Faculty of Mechanical and Manufacturing Engineering Technology

PRODUCTIVITY PLANNING TO REDUCE WASTE BY SIMULATION IN MANUFACTURING SYSYTEM

Loh Suet Leng

Bachelor of Manufacturing Engineering Technology (Process and Technology)

2018

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: Productivity Planning to Reduce Waste by Simulation in Manufacturing System

SESI PENGAJIAN: **2018/19 Semester 2**

Saya **LOH SUET LENG**

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran

☐	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☐	TIDAK TERHAD	

Disahkan oleh:

_____ _____

Alamat Tetap:

NO. 31 Jalan Kebangsaan 37,

Taman Universiti 81300,

Skudai, Johor.

Cop Rasmi:

** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I hereby, declared this report entitled "Productivity planning to reduce waste by simulation in manufacturing system" is the results of my own research except as cited in references.

Signature : …….

Name : ……

Date : ……

APPROVAL

This report is submitted to the Faculty of Mechanical Manufacturing Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours. The member of the supervisory is as follow:

Signature : …….

Supervisor Name : ……

Date : ……

DEDICATION

To my beloved parents

ABSTRACT

Industrial revolution 4.0 has been broadly deliberated for most global industries which production will become more specialized and complex. Hence, line efficiency and productivity is crucial in manufacturing industry. In manufacturing industry, the production process consist of wastes are the critical problem faced in many industries nowadays. Waste is any activity which adds cost or time, consume resources more than necessary to produce the product but doesn‟t add value to a product. Lean manufacturing plays an important role to eliminate non-value added activities which is wastes. In this case study is conducted at electronics and mechanical assemblies. This project focuses on the assembly‟s production line of product big rack. The problem statements of the production line are having uneven cycle time, different workload in the workstations and the abilities of operators that cause the unbalance line. Line balancing has been use for balance the operator workload in the workstations to minimize work load of stations and enhance output efficiency. The workstations of production line big rack has been reduce from14 workstations to 8 workstations. Then, Arena simulation use to study assembly production line of big rack. Arena simulation use for simulate before and after line balancing show the result of number of operator reduce 1 person and the output increases from 121 units to 149 units in 3 hours production line run. Simulation results based on variables parameter such as number of operator and number of workstations gives option to company make a decision making on the productivity improvement on the big rack production line.

ABSTRAK

Revolusi industry 4.0 telah dibincangkan secara meluas untuk kebanyakan industry global disebabkan pengeluaran semakin menjadi lebih khusus dan kompleks. Oleh itu, kecekapan dan produktiviti talian adalah penting dalam industri perkilangan. Dalam industri pembuatan, proses pengeluaran yang mempunyai bahan buangan adalah masalah kritikal yang dihadapi dalam kebanyakan industri pada maa kini. Bahan buangan adalah activiti yang tidak menambah nilai kepada produk dengan menambah kos atau masa, penggunaan sumber lebih daripada yang diperlukan untuk menghasilkan produk. Pengilangan lean memainkan peranan penting untuk menghapuskan aktiviti yang merupakan sisa buangan. Projek ini mengkaji dalam kilang pengabungan electronik dan mekanikal. Projek ini memberi tumpuan kepada masalah yang berlaku dalam bidang pengeluaran produk rak besar. Penyata masalah dalam barisan pengeluaran adalah masa kitaran yang tidak sekata, beban kerja yang berbeza di stesen kerja dan kebolehan pengendali yang menyebabkan barisan pengeluaran tidak seimbang. Pengimbangan larian telah digunakan untuk menyeimbangkan bebean kerja pengendali di stesen kerja untuk meminimumkan beban kerja stesen dan meningkatkan kecekapan pengeluaran. Stesen kerja barisan pengeluaran produk rak besar telah mengurangkan dari 14 stesen kerja ke 8 stesen kerja. Kemudian, penggunaan simulasi Arena untuk mengkaji pemasangan barisan pengeluaran rak besar. Penggunaan simulasi arena untuk mensimulasikan sebelum dan selepas mengimbangi baris menunjukkan hasil bilangan pengendali mengurangkan 1 orang dan peningkatan output dari 121 unit menjadi 149 unit dalam 3 jam kerja. Hasil simulasi membuat keputusan berdasarkan parameter pembolehubah seperti bilangan orang kerja dan stesen kerja untuk kilang memebuat keputusan tentang meningkatkan hasil kerja.

