CHAPTER I
INTRODUCTION

This chapter contains about background, problem formulation, objectives, and scopes of the research, assumption, and outline of report.

1.1 Background

Cement is an inorganic, non-metallic substance with hydraulic binding properties, and is used as a bonding agent in building materials. It is a fine powder, usually gray in color, that consists of a mixture of the hydraulic cement minerals to which one or more forms of calcium sulfate have been added (Greer *et al.*, 1992). When mixed with water it forms a paste, it hardens due to formation of cement mineral hydrates. Cement is the binding agent in concrete, which is combination of cement, mineral aggregates, and water. Concrete is a key building material for a variety of applications (Kema Inc,2005).

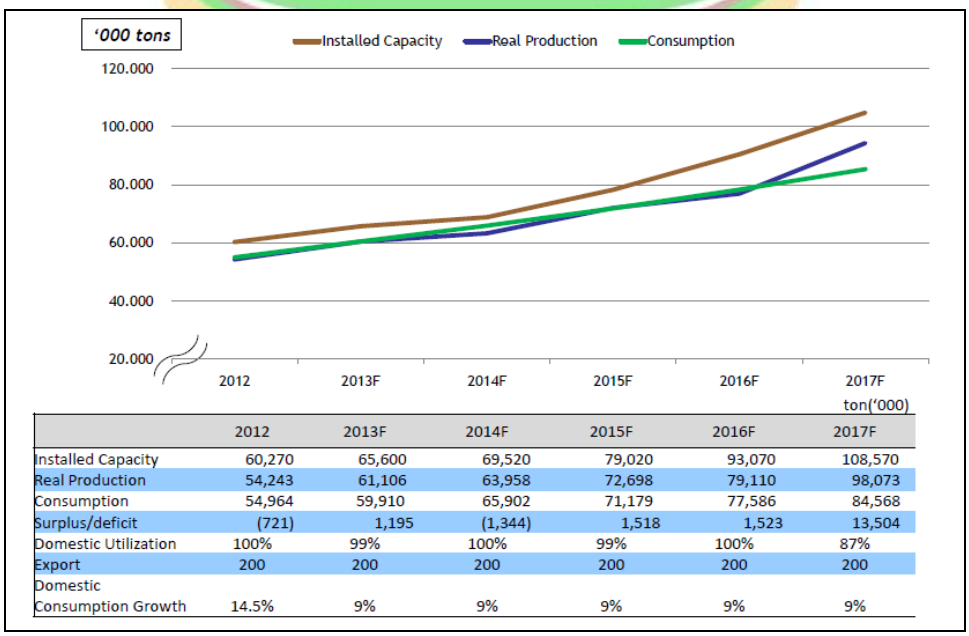
According to US Census Bureau (2002), the cement manufacturing industry is identified by North American Industry Classification System (NAICS) code 32731 (formerly identified as SIC code 3241). The cement industry comprises establishments primarily involved in manufacturing portland, natural, masonry, pozzalanic, and other hydraulic cements. Cement manufacturing establishments may calcine earths or mine, quarry, manufacture, or purchase lime (Kema Inc, 2005). Industry Classification based on International Standard of Industrial Classification (ISIC) are divided into nine industries, cement industry is one of them. Cement is one of the strategic commodities that play a vital role in supporting acceleration of infrastructure development and economic growth (The Indonesian Ministry of Industry, 2012).

Data from *Badan Pusat Statistik* (BPS, 2014) show an increasing growth of manufacturing industry which is included in processing (cement industry) rise 6.78 percent at second quarter of 2014 compared to that second quarter of 2013. The growth was caused by the Indonesian government projects in various sectors of infrastructure development. This caused the increasing in quantity cement production in Indonesia. Table 1.1 shows the data from the Ministry of Industry on capacity building and cement demand year 2012-2016 (*Asosiasi Semen Indonesia*, 2012).

Table 1.1 Installed Capacity in Some of The Indonesian Cement Companies (www.asi.or.id)

Company	2012		2013		2014		2015		2016*	
	Clinker	Cement	Clinker	Cement	Clinker	Cement	Clinker	Cement	Clinker	Cement
Lafarge	1,2	1,6	1,2	1,6	2,4	3,2	2,4	3,4	2,4	3,4
Padang	5,6	6,4	5,625	6,62	6,855	8,16	8,22	9,26	8,22	9,26
Baturaja	1,2	1,35	1,2	1,5	2,3	2,6	2,3	2,7	2,3	2,7
Indocement	15,6	21,1	15,6	21,1	18,1	23,1	18,1	23,1	18,1	23,1
Holcim	6,4	8,7	7,6	8,7	7,6	10,7	7,6	10,7	7,6	10,7
Gresik	9,1	11,3	10,5	13,12	10,5	13,12	10,5	13,12	10,5	15,62
Tonasa	6,3	6,55	6,3	7,15	6,3	7,15	6,3	7,15	6,3	7,15
Bosowa	1,8	3	4,3	5,5	4,3	5,5	4,3	5,5	4,3	5,5
Kupang	0,3	0,57	0,3	0,57	0,3	0,57	0,3	0,57	0,3	0,57
Total	47,5	60,57	52,625	65,86	58,655	74,1	60,02	75,5	60,02	78,5

