 p-value benchmark. Thus, the ANOVA test shows that the regression model is valid, and the independent variables have a positive impact on the efficiency of the crisis response.

4.7.1. Regression Coefficients

Independent Variable	B	Std. Error	Beta	t	Sig.	VIF
Constant	0.62	0.18	—	3.44	0.001	—
Risk Identification	0.18	0.05	0.19	3.60	0.000	1.88
Risk Assessment	0.10	0.05	0.11	2.02	0.045	2.15
Risk Response	0.21	0.05	0.22	4.12	0.000	2.32
Monitoring & Control	0.16	0.05	0.17	3.14	0.002	2.45
Communication & Information	0.28	0.05	0.31	5.66	0.000	2.10

The Regression coefficients in Table 4.10 quantify the changes in efficiency in the crisis response brought about by each of the independent variables. Results here show that all

the dimensions of ERM positively and statistically significantly influence efficiency of the crisis response. Out of these dimensions, the predictor of the most concern is communication and information sharing (Beta = 0.31) while the others, that is, risk response and risk identification, have Betas of 0.22 and 0.19 respectively. Therefore, the effectiveness of the systems and mechanisms for communication and information sharing in the organization determines the efficiency of crisis response.

4.8.Hypothesis Testing Summary

Table 9:Hypothesis Testing Results

Hypothesis	Relationship	Result
H1	Risk Identification → Crisis Response Efficiency	Supported
H2	Risk Assessment → Crisis Response Efficiency	Supported
H3	Risk Response → Crisis Response Efficiency	Supported
H4	Monitoring & Control → Crisis Response Efficiency	Supported
H5	Communication & Information → Crisis Response Efficiency	Supported
Main Hypothesis	ERM → Crisis Response Efficiency	Supported

All of the proposed hypotheses were found to have significant statistical support. The results of the dimensions of enterprise risk management have a positive impact on the efficiency of crisis response. This positively correlating hypothesis emphasizes the importance of adopting an all-encompassing enterprise risk management framework within an organization.

This study shows that applying Enterprise Risk Management (ERM) practices positively affects crisis management centers' ability to respond to crises efficiently. The research conducted revealed that each of the dimensions of ERM should be utilized to improve the organizational ability to prepare and respond to crises. It can be concluded that organizations using ERM practices in a systematic and integrated manner improve their ability to detect, assess, and respond to risks and threats.

Of the ERM dimensions analyzed for this study, the greatest impact on emergency response was from the provision of an integrated, cooperative method of communications, and the distribution of critical information and instructions. This finding emphasizes the significance of a communications system and the streamlined distribution of critical information during responses to emergencies. An integrated system maximizes the speed of response and the ability of the crisis management personnel to perform their assigned tasks. As a result, organizations with integrated communication and information systems can better focus their crisis response endeavors and alleviate confusion, bottlenecks, and issues in their emergency response processes.

In addition, the findings demonstrate the importance of the various components of ERM, such as the identification of risks, measured risks, the development of risk response strategies, and the monitoring and control of mechanisms, in enhancing the efficiency of responding to crises. Risk identification aids organizations in pinpointing the exact problem prior to its expansion, as measured risks help in setting the order of importance of the problem in terms of its possibility and the severity of the consequences if the problem is left to continue. The development of risk response strategies gives the organization the ability to devise plans for control or contingency, and the monitoring and control of mechanisms helps to ensure that responses to crises and the management of risks are evaluated continuously.

The findings are in line with previous studies, stating that the organizations which manage risk systematically are able to withstand the unforeseen disruptions better than those which do not. Many scholars have pointed out that through ERM systems, flexibility and adaptability of organizations are increased, as well as their ability to manage crises. Systematic management of risk combined with the organization of goals and the course of activities of the organization aids in the effective management of risk and the retention of stability of the organization under the condition of crisis.

In a positive sense, results show that implementing an integrated ERM framework significantly enhances the effectiveness of an organization's response to crises. Such response efficiency and organizational resilience are attained by investing in the integrated risk communication systems and coordination, and the ongoing risk surveillance structures.

Chapter Summary

This chapter presented the statistical analysis of the data collected from **220 respondents** using SPSS. The findings demonstrate strong reliability of the research instrument and significant relationships between ERM dimensions and crisis response efficiency. The regression model explains a substantial portion of the variance in crisis response efficiency, confirming the importance of ERM practices in improving crisis management performance.

