UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMPLEMENTATION OF FIRST IN FIRST OUT SYSTEM IN SUB-ASSEMBLY COMPONENTS IN CASTING INDUSTRY

Submitted in accordance with requirement of the University Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Hons.)

by

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FACULTY OF MANUFACTURING ENGINEERING

2020

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Sesi Pengajian: **2019/2020 Semester 2**

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DECLARATION

I hereby, declared this report entitled "Implementation of First In First Out system in Sub-assembly Components in Casting Industry" is the result of my own research except as cited in references.

Signature : .....

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Date : 26 AUGUST 2020

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment of the requirement for Degree of Manufacturing Engineering (Hons). The member of the supervisory committee is as follow:

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ABSTRAK

Menurut para ahli dalam bidang *Lean*, terdapat tujuh *waste* termasuk penghasilan berlebihan, inventori, pengangkutan, proses, kerja ulang, gerakan menunggu dan gerakan yang tidak perlu. Dalam penyelidikan, terdapat dua *waste* utama yang terlibat iaitu *waste* inventori dan *waste* pengangkutan. Masalah yang dihadapi oleh syarikat adalah kapasiti penyimpanan yang tidak mencukupi dan masa bergerak yang tinggi dalam komponen sub-assembly. Pengeluaran Lean (LM) adalah pendekatan biasa yang digunakan untuk menghapuskan *waste*. Sebuah syarikat pemutus perkakasan pintu di Melaka telah melaksanakan reka bentuk First In First Out (FIFO) yang dilaksanakan sebagai cara penyelesaian utama untuk meningkatkan kapasiti penyimpanan dan mengurangkan masa pergerakan komponen. Alat lean seperti gambar rajah *Ishikawa* dan *5S* dilaksanakan untuk membantu sistem FIFO. Objektif penyelidikan adalah untuk mengkaji sistem semasa yang berlaku di gudang, mereka sistem FIFO yang baru dan mengesahkan sistem FIFO. Kajian ini memberi tumpuan kepada komponen sub-assembly di kawasan gudang tertutup. Sistem semasa dikaji dengan menggunakan metodologi seperti pemerhatian, sesi brainstorming, wawancara separa berstruktur dan merujuk kepada sumber sekunder. Sistem FIFO dicadangkan dengan membuat perancangan semula di gudang, alat reka bentuk termasuk *Morphologi Chart*, *concept screening* dan *concept scoring*. *Standard Operating Procedure* (SOP) baharu telah dicipta. Pengesahan dan sistem FIFO boleh dilakukan dengan membuat perbandingan sebelum dan selepas FIFO system dijalankan. Dengan melaksanakan sistem FIFO, kapasiti storan dijangka meningkat dan masa pengerakan komponen sub-assembly dapat dikurangkan.

ABSTRACT

According to lean experts, there are seven waste including overproduction, inventory, transport, process, rework, waiting and unnecessary motion. In the research, there are two major wastes involved which is the inventory waste and transport waste. The problem faced by the company is insufficient storing capacity and high moving time of sub-assembly components. Lean Manufacturing (LM) is the common approach applied to eliminate waste. A door hardware casting company in Melaka has implemented First In First Out (FIFO) design as the main solution to increase storage capacity and reduce the moving time of sub-assembly components. Lean tools such as the Ishikawa diagram and 5S are implemented to aid the FIFO system. The objectives of the research are to study the current system in the warehouse, to design the FIFO system in the warehouse then to implement FIFO system in the warehouse. This study focused on the sub-assembly components in the indoor warehouse area. The situation in the warehouse before implementing FIFO was studied by using methodology such as observation, brainstorming sessions, semi-structured interview and referring to secondary sources. The FIFO system was proposed by redesigning the warehouse, the design tools included are Morphological chart, concept screening and concept scoring. New Standard Operating Procedure (SOP) is proposed. The verification and validation of the FIFO system were done by making a comparison before and after implementing FIFO system. By implementing a FIFO system, the storage capacity can be increased and the moving time of sub-assembly components can be reduced. Increased storage capacity and reduced components moving time will result in reduction of inventory waste and transport waste.

DEDICATION

Only

my beloved father, Lim Soon Kok

my appreciated mother, Ng Soh Keng

for giving me moral support, money, cooperation, encouragement and also understandings

Thank You So Much & Love You All Forever

ACKNOWLEDGEMENT

Foremost, I would like to express my sincere gratitude to my respected supervisor, Associate Prof. Ts. Dr. Effendi bin Mohamad for the great mentoring that was given to me throughout the project. He has contributed beneficent ideas and suggestions to make this research project a favourable result.

Besides, I would like to express my gratitude to the Dormakaba Production Malaysia Sdn. Bhd., Mr. Aswan, the department manager. Throughout his guidance and help, I can gather all the information required. I would also like to thank the section manager, the technicians, the operators, the engineers for their kind supervision, advice and guidance as well as exposing me with meaningful experiences throughout the study.

