CRITICAL SUCCESS FACTORS IN A COMPLEX BROWNFIELD CONSTRUCTION PROJECT

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DEDICATION

Alhamdulillah, special thanks to my beloved wife, mother, family, supervisor, and friends who have always supported me throughout this journey

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ABSTRACT

A minimal number of studies have explored developing the critical success factors (CSFs) in a brownfield construction project in Malaysia. This study intends to understand the CSFs perceived by the construction practitioners, identify and rank all the CSFs in a complex brownfield construction project, and establish the top five (5) most influential CSFs complex brownfield construction project. Brownfield project refers to a project that performs construction, modification, and rejuvenation work on the existing oil and gas platform and ongoing operations with intentions for major or minor expansion, debottlenecking, or rejuvenations in a live plant, to tie-ins of a new element. In the volatile oil and gas (O&G) market prices, the O&G companies are preferable to perform redevelopment of existing fields that the underlying basis is lower capital expenditure (CAPEX) compare to greenfield projects and provide the higher return of investment (ROI). In this study, the literature review was performed, conducted a semi-structured interview, and distributed surveys to respondents from various oil and gas companies in Malaysia. From the questionnaires survey conducted, a correlation will be tested study on to tabulate and rank the critical success factors for a complex brownfield construction project. Furthermore, the results from the questionnaires will be analyzed using the Relative Importance Index (RII), then to define and to develop the top five (5) most influential CSFs in a complex brownfield construction project. The discussion further suggested that the management strategy can manage all the top five (5) identified CSFs from the surveyed and analyzed using the Relative Importance Index (RII).

ABSTRAK

Sebilangan kecil kajian telah meneroka pengembangan faktor kejayaan kritikal (CSFs) dalam projek pembinaan projek brownfield di Malaysia. Kajian ini bertujuan untuk memahami CSFs yang dirasakan oleh pengamal pembinaan, mengenal pasti dan memberi peringkat semua CSFs dalam projek pembinaan brownfield yang kompleks, dan mewujudkan lima (5) projek pembinaan brownfield kompleks CSFs paling berpengaruh. Projek Brownfield merujuk kepada projek yang melakukan kerja pembinaan, pengubahsuaian, dan menaiktarafkan pelantar minyak dan gas sedia ada dan masih beroperasi dengan tujuan untuk penambahan kemudahan baru, peningkatan kapasiti, atau menaiktaraf pelantar minyak dan gas ketika masih beroperasi, dan untuk memasang kemudahan-kemudahan baru . Dalam harga pasaran minyak dan gas (O&G) yang tidak menentu, syarikat O&G lebih fokus melakukan pembangunan semula kawasan minyak yang sedia ada dengan perbelanjaan modal yang lebih rendah (CAPEX) berbanding dengan projek membina pelantar minyak baru dan memberikan pulangan pelaburan (ROI) yang lebih tinggi. Dalam kajian ini, tinjauan literatur telah dilakukan, melakukan wawancara separa berstruktur, dan menyebarkan tinjauan kepada responden dari pelbagai syarikat minyak dan gas di Malaysia. Dari tinjauan soal selidik yang telah dilakukan, korelasi akan diuji dengan objektif kajian untuk direkodkan dan menentukan faktor-faktor kejayaan penting untuk sebuah projek pembinaan brownfield yang kompleks. Selanjutnya, hasil data dari soal selidik akan dianalisis menggunakan Relative Importance Index (RII), dan kemudian untuk menentukan dan menghasilkan lima (5) CSFs paling berpengaruh dalam projek pembinaan brownfield yang kompleks. Perbincangan selanjutnya menghuraikan strategi-strategi pengurusan dalam menguruskan kesemua lima (5) CSFs teratas yang dikenal pasti dari yang data soal selidik yang dianalisis menggunakan Relative Importance Indeks (RII).

