FACTORS AND IMPACTS OF EXCUSABLE DELAYS IN MALAYSIA ENGINEERING, PROCUREMENT AND CONSTURCTION PROJECTS

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DEDICATION

To my beloved late parents (Mr & Mrs Munusamy) for all the love that still fresh in my memories and my elder brother Mr. Saravanan Munusamy without whom education may not be something possible for me in yesteryears.

This also specially dedicated to love and back bone of my life, my dearest wife Parimala Durarajoo and my wonderful blessings of life – Daughter Sanjana & Son Pragateesh

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ABSTRACT

Construction project delays remain as global phenomena that attracts research interest of many scholars for decades. Delays caused by internal stakeholders (owner and representatives) and external factors which are beyond contractor's control are excusable delays which entitles extension of time with/without compensation to contractor. Rising popularity of Engineering, Procurement and Construction (EPC) project delivery strategy in energy sector necessitate the owners and representatives of the sector to understand the factors and impacts of excusable delays on EPC project. The main objective of this study is to identify major factors and impacts of excusable delays on Malaysia EPC projects. The response for the study were collected based on systematic literature reviews and Likert scale questionnaire surveys. The responses obtained from questionnaire were statistically analysed by using relative importance index to establish the major factors and impacts as well as mitigation strategies for excusable delays of Malaysia EPC projects. The study identifies employer as major contributor of excusable delays followed by consultants and external factors. The perspective difference between employer, consultant and contractor also analysed and its evident that these stakeholders differs in factors causing the excusable delays but having almost same perspective on the impacts of excusable delays. The major impacts of excusable delays in Malaysia EPC projects are in term of cost and schedule overrun, additional financial lost, increasing number of reworks and loss of profit/revenue for all the stakeholders. Minimising changes and finalising design in initial phase of project are identified as top mitigation strategies that will eliminate and minimise the excusable delays. Formation of project steering committee and eliminate the limitation of inadequate resources were also identified as factors that will reduce and eliminate the excusable delays in Malaysia EPC projects.

ABSTRAK

Isu kelewatan dalam menyiapkan projek pembinaan masih menjadi satu fenomena global yang menarik minat ramai penyelidikan sejak beberapa dekad lalu. Kelewatan yang disebabkan oleh pihak dalaman yang berkepentingan seperti pemilik dan perunding serta faktor-faktor luaran di luar kawalan kontraktor adalah merupakan kelewatan yang dibenarkan (excusable delays) yang membolehkan lanjutan masa dengan atau tanpa pampasan diberikan kepada kontraktor. Meningkatnya populariti Kejuruteraan, Perolehan dan Pembinaan (EPC) dalam strategi penyampaian projek di sektor tenaga memerlukan pemilik dan wakil sektor tersebut memahami faktor dan kesan kelewatan yang dibenarkandalam projek EPC. Objektif utama kajian ini adalah untuk mengenal pasti faktor dan kesan utama kelewatan yang dibenarkan terhadap projek EPC di Malaysia. Data untuk kajian dikumpulkan berdasarkan tinjauan literatur sistematik dan tinjauan soal selidik. Tanggapan yang diperoleh dari soal selidik dianalisis secara statistik untuk menentukan faktor dan kesan utama serta strategi mitigasi untuk kelewatan projek EPC di Malaysia. Kajian ini mengenalpasti majikan sebagai penyumbang utama kelewatan yang dibenarkan dan disusuli oleh faktor perunding dan faktor luaran. Kajian ini juga mengenalpasti perezaan pendapat antara majikan, perunding dan kontraktor. Mereka mempunyai perbezaan pendapat dari segi factor yang menyebabkan kelewaran yang dibenarkan akan tetapi mereka hamper sependapat dari segi kesan kelewatan yang dibenarkan. Kelewatan ini memberi kesan kepada projek baik dari segi kos dan jangka masa yang berlebihan, kerugian kewangan tambahan untuk pihak berkepentingan utama, peningkatan jumlah kerja semula dan kehilangan keuntungan / hasil bagi semua pihak yang berkepentingan. Meminimumkan perubahan dan menyelesaikan reka bentuk terperinci pada fasa awal projek dikenal pasti sebagai strategi mitigasi teratas yang akan menghilangkan dan meminimumkan kelewatan yang dapat diterima di projek EPC. Pembentukan jawatankuasa pemandu projek dan penghapusan batasan sumber daya yang tidak mencukupi juga dikenal pasti sebagai faktor yang akan mengurangkan dan menghilangkan kelewatan yang dibenarkan dalam projek EPC di Malaysia.