The next chapter will discuss the findings in relation to previous literature and provide conclusions and recommendations.

CHAPTER FIVE

5. DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This chapter elaborates on the findings from the statistical analysis carried out in Chapter Four. Here the objective is to explain the results in context of the study's objectives and hypotheses, and in relation to the empirical literature on enterprise risk management and crisis management. Additionally, this chapter elucidates the study's practical and theoretical implications for organizations involved in crisis management in the industrial context.

Industrial cities pose unique challenges due to their operational complexity, levels of technology, use of dangerous materials, and the concurrent interlinked flow operations. Such factors can lead to potential crises. These include industrial accidents, environmental crises, technological failures, or operational disruptions. Consequently, organizations in these environments must design and implement risk management systems to respond to crisis situations.

Enterprise Risk Management (ERM) is gaining a positive reputation within the managerial community. With this approach, management can focus on the positive outcome of management strategies and frameworks, instead of the previously reactive nature of focusing on crises. This is achieved by integrating the ERM process throughout the organizational structure and different levels, thus enhancing the organization's ability to withstand shocks and disruptions, and promoting crisis preparedness.

The study evaluated how ERM practices influence the efficiency of the response to crises in crisis management centers in the industrial cities of Saudi Arabia. The study explored the different dimensions of ERM and how they contributed to the efficiency of responses to crises.

This chapter is divided into different sections. In Section 5.2, a comparison of the findings of this study and the findings of the previous studies is presented. In Section 5.3, the main conclusions which can be drawn from the findings are presented. Section 5.4 gives a set of recommendations to policymakers, managers and the authorities in charge of crisis management. In Section 5.5, the limitations of the study are discussed, while Section 5.6 gives the recommendations for the future studies.

5.1.Results and Discussion

The findings of this study demonstrate that the implementation of Enterprise Risk Management (ERM) has a positive impact on the efficiency of the response to crises in the crisis management centers that are located in the industrial cities. The findings show that the organizations that implement risk management systems that are formalized and integrated are in a better position to identify and manage the risks, organize the operational response to the crisis, and manage the result of the crises.

Communication and information exchange were found to be the most significant dimensions impacting the efficiency of the organization's crisis response. In crisis situations, rapid and accurate information flows among the various members of the crisis management team, the decision makers, and the other external contacts is crucial. Informed decision making and effective crisis management are hampered, rather severely, by delays or inaccuracies in the flow of information. Thus, the organizations that are able to integrate more effective communication systems are better able to manage the coordination of crisis response actions.

These findings are in support of the case made by Boin et al. (2017), regarding the importance of communication and coordination in crisis management systems. In crisis

management, systems that facilitate effective communication are able to manage uncertainty and facilitate better decision making.

These findings also establish the importance of risk identification in enhancing the state of preparedness of an organization for possible future crises. In industrial settings, where complex systems and structures are employed, potential risks and threats need to be identified and countered before they become crises. Risk detection and intervention are vital for the safe and uninterrupted operation of the system.

This finding confirms the results of Hopkin (2018), who stated that identifying risks in advance is one of the most important factors in the success of risk management systems. Organizations that routinely identify operational risks are better able to develop contingency plans and lower the chances of a devastating disaster.

The study also observed that risk assessment has a positive effect on the efficiency of the response to a crisis. Risk assessment is the process of weighing the chances that a risk will materialize and the consequences of the risk. Organizations that assess risk are able to identify and pay more attention to those risks that are of the greatest potential detriment and direct their efforts to reduce the potential impact.

Decision-making is also improved through the process of risk assessment, since it helps to clarify the issues, giving the management a better-organized view of the potential risks and their impact. This supports Lam (2017), who stated that risk assessment is a tool that organizations can use to enhance their strategic planning and improve their ability to cope with ambiguity.

The study also made an important finding concerning the risk response strategies and their role in improving the quality of crisis management. Organizations that develop elaborate response plans, emergency response protocols and contingency plans are better able to manage crises. Such plans enable organizations to communicate the crisis response plan quickly and ensure that response teams move in a prompt, coordinated, and organized manner.

