ENHANCING MATERIAL SUPPLY SYSTEM FOR IMPROVING THE FLOW PROCESS OF ASSEMBLY LINE

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

by

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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 (Process) (Hons.). The member of the supervisory is as follow:

……

(Project Supervisor)

PM. Dr. Mohd Rizal Bin Salleh

ABSTRAK

Tujuan pembelajaran ini untuk memperbaiki aliran proses untuk bahan mentah di kilang pemasangan. PHN Industry telah meminta untuk mencari masalah dan memhapuskan masalah di kawasan pemasangan. Masalah berlaku di kawasan pemasangan kerana mempunyai stor sementara dan kontena yang besar. Masalah ini akan mengakibatkan pengendalian barang yang banyak, melambatkan bahan mentah sampai ke stesen kerja dan pembaziran pergerakan pekerja. Untuk menyelesaikan masalah ini, merekabentuk kembali kontena. Simulasi telah dilakukan daripada perisian Simul8 untuk mengenalpasti keupayaan pengeluaran antara sistem sedia ada dan sistem peningkatan. Keputusan berdasarkan simulasi menunjukan bahawa sistem baru telah mengurangkan penghantaran bahan sebanyak 20 minit. Keputusan simulasi menunjukkan sistem sedia ada menghasilkan waktu menunggu selama 19.91 minit manakala sistem baru mengurangkan waktu menunggu kepada 2.32 minit. Pembolehubah yang boleh diambil adalah kelajuan penghantaran barang kepada stesen kerja, jarak pergerakan pekerja, masa menunggu di stesen kerja 1, dan keluasan di kawasan pemasangan. Pembolehubah ini sangat penting untuk menjamin kemampanan dan keuntungan kepada syarikat.

ABSTRACT

This study was to improved the material supply system of the parts in the assembly area of PHN Industry. The problems occurred at the production area involding with the temporary inventory called Link Process System (LPS) and the used of big metal container for material supply. These problems create improper material handling of the parts, delay delivery of parts to the workstation, and create unnecessary movement for the workes. Some actions had been proposed to enhanced these problem.Simulation was conducted using Simul8 to find out the production capability by comparing with the current and the proposed improvement system. The simulation result shows that the proposed improvement technique can improve the productivity by reducing delivery time of parts by 20 minutes to the workstation. Based on the result, the current system create an average waiting time of 19.91 minutes while the improvement system reduced the waiting time to 2.32 minutes. This significant result shows that the proposed technique was more efficient than the current. The consideration taken were delivery time, the moving distance of workers, the waiting time at the workstation 1, and the area reduced at the production plant.

DEDICATION

This study is dedicated to my beloved father and mother, Zainal Abdin bin Ibrhim and Tengku Aida Binti Tengku Ahmad and also my family members, my brother and sisters, who provides the most supportive atmosphere of loving and caring that help me cope with situation.

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TABLE OF CONTENT

Abstrack		i
Abstract		ii
Dedication		iii
Acknowledgement		iv
Table of Content		v
List of Table		viii
List of Figures		ix
CHAPTER 1: INTRODUCTION		**1**
1.1	Background	1
1.2	Purpose	3
1.3	Company background	3
1.4	Problem statement	3
1.5	Objective	4
1.6	Scope	4
CHAPTER 2: LITERITURE REVIEW		**5**
2.1	Lean concept	5
2.2	Lean manufacturing	6
2.2.1	Types of waste in lean manufacturing	7
2.2.2	Motion and time study	8
	2.2.2.1 Definition of time study	8
	2.2.2.2 Uses for time study	9
	2.2.2.3 Time study equipment	9
	2.2.2.3.1 Stopwatch	9
	2.2.2.3.2 Video equipment	10
2.2.3	Cause and effect diagram	11

