SOLVING BOTTLENECK AT PRODUCTION LINE THROUGH SIMULATION TO ENHANCE PRODUCTIVITY AT MANUFACTURING COMPANY

LEVYNIA IMAS ANAK HENRY SANG
B091910217

BACHELOR OF MANUFACTURING ENGINEERING TECHNOLOGY (PROCESS AND TECHNOLOGY) WITH HONOURS

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Levynia Imas Anak Henry Sang

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DECLARATION

I declare that this Choose an item. entitled "Solving Bottleneck at Production Line Through Simulation to Enhance Productivity at Manufacturing Company" is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : Levynia Imas Anak Henry Sang

Date : 26/01/2023

APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours.

Signature	:	
Supervisor Name	:	Ts.Dr. Mohd Soufhwee Bin Abd Rahman
Date	:	27/1/2023

DEDICATION

Praise to God for the strength, guidance and knowledge that was given by God for me to complete this study.

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To my beloved parents, families and my friends for every support that was given to me.

&

To my supervisor, Ts.Dr. Mohd Soufhwee Bin Abd Rahman for guidance and advice in completing this research.

&

To all people who support me throughout my journey.

ABSTRACT

In Lean manufacturing, waiting waste is important to stream and indeed is probably the second most critical waste among all seven wastes. Line balancing is a technique implemented in the industry to eliminate wasteful waiting. Growing manufacturing companies have begun to incorporate lean manufacturing ideas into their organizations. It is important in industry to solve productivity problems in the production line. This research was conducted at PEPS-JV Sdn. Bhd .Currently, the case company discovered that they are lack of attention to the accuracy of cycle time and have unequal workload among the operator. Decisions will be made by using lean manufacturing techniques to solve this problem. In addition, lean tool line balancing is another tool to support researchers to solve bottlenecks in production lines. The aim of this study is to conduct a line balance study using Arena simulation software to improve the smoothness of the production line and thus increase productivity. Real-time data will be collected in case companies and shown in histograms. To move towards IR4.0, Arena simulation software is used to verify the productivity of the new workstation design. An Arena simulation model that can be used to make strategic decisions about process improvement will be built using bottlenecks as a basic step to solve problems in a productivity production line. This model can take advantage of the facts needed to make such a decision. The effect of using appropriate lean tools on a production line can be usefully analyzed through the use of simulation. The overall productivity produced by a manufacturing company's production line attempts to represent the manufacturing company's ideal future situation. As a result, the time study methodology used in this study to analyze the production line and provide it with a more effective selection tool. At the end of this study, a comparison of the results of the existing production line system and the new production line in the simulation model after the implementation of corrective actions shows that the productivity of product production has increased by 11.7% if reduced workstations and 2.5% increased if operator 2 does work on workstation 2. In this research, using the method of line balancing and Arena simulation is the best to solve the problem of bottlenecks issue that occurs in the production line. The proposed solution is a reduced workstation because the percentage productivity of product production is higher compared to the second one.

