STUDY ON THE MANAGEMENT OF ENGINEERING PROCUREMENT AND CONSTRUCTION (EPC) PROJECTS

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To my beloved Father, Mother, Brother and Sisters

THANK YOU

Thousand of candles can be lit from a single candle,
and the life of the candle will not be shortened.
Knowledge never decreases by being shared.

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ABSTRACT

Procurement system in construction industry can be categorized into several methods. One of them is EPC type of procurement. EPC is the abbreviation for engineering, procurement and construction. EPC is a type of construction contract where the contractor is responsible for engineering services, procurement of materials, and construction. Power plants, factories, gas development project, infrastructure projects, and industrial plant construction sectors are the typical examples of EPC projects. With its rapid development, Indonesia needs many industrial public sector projects. Especially with the population over 230 million people and blessed with so many natural resources, its demand for power plant projects, gas development projects, and other type of industrial sector projects has risen significantly. Meanwhile, PT Waskita Karya (Persero) is one of the main leading construction company in Indonesia and it just recently established EPC Division in 2011. Therefore, this research aims to (1) identify the nature of EPC projects, (2) identify EPC projects management system as applied in Waskita, and (3) determine the strategies which can improve the effectiveness of EPC business process. The findings of this research are (1) there are 34 (thirty four) EPC projects' characteristics, in which 10 (ten) of them are specifically only found in EPC projects; (2) EPC projects in Waskita are quite different in their implementation, where for some projects, EPC Division serves only engineering and procurement phases; and (3) the improvement strategies can be divided into 3 (three) groups, namely: for contractor with 15 strategies, for employer with 5 strategies, and for both parties with 6 strategies. At the end, this research is important for all players to face the increase popularity of EPC project procurement.

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LIST OF ABBRIEVATIONS

AGC	Associated General Contractors of America
AIA	American Institute of Architects
BANI	Badan Arbitrase Nasional Indonesia (*en*: Indonesian National Board of Arbitration)
DB	Design and Build
DBIA	Design-Build Institute of America
DLP	Defect Liability Period
EIC	European International Contractors
ENAA	Engineering Advancement Association of Japan
E-P	Engineering and Procurement
EPC	Engineering, Procurement and Construction
EPCC	Engineering, Procurement, Construction and Commissioning
EPCI	Engineering, Procurement, Construction and Installation
EPC-LLIs	EPC with Long Lead Items
EPCM	Engineering, Procurement and Construction Management
FIDIC	Fédération Internationale des Ingénieurs-Conseils
GDP	Gross Domestic Product
ICE	Institute of Civil Engineers
IDR	Indonesian Rupiah
IPP	Independent Power Producers
IRR	Internal Rate of Return
JCT	Joint Contract Tribunal
LNG	Liquid Natural Gas
LSTK	Lump Sum Turn Key
MW	Mega Watt

NPV	Net Present Value
PEST	Political, Economic, Social and Technological
PLN	Perusahaan Listrik Negara (*en*: State Electric Company)
PLTA	Pembangkit Listrik Tenaga Air (*en*: hydro power plant)
PLTG	Pembangkit Listrik Tenaga Gas (*en*: gas power plant)
PLTMH	Pembangkit Listrik Tenaga Mini Hidro (*en*: mini hydro power plant)
PLTU	Pembangkit Listrik Tenaga Uap (*en*: steam power plant)
PMI	Project Management Institute
PT	Perseroan Terbatas (*en*: limited company)
ROE	Return on Equity
ROI	Return on Investment
SMW	Sistem Manajemen Waskita (*en*: Waskita Management System)
SWOT	Strengths, Weaknesses, Opportunities and Threats
TCP	Time, Cost, Performance
US$	United State Dollar