Lastly, I would like to give a special thanks to my appreciated seniors and friends who gave me untold motivation and cooperation in completing this report especially to, Mohammad Afif bin Embok Resa for the nonstop encouragement, Kee Chung Terk for the gainful scientific advice, Wong Sook Ee for the countless moral support. They had given their crucial suggestions and critics throughout my research. Thanks for the great friendship.

In short, I would like to thank everyone who has contributed to this Final Year Project report including the panels, as well as expressing my apology if any inconvenience has been done.

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LIST OF ABBREVIATIONS

LM	-	Lean Manufacturing
FIFO	-	First In First Out
DOSM	-	Department of Statistics Malaysia
LIFO	-	Last In First Out
WIP	-	Work in Process
JIT	-	Just in time
5S	-	Sort, Shine, Set in order, Standardize, Sustain
6M	-	Man, Machine, Method, Material, Measure, Mother nature
QLR	-	Qualitative research
QTR	-	Quantitative research
SOP	-	Standard Operating Procedure

LIST OF SYMBOLS

S	-	Second
%	-	Percent

CHAPTER 1
INTRODUCTION

There are few aspects highlighted in this chapter. The background of the study provides the user with vital information regarding the title. Current problems in the industry are identified. The objectives of the study project are stated to provide clear guidelines for the project which is within certain focus aspects. The advantages of the project are mentioned as well to highlight the importance of FIFO implementation.

1.1 Background of Study

According to the Malaysia Economic Performance Third Quarter 2018, the manufacturing sector is one of the sectors which beneficial in economic growth. Manufacturing sector contributes second highest for the consumption expenditure with 23%, which is above Agriculture, Construction, Mining and Quarrying (Department of Statistics Malaysia, 2019). The sub-sectors of manufacturing sector including electronic, electrical and optical products generate RM361.8 billion (28.4%) which contribute to the biggest amount of gross output according to the Annual Economics Statistics 2018 Manufacturing sector.

William (2015) mentioned that there are wastes in manufacturing sector and the wastes are the equipment, parts, space, materials and working time that are not required. The author mentioned that there are seven categories of manufacturing wastes including overproduction, inventory, transport, process, rework, waiting, unnecessary motion.

Virender *et al.* (2017) mentioned that there are lean strategies in Lean Manufacturing (LM) to eliminate waste. Waste is non-value added for industry and difficult to eliminate. Bill (2005) claimed that LM is manufacturing without the involvement of waste. The author

mentioned that LM is a production system that removes all wastes and applies continuous improvement to generate a perfect product.

Maarten *et al.* (2014) mentioned that the application of FIFO towards asset rotation is a common approach to ensure the stock is unloading based on its arrival time by prioritizing to load out the products that spent the most time in the warehouse. The author claimed that implementation of FIFO in warehouse management is one of the supply chain strategies to generate product management efficiently. According to Meinarini *et al.* (2018), FIFO application allows the incoming and outgoing goods process to be well managed and also easy and practical to be implemented. While Airline (2015) mentioned that the application of FIFO ensured that the inventory to be counted easily.

A case study is conveyed in a casting manufacturing company. The company manufactures many types of products including door control, automatic, movable wall, glass fittings products, and accessories. The main product includes door hardware. The main focus of the research study is in the warehouse by focusing on the loading and unloading processes of sub-assembly components. A FIFO design will be proposed and implemented aided by the lean tools.

1.2 Problem Statement

According to Rene *et al.* (2007), the inventory moving process is stated as the most labour-intensive and costly activity for every warehouse; the cost of inventory moving is predicted to be 55% of the total expenses in a warehouse operation. Bad performance in order picking can lead to unsatisfaction and high warehouse operational costs.

Based on the observation study and brainstorming sessions with the engineers, there is a problem such as insufficient storing space for all of the sub-assembly components in the warehouse. The problem of insufficient storing space causes the components are placed in an unorganized manner.

Figure 1.1 shows the current and plan storage capacity of the indoor warehouse area. The current warehouse is capable to store only 85% of the sub-assembly components. This research is planned to achieve the goal of increasing in 5% of storage capacity, which is achieving 90% of storage capacity.

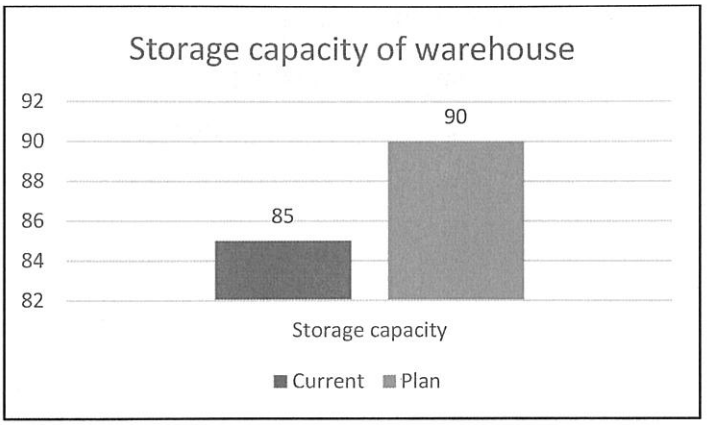

Figure 1.1: The current and plan storage capacity of the indoor warehouse area

There is also a problem such as there is no visual information on the sub-assembly components. Workers who are not familiar with the process are having difficulty to look for the sub-assembly components needed since there is no label on the components. Information such as components name and quantity are not provided.