2.2.4 5S techniques 13
2.3 Plant layout design 14
2.4 Flow analysis 14
2.4.1 Flow diagram 15
2.4.2 Operations charts 15
2.5 Flow process charts 15
2.6 Inventory 16
2.6.1 Types of inventory 17
2.6.2 Functions of inventory 17
2.7 Material supply system 18
2.7.1 Continuous supply 19
2.7.2 Batch supply 20
2.7.3 Kitting 20
2.7.3.1 Reason for kitting 21
2.7.3.2 Benefit of kitting 21
2.7.3.3 Disadvantages of kitting 23
2.7.4 Material handing 24
2.7.5 Packaging and unit loads 25
2.8 Simulation 27

CHAPTER 3: METHODOLOGY 31
3.1 Working structure and method use 31
3.2 Research approach 33
3.3 Research strategy 34
3.4 Qualitative and quantitative method 34
3.5 Data collective 35
3.6 Validity and reliability 35
3.7 Process documentation 36
3.8 Methods 37
3.8.1 Time study 37

CHAPTER 4: RESULT & DISCUSSION **39**
4.1 Current state analysis 39
4.2 Material receiving and repacking process in warehouse area 37
4.2.1 Receiving parts 37
4.2.2 Repacking process 37
4.3 Delivery of the parts in assembly area 38
4.4 The proposing idea 39
4.5 The design concept 41
4.6 The result 42
4.6.1 The distance travel by workers 47
4.6.2 Area saves 49
4.6.3 Layout of workstation 50

CHAPTER 5: CONCLUSION & FUTURE WORK **52**
5.1 Conclusion 52
5.2 Recommendation for future work 53

REFERENCE **54**

APPENDICES
A Gantt chart

LIST OF TABLE

2.1	Flow chart table	16
2.2	Catergories of materials supply principle	19
4.1	Quantity of the parts before and after the improvement	41
4.2	Example of the parts	42
4.3	The result on waiting time at workstation 1	43
4.4	Distance travelled by workers	48

LIST OF FIGURES

2.1	Stopwatch	10
2.2	High definition camera recorder	11
2.3	Example of Fishbone diagram	13
3.1	The working structure during the study	32
3.2	A step-by-step procedure for process documentation	37
4.1	Flow chart of the parts	36
4.2	Repacking activity	38
4.3	Material flow from the current system	39
4.4	Material flow by using proposed idea	40
4.5	Mobilize racking trolley	41
4.6	Current system waiting time in workstation 1	44
4.7	Improvementt system waiting time in workstation 1	45
4.8	Workstation working hours (before)	46
4.9	Workstation working hours (after)	46
4.10	Material flow from the gate plant for current system	47
4.11	Material flow from the plant gate for improvement system	47
4.12	Distance travelled by workers	48
4.13	Area saved	49
4.14	Current workstation 1 layout	50
4.15	Recommended workstation 1 layout	51

CHAPTER 1
INTRODUCTION

1.1 Background

The material supply plays an important role in order to ensure the product assembly process can be completed according to customers demand. Improper material supply can generate inventory in the production line which was affected the quality delivering and the cost of the product. The material supply system in the plant should be performed in an efficient way. The delivered material should be ready to be used by the operators.

In today's competitive world, many manufacturing companies concerned to increase their customer's satisfaction by steadily improving their delivery but still keep quality at the top level. However, the companies need to place the price as low as possible to be able to compete with the others but still gaining their profitability.

One should have a strong vision and clear idea of its future goals to establish the most effective production system.The manufacturers are thirst in search of perfection after the Toyota Production System introduce the lean philosophies (Dennis, 2002). Lean philosophies help companies not only to control their production but also help them to combine the improvements in the operational and commercial aspects and manage them to find the way that provides long-term business success and employee capability to continuously leap that company to further improvement (Dennis, 2002).

Material supply decisions were really important since they enable a manufacturer to increase the control and affect the overall efficiency of its production system (Corakci, 2008). Kitting is practiced as a method of material supply among others such as continuous supply, batching and sequencing (Johansson, 1991).