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CHAPTER 1

INTRODUCTION

1.1 Background of Research

A project can be defined as a group of interrelated activities constraint by a specific budget, scope, schedule and other related factors to achieve certain goals. While according to the International Standard Industrial Classification issued by the United Nations (1968) defines *construction* as: "constructing, altering, repairing and demolishing building; constructing, altering and repairing highways and streets and bridges; viaducts, culverts, sewers, and water, gas and electricity mains; railways roadbeds, sub-ways and harbor and water ways; piers, airports and parking areas; dams, drainage, irrigation, flood control and water power projects and hydroelectric plants; pipe lines; water wells; athletic fields, golf courses, swimming pools and tennis courts; communication systems such as telephone and telegraph lines; marine construction, such as dredging and under water rock removal; pile driving, land draining and reclamation; and other type of heavy construction... mining services such as preparing and constructing mining sites and drilling crude oil and natural gas wells… specialist trade contractors' activities…".

Construction projects can be categorized in several ways. The most commonly used categorization as described by Hinze in Construction Contracts (2011, p.10) is housing construction, nonresidential building construction, engineering construction, and industrial construction. Each categories has their own determinants and demand factors.

Meanwhile, *EPC* is the abbreviation for Engineering, Procurement and Construction. EPC is a type of construction contract where the contractor holds the responsibility for engineering services, procurement of materials, and construction. Due to its characteristics, EPC project is also known as turnkey project service. The term '*turnkey*' here is used to indicate that the project is delivered to the employer ready for operations.

In EPC project, the contractor holds all responsibility from the beginning. It includes the provision of engineering services, materials procurement and construction services. Power plants, factories, gas development project, infrastructure projects, and industrial plant construction sectors are the typical examples of EPC projects. Accordance with the improvement of construction delivery systems, EPC type of contract is more widely used all over the world. One of the main reasons is that it will distribute the employer's risk to the main contractor. By this way, employer expects to get a higher degree of certainty as to costs and time, and the contractor takes full responsibility for the engineering (design), procurement and construction (execution) phases of the project. The popularity of this procurement method has made organizations such as FIDIC to respond the need for appropriate standard form of construction contract that are more closely reflected today's market conditions, namely FIDIC Conditions of Contract for EPC/Turnkey Contracts (the Silver Book).

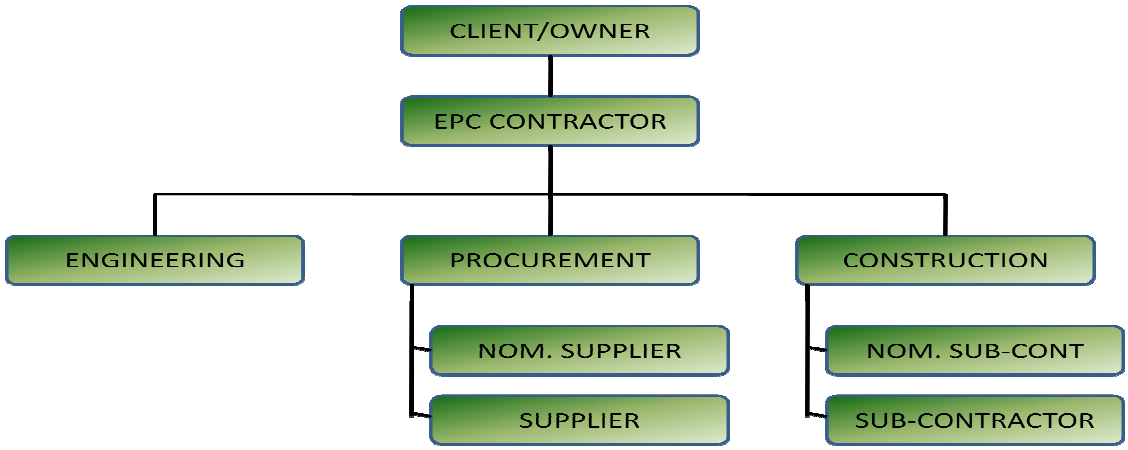

Figure 1.1 Typical EPC Project Organization

There are three main aspects which should be considered in executing any project, i.e. the TCP Triangle which stands for time, cost, and performance aspects in a project. In order to get a project successfully completed, a good project management implementation is needed. PMI as in PMBOK Guide 2008 (p.6) has defined *project management* as the implementation of construction-related knowledge, skills, tools, and techniques to project activities with the aims to meet the project requirements. Project management is accomplished through the appropriate application and integration of the 5 (five) process groups; i.e. initiating, planning, executing, monitoring & controlling, and closing.