These results are consistent with Fraser and Simkins (2016), who showed that organizations with more integrated ERM systems have greater organizational resilience and preparedness for crises.

The results also suggest that the monitoring and control systems have a substantial impact on the effectiveness of crisis response. Organizations that continuously monitor risk factors and keep the company on crisis watch can act before it intensifies into a greater crisis. Furthermore, the monitoring systems provide the means for an organization to assess the effectiveness of the risk management actions taken and adjust the risk management policy.

Up to date monitoring systems used within an organization often consist of a number of more advanced systems like real-time data monitoring, predictive maintenance, and environmental monitoring, etc. These systems help organizations to detect abnormal conditions in a timely manner and to take corrective measures before the disruption becomes too large.

In conclusion, results reaffirm that Enterprise Risk Management offers a unique structure that improves the organizational resilience, preparedness to cope with crises, and effectiveness of crisis response systems. Within an integrated organizational setting, risk management practices can significantly enhance the management of a complicated and unstructured environment.

5.2. Conclusions

The analysis of the data and the discussion of findings provide the framework to construct a number of conclusions.

To begin with, the research corroborates that Enterprise Risk Management, which is hereafter referred to as ERM, is useful in bolstering the efficacy of organizations' crisis response capabilities in the industrial sector. Businesses with ERM-based integrated risk management systems, in particular, display the ability to effectively manage unforeseen disruptions, as well as the ability to respond to and manage crises.

Additionally, the results underscore the efficacy of information and communication during crisis management. Well-structured communication systems are invaluable in facilitating organizations' coordination of crisis response activities. Along the same lines, these systems help to reduce response times at all levels and give decision makers access to critical and pertinent information during a crisis.

Moreover, the study affirms the impact that improvement of the organizational preparedness, and the processes of risk assessment and risk identification have on systematized organizations. Such organizations are, and are likely to be, very effective in crisis prevention and mitigation.

Furthermore, the assassination of any menace, coupled with active response planning and supervising mechanisms, is a key differentiator in the overall improvement of the organizational resilience. Organizations that are active in crisis management with the proper systems are, and are likely to be, the best in managing the highest levels of crisis complexity.

Finally, the study shows that industrial ERM in the crisis management systems within industrial cities of developing countries, and in the case of Saudi Arabia, ERM integrated systems within industrial cities of Saudi Arabia, is one of the most effective methods to ensure the safety and operational sustainability of rapidly developing economies.

5.3.Recommendations

In regard to the empirical results from the analysis, there is potential to formulate both practical and empirical tactical recommendations regarding how to improve the efficiency of enterprise risk management strategies and enhance the efficacy of crisis management in the context of industrial zones.

To begin with, the relevant municipal bodies in industrial zones should develop and enhance the systems of communication and information exchange that exist between the various participants of the crisis management systems. Well-functioning communication systems in the context of a crisis are of paramount importance, because they facilitate the timely and reliable separation of information to be delivered to the decision-makers and operational employees. Hence, it is recommended that industrial zones create communication systems that are able to integrate the crisis management centers with the industries, the emergency services, and the control bodies. In crisis situations, the systems of digital communication, real-time alerts, and decentralized command control of the operational activities are to be functional as they will facilitate and accelerate the response to the crisis.

Second, organizations ought to implement cutting edge risk assessment technologies and early-warning systems to avert issues escalating into severe crises. The current use of dangerous materials and large-scale, complex operations in industrial settings require advanced monitoring systems. The identification of risk before a situation becomes dangerous can be achieved using predictive analytics, AI-based risk identification, and other

safety monitoring technologies. The use of these technologies increases an organization's operational safety and accident prevention capabilities.

Crisis management centers are required to conduct additional training, and drills improve the response time of their staff. The drills should be designed to improve the ability to control and communicate during a potential crisis in a facility. The readiness of staff to respond is increased by practicing crises drills in realistic settings, and they should be encouraged to develop a philosophy of training that encompasses the integration of several industrial, emergency, and governmental organizations.

Fourth, organizations are encouraged to create all-inclusive systems for the monitoring and evaluation of their activities in relation to risk management. The ability to evaluate the quality and effectiveness of risk management activities is driven by the organization's ability to measure and monitor risk management activities. This tolerance for risk, in relation to the organization's KRIs, is the best measure of the organization's ability to prepare itself for and to deal with risk. In relation to the operational risk continuum, organizations need to evaluate the relevant risk management policies regularly to remain relevant to the policies and to evaluate the policies.