ABSTRAK

Dalam pembuatan Lean, sisa menunggu adalah penting untuk aliran dan sememangnya mungkin merupakan sisa kedua paling kritikal antara kesemua tujuh sisa. Pengimbangan talian adalah teknik yang dilaksanakan dalam industri untuk menghapuskan menunggu yang membazir. Syarikat perkilangan yang semakin berkembang telah mula memasukkan idea pembuatan tanpa lemak ke dalam organisasi mereka. Adalah penting dalam industri untuk menyelesaikan masalah produktiviti dalam barisan pengeluaran. Penyelidikan ini dijalankan di PEPS-JV Sdn. Bhd .Pada masa ini, syarikat kes mendapati bahawa mereka kurang mengambil berat tentang ketepatan masa kitaran dan mempunyai beban kerja yang tidak sama rata di kalangan pengendali. Keputusan akan dibuat dengan menggunakan teknik pembuatan kurus untuk menyelesaikan masalah ini. Di samping itu, pengimbangan garisan alat tanpa lemak ialah alat lain untuk menyokong penyelidik menyelesaikan kesesakan dalam barisan pengeluaran. Matlamat kajian ini adalah untuk menjalankan kajian imbangan garisan menggunakan perisian simulasi Arena bagi meningkatkan kelancaran barisan pengeluaran dan seterusnya meningkatkan produktiviti. Data masa nyata akan dikumpul dalam kes syarikat dan ditunjukkan dalam histogram. Untuk bergerak ke arah IR4.0, perisian simulasi Arena digunakan untuk mengesahkan produktiviti reka bentuk stesen kerja baharu. Model simulasi Arena yang boleh digunakan untuk membuat keputusan strategik tentang penambahbaikan proses akan dibina menggunakan kesesakan sebagai langkah asas untuk menyelesaikan masalah dalam barisan pengeluaran produktiviti. Model ini boleh mengambil kesempatan daripada fakta yang diperlukan untuk membuat keputusan sedemikian. Kesan penggunaan alat kurus yang sesuai pada barisan pengeluaran boleh dianalisis dengan berguna melalui penggunaan simulasi. Produktiviti keseluruhan yang dihasilkan oleh barisan pengeluaran syarikat pembuatan cuba mewakili situasi masa depan ideal syarikat pembuatan. Hasilnya, metodologi kajian masa yang digunakan dalam kajian ini untuk menganalisis barisan pengeluaran dan menyediakannya dengan alat pemilihan yang lebih berkesan. Di akhir kajian ini, perbandingan keputusan sistem barisan pengeluaran sedia ada dan barisan pengeluaran baharu dalam model simulasi selepas pelaksanaan tindakan pembetulan menunjukkan bahawa produktiviti pengeluaran produk telah meningkat sebanyak 11.7% jika stesen kerja berkurangan dan 2.5. % meningkat jika operator 2 melakukan kerja di stesen kerja 2. Dalam penyelidikan ini, menggunakan kaedah pengimbangan garisan dan simulasi Arena adalah yang terbaik untuk menyelesaikan masalah masalah kesesakan yang berlaku di barisan pengeluaran. Penyelesaian yang dicadangkan ialah stesen kerja yang dikurangkan kerana peratusan produktiviti pengeluaran produk adalah lebih tinggi berbanding dengan yang kedua.

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LM	-	Lean Manufacturing
TPS	-	Toyota Production System
VSM	-	Value Stream Mapping
JIT	-	Just in Time
TPM	-	Total Productive Maintenance
OEE	-	Overall Equipment Effectiveness
TQM	-	Total Quality Management
KPI	-	Key Performance Indicator
SMED	-	Single-minute Exchange of Die
PDCA	-	Plan Do Check Act

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

The study's justification and overview were laid out in this chapter. The chapter begins with an introduction to the business and the theory behind the project. The next step is to talk about what you want to accomplish.

1.1 Background

Digital industrial technology was referred to Industry 4.0, became widely accessible, manufacturing businesses immediately began experimenting with more efficient techniques of production. The companies operate within this sector are able to take action on management strategies that will enable to enhance the characteristics of their production and services, increase the quality, and decrease their costs of their product, all while improving their capital productivity and providing services to their customers. The fact that manufacturers have decided not only to fulfil the needs of domestic markets but also to provide a product of higher quality to international markets. As a result, to be taken in order to constantly enhance the manufacturing process and eliminate waste so that the product can be delivered.

In this work, lean tools is essential element of the lean manufacturing concept and principles that aim to increase the efficiency of the production line. Lean manufacturing is a tool that may be used to increase profits and to improve the efficiency of the system by reducing waste. This is due to the implementation of a bottleneck, which attempts to distribute work among all operators while reducing the number of workstations in the production line.

In addition, most of the production lines does not apply simulation as their tools before real production started. It can be used to analyse a variety of scenarios, also known as simulation scenarios, in order to develop and improve processes. As a result, the decision was made to combine bottleneck study with Arena simulation in order to make that output a decision about how to increase productivity in the production line. In the real world, where every company wants to be successful in the long run on the global market, competition and excellence are very important.

