# PROPOSING FUTURE VALUE STREAM MAPPING FOR SAFETY PIN MANUFACTURE

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA
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## PROPOSING FUTURE VALUE STREAM MAPPING FOR SAFETY PIN MANUFACTURE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Management)(Hons.)

by

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# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

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# APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) (Hons.). The member of the supervisory is as follow:

……

(PROFESOR MADYA DR MOHD RIZAL BIN SALLEH)

# Abstract

This study is regarding the study of production flow of a manufacturing company that has high lead time to complete production of one product. Value Stream Mapping (VSM) is one of the lean manufacturing technique used to identify wastes occurred in the production line. From the analysis of the Current Value Stream Mapping (CVSM), the root causes of the problem and also wastes occurred are identified. By referring the root causes occurred, the improvement can be proposed and can being visualized in the Future Value Stream Mapping (FVSM). Simulation is used to mimic the actual current condition and the bottleneck of the process can be shown by using simulation. The problem detected from the simulation result can be improved by using lean tools or by using simulation.

# Abstrak

Kajian ini berkaitan dengan aliran produksi oleh sebuah syarikat pembuatan yang mempunyai lead time yang tinggi untuk menyiapkan satu produk. 'Value Stream Mapping (VSM)' ialah salah satu kaedah 'lean manufacturing' yang digunakan untuk mengenal pasti sisa atau perkara yang tidak diperlukan yang terjadi di dalam barisan produksi. Dari analisis dari 'Current Value Stream Mapping (CVSM)', punca berlakunya masalah dan juga terdapatnya perkara yang tidak diperlukan dapat dikenal pasti. Berdasarkan punca masalah yang terjadi, beberapa kaedah peningkatan dapat dicadangkan dan juga ditunjukkan di dalam 'Future Value Stream Mapping (FVSM)'. Simulatsi digunakan untuk meniru keadaan sebenar produksi dan sebarang permasalahan di dalam process dapat ditunjukkan melalui simulasi.

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VSM - Value Stream Mapping

VA - Value Added activity

NVA – Non-Value Added activity

CVSM - Current Value Stream Mapping

FVSM - Future Value Stream Mapping

WIP - Work In Progress

# CHAPTER 1

This introductory chapter has provided some background of the project. This chapter explains about the background, problem statement, company background and objectives of the project. Lastly, scope and limitation of the project is discribed in this chapter.

## 1.1 Background

The manufacturing industry is becoming more competitive and struggle to increase their efficiency and productivity. Each company comes out with variety of tools, techniques or methods to solve the problem. There are many types of waste occurred in the industries. Lean manufacturing is one of the best techniques to reduce or eliminate waste. Lean manufacturing is a systematic operation or strategy in reducing or eliminating waste. There are variety types of lean manufacturing tools or techniques such as 5S, Kaizen, Kanban, Value Stream Mapping, Andon, Jidoka and others. One of effective techniques that can be used in identifying the wastes is Value Stream Mapping. Value Stream Mapping (VSM) is used in many of manufacturing industries to identify its wastes.

VSM is a visualization technique that is applied in many fields, especially in manufacturing industries to identify wastes. It is used to analyze the flow material and information starting from the raw material of the product until the last part of the process that is usually packing or shipping process. VSM can be functioned as beginning point towards engineers, management, suppliers, schedulers, production associates, and customers in helping them to identify waste and also the source of the

waste. Beside visualization techniques, VSM also can be used as communication tool, business planning tools and management process tool.

## 1.2 Problem Statement

Prym Consumer Malaysia Sdn Bhd is a manufacturing company located at Tanjung Kling, Melaka, Malaysia. Prym manufactured products related to needlecraft and sewing. Almost 95% of product manufactured by Prym are exported to other countries.

As a manufacturing company, Prym Consumer also facing with the same other manufacturing company which is problem that related to wastes; longer lead time and cycle time of process time. One of the highest customer demand products in Prym is safety pin. There are 23 types of safety pin and these safety pins undergo the same production safety, but a different finishing process; nickel and passivation. Duration of producing a safety pin is approximately process is 14.5 days. The main problem is related to its lead time and cycle time. The process of the safety pin manufacturing is the continuous production line starting from the receiving raw material until the finished goods. Delay, machine breakdown, defects, and other problem may affect the lead time and cycle time of the production. The process also cannot be continued if the previous process was incomplete.