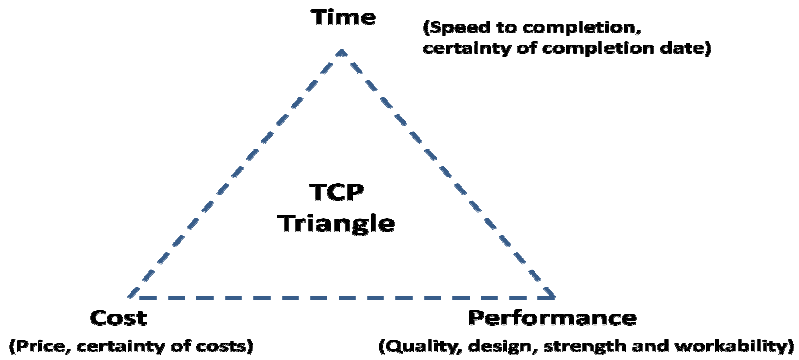

Figure 1.2 The TCP Project Triangle

Initiating process deals with the identification of project key players, feasibility and viability study of the project, and development of project charter. Planning process deals with project scheduling and cost estimating, development of WBS, project design and planning, and development of subsidiary plan (risk, human resource, quality, procurement, monitoring and reporting, etc). Executing process deals with execution of project design according to statutory provisions and technical specifications. Monitoring & controlling process deals with project monitoring and reporting status, management of project risk and future impacts, etc. While closing process deals with close-out contract, complete administrative close-out, and deliver project to the employer.

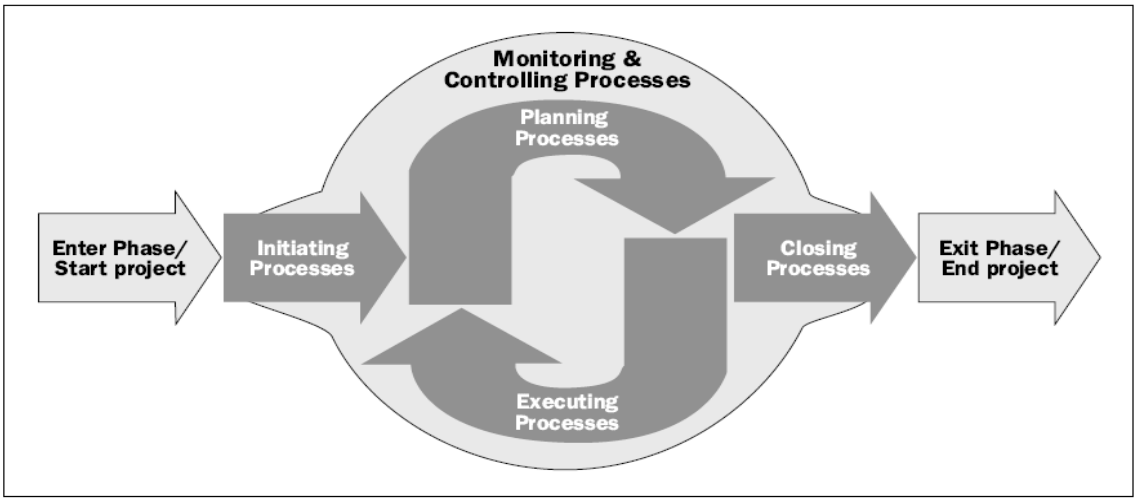

Figure 1.3 Project Management Process Group
(PMI, "*A Guide to PMBOK 4th Ed.*", 2008, p. 40)

Figure 1.4 below shows the typical project life cycle for any construction project. From this figure, we can see the significance of each stage of project management in delivering the new project until its completion. This is mainly because each stage is always dealing with cost, time, and performance. Considering this reason, a good implementation of project management is a must in ensuring the success of a project.