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LIST OF ABBREVIATIONS

AACE	-	Association of Advancement Cost Engineering
CIDB	-	Construction Industry Development Board of Malaysia
EPC	-	Engineering, Procurement and Construction
FI	-	Frequency Index
GDP	-	Gross Domestic Product
LD	-	Liquidated Damage
PBSRG	-	Performance Based Studies Research Group
PMI	-	Project Management Institute ®
PMT	-	Project Management Team
RII	-	Relative Importance Index

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CHAPTER 1

INTRODUCTION

1.1 Problem Background

In any country, construction industry is one of the significant and important industry that contributes for the nation's growth in term of nation's GDP, country's image and socio-economy. In Malaysia, construction recorder RM 204.4 Billion in value of gross output in 2017 with annual growth of 7.2 percent per annum (DOSM 2019).

Construction projects in Malaysia are usually divided in to two main and broad categories - public and private projects. According to statistics of CIDB (2018), the private sectors compromise about 70.2% of total RM106.6 Billion of project value registered under CIDB. As a complex industrial sector, construction industry always has its' own set of issues and challenges over the time. The challenges are varying from high cost of construction, shortage of the skill manpower, low productivity dues to the low and unskilled workers, cost of accidents and incidents which lead to work stoppage and loss of revenue, lack of safety compliance which are usually involves process related ad behavioural related safety incidents, inadequate material which usually escalate the price fluctuation and many other challenges that always inseparable in construction industry. These challenges and risk always cause construction project always faced inevitable challenge in meeting the schedule, cost and quality of the project.

Success criterion for construction projects is defined when it meets the stakeholder expectations in-term of on-time project completion, within the project cost or with value engineering that reduces the cost, within the approved budget and most importantly built according to the specifications that meets and satisfy the

project end users. Construction just as any other business sectors focuses on maximizing profit of the organization and at the same time reduces the cost. The one thing that is inevitable in construction projects are delays and the impact of the delays to the construction completion. Completing the project within the stipulated time frame according to the project schedule is a critical factor for project success (Chan, 1997). Timeline moved beyond the contractual completion date and milestone agreed by contracting parties of a project is defined as construction schedule delays which usually cause over expenditure of resources (Nguyen 2020).

In construction project management, triple constraints are the important elements that project management team need to tightly control to achieve the project completion within the time, cost and defined scope. Even with sophisticated project management techniques and construction technologies, the delay is an inevitable phenomenon in construction world. Construction delays are usually categorised into 5 most common categories such as critical, non-critical, concurrent, compensable and excusable delays (Enshassi.A, 2009).

Construction delay is also defined as prolonged construction period which is way and beyond the estimated time of completion stipulated in contract or any agreed completion date agreed by all parties. The delays become a norm in the context of project delivery as it seems to be an inevitable part of construction project executions and a global phenomenon (Sambashivan & YW, 2007). This risky phenomenon attracts many scholars and researchers to find factors and impacts of the delays on projects.

The delay in construction is one of the major risks that project owners would like to eliminate or minimise to a tolerable level in order to reduce the impacts in term of the cost overruns as well as reduce the opportunity loss due to the delay in completing the project. The contractor also suffers the same due to delay in completing a project as they need to pay more in in-terms of material cost due to the price fluctuation caused by economic inflations, excessive overhead cost and overrun cost of labours (Shahsavand, Marefat, & Parchamijalal, 2018).