"Pack on Demand" is the upcoming company project proposed by the engineer to shorten the lead time. The objective of the project is to reduce the production time from 19 weeks into 15 weeks. VSM is acknowledged as the best technique in identifying the waste and the source of the waste occurred along the manufactured process. VSM is needed in to visualize the current process map together with the material and information flow starting from the ordering process until the last process as for Prym, its last process is shipping.

## 1.3 Company Background

Prym Consumer Malaysia Sdn. Bhd. is a sewing and handicraft accessories production company located in Tanjung Kling Free Trade Zone, Melaka. It is incorporated under the name of Newey (Malaysia) Sdn. Bhd. on 1st January 1975, Newey officially commenced production. On 6th March 2000, it changed its name to Prym Newey Malaysia Sdn. Bhd. and on 28th November 2005, it changed its name to Prym Consumer Malaysia Sdn. Bhd.

For Prym Consumer, over 95% of the company's product are exported to other countries such as the United States of America, Canada, United Kingdom, Australia, Latin America, Africa, and Asia with the balance sold to the local companies located either in Free Trade Zones or possessing licensed manufacturing warehouse status. The company is the largest supplier of hard haberdashery to the US and European markets.

Prym Consumer Malaysia Sdn. Bhd. consists of three divisions, namely Haberdashery Division Manufacturing, Intimates Division Manufacturing and Factored Items Division Manufacturing. For Haberdashery Division Manufacturing, its core-manufactured products are safety pins, straight pins, pin balls, pearlised pins and hooks and eyes. For Intimates Division Manufacturing, its products ranging from continuous tape sewing, ultrasonic cutting and sealing, to extender and bra-back sewing, with build in dye house that achieved fashion colors to the industry standard.

Figure 1.1:Prym Consumer Malaysia Sdn. Bhd

## 1.4 Objective

a) To understand and collect the data of current process flow of safety pin at Prym Consumer Malaysia Sdn Bhd.

b) To create and analyze Current Value Stream Mapping (CVSM) and identify the existing of wastes in the production processes.

c) To propose Future Value Stream Mapping (FVSM).

d) To validate Future Value Stream Mapping using simulation tool.

## 1.5 Scope

This case study focuses on analyzing the manufacturing processes of an industry and identifying the wastes occurred along the processes. This project will be carried out at Prym Consumer Malaysia Sdn Bhd, Melaka. The product chosen is safety pin which has the highest customer demand and also having acritical lead time compared to other products. This case study will be conducted in Haberdashery Division

Manufacturing which the primary production line located and also at the Factored Items Division Manufacturing or packaging division. Each information or data in all processes starting from raw material up until last process, shipping will be analyzed to identify the wastes. Value Stream Mapping (VSM) is the best technique in carrying out this project. Current Value Stream Mapping (CVSM) is used to construct the current flow of the process in visualization form. Simulation tools will be used to validate the VSM and also functioned as the tool to propose the Future Value Stream Mapping (FVSM). The consequence from the result of simulation will be used to propose the best of lean manufacturing tools or techniques for improvement plan.

# CHAPTER 2
# LITERATURE REVIEW

This chapter of the report is made on reviews of the existing research that related to the project title. All the reviews such as lean manufacturing, value stream mapping, simulation and others important factor will be discussed in this chapter. All the information was collected and sorts in order to make this project run properly.

## 2.1 Lean Manufacturing

Lean manufacturing has increasingly been applied in many industries, especially in manufacturing industries. Lean manufacturing or also known as Lean Production is a manufacturing concept based on the fundamental goals of Toyota Production System (TPS). The fundamental goals of TPS are focusing on minimizing wastes and to maximize customer value. Lean manufacturing is defined as a systematic method of minimizing the waste to maximize value, and by flowing the product or service at the pull of customer demand (Locher, 2008). According to Bayou and Korvin, (2008), lean manufacturing is one of a strategy to earn less input for a better achievement of the organization's goals through producing better output, where 'input' is referred to the physical quantity of resources used and their costs, while for 'output', it is referred as the quality and quantity of the products sold and the corresponding customer services.

Idea of lean was generated by Henry Ford as he required organizing the worker to provide an efficient mass production system. Ford arranged fabrication steps in process sequence wherever possible using special-purpose machines and go or no-go gauge to fabricate and assemble the components going into the vehicle within a few

minutes, and deliver perfectly fitting components directly to line-side (Lean Enterprise Institute, 2010). The idea of Ford is put together when he designed the production line for his new model T Ford. But, Ford did not invent much of it as the problem of his production line was not flexible. Toyota is enhancing the idea of the lean after the Second World War. Japanese manufacturer facing the shortages of material, financial and also human resources. Toyoda, Shigeo Shingo and Taiichi Ohno put idea together initiating a new, disciplined, process-oriented system that is known as 'Toyota Production System' (Fawaz & Jayant, 2005).