ACKNOWLEDGEMENT

First, I would like to thank to Dr Lau Kok Tee and also to Mr. Mohd Soufhwee Bin Abd Rahman for their guidance and patience in helping me completing the Final Year Project. Thank you again Mr. Mohd Soufhwee Bin Abd Rahman knowledge and guidance have helped me understand and improve my knowledge. Besides, I would like to thank LIKOM Company, Mr. Shamsul Baharin, Mr. Azman Abdullah, Mr Veljierson M give me chance to study production line and help me a lot during the time I visited. I will like to express my thankfulness towards my family and friends, especially my family who gives me supports in financially and emotionally with a great heart.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURE

LIST OF APPENDICES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

AR	Augmented Reality
CM	Cellular Manufacturing
CPS	Cyber-Physical System
FYP	Final Year Project
IoT	Internet of Things
NVA	Non-value added activities
PLT	Production Lead-time
SMED	Single Minutes Exchange of Dies
SOP	Standard Operating Procedures
TPM	Total Productive Maintenance
TPS	Toyota Production System
VSM	Value Stream Mapping
WIP	Work-in-progress

CHAPTER 1

INTRODUCTION

1.0 Introduction

The introduction will described about the project background, problem statement, objectives, scope, and limitation. Introduction also gives briefly explanation of summary of this project. This allow reader understand the flow and process of the overall study.

1.1 Background

In 1913, Henry Ford synthesised interchangeable parts with using standard work and move the conveyors and created flow production. The manufacturing lines in process has been aligned for provide components assemble into vehicles in short time. Then, Kiichiro Toyoda, Taiichi Ohno and others revisited the Ford‟s thinking and invented Toyota Production System (TPS) at Toyota. In 1990, James P. Womack, Daniel Roos and Daniel T. Jones have described lean process in the book “The Machine That Changed the World”. Therefore, James P. Womack and Daniel T. Jones have distilled those lean principles in 1996. Lean manufacturing have developed by Japanese automotive industry which is Toyota to improve the Japanese economy after World War II.

Lean manufacturing can be known as Lean production. Nowadays, Lean manufacturing became the most popular paradigms in different manufacturing and service industry for waste elimination. Lean manufacturing is a strategy that oriented towards achieving the shortest possible cycle time by eliminating wastes. Besides that, implement

lean manufacturing in any type of company become competency for competitiveness and sustainable manufacture. In lean manufacturing, wastes can define as non-value added activities (NVA) which are overproduction, over processing, motion, transportation, inventory, waiting and defects. According to Natasya et al. (2013) stated that lean manufacturing have eight types of waste which is utilization people.

The successful for implementing Lean tools and techniques in various sector of company or industry need to focus on all aspects such as Cellular Manufacturing(CM), Single Minutes Exchange of Dies (SMED), Value Stream Mapping (VSM), Kanban, Kaizen, 5S concept, Total Productive Maintenance (TPM), Line balancing, Inventory control and so on.

Value stream mapping is the framework of lean manufacturing. According to Kamle et al. (2018) mentioned that Value stream mapping as function of identify the wastes and bottleneck processes. 7 wastes can be identified and solution will be suggested. In value stream mapping, the takt times, production lead times, processing time are different attributes that simulated and analysed by both current and future state stream mapping. There are few steps to start the Value stream mapping (VSM) which are define product, current state, future state and implementing. First step of VSM is identifying the product or product family due to the process and the resources need in production process. Secondly, identify the wastes of process by current state map. It is the design flow for production flow of raw material. Next, draw the future state map which has eliminated waste of the process. Lastly, implementing is the important process for achieved the future state map.

According to Azizi et al. (2015) stated that Value Stream Mapping (VSM) eliminate wastes in Small Medium Enterprise (SME) and also brings improvement of productivity. In this case study, SMED and Kaizen techniques have been implemented in the future state map of the Value Stream Mapping (VSM) to reduce the work in process (WIP) and lead time. According to Sharma et al. (2017) team work, communication, wisely use of resources, and continuous improvement can be improve and encourage through Lean principles.

1.2 Problem statement

Based on the factory visit LIKOM, manufacturing industry faced the problem of unbalance line in production line. According to Salonits et al. (2017) the top management is key factor in all industry or big organization. In some company has face problem but do not have good management to solve the problem. Through literature review, the commitment of the top management and the strong leadership ability to exhibit excellent project management style is play an important role.

The problem statements of the production line are having uneven cycle time, different workload in the workstations and the abilities of operators that cause the unbalance line. From the case study, most company use lean tools to achieve the improvement their productivity and quality of product. Lean tools are the effective to identify non-value added activity and eliminate it. Then, ARENA simulation software use simulation in this project. Nowadays, most of the SME Company has a vision and mission further to Industry 4.0. Thus, apply ARENA simulation as the improvement to Industry 4.0.

1.3 Objectives

Generally, the objective of this project is to analyse the productivity performance based on line balancing technique, to propose a suggestion to improve the current production line and to simulate an effective theory by Arena Simulation. The objectives needed to support the project to ensure that the project is successfully accomplished include:

1. To analyse the productivity performance based on line balancing technique.
2. To propose a suggestion to improve the current production line.
3. To simulate an effective theory by Arena Simulation.

1.4 Project scope

In this project, the main scope of project is focus on one product from family product in industry. Identify the waste of the product in the production line by adopt lean tools. The selection of the suitable simulation software to be implemented in the industry is made.

1.5 Organization of report

The Final Year Project (FYP) has a total combination of five chapters in a whole thesis. There are total five chapters in this report and each chapter has their own information needed to be presented.