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In early 1910, the oil and gas industry began in Miri, Sarawak, in Malaysia. The first oil was discovered in Malaysia by the Shell company. Shell began to explore oil both offshore and onshore Sarawak, and the company constructed Malaysia's first refinery in 1914. The first oil discovered was at onshore Miri, known as Canada's Hill, and the first reservoir found name Grand's, Oil Lady. Malaysia's multinational oil and gas company is Petroliam Nasional Berhad (PETRONAS), now undertakes oil exploration and production. Oil production rises and finds new reserves, even with Malaysia's current oil and gas industry trend. The output and use of oil indicate that Malaysia's oil and gas reserves will not be exhausted soon.

Brownfield project defines a project involving upgrading or rejuvenating existing facilities to cater to production enhancement, extending production profile, and installing new equipment or tie-in with a new greenfield platform. According to Visser & Brouwer (2014), the difference between brownfield projects with greenfield projects is that the project executes in the environment of existing facilities and ongoing operations. Construction works offshore expose the volatile environment. The brownfield oil and gas (O&G) project faced challenges in unpredicted conditions or situations such as waiting on the weather (WOW), operational constraints, high risks environment, and construction work in aging facilities. There are three primary phases for offshore construction work activity: pre-shutdown, shutdown, and post-shutdown phase. Each phase duration will determine based on the overall project's scope and then schedule the content to perform in the pre-shutdown, shutdown, or post-shutdown stage.

With the current unpredictable oil price in the market, the O&G companies prefer brownfield projects compared to greenfield projects. The brownfield project is a relatively low capital expenditure (CAPEX) and a high return on investment (ROI) (Hassan, Wasnik, Singh, Kamal, & Takeiddine, 2016). Even though the brownfield option is preferable because of its low CAPEX and higher ROI, the challenges and risks in managing brownfield O&G projects are still there. The tasks need to deal with a few challenges and risks, such as aging facilities (Lim, Muda, Razali, Sidek, & Hashim, 2015), insufficient information about the existing facilities, and clashing activities operation and maintenance works, and many more. Without clearly defining strategies in executing and managing the brownfield, O&G projects will be unlikely to achieve the projects' targets and deliverables.

1.2 Problem Statement

The first discovered field in Malaysia was E-11 at Miri offshore, where the oil and gas industry began in 1982 (Seong, Husain, & Abdul Karim, 1995). The platform's design criteria are to operate up to 25 years old in designing any offshore platform. With the year started in Malaysia's oil and gas industry, most Malaysia's fields have aging facilities more than 30 years old. This current situation led to increasing brownfield projects to upgrade and rejuvenate the existing platform to extend production life. Brownfield project is more challenging than the greenfield in nature since the brownfield project is executing. At the same time, platforms still live on existing & aging facilities and the simultaneous operation mode. There are many challenges and risks anticipated in managing the brownfield O&G projects since the projects to be performed on existing facilities and aging facilities. Among the challenges faced in brownfield projects have always been cost and schedule overrun driven by various issues such as unclear scope definition, change in project scope during execution, errors in the design causing rework, poor interface management, etc.

Among the critical path for the brownfield project is to ensure the readiness of the planned shutdown. In any brownfield project, the shutdown days and dates are essential for production planning. Meanwhile, with any extension days of shutdown or delay for platform start-up, the domino effect will be the production deferment and inability to release monetization. The critical success factors for successful brownfield projects are vital for the project to ensure it able to complete within plan schedule, plan scope, plan cost, and plan quality. Consequently, if the brownfield project delayed in completing plan shutdown activities, the project duration increase, and the project will not achieve project deliverables. Re-evaluate the project's critical success factors necessary to ensure the brownfield projects deliver the project successfully.