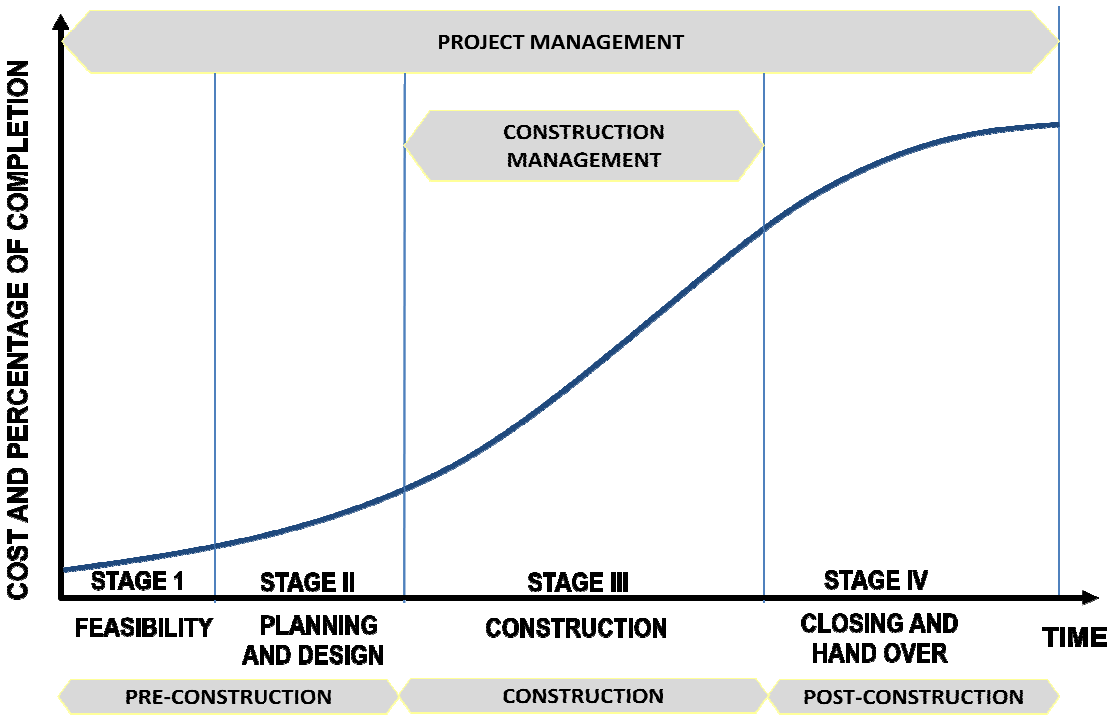

Figure 1.4 Typical Project Life Cycle

The project implementation process is very complex and requiring simultaneous attention to a wide variety of human interactions, budgetary issues, and technical variables. As a result, the organizational project manager is faced with a difficult job characterized by overload tasks, frenetic activities, fragmentation, and superficiality. Often the typical project manager must take the responsibility for the project outcomes without sufficient time, budget, or people to handle all of the elements crucial for the success of the project. Projects are often initiated in the context of a turbulent, unpredictable, and dynamic environment. As a result, it is important that the project manager would be well served by more information about project specific factors critical to project success. The project manager needs the necessary tools to assist him or her to focus his or her attention on important areas and set differential priorities across different project elements. If it can be demonstrated that a set of factors under the project manager's control have a significant impact on project implementation success, the project manager will be better able to effectively deal with the many demands created by his job, channelling

his energy more efficiently in attempting to successfully implement the project under development (Jeffrey and Dennis, 1987).

