CHAPTER I
INTRODUCTION

This chapter consists of the background, problem formulation, research objectives, research scopes and outline of the research report.

1.1 Background

In today's world, global competition has led to changes fundamental in the competitive environment of the manufacturing industry. The company must develop strategic objectives that result in competitive advantage in market. To achieve this, companies need to implement World Class Manufacturing concept. World Class Manufacturing (WCM) is concept that has the characteristics of high productivity, quality and flexibility (De Fellice, 2015).

The company always strives so that every demand for its products can always be fulfilled, and every production process that is carried out can be carried out effectively and efficiently. The company can ensure that this can be implemented by analysing the production capacity in terms of machine capacity, transportation, and quality of raw materials. It is maintaining the production machinery and adjusting capacity and usage methods following the quality of the availability of existing raw materials. The company's efforts to maintain the standard of product produced by taking care of the production machines used and ensuring the use of quality raw materials under existing needs so that the production can still fulfil capacity and quality is still following existing standards (Helali and Kalai, 2013).

PT Semen Padang is a manufacturing company that produces cement as a product. PT Semen Padang was founded on March 18th, 1910, under the name NV Nederlandsch Indische Portland Cement Maatschappij (NV NIPCM) which was the first cement factory in Indonesia. Along the way, this factory continues to develop. Based on the Letter of the Minister of Finance of the Republic of Indonesia

No.5326/MK.016/1995, the government consolidated three state-owned cement factories consisting of PT Semen Tonasa (PT ST), PT Semen Padang (PT SP), and PT Semen Gresik (PT SG), which was realized on September 15th, 1995. The three companies were under the holding of PT Semen Gresik (Persero) Tbk. Since January 7th, 2013, PT Semen Gresik (Persero) Tbk changed its name to PT Semen Indonesia (Persero) Tbk according to the results of the Extraordinary G eneral Meeting of Shareholders (EGMS) in Jakarta on June 26th, 2012. PT Semen Padang together with PT Semen Gresik, PT Semen Tonasa, and Thang Long Cement Company Vietnam are officially part of PT Semen Indonesia, the largest cement company in Indonesia (www.semenpadang.co.id , accessed 1st December 2021)

As we know, with the complexity and ambiguity of today's world conditions, companies must be able to survive and become more efficient while maintaining quality following predetermined standards. Based on the interview with Planning and Maintenance Evaluation PT Semen Padang, there are several stages in the cement production process at PT Semen Padang, from mining raw materials to the packaging process. The cement production process begins with the grinding process of raw materials in the raw mill. This process mixes four primary raw materials: limestone, silica stone, clay, and iron sand. The quality of each raw material plays an essential role in producing the raw mix of the cement production process.

In clay material, two levels are very concerned as the eligibility criteria for clay that the production process can use, which are Al_2O_3 and H_2O. Clay plays a significant role in achieving Al_2O_3 levels following existing cement manufacturing standards. The levels of Al_2O_3 and H_2O in clay have their respective maximum and minimum standard values. **Figure 1.1** shows the changes in the levels of Al_2O_3 and H_2O in the supply of clay material in 2021.

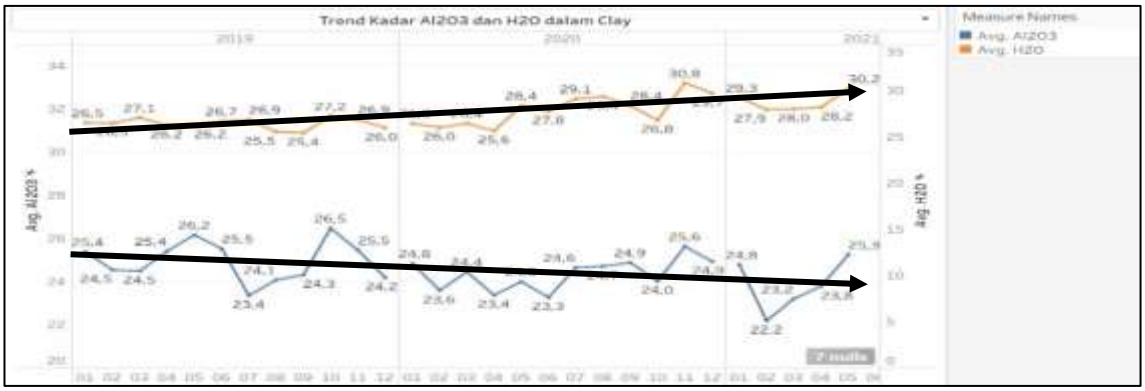

Figure 1.1 Clay Supply Trends 2020-2021
(Source: Production Planning & Controlling Departement of PT Semen Padang)