Fifth, evidence-based policies will enable organizations to adopt best practice risk management principles, including ISO 31000 and the COSO enterprise risk management framework. The recommended practices provide a basis for dealing with risk in a systematic way. The integration of best practices with management systems and risk management practices will improve governance, transparency, and organizational readiness in dealing with risks. The regulatory authorities are encouraged to make the integration of ERM (enterprise risk management) compliance for the management of safety in industry risk.

Sixth, the overseeing government bodies for industrial cities should strengthen the partnership and collaboration between industrialists, emergency services, regulators, and crisis management. Effective crisis management relies on the collaboration of multiple stakeholders. Creating collaborative platforms, emergency response plans, and inter-agency coordination could greatly improve the efficiency of crisis management. Strengthened public-private partnerships may be central to advancing risk management and crisis preparedness at the national level, as well.

Lastly, organizations ought to foster and cultivate risk awareness and proactive risk management amongst employees. Risk management should not be reserved for certain departments, rather, it should be engrained in the culture and the fabric of the daily operations of the institution. Prompting employees to report safety issues, engage in risk management, and adhere to prescribed procedures will foster institutional resilience and enable preparedness for crises.

5.4.Limitations of the Study

There are many insights in this study concerning the interplay between enterprise risk management and the efficiency of crisis response, but there are many limitations that should be noted.

First, most research makes use of self-reported survey data from crisis management practitioners. Respondents may have subjective views of the efficiency of crisis response and ERM practices. Respondents' comments may have been filtered by personal experiences, organizational culture, and the instrument's ability to capture reliability and validity may have been somewhat compromised, despite the instrument's ability to capture these dimensions.

Second, the research was concerned with crisis management centers situated in industrial cities. This may have implications on the restriction of the findings' applicability to other organizational frameworks. There could be differences in practices of risk management and systems of crisis response in other frameworks, like healthcare, and in the other public administration and transportation systems. Hence, the findings of this research may be limited to industrial environments.

The third point relates to the fact that the research was cross-sectional. Data was, thus, limited to one time capture, and the research did not consider the dimension of time: how practices of risk management and the efficiency of crisis response evolved. This means that in order to gain a more robust understanding of how ERM practices shape the organizational resilience and the crisis management competencies of the organizations, time should be an additional dimension to be factored in. This will be more possible in longitudinal studies.

The study also looked at ERM dimensions such as risk identification, risk assessment, risk response, and control and communication, and while these are considered core elements of frameworks for enterprise risk management, other aspects like the effectiveness of leadership, organizational culture, and technology could also play a role in the efficiency of a response to a crisis.

The study, despite presenting an analysis with limitations, contributes to the body of knowledge of enterprise risk management, and crisis management, especially in an industrial city context.

5.5.Future Research Directions

The findings of this study may serve as a basis for future research in multiple other areas of enterprise risk management and crisis management.

Future studies may also explore the impact of digital tools such as big data analytics and artificial intelligence systems on enterprise risk management frameworks. The use of these technologies for real-time risk monitoring, risk analysis, and automated systems for crisis management would transform risk management practices and would make significant contributions to the body of knowledge in organizational resilience.

Comparative research can be done to analyze how risk management methods differ in various industries or countries. This type of research can locate best practices in enterprise risk management, and how regulatory structures, organizational structures, and culture determine the effectiveness of risk management.

Additionally, future research may analyze how organizational leadership and corporate culture support the integration of enterprise risk management systems. Integrating risk management practices into an organization is dependent on leaders' commitment and employees' active participation.

Crisis preparedness training for employees may be one area future research examines in relation to its effect on organizational response to crises. This type of research can assist organizations in developing more effective strategies for building the capacity of employees to manage emergencies.

Finally, the impact of enterprise risk management practices on organizational resilience and performance in relation to crises is an area that can be studied using

longitudinal research methods. This type of research can enhance the understanding for the evolution of risk management systems and how this evolution is related to performance.

