RISK MANAGEMENT IN THE ELECTRICITY DISTRIBUTION SYSTEM OF THE UNITED ARAB EMIRATES

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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AHMED HUSAIN AL MARZOOQI

A thesis submitted
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DECLARATION

I declare that this thesis entitled “Risk Management In The Electricity Distribution System of The United Arab Emirates” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : Ahmed Husain Al-Marzooqi

Date : 12/02/2025

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APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality as a partial fulfillment of Doctor of Philosophy.

Signature :.....

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DEDICATION

I dedicate my thesis work to my family and many friends. A special feeling of gratitude to my loving parents, Zalikhah and Husain whose words of encouragement and push for tenacity ring in my ears. My brother Sultan and sisters Tahreer and AlAnood have never left my side and are very special.

I also dedicate this thesis to my wife Maith AlHosani and children who have supported me throughout the process. I will always appreciate all they have done and the patience for the times I was away.

I dedicate this work and give special thanks to my best friend Ali AlHammadi for being there for me throughout the entire doctorate program. You have been my best cheerleaders.

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ABSTRACT

The current study focused on the aspect of risk management in the electricity distribution sector of the UAE. More particularly, the focus was on one of the key electricity distributors, the Abu Dhabi National Energy Company, PJSC (TAQA), which operates in the UAE and other countries across the globe. The overarching aim of this study was to investigate the optimization of risk management in the UAE electricity distribution sector using TAQA as the case study. The specific objectives were to evaluate the relationship between risk management methods, enterprise risk management (ERM), risk culture, and risk optimization recommendations with risk performance at the organization. The quantitative research methodology was used in this study. Using the quantitative methodology, data was collected from 390 participants from TAQA. Surveys were used for the collection of data and SPSS was used to conduct regression analyses to establish relationships between variables. Based on the regression analyses, all hypotheses were supported. One of the notable findings of the study indicated that risk management methods significantly impact risk performance. Better risk management methods lead to more efficient risk management approaches. More so, the implementation of ERM leads to better risk performance in the organization. It was also found that the presence of a risk culture leads to better risk performance. Lastly, it was found that elements such as ERM need to be put in place to enhance risk optimization in the organization. All study objectives were achieved. It is fundamental that risk management is prioritized in the electricity distribution system of the UAE. Through the example of TAQA, the entire industry stands the chance to do better in the future.

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PENGURUSAN RISIKO DALAM SISTEM AGIHAN ELEKTRIK DI EMIRIAH ARAB BERSATU

ABSTRAK

Kajian semasa memberi tumpuan kepada aspek pengurusan risiko dalam sektor pengagihan elektrik di UAE. Secara khusus, tumpuan kajian diberikan kepada salah satu pengedar elektrik utama, Syarikat Tenaga Nasional Abu Dhabi (Abu Dhabi National Energy Company), PJSC (TAQA), yang beroperasi di UAE dan beberapa negara lain di seluruh dunia. Matlamat keseluruhan kajian ini adalah untuk menyiasat pengoptimuman pengurusan risiko dalam sektor pengagihan elektrik di UAE menggunakan TAQA sebagai kajian kes. Objektif khusus kajian adalah untuk menilai hubungan antara kaedah pengurusan risiko, pengurusan risiko perusahaan (Enterprise Risk Management, ERM), budaya risiko, dan pengesyoran pengoptimuman risiko dengan prestasi risiko di organisasi. Metodologi kajian kuantitatif digunakan dalam kajian ini. Menggunakan metodologi kuantitatif, data dikumpul daripada 390 peserta dari TAQA. Tinjauan digunakan untuk pengumpulan data dan SPSS digunakan untuk menjalankan analisis regresi untuk mewujudkan hubungan antara pembolehubah. Berdasarkan analisis regresi, semua hipotesis kajian telah disokong. Salah satu penemuan penting kajian menunjukkan bahawa kaedah pengurusan risiko memberi impak yang ketara kepada prestasi risiko. Kaedah pengurusan risiko yang lebih baik membawa kepada pendekatan pengurusan risiko yang lebih cekap. Tambahan pula, pelaksanaan ERM membawa kepada prestasi risiko yang lebih baik dalam organisasi. Ia juga didapati bahawa kehadiran budaya risiko membawa kepada prestasi risiko yang lebih baik. Akhir sekali, didapati bahawa elemen seperti ERM perlu disediakan untuk meningkatkan pengoptimuman risiko dalam organisasi. Semua objektif kajian tercapai. Asas utama dapatan adalah bahawa pengurusan risiko diutamakan dalam sistem pengagihan elektrik di UAE. Melalui contoh TAQA, seluruh industri berpeluang untuk melakukan yang lebih baik pada masa hadapan.

