



**Faculty of Manufacturing Engineering**

**WASTE REDUCTION IN HEALTHCARE DEPARTMENT BY  
IMPLEMENTING VALUE  
STREAM MAPPING TECHNIQUE**

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**Master of Manufacturing Engineering (Industrial Engineering)**

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IMPLEMENTING VALUE  
STREAM MAPPING TECHNIQUE**

**NOR WAHIDA BINTI HASBULLAH**

**A thesis submitted in fulfillment of the requirement of the degree of Master of  
Manufacturing Engineering (Industrial Engineering)**

**Faculty of Manufacturing Engineering**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

## **APPROVAL**

I hereby declare that I have read this report and in my opinion, this report is sufficient in terms of scope and quality as a partial fulfillment of Master of Manufacturing Engineering (Industrial Engineering).

Signature :.....

Supervisor Name :.....

Date :.....

## DECLARATION

I declare that this thesis entitled “Waste Reduction In Healthcare Department By Implementating Value Stream Mapping Technique” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : .....

Date : .....

## **DEDICATION**

For My Project Supervisor, Dr. Effendi bin Mohamad, My Grandparents, Thean Inn Ngan & Lim Young Inn, Father & Mother, Hasbullah bin Jalal & Nor Hazlin Thean bte Abdullah, thanks for everything.

## ABSTRACT

Although lean manufacturing has been employed in different sectors, its usage is more prominent in the manufacturing area. However, now the trend is certainly also spreading to other domains like the hotel and the healthcare sectors. In the healthcare domain, this approach is typically called lean healthcare. For several years, patient waiting time has remained a grave concern. Initially, it might look like the patient is not perturbed about waiting for a treatment. However, it was clear from a survey conducted in the service sector that the waiting experience is typically disapproving and has evidently impacted the overall contentment of customers with the service being offered. In Malaysia, the overall waiting time for patients in different clinics ranges from 18 to 85 minutes. Around 21 percent of patients seem to be discontented; in other words, their experienced was unfair. This study, carried out in Polyclinic Ayer Keroh, Melaka, involves workers and patients connected to the healthcare system. A robust lean tool called Value Stream Mapping is formulated to ascertain the waste existing in the present process of the healthcare system. According to the results, there is an unnecessary waste existing, including personal attitude, ambiguous information, and outmoded patient approach and clinic layout, which cause prolonged waiting times. Recommendations are made for the deployment of a new user interface, Kanban, 5s, and re-design of the present mechanism for healthcare organisations, which offer greater value-added time for patients as well as the staff, thereby decreasing the non-value added time and the waiting time.

## ABSTRAK

Walaupun “Lean” sebenarnya telah lama digunakan dalam pelbagai jenis sektor, tetapi umumnya, penggunaan “Lean” khasnya dalam sektor pembuatan. Walaubagaimanapun, pendekatan “Lean” ini sudah mula tersebar kepada pelbagai bidang lain seperti sektor penjagaan kesihatan dan sektor perhotelan. Sektor penjagaan kesihatan, biasanya diiktiraf sebagai “Lean” dalam penjagaan kesihatan. Selama bertahun-tahun, masa menunggu bagi setiap pesakit telah menjadi satu isu yang serius. Secara kasarnya, ia mungkin kelihatan seperti pesakit tidak peduli menunggu untuk mendapatkan rawatan. Walau bagaimanapun kajian daripada sektor perkhidmatan mendedahkan bahawa waktu menunggu biasanya tidak menguntungkan dan telah terbukti untuk mempengaruhi kepuasan keseluruhan pengguna dengan perkhidmatan yang diberikan. Keseluruhan masa menunggu bagi setiap pesakit di seluruh klinik dalam Malaysia adalah dari 18 minit hingga 85 minit. Sekitar 21% daripada pesakit cenderung kepada sikap tidak berpuas hati dan menunjukkan bahawa yang berpengalaman adalah tidak munasabah. Kajian ini dijalankan di Poliklinik Ayer Keroh, Melaka dan ia melibatkan pesakit dan pekerja yang mengambil bahagian dalam sistem penjagaan kesihatan. Satu teknik yang dikenali sebagai “Value Stream Mapping” akan digunakan untuk menentukan kewujudan proses yang tidak relevan di dalam sistem semasa. Hasil kajian menunjukkan bahawa terdapat kewujudan proses yang tidak relevan yang sepatutnya dielakkan seperti sikap kakitangan, maklumat yang tidak jelas, berlebihan pesakit dan susun atur klinik dalam sistem yang membawa kepada masa menunggu yang lama bagi setiap pesakit. Antara cadangan yang dibentangkan untuk mengatasi masalah yang diketengahkan adalah penggunaan sistem 5s, Kanban dan susun atur semula sistem semasa di mana masa yang diperuntukkan untuk proses yang relevan akan bertambah dan boleh digunakan oleh kedua-dua pesakit dan kakitangan sekali gus mengurangkan masa menunggu bagi setiap pesakit.