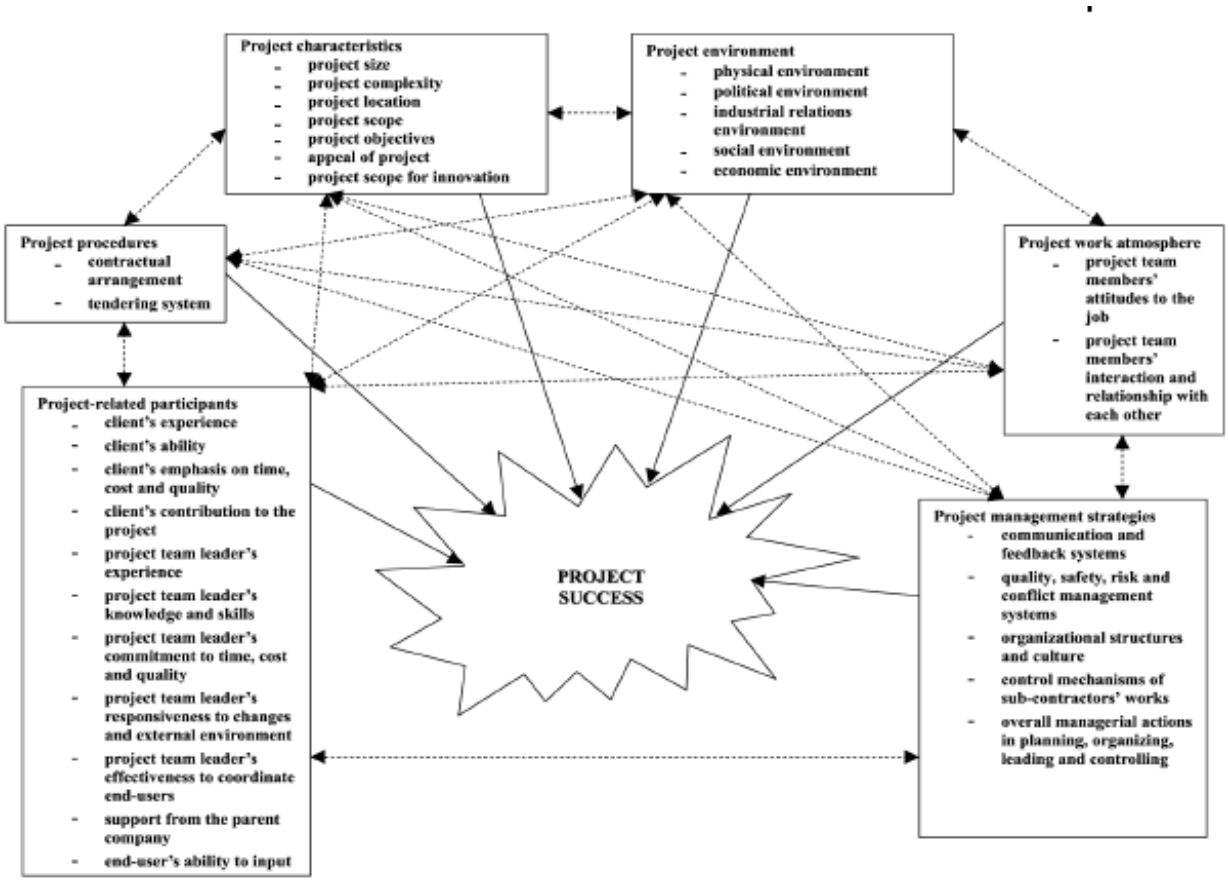

Figure 1.5 Critical Factors in Project Success (Edmond W.M. Lam, Albert P.C. Chan & Daniel W.M. Chan, 2004)

Project management implementation for EPC projects is quite different with project management implementation for building and civil engineering works. One thing that differentiates this is the project procurement system. In traditional procurement system, whether for building and civil engineering works, design will be prepared by the employer and his architects. The contractor will only be responsible for managing the project during the construction period and this responsible will be completed by handing over and closing ceremony of the project. In another aspect, contractor also is not been troublesome with financial problems because the project financing is in the concern of the employer and not the

contractor. The contractor will only receive the payment for his work performance based on the payment procedure which is already been agreed under its contract.