### 2.1.1 Principle of Lean Manufacturing

Lean is a philosophy that began with five principles that also known as lean thinking. Based on Womack and Jones, (1996), there are 5 principles of lean manufacturing. Figure 2.1 is the lean principles proposed by Womack and Jones (1996):

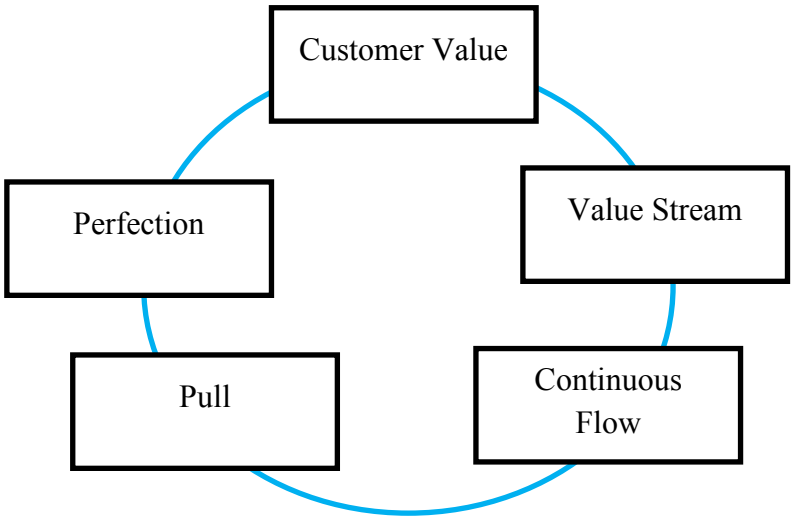


Figure 2.1: Principle of Lean Manufacturing

#### 2.1.1.1 Customer Value

Customer value is based on customer requirement or demand. The critical starting point of lean is identifying the customer value. The information of product that customers willing to pay for and only are defined by the customer is the value of significance (Womack and Jones, 1996). Value can be defined from the vantage point of the customer.

#### 2.1.1.2 Value Stream

The second step in lean principle is to identify and mapping the value stream. A value stream is an entire set of activities involving all parts of the organization starting from the starting point of raw material until the delivering the product or service. The value stream mapping also is the activity that is conducted correctly and in the right sequence of process flow, produce the product or services from the customer requirement. The value stream map is a tool used to show the flow of material and information from beginning, followed by production process until finished good.

#### 2.1.1.3 Continuous Flow

The next step in lean principle is a continuous flow. Flow in ideal state, simply implies a seamless sequence of activity throughout the process, with no stalls, no disruptions, and no disconnect or backtrack loops (Carreira, 2005). According to Womack and Jones, (1996) flow can be referred as progressive achievement of tasks along the value stream. Womack and Jones (1996) also mentioned that continuous flow is the movement of products from workplace to workplace. Flow is concerned about achieving a holistic route through the development of the product.

#### 2.1.1.4 Pull

The forth principle implies that the product produced is based on demand. Pull concept are conducted when they are required to be done, not before the demand. According to Womack and Jones, (1996) pull theory is the concept of letting the customer required the product for you as they need rather than pushing concept of product. Manufacture or production only responds towards the requirement by making the customer demand and only the customer want that product or services.

#### 2.1.1.5 Perfection

The last step in lean principle is continuous improvement. The essential of principle of a lean manufacturing is the continuous improvement and seek for the perfection. After the implantation of the other four principles, one should understand the system and process better and hence, able to generate ideas for improvement (McCarren, 2005). Lean system can be leaner and faster beside it is easier to identify and eliminate waste occurred as waste become more visible.

### 2.1.2 Type of Waste in Lean Manufacturing

Waste can be defined as the activity that add cost, but do not add value to the product. Waste also can be defined as "to use, consume, spend, or expend thoughtlessly or carelessly" (Nash & Poling, 2008). Waste cannot be totally eliminated, but it can be removed or reduced in another way to ensure that waste will not affect the productivity. These activities which add cost, but do not produce better product, from the customer's vantage point. They are non-value added (NVA) activity, as they did not add any value from the customer's point of view (Carreira, 2005). Taiichi Ohno, the Toyota's Chief Engineering was the pioneer that discovers about the seven types of wastes. The seven types of wastes are:

a) Overproduction

Overproduction means making too much compared to the order, too early or produces it without any requirement. This can lead to other wastes such as waiting, inventory and others.