According to study conducted in 2015 by CII (Construction Industry Institute), only 2.5% of construction project is considered as successful in term of completion of project on time, cost, within the scope and meeting the business needs. The report also identifies that 25 to 50 % of the waste in coordinating labour on the project which in turn causing delay in completing the project. Project completion on time identified as an important factor for socio-economic growth as well as improvement of standard of living and creation of wealth of any country. Based on the growth of the socio-economic of the nation attains, thereafter these countries are categorised as underdeveloped, developing and developed countries on the basis of quality and quantity of accomplished construction projects inside their province (G. Sweis et al. 2008)

Researchers around the world has paid tremendous efforts in identifying causes and factors causing delays in the construction projects. A study found that 70% projects are delayed in Saudi Arabia and in the ranges of 10-30% slippages as compared to the project contractual completion (Assaf and Al-Hejji 2006). Delays also define as integral part of the modern construction processes and found that project delays are originates from project inception stage itself when the project is initiated (Yates and Epstein 2006).

The oil and gas industry which is part of the industrial projects are known as the largest and most important industries in the world that impact the livelihood of people. The oil and gas turmoil in term of oil prices usually attracts the attention of the world as this energy sector has direct impact on other industrial sectors that supports and depends on oil and gas industry.

The volatility of oil price does not impact the energy demand globally and according to International Energy Agency estimated the energy demand is expected to increase 32% by 2040 and International Energy Agency (IEA) in 2011 estimated that the annual global oil and gas project capital project investment will be about US 1 trillion per year between 2011 to 2035 (IEA 2011). Executing the projects on such a scale is always has its challenge in terms of the project completion on time as well as on cost.

Construction projects for oil and gas sectors are considered as one of the main stakeholders of industrial construction projects. Malaysia as one of the largest Oil producing country in the region requires a lot of infrastructure that supports mid-stream and down-stream part of the oil and gas projects.

Projects executed for oil and gas industry does not get much of attention in terms of cost performance until to the recent oil price crashes (Rui, et al., 2017) and performance of 78% oil and gas megaprojects (greater than US 1 Billion in Total In Cost) recorded as having serious cost overruns (cost indices of 1.3) and 33% of schedule slips (Merrow, 2012). The delays and cost over-runs are always present in the construction industry immaterial of the size of the project in term of the capital cost.

Construction of oil and gas projects are usually involving huge financial investments and commitments, long construction duration and countless risks causes negative effect on the completion of the project on time and schedule (S. U. K. Suppramaniam, Ismail, and Suppramaniam 2018). The implication of not completing a project on time also usually have 'domino effects' on the subsequent operational needs of an organization as well as adds the financial burden to the organization.

The delays in construction does not have any limitation in term of the sectors -government, private building and industrial), size of the project -capital cost and duration of the projects. Identifying delays, finding the cause of the delay and mitigate the delay is always remain a great challenge for the construction professionals.

1.2 Problem Statement

Delay in construction always remains as one of the main challenges that the industry facing over the years. Delay of construction projects in Malaysia not a new phenomenon where a study on MARA developments in 2011 found almost 90% of the projects undertaken by MARA are completed beyond the project completion date as required in contract and the same was observed in public projects as 70% of the public sector projects were not completed within the schedule (Abdullah, Rahman, and Awang 2011; Othman and Ismail 2014).

Many scholars grouped delays into two main categories known as internal delays and external delays. The internal delays are usually caused by the stakeholders of the project such as project owner, construction main contractor, trade contractors and parties directly involved in the construction where-else the external delays are the one caused by the external factors which usually outside the control of the stake-holders such as unusual bad weathers, pandemic outbreak such as current COVID19, government related changes and impacts and market volatility which causes the fluctuation of the material cost.