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## LIST OF ABBREVIATION

BMI	-	Body Measure Index
CSM	-	Current State Map
FSM	-	Future State Map
LM	-	Lean Manufacturing
NMRR-		National Malaysian Research Registry
SMED-		Single Minute Exchange Of Die
UTM	-	Universiti Teknologi Malaysia
UI	-	User Interface
VA	-	Value Added
NVA	-	Non-Value Added
WIP	-	Work In Process

## CHAPTER 1

### INTRODUCTION

#### 1.0 Background

Health-related organizations tend to be under an intense burden to enhance productivity (Johari *et al.*, 2011). The requirements for health care services is growing, and yet monetary circumstances concerning health care systems is not boosting (Potrafke, 2010). In this doctrine, healthcare systems are stunted to be as reasonably priced, easily accessible, secure, comprehensive, reliable and cost-effective as feasible (Zhu, 2013). Conceptually is actually uncomplicated and yet is not even simplistic to clearly define the term Lean, the core philosophy regarding this specific keyword is towards continuous improve any kind of plan of action by means of reduction or elimination of all the tasks non-value added or “mudas” in Japanese (Radnor, Howleg, & Waring 2012).

Significantly more than 1600 content articles associated along with the term Lean, have been circulated since 1982, around the world (Arrieta and Giraldo, 2014). Lean Manufacturing has actually been utilized in various types of sectors, but predominantly in manufacturing sectors (Zaharee *et al.*, 2014). Presently, these specific approaches are definitely shifting towards various other areas such as the healthcare sector, hotel sector, within the healthcare sector, are usually recognized as Lean Healthcare (Joosten *et al.*, 2009). Numerous healthcare organizations in Europe country like Scotland cancer Treatment, the Royal Bolton Hospital, Nebraska Medical Center, the Pittsburgh General Hospital and Flinders Medical Centre adopt

the Toyota Production System as the overall performance enhancement strategy along with outstanding outcomes maximizing customer service as well as work circumstances towards the people who works in those hospitals (Arrieta and Giraldo, 2014).

In order to start accomplishing Lean thinking in healthcare is to place the patient in the foreground or a highlight as well as include the period and comfort as the essential overall performance or efficiency measures of the system (Ramseook *et al.*, 2010). The lean principles as multi-skilled teams taking care of the patient and an active participation of the patient in the process were emphasized (Fillingham, 2007).

Hence, an analysis of the health care sector system should be immediately done in order to achieve the Lean goals and increase the productivity. This proposal aims to utilize analysis result by the implementation of Lean tools so that the health care sector can refer to it in order to create a new system to enhance the productivity as well as reducing and eliminate all non-value added activities in the system.

## **1.1 Purpose**

The focus of this project is to understand the productivity level of current systems in healthcare services in Malaysia. The productivity is measured based on the interaction between the patients (the customer) with the staff (the worker) and vice versa, plus the compatibility of the patients and the staff to the current system installed in healthcare services.

This project is primarily concerned with the time taken for each action between the patients, the staff and their interface with the present system. To achieve this, the equipment or process that was used in this experiment is:

- a) Observation of recent flow in a system of Healthcare. This is to specify a value from the standpoint of the end customer (the patient) and to identify the value stream.
- b) Time study used in this project to study the time taken in each step involve in the Healthcare system between the patient, staff, and the system as well as to enhance the time needed to complete each task involved in each step in a system of Healthcare.
- c) Implementing value stream mapping as lean tools in order to attain the time study more distinctly and to confirm which task lead to bottleneck as well as to eliminate the bottleneck as reduce the time taken and the total lead time in the Healthcare system.

## **1.2 Problem Statement**

For many years, the patient waiting time has become a serious issue. This is because the waiting time of the patient is a measure of organizational efficiency (Pillay et al, 2011). At first glance, it may seem like the patient is not bothered to wait for a treatment. However, according to Barlow (2002), the survey of service sector reveals that waiting experience is commonly unfavorable and have been proven to influence overall satisfaction of consumers with the service being provided. Pillay et al (2011) mentioned that the overall waiting time of patients in various clinics in Malaysia is from 18 minutes to 85 minutes in which 21% of patients tends to be dissatisfied and indicates that the experienced was unreasonable. If this is continued to be happening for a long term, government and clinics will face a serious loss as extra waiting time is where the resources are not used to improve patients medical condition. According to Barlow (2002), the patient will lose their valuable time while hospital lost their reputation and staff will experience tension and stress. It is a loss-loss strategy. A study will be

conducted in the Ayer Keroh Health Clinic to observe the flow of the patient and staff that may lead to the excess waiting time. A current value map will be created and lean tools will be used to overcome the issue. A simulation will be conducted to verify the compatibility of the future value map process flow.