Resource: Industrial Ministry
Capacity in a million tons
*Forecasting



	2012	2013F	2014F	2015F	2016F	2017F
Installed Capacity	60,270	65,600	69,520	79,020	93,070	108,570
Real Production	54,243	61,106	63,958	72,698	79,110	98,073
Consumption	54,964	59,910	65,902	71,179	77,586	84,568
Surplus/deficit	(721)	1,195	(1,344)	1,518	1,523	13,504
Domestic Utilization	100%	99%	100%	99%	100%	87%
Export	200	200	200	200	200	200
Domestic Consumption Growth	14.5%	9%	9%	9%	9%	9%

Figure 1.1 Domestic Demands versus National Capacity for 2012 until 2017 (PT Semen Indonesia Persero Tbk, 2013)

There are numerous challenges facing the industry in today's competitive environments. One of the major challenges is its capability to adopt and introduce the improvement approaches and techniques by which the overall enhancement can be achieved. The need for improving the efficiency of the production line is widely acknowledged in order to reduce the downtime rates, and satisfy high levels of market demand for their product (Khalil *et al*., 2013).

According to Khalil *et al*. (2013), cement industry is an ideal example of a continuous process industry and it will be used to demonstrate that the lean philosophy is applicable outside the realm of discrete manufacturing. The development of cement industry sector in Indonesia must be able to manage the production process to be more effective and efficient. Rate to fulfill consumer demand is one of the most important things to improve the company's competitiveness. In order to improve a product, a company is required to understand what kind of activities can increase the value (value added) on the product. A number of methods can be used as an innovative form of the waste reduction in the production process.

Lean manufacturing developed by Eiji Toyoda and Taichi Ohno of Toyota in the 1950s and 1960s which continuously identify and eliminate waste from the system (Womack *et al*., 1990).Waste identification based on Lean Manufacturing principle is divided into seven types. Seven wastes consist of overproduction, waiting, inventory, transportation, over-processing, motion, and defective products (Gasperz, 2011).

PT Semen Indonesia (Persero) Tbk is a company which focuses on industry, production, cements trading, and provides services that are related to cement industry and/or other industries. The company has a high commitment to increase the value of stakeholders. Innovation is one of the efforts of the company to improve its competitive towards sustainable growth. The innovation of company is composed to two categories, namely: incremental innovation and breakthrough innovation. Incremental innovation is a business or activities to find

a common cause and eliminate a problem and to make sure there is no same problem, through Quality Control Group, Suggestion System (SS) program, 5S program (*Seiri*, *Seiton*, *Seiso*, *Seiketsu*, and *Shitsuke*), and TPM (Total Productive Maintenance). Breakthrough innovation is an effort to find, plan, and implement new ideas that resulting in a positive impact significantly (www.semenindonesia.co.id).

PT Semen Padang is a joint venture company in the cement industry and a company's member of PT Semen Indonesia Group which has a strong commitment to improve the competitiveness through a number of aspects such as productivity and operational efficiency in all fields, management of resources effectively and efficiently, and compliance customer expectation for all products produced by the company to fulfill the quality requirements and provide the best service (www.semenpadang.co.id) .

The cement production processes at PT Semen Padang are divided into three main machines i.e.: raw mill, kiln, and cement mill which are connected to each other as a continuous flow. Raw mill is used to crush the materials such as limestone, chalk, silica, iron sand, and clay. The materials are extracted from mining and quarrying activities. Therefore, the size of materials has to reduce before processed into kiln (clinker production). According to Kema Inc (2005), clinker is produced through a controlled high-temperature burn in a kiln of a measured blend of calcareous rocks (usually limestone) and lesser quantities of siliceous, aluminous, and ferrous materials. The last machine is cement mill which used to mix the cement with any additional substances such as gypsum, limestone, and pozzoland.

During the production processes, it can be identified some wastes might be occurred from the operators, machines, nature, and others. For example, the cement industry of Bangladesh have some wastes are include in the system such as lead time (waiting time), delays, and inventories. It caused the company's inability to fulfill the customer's demand (Saifuddoha *et al.*, 2013). According to

Rono (2013), there are problems found in Bamburi Cement Limited Industry such as ineffective inspection of equipment, lack of quality maintaining, delays, and breakdowns. Lean manufacturing help to maintain a good relationship with the customers by producing high quality product without delays.