1.2 Problem Statement

In the modern, global marketplace, manufacturer need to compete to each other to deliver the best service to their customer. As a result, a lot of businesses are constantly searching for innovative approaches to enhance the productivity of their production lines. Significant percentage of manufacturers does'nt have clear understanding on how to implement lean concepts into their operations. Many industries keep making same mistake of producing unnecessary waste or sacrificing productivity on the production line, resulting in customers not receiving their orders on time. The automotive business, PEPS-JV Sdn. Bhd, then, will serve as the primary target of this investigation.

By making suggestions for ways to improve the production line using other good methods, they require assistance from a good technique such as the bottleneck lean tool, which analyses the lean waste that occurs in the production line. The company's PEPS-JV Sdn. Bhd production system, it is important to make use of this method in order to identify the right reliability in the production line and the primary case of products in order to satisfy customers. The bottleneck, the problem that has to be solved, is a tool that can be used to increase profits in order to improve the efficiency of the system as a whole by decreasing or eliminating waste (Bastos et al., 2018). Furthermore, the lean tool line balancing is another tool to support the research to solve the bottleneck.

Moreover, developments in information technology have increased manufacturers' potential, allowing them to achieve good financial performance while simultaneously improving product quality and reducing costs. As a result, by using Arena simulation software the validate the performance of the system and associate lean manufacturing with the idea of Industry 4.0. The bottleneck analysis and the Arena simulation are going to be combined as a result of a decision. The output of this combination will be a decision about how to improve productivity in the production line.

1.3 Research Objective

The objectives of this work included the following:

1) To proposed a combination between bottleneck and simulation in process improvement.
2) To validate the proposed methodology for bottleneck and simulation.
3) To suggest a improvement alternative through proposed methodology.

1.4 Scope of Research

This research aims to identify the bottleneck lean tool and simulation activity in the manufacturing process and improve productivity as a result. To better understand and conceptualise the production process, the decision was made to revisit the production planning. Then, the findings of this study will show that the lean technique can be used to make improvements. The aims for this research are to provide smooth flow of production and the biggest possible productivity increase. This study will conduct by using the line balancing method in PEPS-JV(M) Sdn Bhd. The line balancing method will be applied in production line 4 (3MO), which assembles the Frame Comp Rear RH LH by spot welding.

Additionally, simulation and bottleneck lean tools can also be used to analyse current processes and make suggestions for improvement to the management of a company. Arena is the software that will be used for simulation purposes. Research in this area uses the bottleneck lean tool in the Arena simulation to conceptualise current manufacturing processes. Next, a simulation model is used to examine the current stream of waste for lean waste. Many lean tools, like Kanban, the Pull System, Standard Work Tool and Line Balancing, can help shorten lead times and help management increase customer delivery rates.

1.5 Summary

The project improvement research will be conducted based on the problem that has been identified and the advanced conceptual understanding of the project background. Within the scope of research, the study is also based on three main objectives. The process of studying will go smoothly and be clear if there are clear limits set in the scope of research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The main objective of a literature review is to evaluate and analyse what approved researchers have written on a given issue. This section aims to express information about bottlenecks and simulation ideas related to productivity improvement. The concept of bottlenecks and simulations, case studies of successful implementations of this approach will be highlighted. Then, this section includes case studies that demonstrate how Bottle-neck and simulation were used in a Lean Manufacturing Company. Furthermore, this section identifies gaps in previous research as well as what needs to be studied further about the use of the lean technique.

2.2 History of LM

A manufacturing practise known as Lean Manufacturing (LM), or simply Lean, considers any expenditure of resources other than the creation of value to be wasteful and thus a target for elimination. 'Value' is defined by a customer's willingness to pay for the product. The lean concept dates back to the end of the 19th century and the beginning of the 20th century, when Henry Ford and other manufacturers began developing production systems that were more efficient. Figure 2.1 depicts a high-level overview of the evolution of lean management over time. Eli Whitney, Taylor, Gilbreth, Henry Ford, Shingo, and Ohno all played significant roles in the evolution of the lean concept. (Krishnan et al., 2018)

