Chapter 1

INTRODUCTION

1.1 INTRODUCTION

Since the 1990s, the manufacturing industry has been facing dramatic changes at an accelerated rate, and reducing waste and inventory level are becoming the most important in competing with other enterprises. The changing business environment brings huge pressure on the enterprises business activities. These uncertain and unpredictable changes force the enterprises to take proper action in order not to lose competitive advantage, and to keep the advantaged competitive position. The concept of flexible manufacturing system has been implemented in response to these challenges for companies. The objectives of flexible manufacturing system are to present opportunities for manufacturers to improve their technology, competitiveness, and profitability through a highly efficient and focused approach to manufacturing effectiveness (Buzacott *et. al.*, 1986).

1.2 BACKGROUND OF THE STUDY

For every factory, waste and inventory level should be reduced as much as possible. In order to achieve these, a fertilizer plant must have a flexible, adaptive and reconfigurable paradigm that can be entitled by a unique term: Flexible Manufacturing Systems (FMS). The primary reason for implementing FMS lies in its versatility (flexibility). In general, increased flexibility enables a company to adjust more easily to

changes in the market place and in customer requirements, while maintaining high quality standards for its products. There are many ways and enabling technologies developed by researchers to help a plant to achieve “flexibility”, but suitability of implementing the enabling technologies is a critical issue raised by a user. This case study is going to find the particular problems and generate solutions to the fertilizer plant. A suitable enabling technology is implemented in the fertilizer plant of research. To be exactly, flexible manufacturing system (FMS) is integrated in the fertilizer plant of research and results of before and after implementation are compared. The framework of the study is following PDSA cycle.

1.3 PROBLEM STATEMENT

The problem statements of the study are explained in the following paragraphs. Data shown below is based on the data of month March 2010.

- **Loss of Material**

The loss of material is considered as a waste to the fertilizer plant. For every working hour, 14.41 tons or 32.76 percent of material was lost. The loss of material happened at the end on each conveyor belts. The loss of material was mainly caused by improper moving speed of the conveyor belts and uneven weight distribution of powder material on the conveyor belts. The loss of material caused decrement in productivity, environmental problems, formation of soil, machines breakdown, lower the performance of equipment and deterioration of quality of the products.

- **Low Productivity**

The planned monthly output was 9856 tons, but the actual monthly output was 6628.16 tons, which was considered as low productivity. The low productivity was caused by a huge loss of material during processing of raw material. The low productivity caused late delivery time to customer and low production capacity.

- **Low Machine Utilization and OEE**

Planned Overall Equipment Effectiveness (OEE) of machines was 60 percent, but the measured OEE was 32.44 percent, which was considered as low machine utilization. The low OEE value happened at the key machines of the plant. Low machine utilization was caused by loss of material during processing of raw material, hazardous and dirty working environment, formation of soil, machines breakdown, low performance of equipment and bad quality of the products. Low OEE of machine caused low profit or earning capacity and high percentage of losses.

- **High Quantity of Reworked Material**

Reworked material adds load to WIP material, and results in higher inventory level of the plant. The measured quantity of reworked material was 153.12 tons. High quantity of reworked material was caused by loss of material. The loss of material indirectly degraded the quality of the products, so the products had to be reworked to recover their quality. High quantity of reworked material disrupted schedule of the plant and caused late delivery to customer. The details of the problem are explained in page 69.

1.4 GOAL AND OBJECTIVE OF THE STUDY

The main goal of this study is to reduce waste and inventory of the plant. The objectives of this study are:

- To reduce the level of loss of material to about 15 percent, or 6.6 tons per hour after 3 months of implementing Flexible Manufacturing System.
- To increase the monthly output to about 8000 tons (20%) after 3 months of implementing FMS.
- To increase the Overall Equipment Effectiveness of machines to about 60 percent after 3 months of implementing FMS.
- To reduce the reworked material per month to about 90 tons (40%) after 3 months of implementing FMS.

1.5 SCOPE AND LIMITATION OF THE STUDY

The study is focusing on key machines of a GT cell of the plant. The limitations of this study are as below:

- Due to time constraint, this study could not cover all the machines and equipment that are available in fertilizer plant.
- The ideal moving speed of the conveyor belts is determined by Taguchi's matrix and ANOVA. The calculation is not discussed in this study to avoid infringement.
- This study does not focused on the sophisticated mechanical and electrical aspects of the FMS, but brief explanation is given.

1.6 METHODOLOGY OF THE STUDY

The methodology of this study is shown in Figure 1.1. The framework of study follows PDSA cycle, which is explained in chapter 3 and 4.