The activities of delivering materials to the assembly line in predetermined quantities that were sorted together in specific containers in knowing as kitting (Corakci, 2008). Rather than delivering required materials to the assembly line in a large amount of quantities, the materials can be sorted in the kit containers before they are delivered to the assembly line (Bozer & Mc Ginnis, 1992).

Material supply system contains a certain number of related elements. Material supply system divides to six design area which are material supply, storage,transportation, material handling, packaging, and manufacturing planning and control (Johansson, 2006).

With the automotive models are constantly changing in time, this trigger the demand for the flexibility of the production and material supply system. The material supply system is always concentrated on keeping low inventory levels, while at the same trying to achieve a high availability of the material (Hales & Andersen, 2001).

There are three ways Caterpillar BCP-E. Leicester (CAT) trying to decrease the space and walking distances which are optimizing container size, reducing container quantities, and delivering parts in kits (Carlsson & Hensvold, 2007).

When kitting is apply properly, it has been observed numerous benefits for the assembly line. Since kitting involves the gathering of all parts together from the stock and placing the kit to assembly line, it involves a lot of possible sources of waste. From lean philosophy point of view, this is worthwhile to think about to find out how the ways to lean kitting are possible (Vujosevic, 2008).

1.2 Purpose

The purpose of this study is to enhance the material supply system of the assembly area at PHN Industries Sdn. Bhd., Alor Gajah.

1.3 Company background

PHN Industry Sdn Bhd, a leading specialist in the automotive components manufacturing industry, is indeed a success story in its own right. Incorporated in October 1990, amidst the growing national aspiration to transform Malaysia from an agriculture based economy into a high growth, net worth thriving manufacturing based economy, the company has fulfilled this ambition and is continuing to further raise the bar in automotive parts and components manufacturing both locally and internationall**y.**

1.4 Problem statement

PHN Sdn. Bhd. which is located at Alor Gajah, Malacca, was having problem due to late delivery of parts from warehouse area to assembly area. This problem will create more waiting time at assembly line. The delayed was due to sorting operation that happened at the assembly area for kitting purposes. The parts came from the warehouse area delivered by forklift and then the workers sorting for the temporary inventory. The sorting parts were already happened in the warehouse area. Therefore, it created more waiting time and waste movement of the workers.

1.5 Objectives

(a) To identify the problem with the current system

(b) To eliminate the unnessesary waste

1.6 Scope

The study will be performed at PHN Industry Sdn. Bhd. The scope of the study will involve internal logistics from goods reception to the production line. The study will cover the logistics of the material and enhance the material supply system to improve the flow process in the assembly plant.

CHAPTER 2
LITERATURE REVIEW

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2.1 Lean concept

The lean manufacturing philosophy aims to eliminate and reduce the wastes in the whole area, including customer relations, product design, supplier networks and factory management. It can be adopted to the industries to compete in the competitive world by serving its customers better and continuously improve of cost reduction.

To understand the lean manufacturing concept, it can be organized into three levels included of lean manufacturing objectives and basic principles, primary management and production strategies used to gain the objectives and instill basic principles and implementation techniques which are the practices and procedures for implementing and maintaining the strategies (ReVelle, 2002).

The better reducing and elimination of waste will reduce the cost of operating and the company can grant the customer's wishes for maximum value at the lowest cost. The one form of method of eliminating the waste is to not let the same mistake repeated because mistake is counted as a form of waste.

2.2 Lean manufacturing

Lean manufacturing, lean enterprise, or lean production, often simply, "Lean," is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination. Working from the perspective of the customer who consumes a product or service, "value" is defined as any action or process that a customer would be willing to pay for.

Essentially, lean is centred on preserving value with less work. Lean manufacturing is a management philosophy derived mostly from the Toyota Production System (TPS) (hence the term Toyotism is also prevalent) and identified as "Lean" only in the 1990s (Womack et al, 1990). TPS is renowned for its focus on reduction of the original Toyota seven wastes to improve overall customer value, but there are varying perspectives on how this is best achieved. The steady growth of Toyota, from a small company to the world's largest automaker (Bailey et al, 2008), has focused attention on how it has achieved this success.