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LIST OF ABBREVIATIONS

ERM	-	Enterprise Risk Management
TAQA	-	Abu Dhabi National Energy Company
UAE	-	United Arab Emirates

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LIST OF SYMBOLS

p-value	-	Probability value
df	-	Degree of Freedom

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LIST OF PUBLICATIONS

AlMarzooqi, A.H., Kasdirin, H.A., and Mansor, N., 2022. Model of risk classification in the electricity distribution sector of the UAE. *Journal of Management Information and Decision Sciences*, 25(S3), pp.1-8.

AlMarzooqi, A. H., Kasdirin, H. A., and Mansor, N. 2022. Development of risk management practices in the electricity sector of the UAE. *Journal of Management Information and Decision Sciences*, 25(3), pp.1-9.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter introduces the theme of the thesis - analysis and assessment of risk management methods applied to the electricity distribution system in the United Arab Emirates (UAE) electricity markets. The information presented in this chapter is supposed to develop a general understanding of the study problem and objectives among the general audience. It includes the analysis of the research background, problem statement and the presentation of the key research questions and objectives. The scale of the study and the importance of its findings are discussed to identify the level of relevance and importance of the p resented study, in addition to the discussion of the potential impact of the research in the fields of theory and practice. The thesis structure is presented to inform the readers about the content and structure of the research. The final section of the chapter included a brief summary of the chapter information is provided.

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To clearly identify the theme of the study, it is important to identify and analyze in detail the specific terms that form its structure. The first term defined by the researcher in the process of literature sources analysis for the aims of the thesis is risk. The definition of the term stated in the Oxford English Dictionary, which defines risk as “hazard, danger; exposure to mischance or peril” (RAIS, 2020). In this definition, a clear negative characteristic of the risk as a theoretical phenomenon can be observed. Nevertheless, such a definition of risk management cannot be considered as proper for application in the context

of the thesis theme, mainly due to the limited nature of the concept and difficulties of its application to the research issue. In the conditions of the electricity distribution system in the UAE, which is the object of the study, the definition stated in the Oxford English Dictionary does not consider a full range of situations that can be estimated as risk-related. Hence, an alternative definition of risk is sensible in the context of the presented study.

Risk management is becoming one of the most critical aspects in contemporary organizations. For organizations to attain their goals in their respective industries, they need to comprehend the types of risks that they face and manage them in the best way possible. In the current thesis, the researcher utilizes the definitions of risk mentioned by Lyon and Popov (2022). Lyon and Popov (2022) define risk as, "the probability or likelihood of an occurrence, and the resulting severity of the consequences". The meaning from this definition is that risk needs to be evaluated in terms of its occurrence and the effects that are associated with its occurrence. In this way, the term risk is applied to characterize the probability of any event that could upset the existing balance between the object of the study and the environment – both in the positive and in the negative way.

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In this thesis, the focus is to investigate the management of risk in the electricity distribution system in the UAE. Hence, it is vital to comprehend aspects that constitute risk management in the organization. Srinivas (2019) opines that risk management is a planned and structured process that focuses on helping the project team make the right decision at the right time in regard to the identification, classification, and quantification of risks in order to manage and control risks effectively. Risk management is always geared at ensuring that any costs that could be associated with the failure to manage the risk are handled before the occurrence of the risk (Srinivas, 2019). Hardy et al. (2020) presents a more succinct

comprehension of risk management noting that it entails weighing alternative courses of action and selecting the most appropriate one based on the existing economic, social and political concerns or with the organization's level of risk appetite and tolerance. Therefore, risk management needs to be set up in a manner that enables managers to pick the most appropriate course of action in their decision-making process as far as organizational risks are concerned.

The risk management process in the organization needs to be elaborate. Latur (2020) points out that the risk management process needs to start with the establishment of the context, identification of the potential risks, assessment of the identified risks, putting in place measures to treat the identified risks, and the review and establishment of the plan towards risk management. In each of these steps, effective risk management in the organization is attained when managers have a clear understanding of the sources of the risks and the impact of each risk on the organization (Gephart and Topal, 2018). Generally, risk management should be all-inclusive where each of these steps is carefully followed to avoid exposing the organization to any shocks.

