

ELIMINATING WASTE: ENHANCEMENT OF
PRODUCTIVITY OF MANUFACTURING COMPANY

MOHD FAHMI BIN AHMAD

UNIVERSITI TEKNIKAL MALAYSIA MELAKA



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**ELIMINATING WASTE: ENHANCEMENT OF PRODUCTIVITY
OF MANUFACTURING COMPANY**

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

By

MOHD FAHMI BIN AHMAD

FACULTY OF MANUFACTURING ENGINEERING

2010



BORANG PENGESAHAN STATUS TESIS*

JUDUL: Eliminating Waste: Enhancement of Productivity of Manufacturing Company

SESI PENGAJIAN: 2009-20010

Saya MOHD FAHMI BIN AHMAD

mengaku membenarkan tesis (PSM/Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hak milik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (√)

SULIT

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD

(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:

(TANDATANGAN PENULIS)

(TANDATANGAN PENYELIA)

Alamat Tetap:
157, Jln Imam Saat,
Kg. Sagil Pt.3,
84020 Tangkak, Johor.

Cop Rasmi:

Tarikh: _____

Tarikh: _____

* Tesis dimaksudkan sebagai tesis bagi Ijazah Doktor Falsafah dan Sarjana secara penyelidikan, atau disertasi bagi pengajian secara keria kursus dan penvelidikan. atau Laporan Projek Sarjana Muda (PSM).
** Jika tesis ini SULIT atau Universiti Teknikal Malaysia Melaka, pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh tesis ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled “Eliminating Waste: Enhancement of Productivity of Manufacturing Companies” is the results of my own research except as cited in references.

Signature :

Author's Name : Mohd Fahmi Bin Ahamd

Date : 20 April 2010

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 Process) with Honours. The members of the supervisory committee are as follow:

.....
(Official Stamp of Supervisor)

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 Process) with Honours. The members of the supervisory committee are as follow:

.....
(Official Stamp of Principle Supervisor)

.....
(Official Stamp of Co-Supervisor)

ABSTRACT

This research addresses the application of the lean manufacturing to the continuous production or processes sector focusing on the automotive manufacturing company. The goal of this research is to investigate how the lean manufacturing can be enhanced the productivity. Thron the evaluation of the problems that have in the automotive manufacturing company and purpose the improvement. a part of that the main focusing is at the Assembly Engine (AE) production line. This research is attempt to identify bottle neck process at the automotive manufacturing industries where are the lean technique are directly applicable. Therefore, the objectives of this research are to implement the concept of lean manufacturing in the automotive manufacturing company, to analyze and identify the wastages, and lastly, to improve the productivity by reducing the wastages.

ABSTRAK

Tajuk projek ini ialah "Menghapuskan Pembaziran: Peningkatan Produktiviti Dalam Perusahaan Pembuatan." Kajian ini bertujuan untuk membahaskan penerapan nilai lean manufacturing untuk diterapkan ke dalam sistem pengeluaran atau sektor pengeluaran dengan memfokuskan pada perusahaan pembuatan kenderaan. Objektif daripada kajian ini adalah untuk menyiasat bagaimana lean manufacturing dapat meningkatkan produktiviti berdasarkan penilaian daripada masalah yang ada di perusahaan pembuatan kenderaan dan bertujuan membaiki proses pengeluaran yang ada di dalam bidang pemasangan injin kenderaan. Selain daripada itu kajian ini bertujuan untuk mengetahui tentang proses kritikal yang terlibat di dalam industri pembuat kenderaan. Oleh kerana itu, tujuan dari penelitian ini adalah untuk menerapkan konsep lean manufacturing di perusahaan pembuatan, untuk menganalisis dan mengenalpasti pembaziran, dan teknik, untuk meningkatkan produktiviti dengan mengurangkan pembaziran

DEDICATION

For my beloved parents and sister, for love, help, and support

ACKNOWLEDGEMENT

First of all, I would like to thank my PSM supervisor, Dr. Mohd Rizal Bin Salleh for his kindness, guidance, experience, advice, constructive ideas, and spending time for discussion regarding this project. He has been “turned me on, turned me around, and boosted me up” with the gift of believing in myself.

Furthermore, to my fellow course mates of 4BMFP who never has been bored to share ideas and state of mind regarding my project; thanks for your time, effort, and opinions. Last but not least, this also goes to my family at home who never stop giving me moral and financial support, especially my parents. The best education starts at home.