Lean manufacturing is a variation on the theme of efficiency based on optimizing flow; it is a present-day instance of the recurring theme in human history toward increasing efficiency, decreasing waste, and using empirical methods to decide what matters, rather than uncritically accepting pre-existing ideas. As such, it is a chapter in the larger narrative that also includes such ideas as the folk wisdom of thrift, time and motion study, Taylorism, the Efficiency Movement, and Fordism. Lean manufacturing is often seen as a more refined version of earlier efficiency efforts, building upon the work of earlier leaders such as Taylor or Ford, and learning from their mistakes.

2.2.1 Types of waste in Lean manufacturing

There are seven types of waste that have been considered in the lean manufacturing, according to ReVelle (2002), which are:

a) The products that cannot sell and making the product to early are called overproduction. The overproduced products must be transported, stored, and inspected as well.

b) The workers are not working in whatever reason which called wating time. It occurs in an unbalanced line which resulting of longer waiting.

c) Transportation is a waste of moving parts around. It can happened in the processing steps, between processing lines, and happen when product is shipped to the customers.

d) The overprocessing means that processing the product that exceed the needs of the customer wants. Create the specification that exceed the needs of customer can be consider as waste.

e) The unnecessary movement such as operators and mechanic moving around to find the tool parts or materials. This is a type of waste because the people are moving and looking busy but it didn't add to the value. The work design and workstation design is the main factors.

f) This is the waste that being plague by the company which is the inventory. All inventory are consider waste unless it can convert to sales. It all the same whether is raw materials, WIP, or finished goods. It consider a waste if it not directly sales.

g) This waste traditionally called scrap. It also called in other name is defective parts. The worker spend valuable time, effort, and energy to make the part in the end the part is defectives.

2.2.2 Motion and time study

Motion and time study is the systematic study of work systems with the purpose of developing the suitable system and method, standardizing the system and method, determining the time required by a qualified and trained personnel working at normal pace to do a specific activity , and training the personnel in preferred method (Barned, 1980).

Stevenson and Sum (2010) stated that cycle time is the maximum time allowed at each workstations to perform the assigned tasks before the work moves on. Cycle time is determine by desired output and operating time per day. Cycle time can be compute by using equation :

$$\text{Cycle time} = \frac{Operating\ time\ per\ day}{Desired\ output\ rate} \quad (2.1)$$

From the cycle time, the theoretical minimum number of stations that necessary to provide specific rate of output can be determine by following formula :

$$Nmin = \frac{\Sigma t}{Cycle\ time} \quad (2.2)$$

Nmin: Theoretical minimum number of station

Σt: Sum of task times

2.2.2.1 Definition of time study

Time study is used to determine the time required by a qualified and well-trained person working at a normal pace to do a specified task. Time study is to measure work. The result of time study is the time that a person suited to the job and fully trained in the specified method will need to perform the job if he or she works at a normal tempo. It is called the standard time for the operation (Barnes, 1980).

2.2.2.2 Uses for time study

According to Barnes (1980), the uses for time study are:

- Determining schedules and planning work.
- Determining standard costs and as an aid in preparing budgeds.
- Estimating the cost of a product before manufacturing it.
- Determining machine effectiveness, the number of machines which one person can operate, and as an aid in balancing assembly lines and work done on a conveyor.
- Determining the time standards to be used as a basis for the payment of a wage.
- Determining time standard to be used as a basis for labor control.

2.2.2.3 Time study equipment

The equipment needed for time study work consists of timing device and observation board according to Barnes (1980). The equipments that are commonly used for measuring work are stopwatch, video recording, and observation board.

2.2.2.3.1 Stopwatch

The stopwatch and electronic timer are commonly used as the timing equipment for time study.