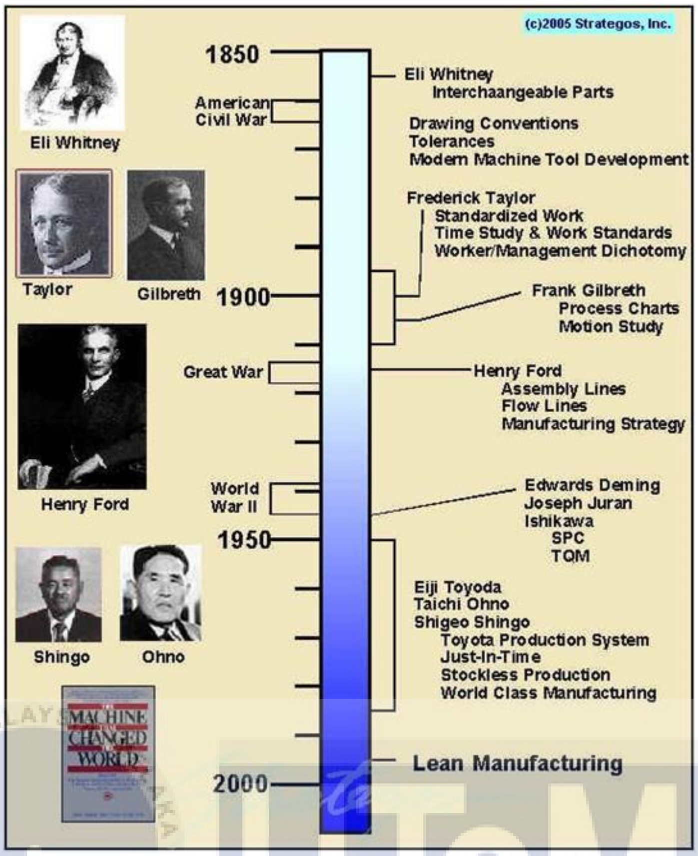

Figure 2.1 History of LM (Krishnan et al., 2018)

Since the 1980s, many business models have been developed to teach and demonstrate business management. However, only a few of these models were long-term and secure. Japan was viewed as a model for a rising manufacturing nation in the late 1980s. It was not only in Japan that Toyota, Nissan, Sony and Honda began to establish market position. Other market participants, consultants, and academics were curious about how these companies designed, implemented, and operated their manufacturing systems. These procedures were to be called "lean production."

2.3 Lean Manufacturing

Productivity and waste reduction are the primary goals of the LM process. By reducing waste in organisations, the lean philosophy aims to maintain a steady flow of production. An important part of LM's creation process is empowering the flow system to attract customers from all over the organisation by using a variety of mechanical practises to identify value-adding processes. By eliminating all waste, Velmurugan et al. (2020) claim that lean is a method that aims to benefit the customer and society while also lowering costs and increasing quality.

The Toyota Production System (TPS), developed in Japan by Taichii Ohno's drives at Toyota Motor Company (Ohno, 1988), aims to reduce waste in a manufacturing operation. The two guiding principles of lean manufacturing are visualisation and "go to see," also known as "go to Gemba," which aim to reduce "Muda," or non-value-added activities. Most manufacturing companies have shifted their focus away from equipment and energy utilisation in order to reduce lead time and "Muda." A company can apply lean manufacturing techniques to a specific production process using a variety of lean techniques. Seven different types of waste are targeted by lean manufacturing, as are numerous tools and techniques that companies around the world have adopted.

2.3.1 Types of Lean Waste

The principle of LM states that customers don't pay for mistakes or waste; they only pay for the product's value. The term "waste" then refers to any flaws or errors that undermine customer loyalty (Yahya et al., 2019). Waste is defined as any activity that degrades product quality while adding no value to the product. Efforts should be made to identify the source of poor product quality and waste so that users in the production line can be improved. According to Ohno, waste includes transportation, inventory, motion, waiting, overproduction, overprocessing, and defects (1988). There are seven types of Lean waste developed and shown in Figure 2.2 that are commonly referred to in manufacturing as TIMWOOD wastes (Cawley et al., 2020).