Therefore, there are potential strategy challenges and gaps that need to identify and address in managing and executing the brownfield project to safeguard project success. By defining the critical success factors (CSFs) in managing and implementing offshore construction in the brownfield project, the project is likely to succeed and achieve excellent project performance. A management strategy to be established on managing the most influential CSFs in a complex brownfield construction project. The oil and gas industry globally has witnessed the fluctuating of the market oil price since 2014, with a decline of 437 billion USD (42%) of awarded EPC projects in 2016 (Onojeta, Karuppusamy, Agrawal, Kamal, & Takieddine, 2019). Then, for the project team to select the greenfield project with higher CAPEX, it is preferable to the brownfield project, preferable with less CAPEX.

1.3 Research Questions

i. What are the success factors in the brownfield project perceived by the construction practitioners?
ii. How critical success factors improve the likelihood of the success of brownfield projects?
iii. What are the critical success factors in the complex brownfield project life cycle?
iv. How is management strategy for the most prominent critical success factors affecting the complex brownfield construction project's success?

1.4 Aim and Research Objectives

This research aims to establish the management strategy to identify critical success factors (CSFs) for a complex brownfield construction project perceived by the construction practitioners. The aim supported by the following research objectives;

i. To study the success factors for brownfield construction project perceived by the construction practitioners.
ii. To identify and rank the critical success factors (CSFs) for a complex brownfield construction project.
iii. To establish a management strategy for the five (5) most influential critical success factors (CSFs) for a complex brownfield construction project.

1.5 Scope of Study and Limitation

The scope of this study is limited to offshore construction in a brownfield project in Malaysian waters. A survey of Betty brownfield project in Miri waters is the latest ongoing offshore construction in brownfield project. Project Management Institute (2017) defines megaprojects as a project where the total capital expenditure (CAPEX) equal to USD 1 billion or more and affected 1 million people or more, and runs for years. A complex project defines as a project that is managing multiple contracts simultaneously or in sequence. The Betty brownfield project's selected study and the project started in 2015; the total CAPEX more than USD 1 billion, and it has been run for many years and involves more than 1 million manhours. The population estimated involved in the project from 2019 to 2020 is about 2,000 persons.

Bokor and Betty's fields are two fields located in Baram Delta Operation (BDO) in Malaysian waters. The fields were first discovered and started their production in the early 1970s, putting the existing facilities' current service life at an average of 40 years. Both fields planned for brownfield projects that consisted of rejuvenation and redevelopment scopes to cater to the upcoming new installation of 2 wellhead platforms (WHP) and one Central Processing Platform (CPP). Brownfield oil and gas project aims to install new facilities and upgrade platforms in both fields. This study concentrates on the redevelopment of Bokor and Betty fields. New facilities installed will provide higher reliability production from the wells via avoidance of deferment caused by the facility's trips due to aging and problematic equipment. With the total cost for the project about half a billion ringgit, it is high.

It is critical for the projects to be delivered on time, on scope, and budget. This study focuses on the project CSFs strategy applied in managing and executing offshore construction in brownfield oil and gas projects in a complex brownfield environment—the challenges on live platforms and the amount of work required to perform on the aging platforms. The case study demonstrates that offshore construction and operation can simultaneously perform well-planned strategies and successfully execute, saving RM34 million production from deferment in the 2019

offshore campaign. Referring to the PMBOK 6th edition (Project Management Institute, 2017), 10 Knowledge Areas will use most projects most of the time. To address the importance of the top five (5) most influential Critical Success Factors (CSFs) strategy for the brownfield project, the CSFs focus element is based on the PMBOK 6th edition 10 Knowledge Areas. Previous studies stated that the CSFs studies typically would come out with a list of four to eight CSFs and may also come out with the priorities of the CSFs (Cooper, 2008), therefore from this basis of reference, the study focus to establish the five (5) topmost CSFs in a complex brownfield construction project. Then to come out with the management strategy to the five (5) most influential CSFs.

1.6 Brief Research Methodology

In achieving the study objectives, the research methodology is divided into six (6) leading groups: Initiating, Planning, Executing, Data Analysing, Findings, and Discussion and Conclusion. Figure 1.1 shows the overall flow chart of the research methodology for this study.