From **Figure 1.1**, the trend of Al_2O_3 levels in clay tends to fall and never reaches 27% according to the minimum standard requirement factory. Based on reports of decreasing levels of Al_2O_3 in clay, further observations were made by the Planning and Production Evaluation Unit to see the availability of clay in West Sumatra. After observing the data obtained as shown in **Table 1.1**, which delivered the availability of clay in West Sumatera.

Table 1.1 Estimated Availability of Clay Reserves (Radius 20 – 50 km) from PT Semen Padang in 2021

No.	Area	Vol. Highgrade (ton)	Vol. Lowgrade (ton)	Description
1	Gunung Sarik	2.043.738	1.235.412	Al_2O_3 (23-25%)
2	Bungus	-	139.500	Al_2O_3 (18-22%)
3	Tajarang (Can Be Proceed)	-	311.293	Al_2O_3 (16-22%)
	Tajarang (Still on Permission Process)	-	18.836.190	Al_2O_3 (16-22%)

(Source: Planning and Production Controlling Departement of PT Semen Padang)

Table 1.1 Estimated Availability of Clay Reserves (Radius 20 – 50 km) from PT Semen Padang in 2021 (Continued)

No.	Area	Vol. Highgrade (ton)	Vol. Lowgrade (ton)	Description
4	Padayo (Still on Permission Process)	1.297.548	-	
5	Lubuak Selasih	-	2.500.000	Al_2O_3 (22-24%)
6	Lubuk Alung	-	2.500.000	Al_2O_3 (22-25%)

Table 1.1 indicates that the availability of high-grade clay in West Sumatra is only found in the Gunung Sarik area with 2,043,738 tons and the Padayo area with 1,297,548 tons. Assuming the clay usage is 1,000,000 tons per year, Highgrade clay will only last three years. Lowgrade clay is available in various regions of West Sumatra Province with a total capacity of 25,022,395 tons which can last for 25 years. The use of lowgrade clay requires adjusting the volume of clay usage that functions to meet the necessary Al_2O_3 levels in the raw mix production process for Cement Products. The usage of low-grade clay containing 18 % Al_2O_3 is led to an increase in the volume of clay used. The production process must adjust the utilization of more clay usage volume immediately to accommodate this extreme situation. Adjusting the volume of low-grade clay used in cement manufacturing aims to achieve the requisite Al_2O_3 values.

The capacity of each transportation machine and clay feeder must follow the required volume of clay usage. Indarung IV Plant's machines were the most affected because the machinery capacity in Indarung IV Plant was designed when the problem of clay quality didn't occur at that time, and it's not suitable for the condition of clay quality nowadays. To meet the demand for tonnage clay requirement, it is necessary to retrofit machinery to the adequate capacity. Problems that will arise if the machinery retrofit is not carried out immediately will be a shortage of Raw Mill production capacity due to the stop of the production process

because of laboratory requests. The production process stop-occurred because of the lack of clay material unless the clay used was high-grade clay, which is currently very limited because its availability in nature is getting less and less. So, improvements are needed for some machinery to prepare the use of lowgrade clay with an extreme index of Al_2O_3 content in clay 18%.

The Indarung IV Plant is one of the leading plants of PT Semen Padang, which started production in 1993. The Indarung IV factory has a production capacity of 1,920,000 tons/year. In the Indarung IV Plant, several types of machinery related to clay are affected by clay quality problems. PT Semen Padang previously determined the capacity of the Indarung IV Plant based on the existing material quality conditions at the time of the initial design. However, currently, there is a problem with decreasing the quality of clay so that the capacity of the clay used needs to be increased to get the same output quality.