TABLE OF CONTENT

Abstract	i
Abstrak	ii
Dedication	iii
Acknowledgement	iv
Table of Content	v
List of Tables	ix
List of Figures	x
List of Abbreviations	xii
1. INTRODUCTION	1
1.1 Introduction	1
1.2 Problem Statement	3
1.3 Objective	4
1.4 Important of the Study	4
1.5 Scope of the Study	5
2. LITERATURE REVIEW	6
2.1 The History of Lean	6
2.2 What Is Lean	7
2.3 Wastes in Lean Manufacturing	11
2.3.1 The Seven Type of Waste	14
2.4 Lean Manufacturing Tools and Technique	15
2.4.1 Kanban	15
2.4.2 Continuous Improvement	16
2.4.3 Just In Time	18
2.4.3.1 Just In Time Production	19
2.4.3.2 Just In Time Distribution	21

2.4.3.3	Just In Time Purchasing	22
2.4.4	Production Smoothing	23
2.4.5	Standardization of Work	24
2.4.6	Total Productive Maintenance	25
2.6.7	Other Waste Reduction	26
2.5	From Lean Manufacturing to Lean Enterprise	27
2.6	Overview of Supply Chain Management	29
2.6.1	Customer Integration	29
2.6.2	Supplier Integration	30
2.6.2.1	Level of Integration	31
2.6.3	Manufacturer Integration	32
2.7	Discrete and Continuous Manufacturing System	33
2.7.1	Application of Lean In discrete Industry	35
2.7.2	Continuous Process Industry and Lean	36
2.8	Value Stream Mapping	37
2.9	Simulation and Value Stream Mapping	41
2.10	Summary	44
3.	METHODOLOGY	45
3.1	Project Planning	45
3.1.1	Planning of Problem Statement, Objectives, and Scope	47
3.1.2	Planning of Literature Review	47
3.1.3	Planning of Methodology	47
3.1.4	Planning of Data Analyzing	48
3.1.5	Planning of Conclusion and Recommendation	48
3.2	Data Gathering	48
3.2.1	Primary Source	48
3.2.2	Secondary Source	49
3.2.3	Discussion	49
3.3.3	Manufacturing Industry	49
3.3	Resource of Information	50

3.3.1	Observation	50
3.4	Gantt Chart	56
4. COMPANY BACKGROUND		58
4.1	Introduction	58
4.2	Department in HMSB Automotive Manufacturer	61
4.3	Assembly Engine Department Layout	62
4.4	Man Power Layout	64
4.5	Assembly Engine Process Cycle	65
5. RESULT & DISCUSSION		70
5.1	Introduction	70
5.2	Problem Identification Using Cause and Effect Diagram	70
5.3	Data Collection	72
5.3.1	Shift A (Day)	72
5.3.2	Shift B (Night)	74
5.4	Line Balancing	76
5.4.1	Line Balancing Shift A	78
5.4.2	Line Balancing Shift B	79
5.5	Data Analysis	80
5.6	Improvement Activities	81
5.7	Line Balancing Improvement	81
5.7.1	Material Supply Improvement 1	83
5.7.2	Material Supply Improvement 2	84
5.7.3	Material Supply Improvement 3	85
5.7.4	Time Study Shift A	86
5.7.5	Time Study Shift B	88
5.7.6	Improvement Line Balancing	89
5.7.7	Improvement Line Balancing Shift A	91
5.7.8	Improvement Line Balancing Shift B	92
5.8	Racking System Improvement	94

5.8.1	Front Damper Unit Improvement	95
5.8.2	Rear Damper Unit Improvement	96
5.8.3	Centre Pillar Garnish Unit Improvement	97
5.9	Quality Concern	98
5.9.1	Front and Rear Damper	99
5.9.2	Centre Pillar Garnish	100
5.10	Safety Concern	101
5.10.1	Front and Rear Damper	101
5.10.2	Centre Pillar Garnish	102
5.11	Return of Investment Result	103
5.11.1	Front Damper Racking Improvement	104
5.11.1.1	Result for Front Damper Racking	104
5.11.2	Rear Damper Racking Improvement	105
5.11.2.1	Result for Rear Damper Racking	106
5.11.3	Centre Pillar Garnish Improvement	107
5.11.3.1	Result for Centre Pillar Garnish	108
5.12	Summary R.O.I Result	109
5.12.1	Front Damper Racking	110
5.12.2	Rear Damper Racking	111
5.12.3	Center Pillar Lower Garnish	112
6. CONCLUSION & RECOMMENDATION		113
6.1	Introduction	113
6.2	Conclusion	113
6.3	Recommendation	114
REFERENCES		115

LIST OF TABLE

3.1	Form designed to record tasks involved during lot processing	52
3.2	Form designed to record tasks and time involved during machine daily setup	52
3.3	Form designed to record tasks involved during machine breakdown	53
4.1	Assembly Engine (AE) process cycle	65
5.1	Data collection Shift A	72
5.2	Data collection Shift B	74
5.3	Improvement data Shift A	86
5.4	Improvement data Shift B	88
5.5	Material supply improvement	94
5.6	Improvement front damper unit	95
5.7	Improvement rear damper unit	96
5.8	Improvement centre pillar garnish unit	97
5.9	Quality concern for front and rear damper	99
5.10	Quality concern for centre pillar garnish	100
5.11	Safety concern for front and rear bumper	101
5.12	Safety concern for centre pillar garnish	102
5.13	Front damper improvement result	104
5.14	Rear damper improvement result	106
5.15	Centre pillar garnish improvement result	108
5.16	Return of investment front damper	110
5.17	Return of investment rear damper	111
5.18	Return of investment centre pillar lower garnish	112