First chapter of this project research is introduction. In this chapter, the general view of study has been explained. The problem, objectives and the scope was stated and written in this part.

Next chapter is followed by the literature review which is focusing on existing concept and theories of related research. The review is developed by collecting the idea from different resources such as a journal, book or the internet.

The third chapter for this research study is the methodology which describe on the process flow of this project in order to achieve the goal.

The result and discussion is in chapter four, mainly in analysing the result of the study. Besides, the result is including in examining and comparing the operation performance of selected industry.

The last chapter for this research study is conclusion and recommendation. This chapter has stated out the achievable of objectives. Moreover, some suggestions have given toward the overall study for future development.

1.6 Expected Result

Based on literature review and online resources, I can expect that Lean manufacturing has been one of the most popular paradigms in waste elimination in the manufacturing and service industry. Line balancing is the lean tools and techniques that assign the task equal over the workstations with minimize the workstations and operator of the assembly big rack process. ARENA simulation software is used to simulation model that can eliminate waste and improve the productivity of the production line.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will mainly discuss on the concept of lean manufacturing. The role of lean manufacturing is discussed in this chapter. The importance of adopt the lean manufacturing in industries is focused in this chapter to show the necessity of the lean manufacturing eliminate wastes in the industries to improve productivity. Besides, this chapter also reviewed on the case study by implement lean manufacturing tools and techniques in the industries. This chapter will be discussing on the Industry Revolution 4.0 at last.

2.1 Productivity

Productivity is the ratio of the output related to input. According to Wacker et al. (2006) stated that the definition of productivity is amount of output produced with the combination of input resources which included capital, labour and other resources. Higher productivity produces with lower of the input resource. According to Beheshti et al. (2010) productivity is generally considered to be the efficient utilisation of organisational resources and is measured in terms of the efficiency of a worker, company or nation. Productivity measures divide into which are multi-factor productivity and labour productivity.

$$\boldsymbol{Productivity} = \frac{\boldsymbol{output}}{\boldsymbol{input}} \qquad (2.1)$$

2.2 Productivity planning

Productivity planning defined as consist a specific plan designed to improve productivity. Typically for productivity plan which are operational planning, tactical planning and strategic planning.

Operational planning defines as who, what, and when the things can be done. Operational planning outlining who do the job and when as well as to evaluate everyone have the interaction with other. When use the planning in productivity plan coordination of suppliers vendors, materials and daily work activities need to be included make sure workers get the necessary resources to do their works.

Tactical planning defines as include systematically organizing and short-term of activities plan which consistent with overall strategic goals. This productivity plan needs mention that who has the responsibility to achieve objectives of each area of productivity planning.

Strategic planning also one of the element of productivity plan with consist of development and implementation of policies. It also has procedures designed to align daily work activities mission of organization. Organization leader determine the future vision by set the objectives such as improving productivity.

Individual productivity usually use for organization planning and also use in improve the worker productivity. Individual productivity can define as set the productivity goals for individual workers with provide training to improve communication skills, eliminate time waters and manage time for the workers.

2.2.1 Factor of affects productivity

There are some factors that affects the productivity is the input.

1. Man

Based on some research, man is one factor that affects productivity. In the production area, researchers observed that some operators not focus on their task and do conversations with others. Besides, some operators loss concentration in job by use wrong tools for the assembly process.

2. Machine

Machine also one of the factor affects productivity due to the machine is old and has fixed number of outputs. This will contribute the company‟s low efficiency rate.

3. Environment

Environment of work place should always light to allow operators to see clearly and also safety issues. If production area in a dark condition will affected the performance of operators and the efficiency of the production. line.

4. Method

The factor that affects productivity is method. When the setup of the production has an uneven takt time of process resulting in workload accumulation so it will cause the company cannot obtain the demand output per day.

2.3 Connection between productivity and lean manufacturing

Based on the case study Rosa et.al (2017), the assembly lines of the steel wire-ropes improves by applies the Lean tools and PDCA method. It has achieved the objective which eliminates wastes by Lean tools in the different areas such as problem in supply, operator movement, the reliability of equipment, balancing of tasks, definition and standardization of work methods. Besides that, the company have increases in productivity of 41% in assembly line. Thus, Lean tools and technique play an important role in the company to improve of productivity.

According to Choomlucksana et al. (2015) study in sheet metal stamping process has determine the process obtain motion waste, worker performance, and total processing time. These wastes can define as non-value added activities to process. The company have improve the efficiency of production processes and identify the opportunities area for waste reduction by take advantages of lean and others improvements tools and techniques which are visual control, Poka-Yoke, and 5S. Therefore, the processing time has been reduced and non-value activities also reduce from 1,086 activities to 261 activities after applying lean manufacturing principles. Thus, non-value activities that exist in company need to eliminate for improvement. Non-value added activities play an important role to success the business because satisfaction of customer dependent upon the amount of value-added activities versus the non-value added activities.