A systematic review on project delays recognizes that the first step towards minimizing the construction delay is to identify the causative factors and take the appropriate measures and mitigation steps in eliminate or minimizing the same (Serdar Durdyev., 2018). Based on the 146-journal paper analysed, the annual trend of the selected articles between 1985-2018 shows there are all time high attention in 2017 (18 articles) as compared to the second highest of 8 articles on 2012 and 2013. This proves that the current competitive market obviously required more attention on reducing the construction project delays in order stay competitive in the market.

Although the causes of the delay in construction projects are widely explored by many researchers and have been documented but the construction industry still suffers from the impacts of the delay in different magnitude (Venkatesh and Venkatesan 2017). It was concluded that most of the research and studies identifies the causes and factors that influences the delay in construction but does not dive in into finding solution or mitigation to the causes of the delay in construction project.

The construction delays are usually defined as excusable and non-excusable delays. The non-excusable delays usually attract more research interest of the scholars in many countries as compared to the excusable delays. Excusable delays are further divided into two main categories as non-compensable and compensable delays. Both of these delays cause the time extension with the compensable delays cause additional cost to the project owners due to the action/inaction of the owner and owner's representatives (Akram Akhund et al. 2017).

Even most of the studies done on construction delays summarises major causes of construction delays in developing countries but very few on the delay factors caused by owners/architects/consultant and external factors attracted the research interest in Malaysia. Besides that, most of the papers on the subject of construction delays in Malaysia focuses on overall delay factors and main focuses are subjects related to the non-excusable delays as compared to the excusable delays on construction projects (Venkatesh and Venkatesan 2017). This shows that factors and impacts of the excusable delays in Malaysia's Engineering, Procurement and Construction project is less analysed and requires necessary factors, impacts and ways to mitigate the same.

1.3 Aims and Objective of study

Effective project management is the key success criterion for construction project execution. The popularity of EPC (Engineering, Procurement and Construction) project delivery strategy in oil and gas sectors requires effective project management team from both owners and representatives. Effective PMT team (project management team- compromise of owners and representatives) to manage construction of EPC type of contracts becoming more crucial as any excusable delays on this type of contract not only cause time loss but also the money as well as the opportunity cost. In depth understanding on what are the factors that will lead to excusable delays and the impacts of the same is becoming important to PMT Team of the projects in order to ensure they could eradicate such factors and mitigate the same in project.

The aim of this study is to investigate major factors, impacts and to justify possible mitigation factors that could minimize the impacts of excusable delays on EPC construction projects. To achieve the aim of the research the following objectives are set in order to meet the aim of the project:

i. To identify the major factors causing excusable delays and its impacts in Malaysia EPC construction projects.
ii. To analyse the perception differences between stakeholders on factors and impacts of excusable delays
iii. To establish possible mitigation steps to eliminate the constriction delays caused by excusable project delay factors.

1.4 Scope of Study

The study was mainly intended to focus on the project in the nature of lump-sum contracts or EPC contracts whereby any excusable delays caused by the owner and their representatives (consultants and Architects). The study was focussing on the oil and gas industry in Malaysia. The contributing data has been collected from all the construction companies and stakeholders that serve the industry. The study shall focus on the factors and impacts of excusable delays in Malaysia EPC projects.

As the perception of the excusable delays may change between stakeholder of the project, the author would like to examine the difference of opinion between the owner (and representative) and the contractor (and service providers) in term of major factors causing delays in construction of EPC/Lump Sum projects.

The mitigation factors were collected based on the intense literature review and industry best practices has been used to check the relevance of the same in Malaysia EPC construction projects. The limitation of adopting the mitigation steps also has been identified in order to see the relationship of the same with the delay caused in the construction projects.