LIST OF FIGURE

2.1	Seven types of waste	13
2.2	Withdrawal Kanban	20
2.3	Withdrawal Kanban	20
2.4	Material flow icons for value stream mapping	40
2.5	Material flow icons for value stream mapping	40
3.1	Flow chart of project planning	46
3.2	Sample form design waste-finding checklist (workshop specific)	54
3.3	Sample form design detailed waste-finding checklists (process-specified)	55
3.4	Gantt chart PSM 1	56
3.5	Gantt chart PSM 2	57
4.1	Process flow in automotive manufacturing	61
4.2	Assembly engine department layout	62
4.3	Assembly engine man power layout	64
5.1	Fish bone diagram	71
5.2	Shift A graph	73
5.3	Shift B graph	75
5.4	Line balancing charts Shift A	78
5.5	Line balancing charts Shift B	79
5.6	Improvement 1	83
5.7	Improvement 2	84
5.8	Improvement 3	85
5.9	Improvement line balancing chart Shift A	91
5.10	Improvement line balancing chart Shift B	92
5.11	Front damper racking improvement graph	103

5.12	Rear damper racking improvement graph	105
5.13	Centre pillar garnish improvement graph	107

LIST OF ABBREVIATIONS

BMFP	–	Bachelor of Manufacturing Process
PSM	–	Projek Sarjana Muda
TPS	–	Toyota Production System
WIP	–	Work In Progress
VSM	–	Value stream Mapping
etc	–	etcetera
JIT	–	Just In Time
USA	–	United State of America
UK	–	United Kingdom
US	–	United State
UTeM	–	Universiti Teknikal Malaysia Melaka
FOL	–	Front of Line
EOL	–	End of Line
SMED	–	Single Minute Exchange of Die
TQM	–	Total Quality Management
TPM	–	Total Productive Maintenance
3PL	–	Third Party Logistic
JITD	–	Just In Time Distribution
JITP	–	Just In Time Purchasing
EDI	–	Electronic Data Interchange
AE	–	Assembly Engine
LET	–	Light Electronic Transducer
VOC	–	Value Outcome Cost
4M	–	Man, Machine, Material, Method
SH	–	Sub-Head
SA	–	Sub-Assembly
PDI	–	Process Department Inspection

CHAPTER 1

INTRODUCTION

1.1 Introduction

Lean manufacturing is a manufacturing strategy that seeks to produce a high level of throughput with a minimum of inventory. Instead of pushing product to the market, it is there pull through a system that are set up too quickly respond to customer demand.

Originally a Japanese methodology known as the Toyota Production System designed by some Japanese leaders such as Sakichi Toyoda, Eiji Toyoda, Taiichi Ohno and Shingeo Shingo, lean manufacturing centers on placing small stockpiles of inventory in strategic locations around the assembly line, instead of in centralized warehouses and minimize the consumptions of resource that added no value to a product. Lean manufacturing has been the symbol of efficiency and optimal performance since the 1980's, mainly due to its association with the automotive industry and Toyota. It has been shown to outperform the traditional production model of large batches on several occasions (Boyer et. al, 1997, Nakamura et. al, 1998). Toyota Production System (TPS) are often used interchangeably, and the philosophy they describe is the same: elimination of waste, maximization of efficiency, and continuous improvement. Converting into a lean strategy involves both operational changes and, also organizational changes. The Toyota Production System (TPS) was based on the desire to produce in a continuous flow, and the recognition that only a small fraction of the total time and effort to process a product added value to the end customer. This was clearly different on what was practiced by Western world. Lean production has now expanded and lean thinking has been applied to all aspects of the supply chain. There are many well documented examples of the

application of 'lean thinking' to business processes including project management (Womack & Jones, 1990). Lean can be applied to all aspects of the supply chain for maximum benefits within the organization are to be sustainable realized. The two biggest problems with the application of lean to business processes are the perceived lack of tangible benefits and the view that many business processes are already efficient. There are many tangible benefits associated with lean business processes. A lean business process will be faster, such as the speed of response to a request for the business process, and as most business processes are linked to organizational supply chains, then this can deliver significant financial benefits to a company (Melton, 2004). The perception that a business process is already efficient is all too often an illusion. Functionally, many business processes may appear very efficient, however the application of Lean Thinking forces us to review the whole supply chain in which the business process sits, and this frequently reveals bottlenecks and pockets of inefficiency (Womack et. al, 1990).