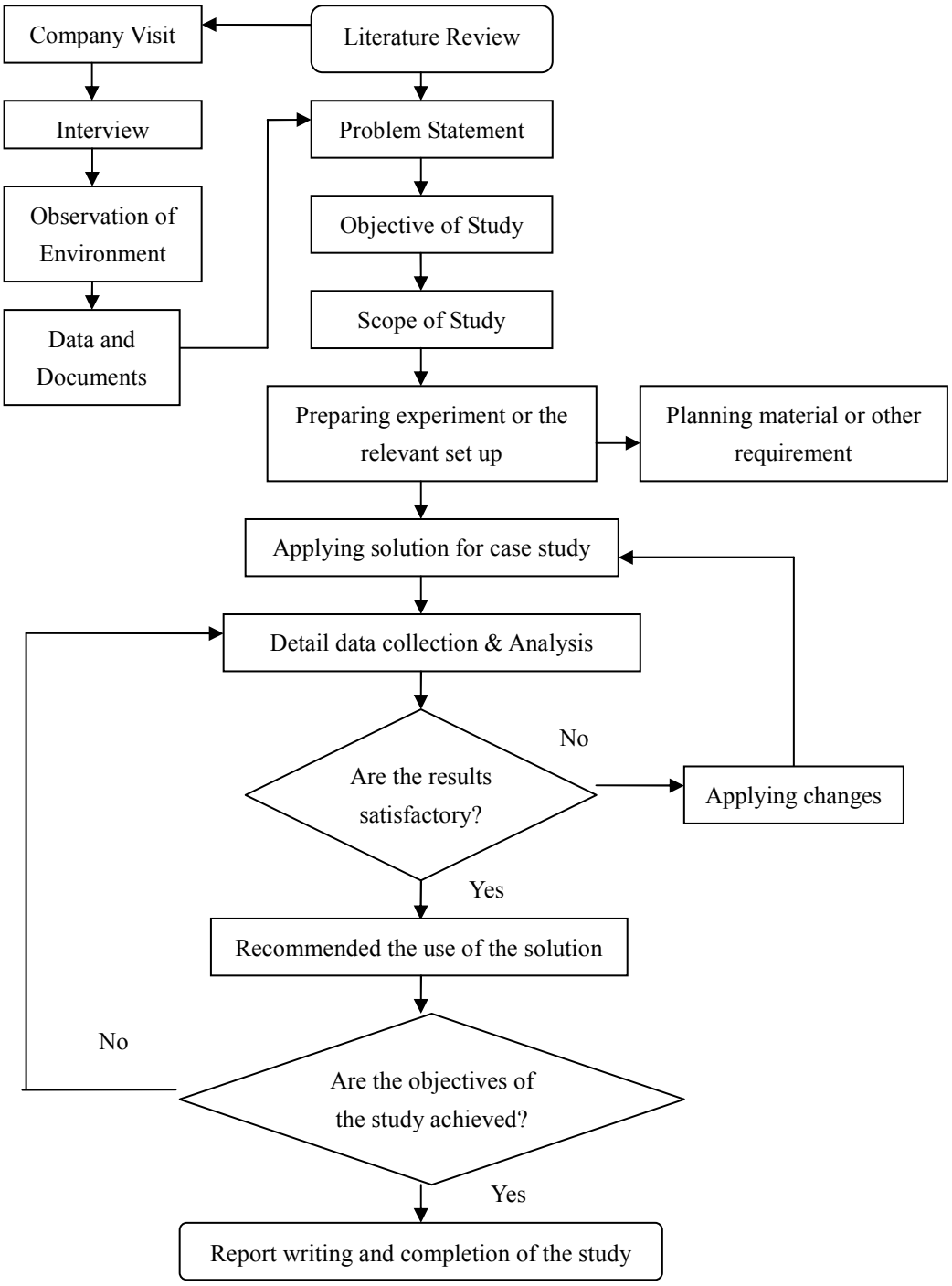

Figure 1.1 Methodology of the study

1.7 ARRANGEMENT OF THE DISSERTATION

This dissertation contains six chapters. The main contents of these chapters are as below:

Chapter 1 is an introduction to the background, objectives, limitations and methodology of the study.

Chapter 2 contains literature review of agile and flexible manufacturing strategies, framework, tools, introduction of FMS, TPM and PDSA cycle.

Chapter 3 shows the research design and methodology, company profile and the description of the project.

Chapter 4 includes framework of data collection, summarized data of the plant and the explanation of implementing FMS.

Chapter 5 shows the analysis of the data collected, results, discussion on the results and improvement evaluation.

Chapter 6 concludes all the analysis and results of this study.