1.5 Research questions and hypotheses

Based on the objectives of the study, the following questions were selected to be answered in order to achieve objectives of the study:

i. What are the major factors of excusable delays in Malaysia EPC construction projects?
ii. What are perception differences between owners, consultant and contractors in term of the causes of excusable delays? Do they see excusable delay factors differently in terms of causes and impacts?
iii. What are the impacts of the excusable delays to the EPC construction projects?
iv. What are the factors that can be considered as possible mitigation strategy of excusable delays in Malaysia EPC construction projects?
v. Are there any factors that limiting the mitigation strategy of excusable delays?

1.6 Methodology of Study

The study was involving both data obtained through literature reviews and development of primary data from the responses of questionnaire by EPC project stakeholders. Extensive literature reviews focused on the excusable delays of construction project, causes and the impacts. Through these collections of factors and causes, author focused on collecting method of mitigation steps and limitation of the same through industrial journals, research papers, books, pertinent articles and data published in international project management and related societies.

The primary data for the study were collected through distributed questionnaires to the EPC project stakeholders in the industry. The questionnaires were structured in the form of the open-ended questions and Likert scales for the respondents to choose the most appropriate responses based on their point of view and experience. The data for the study were collected based on the methodology as below which was divided into five main stages:

1.7 Significance of the study

Current increment in popularity of EPC project delivery strategy in majority oil and gas construction projects signifies the need for owners and the representatives to understand factors that could lead to excusable delays in EPC projects that will have significant impact to the project. Both types of excusable delays of compensable and non-compensable causes significant time loss to the project owners in-term of facility utilization as intended for beneficial use and cost of compensation or opportunity cost. Malaysia as a developing country pathing her way to a status of developed nations shall focus more on state of art project management techniques that leads to more sustainable construction that reduces the waste of resources in terms of materials, excessive manpower use and energy needed to construct a facility. The study intent to analyse the factors that caused by the owners/agents in EPC construction project delays that could be mitigated by following best practices identified through literature reviews and findings.

1.8 Structure of report

The dissertation report is arranged among five chapters. An outline of the different chapters has been briefly highlighted as given below:

Chapter One: **Introduction**

This chapter presented the general introduction of the study. This included the problem statement, the aim, and objectives, and the methodology of the study. In this chapter, the problem statement is clearly defined which leads to the aim and objectives of the study. The scope and limitation of the study are also clarified to avoid any confusion and misconception raised. Lastly the five (5) stages of study methodology from problem identification to concluding results and recommendations is clearly shown in a form of flow chart in Figure 1.1.