In the Indarung V Plant of PT Semen Padang also has the same non-value added (wastes) in the production process such are overproduction, transportation, defects, delays of machine maintenance, and inventory. Hence, evaluation and innovation must be held on the cement production processes. It will affect the development and sustainability of cement industry especially for *Indarung* V Plant of PT Semen Padang which has the largest production capacity 2.3 million tons per year.

Waste elimination has been recognized as the one of the continuous improvement in manufacturing (Mostafa and Dumrak, 2015). Waste elimination is a part of Lean Manufacturing application with 4P (Problem Solving, People and Partners, Process, and Philosophy) categories show in Figure 1.2 (Liker, 2010). Waste will result a negative effect for the company such as inventory tends to raise production costs because it requires additional handling and space, delay time creates a pile of Work in Process between workstation, and overprocessing will increase the rate of redundancy operations (Khalil *et al*., 2013). Therefore, innovation of cement production processes need to be applied using Lean Manufacturing principle consists of waste identification and elimination. The innovation of production processes at *Indarung* V Plant of PT Semen Padang will make effect in increasing the product value and development growth.

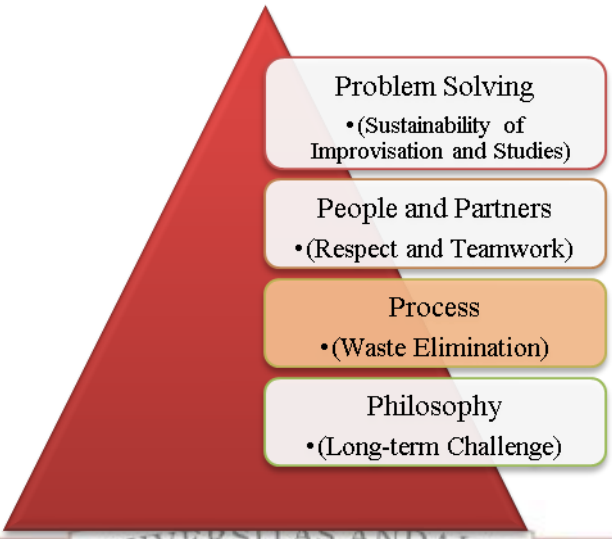


Figure 1.2 4P Categories of Toyota Production System Principle (Liker, 2010)

1.2 Problem Formulation

Based on the background, the formulation problem in this research is how tominimize wastes in the process of cement production and what suggestion can be proposed to PT Semen Padang in improving the cement production process?

1.3 Research Objectives

The objectives of this research are as follows:

1. Identify wastes in the cement production process at PT Semen Padang.
2. Develop an improvement based on the lean manufacturing principles application in the cement production process at PT Semen Padang.

1.4 Research Scopes

Problem limitations in this research are as follows:

1. Research conducted in the *Indarung* V Plant of PT Semen Padang.
2. Research objects only for raw mill, kiln, and cement mill.

3. Data of machine running time, data of production planning and execution, data of material consumption, and data of failure activity in the Indarung V Plant used start from July until December 2015.

1.5 Assumption

Assumption in this research is the activity flow assumed in constant during the research.

1.6 Outline of Report

This report consists of five chapters as follow:

CHAPTER I INTRODUCTION

This chapter contains background, problem formulation, the research objectives, the research scopes, assumption and report outline.

CHAPTER II LITERATURE REVIEW

This chapter contains the theories used to solve the research problems consist of lean manufacturing, lean manufacturing in cement industry, waste identification of lean manufacturing, seven wastes, Value Stream Mapping (VSM), Waste Identification, Value Stream Analysis Tools (VALSAT), Cause and Effect Diagram, and Failure Mode and Effect Analysis (FMEA).

CHAPTER III RESEARCH METHODOLOGY

This chapter contains the steps in carrying out the research started from the preliminary study, identify problems, questionnaire development, data collection, data processing, Current-Future State Mapping based Value Stream Mapping (VSM), determining roots of the problem using Cause and Effect Diagram, consecutive tools in analyzing waste through Value Stream Analysis Tools (VALSAT), determining the potential errors or failure in a system with Failure Mode Effect and Analysis

(FMEA), application lean manufacturing in cement industry, analysis, conclusions, and recommendations.

CHAPTER IV RESULTS AND DISCUSSIONS

This chapter contains the results of research and discussion. Research starts with preliminary and literature study about lean manufacturing, problem identification and formulation, and questionnaire development and validation. Data collection conducted in Indarung V Plant and Planning and Production Technical Department of PT Semen Padang. After that, data is processed with five methods: Value Stream Mapping (VSM), Waste Identification Methods, Value Stream Analysis Tools (VALSAT), Cause and Effect Diagram, and Failure Mode and Effect Analysis (FMEA). Discussion of the research results is about the application of lean manufacturing methods in PT Semen Padang.

CHAPTER V CONCLUSIONS

This chapter contains about conclusions from research results and suggestions for further research.

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