The Indarung IV Plant experienced problems carrying out the production process with the target capacity remaining the same as the previous capacity target. The lack of production capacity of the Indarung IV Plant needs to be covered by retrofitting the machines at the Indarung IV Plant to a suitable capacity. So, Indarung IV Plant can produce with the target capacity as before and deal with problems with the existing clay quality conditions. **Table 1.2** contains the current capacity of some machinery of Indarung IV Plant in PT Semen Padang.

Table 1.2 Machineries Capacity of Indarung IV Plant

No	Nomenclature/ Machineries	Belth Width (mm)	Power Motor (kW)	n2 Gearbox (rpm)	Speed Belt (m/s)	Capacity Existing (t/h)
1	Hopper					175
2	Aproon Feeder					75
3	Crusher					50
4	4C1J02	1000	15	29,2	0,96	323
5	4C1J03	1200	7,5	30	0,8	385

Table 1.2 Machineries Capacity of Indarung IV Plant (Continued)

No	Nomenclature/ Machineries	Belth Width (mm)	Power Motor (kW)	n2 Gearbox (rpm)	Speed Belt (m/s)	Capacity xisting (t/h)
6	4C1J04	650	15	48,14	1,3	115
7	4C1J05	650	7,5	50	1	95
9	25320	650	5,5	50	1	95
10	25420	650	5,5	50	1	95
11	25120	650	5,5	50	1	95
12	25220	650	5,5	50	1	95
13	25121	800	7,5	19,7	0,4	72
14	4R1J07	650	11	49	1	93
15	25247	650	5	50	1	95
16	Feeder Clay 4R1					None
17	Feeder Clay 4R2					None
18	4R1J06	650	11	17,2	0,4	33
19	4R2J06	650	11	51	1,1	97
20	4R1J03	800	30	59,3	1,6	272
21	4R1J04	800	11	50	1	183
22	4R1J05	800	5,5	50	1	183
23	4R2J03	800	30	54	1,8	312
24	4R2J04	800	30	60	1,6	275
25	4R2J05	800		89	1,5	261

(Source: Planning and Production Evaluation Unit of PT Semen Padang)

Based on **Table 1.2**, we can see some Indarung IV Plant's machinery that needs to be analyzed to gain which machinery needs to be retrofitted to conform with the current condition of clay quality. Based on the data from the Planning and Production Evaluation Unit of PT Semen Padang got the information that in Indarung IV Plant, there is no hopper and feeder installation in Indarung IV Plant, for the feeding of clay material in Indarung IV Plant still using table wager with manual gate for each Rawmill Machine. Indarung IV Plant in PT Semen Padang already has their production process itself without considering other plant production process, in **Figure 1.2** interpret the flowsheet of the production process in Indarung IV Plant that passed by clay material.

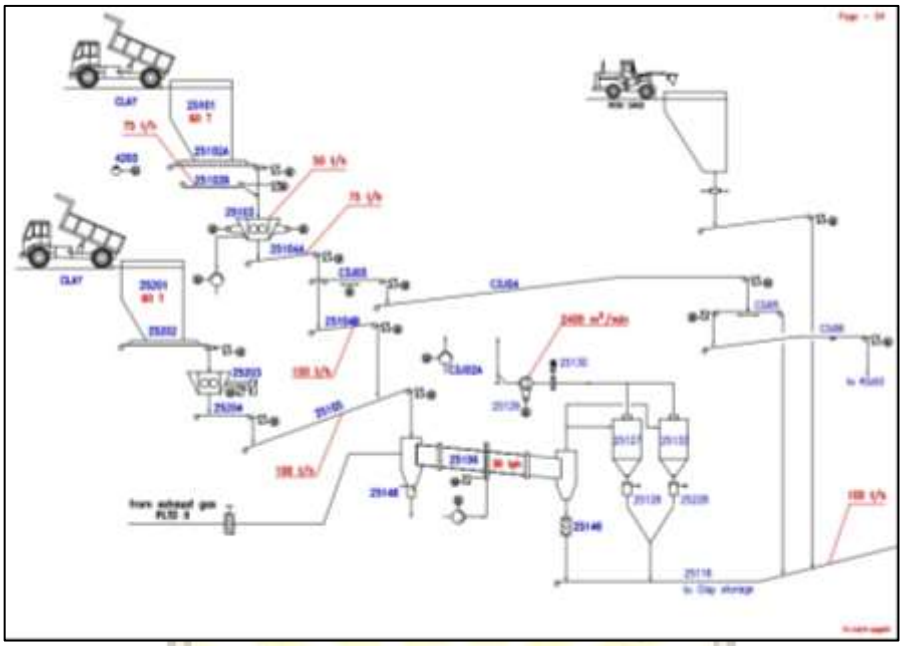

Figure 1.2 Flowsheet Production Process of Indarung IV Plant
(Source: Design & Engineering Departement of PT Semen Indonesia)

