PRODUCTIVITY IMPROVEMENT IN SME INDUSTRY BY USING TIME STUDY AND WORK MEASUREMENT ANALYSIS

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

by

NORSHAMIRA AIZAT BINTI BAHARUDIN

B051810184

971211-10-6350

FACULTY OF MANUFACTURING ENGINEERING

2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: **PRODUCTIVITY IMPROVEMENT IN SME INDUSTRY BY USING TIME STUDY AND WORK MEASUREMENT ANALYSIS**

Sesi Pengajian: **2021/2022 Semester 2**

Saya **NORSHAMIRA AIZAT BINTI BAHARUDIN (971211-10-6350)**

mengaku membenarkan Laporan Projek Sarjana Muda (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 antara institusi pengajian tinggi.
4. *Sila tandakan (√)

☐ SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysiasebagaimana 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. 5-4-2 Gugusan Dahlia,
Jalan Pekaka 8/7,
Seksyen 8 Kota Damansara,
47810 Petaling Jaya, Selangor
Tarikh: 28 June 2022

Cop Rasmi: ABDUL AKRAMIN BIN MOHAMAD
Senior Lecturer
Faculty of Manufacturing Engineering
Universiti Teknikal Malaysia Melaka

Tarikh: 30.6.22

*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 Improvement in SME Industry by Using Time Study and Work Measurement Analysis" is the result of my own research except as cited in references.

Signature : .....

Author's Name : NORSHAMIRA AIZAT BINTI BAHARUDIN

Date : 28 June 2022

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:

.....

(NOR AKRAMIN BIN MOHAMAD)

NOR AKRAMIN BIN MOHAMAD
Senior Lecturer
Faculty of Manufacturing Engineering
Universiti Teknikal Malaysia Melaka

ABSTRAK

Peningkatan produktiviti adalah aspek penting untuk industri pembuatan yang semakin berkembang. Sektor perindustrian yang kian bersaing antara satu sama lain untuk berkembang dan berkembang maju dalam pasaran baru muncul. Kajian masa dan kaedah pengukuran kerja dikenali sebagai alat utama dan digunakan secara meluas untuk meningkatkan produktiviti. Kertas kerja ini membentangkan kajian yang bertujuan untuk meningkatkan produktiviti dan kecekapan proses aliran yang mungkin disebabkan oleh kesesakan dan kewujudan masa terbiar dalam industri pembuatan dengan mengatasinya menggunakan analisis Kajian Masa dan Pengukuran Kerja. Bagi menjayakan projek ini, satu kajian kes telah dijalankan di sebuah syarikat pembuatan sabun yang terletak di Batu Berendam, Melaka. Syarikat ini membuat pelbagai jenis sabun buku dan telah mengedarkannya ke kedai dan hotel. Kaedah pemerhatian terus dan rakaman video digunakan untuk mengenal pasti proses pembuatan sabun. Barisan pengeluaran semasa terdiri daripada lapan langkah proses utama untuk menghasilkan sabun buku ini. Setiap langkah proses utama dibahagikan kepada elemen kerja yang dikehendaki. Punca utama yang dikenal pasti dalam kajian ini ialah masa pengeluaran proses yang tidak seimbang, serta tiada masa standard ditetapkan untuk proses utama dalam barisan pengeluaran. Pemerhatian telah dijalankan ke atas lapan langkah proses utama dengan mengambil kira masa kitaran dan pergerakan setiap kerja yang dilakukan oleh pekerja. Masa standard lapan langkah proses telah dijana dengan mengambil kira elaun dan penarafan prestasi. Satu lagi matlamat kajian ini adalah untuk mencadangkan penyelesaian alternatif untuk menambah baik barisan pengeluaran dan mengurangkan masa kitaran. Bagi mengurangkan masa kitaran terdapat empat kemungkinan penyelesaian telah dicadangkan iaitu penggunaan strategi 5S, membuat Prosedur Operasi Standard (SOP), melaksanakan penyelenggaraan pencegahan menyeluruh (TPM) dan strategi kerja baharu. Penyelesaian yang dicadangkan ini dapat menjadikan barisan pengeluaran teratur, prosedur kerja menjadi lebih mudah untuk dilakukan dan mengimbangi gerakan buruh untuk mengendalikan tugas tertentu.