Figure 1.2 shows that the current moving time of components is 140 seconds for loading, 121 seconds for unloading components. The expected result is to reduce 6% of the moving time during loading and unloading processes of sub-assembly components.

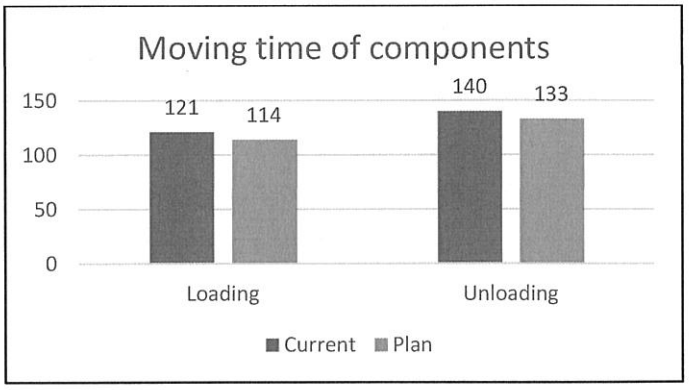

Figure 1.2: The current and plan moving time of sub-assembly components

Metal components will undergo the rusting process if they are left long periods in the storage. According to Talbot *et al.* (2018), iron and steel are applied widely as engineering metals. Rusting of the bare iron and steel on the surfaces is generally slower when in the air while comparing to in the water. In the air, they are more variable, which ranges from approximately 0 to more than 0.1 mm per annual. Therefore, it is important to apply FIFO to prevent the accumulation of old components. It is vital to know which item is the oldest and which is the latest. Items are required to be designed to sort accordingly from the oldest to the latest using the FIFO system.

1.3 Objectives

The objectives are as follows:

(a) To study the current system in the warehouse

(b) To design FIFO system in the warehouse

(c) To implement the FIFO system in the warehouse

1.4 Scope

The study project involves the loading and unloading processes of sub-assembly components. The study only involves the sub-assembly components, it does not involve the finished product, which is the assembly components.

The solution is designed based on the FIFO system which the oldest sub-assembly components are used first rather than the latest sub-assembly components.

The area of research study focused on the indoor warehouse area. Figure 1.3 shows The Autocad drawing of the plan of the indoor assembly area. The indoor warehouse area is marked using a red-dotted line.

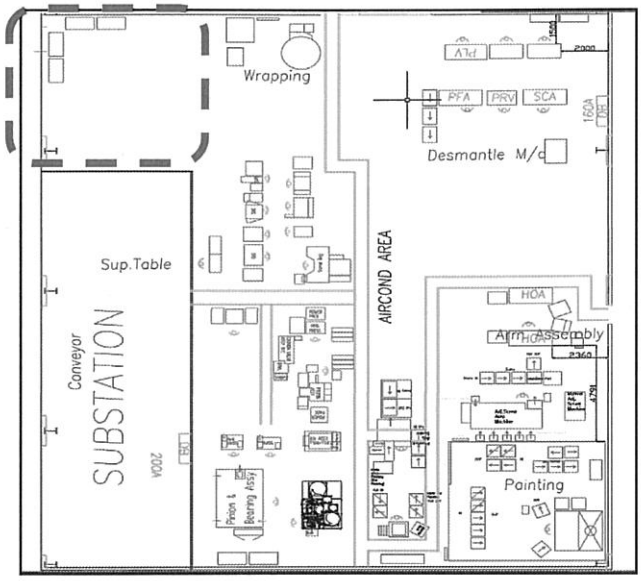

Figure 1.3: The Autocad drawing of the plan of the indoor assembly area

1.5 Importance of Study

There are few benefits can be obtained after the completion of the study. It is significant to propose FIFO to the inventory because it can reduce the lead time of components remain in the storage. The method ensures that the components will be loaded out accordingly from the oldest to the latest components. The components will be easily identified, such as the name, quantity and date of arrival of the components will be stated in the label. The components moving time will be reduced as the time taken to identify the accurate quantity of product will be reduced. The cost of inventory storage can be reduced as implementation of FIFO system can increase the storage capacity. The existing warehouse can be fully utilised without the need for developing a new warehouse. A new warehouse will be required only of the existing storage has maximum utilisation of space.