In addition to eliminating waste, lean manufacturing seeks to provide optimum quality by building in a method whereby each part is examined immediately after manufacture, and if there is a defect, the production line stops so that the problem can be detected at the earliest possible time. The lean manufacturing method has much in common with the Total Quality Management (TQM) strategy. Both strategies empower workers on the assembly line, in the belief that those closest to production have the greatest knowledge of how the production system should work. In a lean manufacturing system, suppliers deliver small lots on a daily basis, and machines are not necessarily run at full capacity. One of the primary focuses of lean manufacturing is to eliminate waste; that is, anything that does not add value to the final product gets eliminated. In this respect, large inventories are seen as a type of waste that carries with it a high cost. A second major focus is to empower workers, and make production decisions at the lowest level possible.

Basically, supply chain management factors heavily into lean manufacturing, and a tight partnership with suppliers is necessary; this facilitates the rapid flow of product and parts to the shop floor. Lean manufacturing strategies can produce excellent results. The

advantages of lean manufacturing include lower lead times, reduced set-up times, lower equipment expense, and of course, increased profits. It gives the manufacturer a competitive edge by reducing costs and increasing quality, and by allowing the manufacturer to be more responsive to customer demands.

1.2 Problem Statement

A progress of Assembly Engine (AE) department at HMSB Automotive Manufacturer is categorized as bottleneck in the production line of automotive manufacturer by the management. Those of the problems are:

- a) Engine Assembly Department is no meet required output per shift which has been set by the department engineer. Thus, AE department from the other shifts are often required to work overtime.
- b) An abnormal of cycle time during shift B (night), which caused the machine to be idled in addition and affected the other next processes.
- c) The number of rejected item at AE department significantly high, and fail of firing tested (must be rework).
- d) The consumption of AE department is very high compare with the number of output that is produced.

1.3 Objectives

The mainly purposes of this project research are:

- To investigate of non value added activities at engine assembly department at company HMSB.
- To analyze how the tools of lean manufacturing can give an impact to the car manufacturing environment.
- To purposes the lean manufacturing tools at engine assembly department at the car manufacturing industry with continues improvement activities.
- To minimized the consumption and increased the productivity of the company up to 85%.

1.4 Importance of the Study

The important of this study is to determine an effective lean manufacturing concept for different tool and technique. It will then decide where most effective of the lean tool and technique can be used. This will be followed by review of the process industry and study the finding regarding application of lean concept and implement it to continuous manufacturing industry particularly.

1.5 Scope of the Study

In order to understand the effect of lean tool in the process sector involved is used to illustrate the procedure of implementing lean tools at a process facility. That refers to a number of different lean techniques, including Takt Time, Kaizen, Line Balancing, and 5S and a few tool that are follow with the suitable of the process achievement. While the obvious result is to improve the performance, the ultimate objective can be achieved. The basics of lean manufacturing employ continuous improvement processes to focus on the elimination of waste or non value added steps within an organization. The challenge to organizations utilizing lean manufacturing is to create a culture that will create and sustain long-term commitment from top management through the entire workforce. Lean manufacturing techniques are based on the application of five principles to guide management actions toward success.

This research project is conducted in Universiti Teknikal Malaysia Melaka (UTeM) and all the data from HMSB Company.

CHAPTER 2

LITERATURE REVIEW

2.1 The History of Lean

After World War II Japanese, manufacturers were faces with the dilemma of vast shortages of shortages material, financial, and human resources. The problem that Japanese manufacturer were face with differences from those of their Western counterparts. These conditions resulted in the birth of the “lean” manufacturing concept. The Toyota Motor Company, led by its president Toyoda recognized that American automakers of an era were out - producing their Japanese counterparts, in the middle of 1940’s American companies were outperforming their Japanese counterparts by a factor of ten. In order to make a move toward improvement early Japanese leader such as Toyoda Kiichiro, Shigeo Shingo, and Taiichi Ohno devised a new disciplined, process-oriented system, which is know today as the “Toyota Production System,” or “Lean Manufacturing”. Taiichi Ohno, who was given the task of developing a system that would enhance productivity at Toyota in generally, considered being the primary force behind this system. Taiichi Ohno drew upon some ideas from the West and particularly from Henry Ford’s book “Today and Tomorrow”. Ford’s moving assembly line of continuously flowing material formed basis for the “Toyota Production System”. After some experimentation, the “Toyota Production” System was developed and refined between 1945 and 1970, and still growing today all over the world. The basic underlying idea of this system is to minimized the consumption of resources that add no value to the product (eliminate waste). In order to compete in today fiercely competitive market, many manufacturing company have come to realize that the traditional mass production concept has to be adapted to the new idea of lean manufacturing.