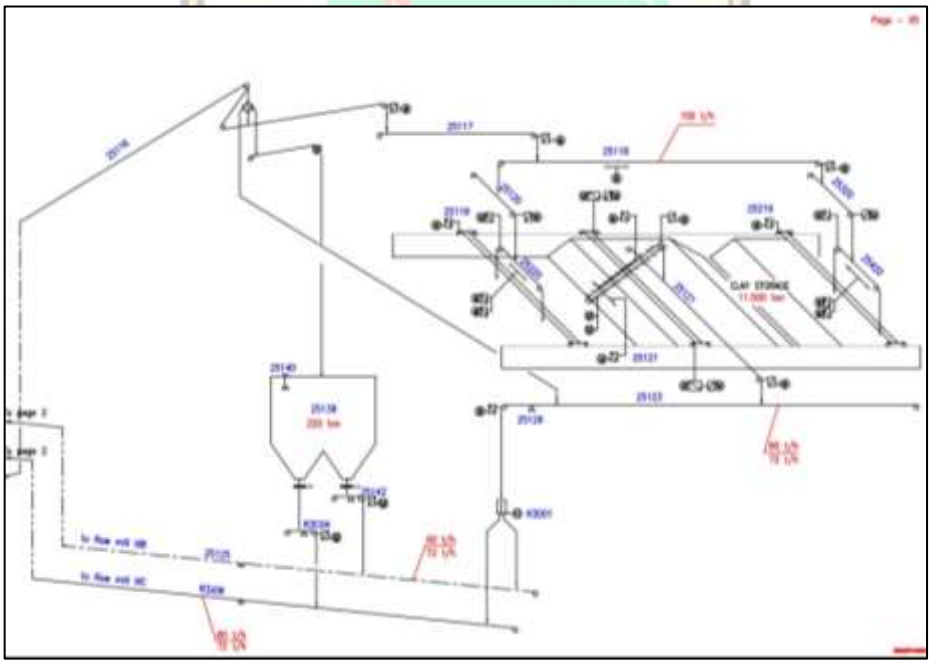

Figure 1.2 Flowsheet Production Process of Indarung IV Plant (Continued)
(Source: Design & Engineering Departement of PT Semen Indonesia)