Lastly, future studies could further develop the conceptual framework of this research by adding dimensions such as organizational learning, technological advancement, and compliance, and how these could affect the association between enterprise risk management and the effectiveness of crisis response.

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7. Appendix: Research Questionnaire

Response Scale

Scale	Description
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

Section A: Demographic Information

No	Question	Options
1	Gender	Male / Female
2	Age Group	20–29 / 30–39 / 40–49 / 50+
3	Years of Experience	Less than 5 years / 5–10 years / 11–15 years / More than 15 years
4	Job Position	Director / Supervisor / Risk Officer / Emergency Coordinator
5	Industrial City	Jubail / Yanbu / Riyadh / Dammam / Jeddah

Section B: Enterprise Risk Management (ERM)

Risk Identification (RE)

No	Statement	1	2	3	4	5
RE1	Our organization systematically identifies potential risks before they escalate into crises.	☐	☐	☐	☐	☐
RE2	Risk identification includes internal and external risk sources.	☐	☐	☐	☐	☐
RE3	Previous incidents are analyzed to identify potential future risks.	☐	☐	☐	☐	☐
RE4	Safety inspections are regularly conducted to detect possible risks.	☐	☐	☐	☐	☐
RE5	Employees are encouraged to report risks and safety concerns.	☐	☐	☐	☐	☐

Risk Assessment (RA)

No	Statement	1	2	3	4	5
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RA1	Risks are evaluated according to their probability and impact.	☐	☐	☐	☐	☐
RA2	Risk prioritization helps in allocating organizational resources.	☐	☐	☐	☐	☐
RA3	Risk assessment results support crisis preparedness.	☐	☐	☐	☐	☐
RA4	Scenario analysis is used to evaluate possible crisis situations.	☐	☐	☐	☐	☐
RA5	Risk assessment is updated regularly.	☐	☐	☐	☐	☐

Risk Response (RR)

No	Statement	1	2	3	4	5
RR1	The organization has	☐	☐	☐	☐	☐

	clear procedures to respond to crises.					
RR2	Emergency response plans are clearly documented.	☐	☐	☐	☐	☐
RR3	Roles and responsibilities during crises are clearly defined.	☐	☐	☐	☐	☐
RR4	Crisis response strategies include prevention and mitigation plans.	☐	☐	☐	☐	☐
RR5	Coordination with external emergency agencies is effective.	☐	☐	☐	☐	☐

Monitoring and Control (MC)

No	Statement	1	2	3	4	5
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MC1	The organization monitors risk indicators continuously.	☐	☐	☐	☐	☐
MC2	Internal reviews are conducted to evaluate risk management systems.	☐	☐	☐	☐	☐
MC3	Risk management policies are regularly reviewed and updated.	☐	☐	☐	☐	☐
MC4	Corrective actions are taken when risks increase.	☐	☐	☐	☐	☐
MC5	Monitoring systems help detect early warning signals.	☐	☐	☐	☐	☐

Communication and Information Sharing (CI)

No	Statement	1	2	3	4	5
CI1	Communication channels during crises are clear and effective.	☐	☐	☐	☐	☐
CI2	Information is shared quickly among crisis management teams.	☐	☐	☐	☐	☐
CI3	Digital systems are used for crisis communication.	☐	☐	☐	☐	☐
CI4	Information sharing improves coordination during crises.	☐	☐	☐	☐	☐
CI5	Communication helps reduce confusion during emergencies.	☐	☐	☐	☐	☐

Section C: Crisis Response Efficiency (CRE)

No	Statement	1	2	3	4	5
CRE1	Our center responds quickly when crises occur.	☐	☐	☐	☐	☐

CRE2	Crisis response teams coordinate effectively.	☐	☐	☐	☐	☐
CRE3	Decisions during crises are taken quickly.	☐	☐	☐	☐	☐
CRE4	Resources are mobilized efficiently during emergencies.	☐	☐	☐	☐	☐
CRE5	The organization effectively minimizes crisis impacts.	☐	☐	☐	☐	☐
CRE6	The organization restores normal operations quickly after crises.	☐	☐	☐	☐	☐

أثر تطبيق إدارة المخاطر المؤسسية على كفاءة الاستجابة للأزمات في المدن
الصناعية: دراسة ميدانية على مراكز إدارة الأزمات في المملكة العربية السعودية

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