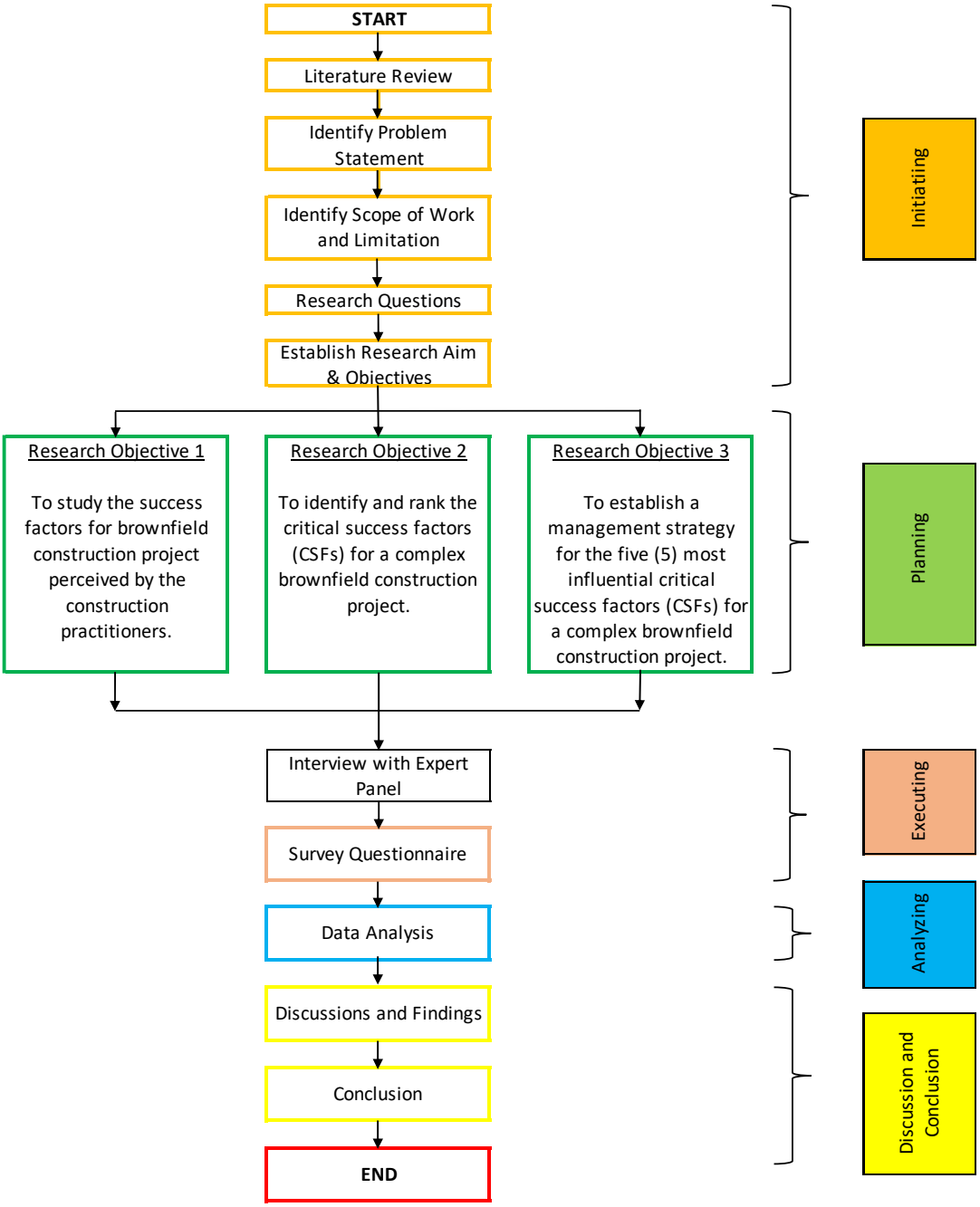

Figure 1.1 Flow chart of Research Methodology

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