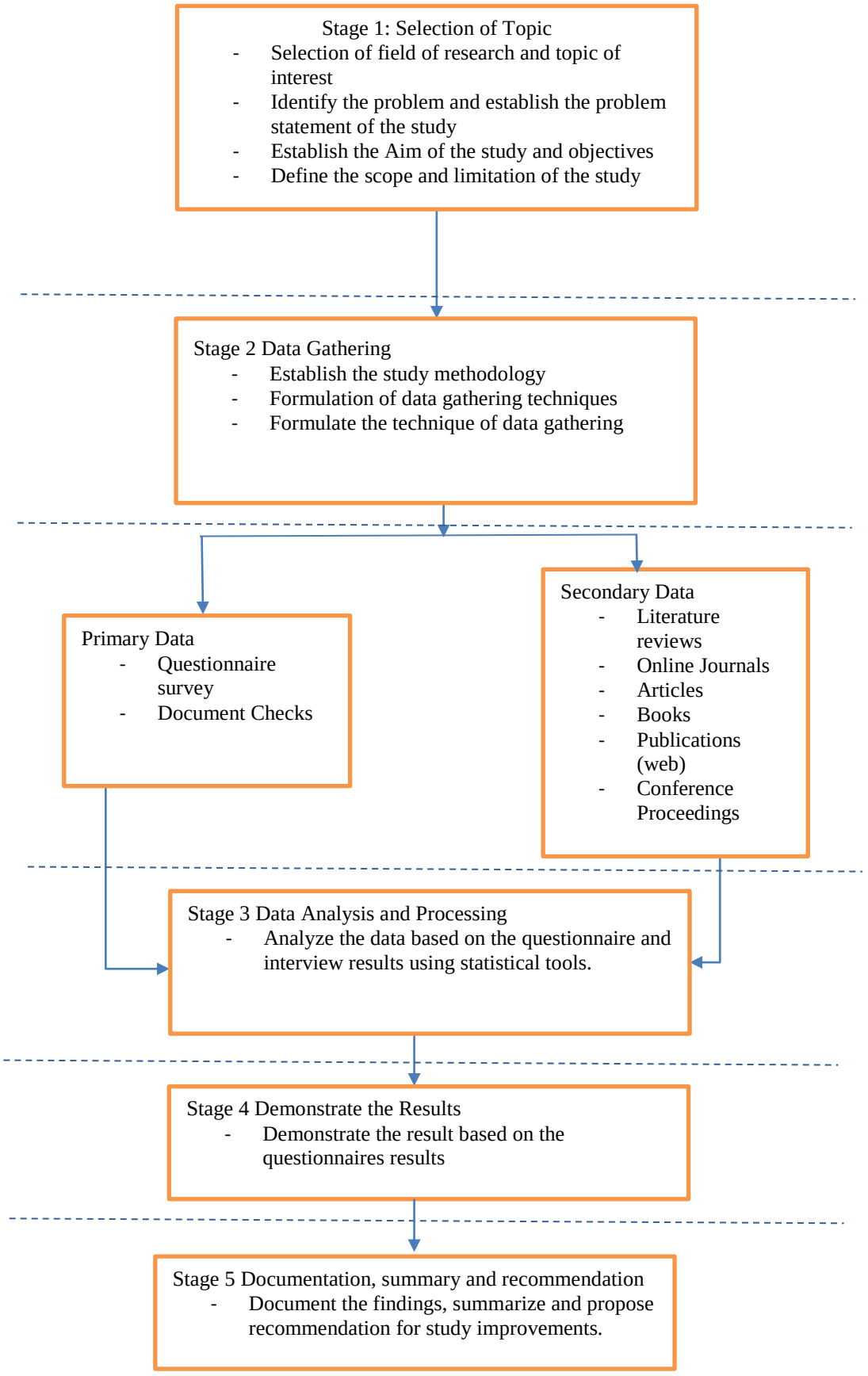

Figure 1.1 Flow Chart Study of Methodology

Chapter Two: **Literature Review**

This chapter comprised a historical and relevant literature review from previous studies on construction project delays. It discusses on the factors that lead to the excusable project delay in a construction project. The compensable and non-compensable factors are further analysed and the root cause of the same is derived from the literature reviews. This chapter also will identify the mitigation steps adopted by other researchers across the industry to overcome the impacts caused by the factors and root causes of the excusable delays. The author also would focus on identifying the limitation in reducing the exposure to the risk of excusable delays.

Chapter Three: **Research Methodology**

This chapter covered a discussion of the research methods used in this study, and data analysis techniques that will be used generally presented and justified the research strategy and data collection techniques. It will clearly state how the related information's and sample data are being collected such as through literature review, questionnaire survey and structured interviews. It also discusses the procedure and techniques of analysing the collected data.

Chapter Four: **Resultsand Discussion**

This chapter will explain in detail the results and discussion of the literature review, questionnaire survey and interview findings in relation to the four (4) objectives of the study as stated above and analysis the findings in relation with the existing body of knowledge on excusable delays in construction EPC contracts and the mitigation steps.

Chapter Five: **Conclusion and Recommendation**

This chapter provides the conclusion and recommendations of the research based on the literature review, findings and analysis in sync with the research questions and objectives. concludes all findings that leads to the achievement of the

four (4) objectives of the study as stated in Chapter 1. It also suggests some recommendations for the betterment of future study.

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