However this is quite different in EPC projects. EPC projects are basically a *design and build* type project. Therefore, design is prepared by both the architect and contractor with the main responsibility will be fall to contractor. Plus, in EPC projects usually applies the contractor will finance some or whole of the project cost and only will be paid after the completion of the project. This system is known as project *pre-financing*[1]. The amount and procedure of payment will depend on the agreed terms in the contract.

1.2 Problem Statement

Since 2008, Indonesia's GDP has been growing significantly. In 2010, its GDP has reached IDR 6,422.9 trillion compares to IDR 4,948.7 trillion in 2008. This means there is a growth as much as 6.0% in 2008, 4.5% in 2009, and 6.1% in 2010. Meanwhile, Indonesia construction industry has also recorded a significant improvement. The industry is experiencing average growth of 7% per year. Moreover, the industry also shows its contribution growth to Indonesia GDP. Table 1 below shows the Indonesia economy data and its relation to construction industry.

[1] The practice of arranging funding in advance of the start date of a project (www.qfinance.com/dictionary/pre-financing). Accessed on 27 July 2012.

Table 1.1 Indonesia Macro Economy and Construction Industry Data

No.	DESCRIPTION	2008	2009	2010
1	GDP (IDR trillion)	4,948.7	5,603.9	6,422.9
2	GDP Growth (%)	6.0	4.5	6.1
3	Construction Industry (IDR trillion)	419.7	555.2	661.0
4	Construction Contribution to GDP (%)	8.5	9.9	10.3
5	Construction Industry Growth (%)	7.5	7.1	7.0

Source: Badan Pusat Statistik (Central Statistic Bureau), 2011

With its rapid development, Indonesia needs many industrial public sector projects. Especially with the population over 230 million people, its demand for power plant projects, gas development projects, and other type of industrial sector projects has risen significantly.

Project is the main business in construction industry. Traditional definition of *construction company* only describes its activities as to construct, alter, repair and demolish man-made structures such as building, highways, dams, airports, power plants, etc. However, with the development of today's market, some big construction companies do not only deal with construction services but also make a deal as investors. In relation to its financial aspect, Adler (1970) described a *project* as the minimum investment which is economically and technically feasible. It means that the construction companies should know and implement a good project management system in order to be financially healthy.

PT Waskita Karya (Persero) is one of the main leading construction company in Indonesia and has many advantages as one of the state-owned companies. Since its establishment on 1st January 1961, it has become one of the leading construction companies which play a major role in the development of Indonesia. Its scope of works includes building and high rise building construction, civil engineering

structures, and EPC projects. For the latest, Waskita has won some fascinating projects such as PLTU Sulawesi Selatan 2x50 MW (South Sulawesi Steam Power Plant Project), PLTA Genyem 2x10 MW (Genyem Hydro Power Project), PLTU Malinau 2x3 MW (Malinau Steam Power Plant Project), Leces Coal Boiler Construction Project, and PLTMH 8 MW Cirompang (Cirompang Microhydro Power Project).

The demand for EPC projects has been growing recently, especially for power plant projects. In 2011, Waskita has bid for some EPC projects such as Batam Independent Power Plant 2x60 MW, Senoro Gas Development Project, PLTU Dumai 2x(120-150) MW (Dumai Steam Power Plant Project), and PLTU Sicanang 2x35 MW & PLTG KIM 2x 80 MW – Belawan, North Sumatra (Sicanang Steam Power Plant Project & KIM Gas Power Plant Project – Belawan, North Sumatra).

With this rapid growth of EPC projects demand, Waskita has made strategic company policy to establish its own division for EPC projects. For this reason, Waskita needs a scholastic management and learning. Waskita has so many experiences over its 50 years operation in building and civil engineering works. However, it must admit that EPC projects have not been in its scope of operation before and therefore it does not fully understand the nature of EPC projects.

There are three reasons why Waskita needs to learn project management for EPC projects. First, as has been described before, Waskita has vast experiences in project management for building and civil engineering projects. For EPC projects, Waskita still needs to learn much in its efforts to find the best method in EPC project management implementation. Both building and civil engineering projects have so many different aspects to give considerations. The same applies for EPC projects.