### **1.3 Research Objectives**

During the observation, an abundance of waste is created by the patient and staff due to the incompatibility with the current system. There are a few objectives of the research:

- a) To develop the current state map.
- b) To determine waste based on the current state map.
- c) To create the future state value stream map of healthcare.
- d) To analyze the efficiency of value stream map in reducing waste in healthcare.

### **1.4 Research Scope**

There are several research scopes of this study:

- a) This research will be conducted in Poliklinik in Ayer Keroh, Malaysia.
- b) This research will involve patients and workers that engage in Pregnancy and Outpatient department.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Lean Definitions

Lean is a philosophy of continuous, incremental improvement (Graban and Natalie., 2007). The lean approach aims towards minimizing waste everywhere within an organization, enhance primary sources as well as set up a firm cultivation focusing on foreseeing out and continuously implementing lean fundamentals to encourage customer contentment (Dahlgard *et al.*, 2011).

In 1970's, Toyota Production System (TPS) was the first introduced the word Lean (Monden, 1983). The word "lean" then become prominent when Womack and Jones (1990) introduced the book *The Machine That Changed the World*. This book describes the successful story of Eiji Toyoda and Thaicchi Ohno in developing the Toyota Motor Company in Japan.

There are vast of different definitions of lean. After all, most of the definitions share the same concept and meaning. For example, Buzby et al., (2002) said that from National Institute of Science and Technology (NIST) Manufacturing Extension Partnership (MEP) had defined lean as "A systematic approach to identifying and eliminating waste (non-value-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection". (NIST/MEP, 1998). While Shah and Ward (2003) define Lean as a multidimensional strategy, dealing with a broad scope of management plans, including just in

time techniques, high-quality programs, cellular manufacturing, group efforts and supply chain management inside an incorporated program.

According to this idea of Lean, it is implemented in all the organization in various industries mainly manufacturing industry. In a similar way, Shah and Ward (2007), describe lean as an integrated social approach method which usually principal goal is to cut down on suppliers wastes, customers wastes and the inside the vendor variableness.

## **2.2 Lean in Manufacturing**

Arslankaya and Atay (2015) explain the application 5s and computerize methods in order to get rid of losses that caused by malfunctions at the maintenance workshop department of the dairy product production. Choomlucksana *et al.*, 2015 in their paper used lean manufacturing tools such as visual control, poka-yoke, and 5s to help in reducing waste as well as boost the efficiency of the production process of a sheet metal stamping area. Rohani and Zahraee (2015) also Rahani and al-Ashraf (2012) in a different paper use a value stream mapping (VSM) technique in improving the production line of a color industry and process industry respectively. Faulkner and Badurdeen (2014) use VSM in visualizing waste in the manufacturing process as well as to use the method in producing more sustainable products. Atieh *et al.*, 2016 use VSM in glass fabrication process company to tackle the long lead time and unbalance production line. Besides that, others lean technique such as kaizen and visualization is being used in process flow improvement of an organization (Singh. *et al.*, 2016). While Dixit and Gohil (2015) explore the use of VSM as the main tool used to identify bottlenecks in the manufacturing process of taper roller bearing so that bottlenecks can be

improved or eliminated to improve flow through the process leading to increased net throughput of the production system. Mulla *et al.*, 2014 emphasizes the use of Single Minute Exchange or Die (SMED) to reduce the change over time in pump manufacturing industry. Sabaghi *et al.*, 2014 revealed the use of kanban and VSM in a plastic fabrication company to reduce setup time in the company.

Korytkowski (2014) has successfully install Heijunka technique to level the assembly line as well as the production line. With the implementation of Heijunka, normally the fluctuation in customer orders can perform directly to the manufacturing system (Pawlewski and Greenwood., 2014). In India, Salunke and Hebbar (2015) have been installing the VSM as one of the tools to reduce lead time plus for continuous improvement. In the different journal from Muvunzi *et al* (2013) also efficiently installing the VSM technique to improve productivity in a company in Zimbabwe. In Malaysia, the journal from Esfandyari *et al* (2011) has also shown a successful story of VSM implementation in the manufacturing company in which the lead time of the production is greatly reduced. While in Spain, Serrano *et al* (2008) has conducted a research and have productively proven that the implementation of VSM in redesigning the manufacturing system is an efficient tool. Ramesh *et al* (2008) discussed how VSM which divided into a current state map and a future state map, help in an organization to identify the non-value added activities in the production process. While Wong and Wong (2011) from Universiti Teknologi Malaysia (UTM), have appropriately discussed the lean approaches in the electrical and electronic company. Not only in the manufacturing of a product, in Sweden, Mutjaba *et al* (2010) has developed a short lead time to produce a software customization. In China, Longhan *et al* (2013) have systematically found the waste generated by CY Company that led to the high cost by implementing the VSM. A case study