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Risk management continues evolving and the management must work in line with the emerging trends. Traditionally, organizations managed their risks in silos where departments were separated from each other and risks handled separately (Lyon and Popov, 2022). In the modern context of risk management, organizations are integrating enterprise resource management (ERM) in their risk management processes. ERM is being integrated in risk management because of the perception that it makes organizations more agile and resilient in achieving their risk management goals (Lyon and Popov, 2022). A more common approach to risk management in the contemporary organization is the enterprise risk

management (ERM) framework. According to Hagg-Rickert and Gaffey (2020), effective planning in regard to the management of risks in the organization involves ERM. ERM entails notable characteristics such as governance and culture, strategy and objective-setting, performance, review and revision, as well as information, communication, and reporting (Caroll et al., 2020). Thus, the essence of contemporary risk management is to be efficient and this is attained using modern approaches that integrate ERM.

1.2 Background of the Research

The demand for electricity globally has been increasing significantly across the years. Due to the rising importance of electricity in the modern world, the parameter of the individual consumption of electric energy is estimated as one of the indicators of the socio-economic development in any given community (Babalola et al., 2022). Together with the development of the modern economy and society, the level of energy consumption and the dependence of society on the availability of energy resources continue growing. In these conditions, the ability of the state to deliver the required amount of energy resources to the end consumer during the required period of time becomes one of the key parameters of competitive advantage in global politics (Gray, 2017). As a result, effective production and management of energy resources are considered to be one of the key conditions for the successful operations of the global economy and society (Welsch and Biermann, 2014). The problem of effective risk management in the energy sector becomes one of the vital questions for the performance of modern society.

A prominent role of the electric energy sector in the performance of modern society also indicates the significance of risks related to the operations of this sector. The level of

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risk should be assessed on the basis of the potential impact of the risk event on the environment, including human society. While other sources of risk for economic and social life might be difficult to estimate, risks related to the failure of the electric energy production and distribution infrastructure can be clearly defined and expressed by human imagination. According to Lee et al. (2022), the development of new information communication technologies (ICT) has played an instrumental role in helping boost energy security by mitigating against various risks such as economic risk, and risks linked to human capital. Consequently, there is need to incorporate ICT in the process of risk management in the energy sector. In this thesis, there is an explication of the quality of risk management in the electricity distribution sector of the UAE. According to Saleh (2024), the electricity transmission and distribution market in the UAE has continued to experience exponential growth. For instance, Saleh (2024) particularly points out that in 2021, the total revenue generated from electricity transmission and distribution market in the UAE was an estimated USD $2.7 billion. The revenue was projected to increase over the next decade and reach an estimated USD $3.74 billion by 2030. Besides being one the fastest growing markets, the electricity distribution market contributes substantially to the country's gross domestic product (GDP) by facilitating economic and social development.

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The commercial, residential, as well as industrial sectors have continued to play a key role in advancing electricity distribution growth in the UAE and will see it expand even further in the future (GlobalData, 2024). The significance of the electricity distribution market underscores its need for a robust risk management strategy to ensure stability in power distribution across the country. The increasing demand for electricity and the need to meet the evolving needs of consumers across the country has made key electricity

distribution agencies to evaluate risks in the market. Major electricity distribution agencies such as the Dubai Electricity and Water Authority (DEWA) and the Federal Electricity and Water Agency (FEWA) continue to pay attention to robust risk management in the course of generating and distributing electricity. For instance, risk management in the electricity distribution market of the UAE has been facilitated primarily through the use of mixed energy sources such as natural gas, nuclear power, and solar power. More so, the UAE government has approved the strategy to increase the share of power generation from renewable sources to 7% by 2030 (Government of Dubai, 2020). The project of primary interest for the UAE electric energy sector is the Mohammed bin Rashid Al-Maktoum Solar Park, which is expected to become the largest renewable energy facility in the UAE by 2030 (Government of Dubai, 2020). It is planned to reduce energy consumption of the Mohammed bin Rashid Al-Maktoum Solar Park to 5GW by 2030 (Government of Dubai, 2020). Other strategic projects that are implemented in the sphere of electric energy production and distribution include 350MW Shweihan solar-based plant and additional 200MW of planned solar projects implemented with the support of the Federal Electricity and Water Authority (FEWA) (Government of Dubai, 2020). Overall, the diverse investment in the energy sector and particularly electricity distribution has been a critical part in the identification of risks and the development of robust risk management frameworks.

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The discussion of the current projects in the sphere of renewable energy in the UAE demonstrates the efforts that are being made in regard to electricity distribution. The UAE power market had a total installed power capacity of 51.2GW in 2023 and is projected to achieve a CAGR of more than 3% from 2023 – 2035 (GlobalData, 2024). The electricity that is distributed is predominantly thermal power and renewable power (GlobalData, 2024).