Second, today many of EPC projects are being held as partnering projects. By this way, employers are trying to engage the main contractors such as Waskita to become a partner and make a partnership. This means Waskita as the contractor has to give funding for the completion of the projects. This is in line with the need for Waskita to become an investor-contractor. Therefore, the project management knowledge for EPC projects is a must. And lastly, Waskita has established a separate division for EPC projects in its company structural organization. The need of project management knowledge for EPC projects is essential in order to ensure the profitability and sustainability of the division.

1.3 Research Questions

In doing this research, there are some questions that need to be answered in order to achieve this research's objectives, namely:

1. What does Engineering, Procurement and Construction (EPC) mean?
2. What is the nature of EPC projects?
3. What are the problems usually occur in EPC projects?
4. How to mitigate and reduce the impacts of these problems?
5. How does EPC projects have been done in Waskita?
6. What is the scope and life cycle of EPC projects?
7. How does project management be implemented in EPC projects?
8. How does risk management be implemented in EPC projects?
9. How does quality management be implemented in EPC projects?
10. Why should someone invest in the EPC projects?
11. How to manage the disputes occur in EPC projects?
12. What are the success criteria in EPC projects?

By answering the above questions will enhance the understanding of EPC project management.

1.4 Research Objectives

The aim of this research is ***to study the project management system for EPC projects***. While the objectives of this research are:

a) To identify the nature of EPC projects
b) To identify the management system for EPC projects applied by PT Waskita Karya (Persero)
c) To improve the effectiveness of the business process for EPC projects

Therefore, with the implementation of good EPC project management system, it will ensure the achievement of the above objectives. In the end, the result of this research will serve as a guidance for PT Waskita Karya (Persero) to comprehend the project management for EPC projects.

1.5 Scope of the Research

The scope of this research consists of the following matters:

a) This research will discuss about the management of EPC projects in 3 (three) aspects, namely: the characteristics of EPC projects, the implementation of EPC project management, and the strategies to improve the effectiveness of the business for EPC projects
b) This research will discuss about the project performance based on 3 (three) criteria, i.e. time, cost and quality

c) Review of available literature data is done to give an understanding of the importance of the management implementation at a very early stage of the project life cycle

1.6 Limitation of the Research

In order to direct the research focus, research limitation should be arranged as follows:

a) The research is limited for EPC project only which is very different with other types of construction categorization
b) The project data are taken from PT Waskita Karya (Persero) as one of the main leading construction company in Indonesia
c) The method used for collecting data consists mainly of two techniques, i.e. expert interview and legitimate data (company data)
d) The total duration for conducting this study is very limited, effective duration is less than 2 (two) months
e) The number of sample (project data) depends on the availability of Waskita EPC Division's company data

1.7 Research Significance

The importance of the research is mainly to identify the nature and problems in EPC projects and by doing so it will eventually improve the project delivery system for EPC projects. This research will result in the implementation of project management for EPC projects which is still seldom be researched before. Lastly, this research also serves as a guidance for PT Waskita Karya (Persero) to comprehend the project management for EPC projects.

1.8 Research Methodology

Research methodology can be seen in figure 1.6.