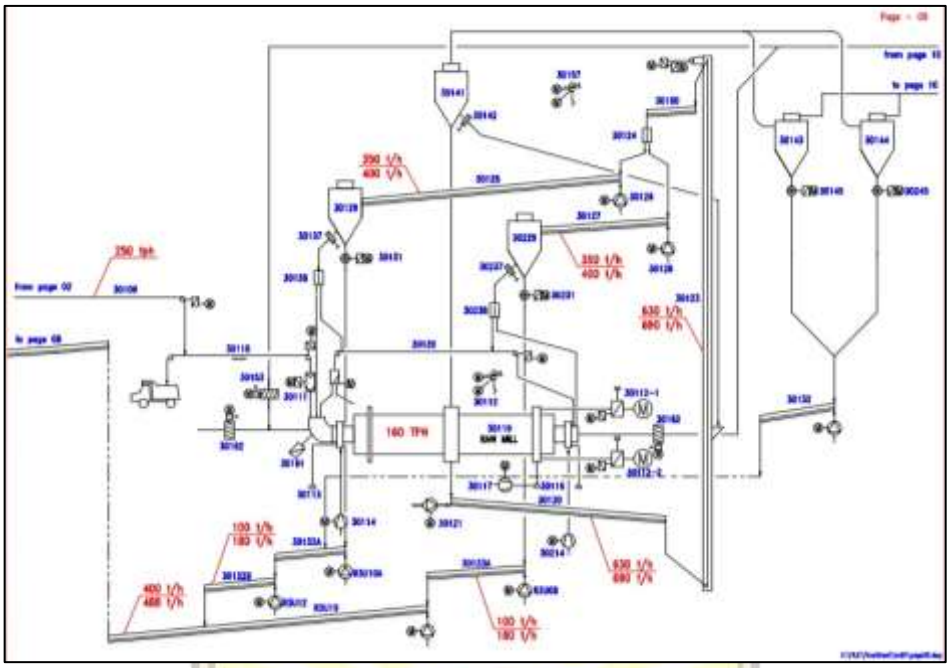

Figure 1.2 Flowsheet Production Process of Indarung IV Plant (Continued)
(Source: Design & Engineering Departement of PT Semen Indonesia)

Figure 1.2 tells us about the production process flowsheet of Indarung IV Plant in PT Semen Padang and the capacity of each machine itself. Clay is one of the most critical materials in cement production. So, in PT Semen Padang, each plant already has its clay storage and clay transport equipment. The clay quality degradation problem comes up with the increasing capacity clay usage issue. The increasing capacity of clay usage impacts some machinery, so some of the machinery with unsuitable capacity capability need to be retrofitted. To find out which machinery needs to be retrofitted, we need to carefully review the production process flow that the clay goes through. Each machine traversed by clay will need to be evaluated for its capacity and whether it is still following the capacity of the clay used. **Figure 1.3** shows the simplier form of production process flowsheet from the clay material obtained to the last machine that the raw material of clay goes through before being processed.

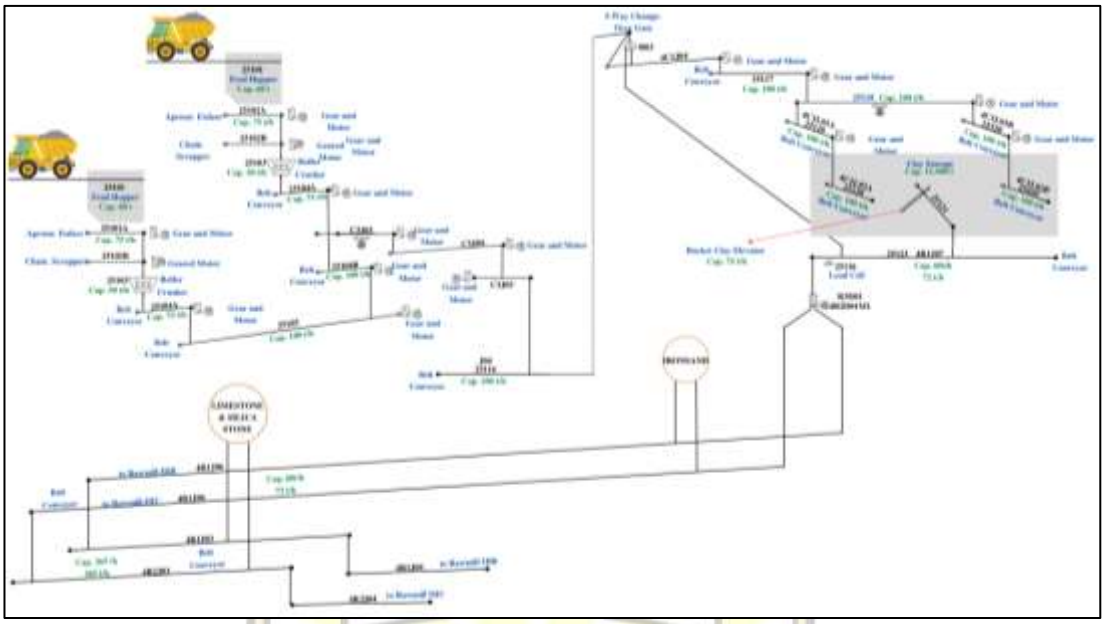

Figure 1.3 Flowsheet Production Process of Indarung IV Plant Traversed by Clay

Based on **Figure 1.3** we can determine which machines are affected by the problem of clay quality degradation by evaluating the capacity of each machine whether it is still in accordance with the tonnage clay that needs to be used. From the evaluation results, it can be seen which machines need to be invested in retrofitting machines at the Indarung IV Plant PT Semen Padang. This is a strategic issue because if this is not done, it will affect the production capacity because of the lack of raw material, which is clay. So, in this investment project, Indarung IV Plant's production process flowsheet needs to be evaluated to fit in with the current condition of tonnage clay usage.