b) Unnecessary inventory

There are three types of inventory such as raw material, work in process (WIP) and finished goods. Inventory will be identified as a waste when the inventory is not needed to accomplish the customer requirement.

c) Transportation

Transportation may appear unnecessary, but actually it does add value. The movement between the processes, materials or double handling can become wastes. For double handling, it may involve manpower which it can affect the productivity or the quality product.

d) Over processing

Over processing can occur in situations which the simple process is done through a complex solution. Steps such as rework, repairing poor quality or correcting mistakes also can be determined as over processing. Setup and changeover cost also categorized as over processing as it is non-value added (NVA) and very sensitive process (Carreira, 2008). A capable process requires a few things in order not to making any defect such as correct method, training and standard requirement (Amelia et al., 2013). It is NVA as it consumes time and machines towards the manufacturing process.

e) Defect

A product which is working on the point in the process when it is determined that something is wrong; characteristics of the product out of specification, something do not look quite right, something that does not meet the aesthetic expectation (Carreira, 2008). The defect is a direct cost for both short and long term. It leads to the cost growth of the cost used in materials and labors for the production.

f) Waiting

Waiting can be considered as a waste when time is not being used effectively. Products or services that are waiting to proceed to the next process due to longer processing time from the previous process, will have to wait for cycle to be completed or waiting for a meeting to be started are the examples of wastes. The waiting occurred due to a few factors such as lack of work knowledge, unmatched worker and machine performance, stock out, capacity bottleneck and machine breakdown.

g) Unnecessary motion

Motion is a type of waste that refers to people, which including the work areas. Besides that, the motion also can become wastes as the unnecessary motion of labor or machines in the production process occurred as it is Non-Value Added activity (NVA) towards the production. The excessive distance travelled or reached by the people in completing their work, including excessive twists or turns, lots of walking, uncomfortable reaches or pickups, lots of movement in reaching the equipment or tools and others are also categorized as motion wastes (Carreira, 2008).

### 2.1.3 Type of Operations

In the manufacturing production flow, there are three types of the operational activities that people engage in related to the customer. The three types of operations are:

a) Value Added (VA)

This type of operation is defined as the activity that gives value and makes better product. Based on Carreira, (2008), there are two important notes regarding VA; definition of value is always in the eyes of the customer and the end result of this cycle of activity is the receipt of cash in the process.

b) Non-Value Added (NVA)

NVA is an activity that not added any value to the products. It is not advancing the product to become a better product and customers are not willing to pay for it.

c) Required Non-Value Added

This activity may be wasteful, but for certain situations, it may necessary to put it in the process.

## 2.2 Value Stream Mapping (VSM)

VSM is one of lean manufacturing techniques that is used to eliminate or reducing waste. VSM is used to analyze the flow material and information starting from the raw material of the product until the last part of the manufacture which is usually will be packing or shipping process. VSM is one of a technique that was initiated from Toyota Way and used in searching for improvement opportunities.

The value stream map will show the current steps of the production, delays, information flows or bottleneck occurred during the production flow. The current value state will visualize the wastes occurred in the production and engineer or management can take action in reducing or eliminating the wastes. After the analysis of the current state map, future state map is proposed as the enhancement from the current state map. Constructing the current VSM would be easier since it is from the existing production flow.

VSM is a costly technique as it required the organization time and resources as it is required detailed screening process if there are NVA in each of the processes in the production line (Perumal, 2014). VSM is also known as a visualize technique as it will point out all the wastes occurred starting from the beginning point of the manufacturing line which is the raw material until the last process of the finishing goods. VSM helps most of the organizational parts such as engineer, management, suppliers and others to identify waste in order to increase the productivity and for better performance.

### 2.2.1 Basic Tool of VSM

There is the basic tool that is important to construct VSM; icons in VSM and basic steps in creating VSM.

#### 2.2.1.1 Symbols of Value Stream Mapping

VSM is known as information and material flow mapping. Many types of symbol are used in developing VSM. According to Perumal, 2014, there are four types of symbols which are material flow, information flow, general flow and process symbols. The table for the four types of symbols is provided in the Appendices.

#### 2.2.1.2 Basic Steps in Completing VSM

There are a few basic steps in VSM. VSM can be created by using pencil and a piece of paper but nowadays, there is an easier way to create VSM. VSM can be created by using software such as Microsoft Excel, Microsoft Vision and others. The basic steps act as guidline to create VSM. Table 2.1 shows the steps use in the VSM development.