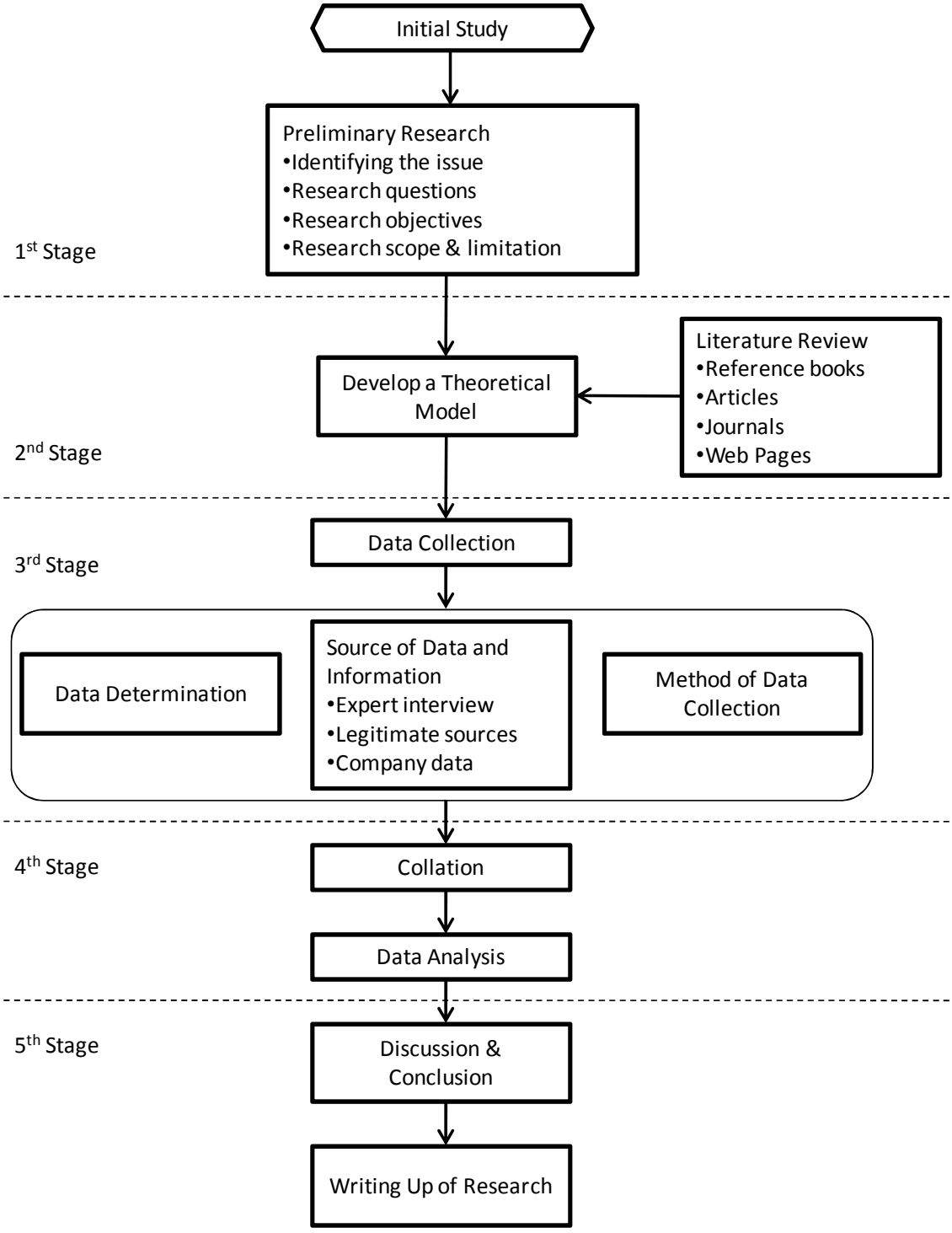

Figure 1.6 Research Methodology

1.9 Report Organization

This study is composed of five chapters as follows:

Chapter 1 presents the introduction of this research which includes background of the study, problem statement, research questions, objectives of the study, scope of the research, limitation of the research, significance of the study, research methodology, and thesis organization.

Chapter 2 will review literatures related to project procurement systems, project management processes, brief introduction on EPC projects and its standard forms, EPC project life cycle, the significance of EPC projects, and some previous researches.

Chapter 3 describes the methodology that is adopted to conduct this research. It consists of the preliminary research, theoretical model, data collection, and data analysis.

Chapter 4 describes data analysis as results of the project management implementation for EPC projects, the nature of EPC projects, EPC as applied in Waskita, and some insights and strategies to improve the effectiveness of business process in EPC projects.

Chapter 5 presents the conclusion of this research and further recommendations for future researches.

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