The investment project for the retrofit of the machines at the Indarung IV Plant was started by analyzing the increased capacity of clay requirements based on the clay quality degradation problem. Furthermore, the capacity of using clay compares with each machine involved, from Storage clay to Raw Mill. Where each machine involved has its capacity and differs from one another. Some machines are already operating at their full capacity, and others are not yet operating at their full capacity. The machines that are already operating at full capacity are likely not to be able to meet the capacity of using clay and require retrofitting. Based on the results of this evaluation, a retrofit investment design for the machines of the

Indarung IV Plant was carried out. Next, we'll be calculating saving from the planned investment, operational costs after the retrofit, analysis of profit and loss, and the investment feasibility parameters which are Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), Profitability Index (PI), and Benefit-Cost Ratio. From the value of some of these feasibility parameters, it can be determined whether this investment project is feasible or not.

Technical study and financial analysis are one of the steps that need to be done on claiming if the investment project can be run or not. The technical study aims to design and make sure the technology and technical works in the investment project already cover the needs of the investment project. The financial analysis on the investment project talks about the fund that the investment needs and the financial rotation. On the financial analysis of the investment, the project has another objective to see whether the investment project is feasible to run or not.

Technical and financial studies on retrofitting the Indarung IV Plant's machinery investment project at PT Semen Padang need to be carried out to support the production process to run according to the desired capacity. Before conducting a technical and financial study of the implementation of the planned investment project, it is necessary to obtain some data related to the needs of the investment project and the desired things as the output of the study conducted. The information or expected outputs from the technical analyses of this investment project are obtaining the capacity of clay needs as raw material for cement manufacture under current conditions after the clay quality degradation problem, getting a capacity shortage of Indarung IV Plant's machinery that needs to be retrofitted. The financial study of the investment project aims to see how the planned investment project can be run or not. Retrofit of production machines is carried out by procuring the expected capacity. This procurement is carried out through investment projects by the company to achieve the set targets. For this planned investment to generate maximum profits and not cause losses, it is necessary to conduct technical and financial studies through this project.

1.2 Problem Formulation

Based on the background description, the formulation of the problem in this research is how the technical needs and financial analysis of retrofitting the Indarung IV Plant's machinery investment project at PT Semen Padang.

1.3 Research Objectives

Based on the formulation of the problem, the objectives of the research of the Indarung IV Plant machinery retrofit investment project are:

1. Technical evaluation of the machinery retrofit investment project at the Indarung IV Plant at PT Semen Padang.
2. Designing and analyzing an investment project for retrofitting machines at the Indarung IV Plant at PT Semen Padang.

1.4 Research Scopes

Research scopes of the problem in this study on the implementation of retrofit Indarung IV Plant's machineries capacity in PT Semen Padang are:

1. Retrofit is only carried out on machineries which Clay material passes.
2. Retrofit of machineries capacity is only carried out at the Indarung IV Plant of PT Semen Padang.

1.5 Outline of Proposal

The outline of the final project proposal consists of three chapter as follows:

CHAPTER I INTRODUCTION

This chapter contains the research background problem formulation, research objective, research scopes and outline of proposal.

CHAPTER II LITERATURE REVIEW

This chapter consists of literatures that related to the problem and some formulas that used to solve the problem.

CHAPTER III RESEARCH METHODOLOGY

This chapter contains the steps carried out in this research consisting of preliminary study, literature review, problem identification, problem formulation, data collecting, data processing, discussions, conclusions and suggestions for future research.

CHAPTER IV DATA PROCESSING

This chapter contains the data collected through direct interviews and observation of the technical study and financial analysis of retrofit Indarung IV Plant's machinery capacity investment project. The data processing is divided into the technical evaluation and financial analysis by giving the result of the feasibility of retrofitting Indarung IV Plant's machinery capacity investment project.

CHAPTER V DISCUSSIONS

This chapter contains an analysis and discussion of the results of technical evaluation and financial analysis by giving the result of the feasibility of retrofitting Indarung IV Plant's machinery capacity investment project.

CHAPTER VI CONCLUSIONS

This chapter contains conclusions of the research and suggestions for future research.