ABSTRACT

Increased productivity is an important aspect for a growing manufacturing industry. The industrial sectors compete with each other to grow and thrive in an emerging market. Time study and work measurement methods are known as leading tools and are widely used to increase productivity. This paper presents a study aimed at improving productivity and efficiency of flow processes that may be due to bottlenecks and the existence of idle time in the manufacturing industry by overcoming them using Time Study and Work Measurement analysis. To make this project a success, a case study was conducted at a soap manufacturing company located in Batu Berendam, Melaka. The company makes a wide variety of soap bars and distributes them to shops and hotels. Direct observation and video recording methods were used to identify the soap bars making process. The current production line consists of eight major process steps to produce the soap bars. Each main process step was divided into the desired job elements. The root cause identified in this study is unbalanced production time, as well as no standard time established for the main processes in the production line. The observation has been carried out on the eight main process steps by taking into account the cycle time and motion of each job performed by the worker. The standard time of eight process steps has been generated by considering the allowances and performance rating. Another goal of this study is to suggest alternative solutions to improve the production line and reduce the cycle time. In order to reduce the cycle time there are four possible solutions has been proposed which is utiljzation of 5s strategy, making Standard Operating Procedure (SOP), implement total preventive maintenance (TPM) and new working strategy. This proposed solution able to make the production line organised, the work procedure become simpler to be performed and balanced the labour motion to handle the specific task.

DEDICATION

I dedicated this to my parents, siblings, my friends and people around me,

Thank you for your endless support, motivation and encouragement,

Stay safe, take care and may Allah bless all of us.

ACKNOWLEDGEMENT

Praise be to God, who is most gracious and most loving, for allowing us to complete this final year 2 project without difficulty. Currently, when I submit a final year thesis, I believe that my research study would not have been feasible without the encouragement, criticism, and guidance of individuals who are important in my academic and personal lives. First and foremost, I'd want to express my gratitude to Sir Nor Akramin Bin Mohamad, my supervisor, whose suggestions were really useful in writing my report, and his concern for the students has always made me perform better confidentially. Thank you for guiding me so well through the completion of my report. I am endlessly grateful to my family, who have always wished for the best for me and supported my efforts to complete this report. Special thanks to my friends who are always willing to help me and always have time to teach me and advise me on how to properly implement my bachelor's degree project, even though we do not meet face to face but do keep in touch with each other. I am eternally grateful to all of my classmates and friends for their unrivalled encouragement and support. Finally, thanks to my panel, who corrected errors throughout the project, this research would not have been possible without the support and love of all of these parties.

TABLE OF CONTENT

CHAPTER 3: METHODOLOGY

CHAPTER 4: RESULT AND DISCUSSION

LIST OF TABLE

LIST OF FIGURE

LIST OF ABBREVIATIONS

PMTS	-	Predetermined Motion Time Study
MOST	-	Maynard Operation Sequence Technique
MTM	-	Methods Time Measurement
MCB	-	Master Clerical Data
BMT	-	Basic Motion Time Study
NVA	-	Non- Value Added
NA	-	Value Added
SOP	-	Standard Operating Procedure
TPM	-	Total Preventive Maintenance

CHAPTER 1
INTRODUCTION

1.1 Background of Study

Productivity improvement refers to increasing production while using the same amount of resources. It is interpret as the proportion between output and input. Removing non-productive process and reducing production cycle time can increase manufacturing process performance to allow manufacturing organizations to be more sustainable and competitive (Mishan and Tap, 2015; Taifa and Vhora, 2019; Shah and Suthar, 2018). In today's competitive and global market, companies are primarily concerned with increasing labor productivity while simultaneously reducing production cycle times.

According to Bauters et al., 2018; Sato and Murata, 2008, by applying the work cycle classification method can detect anomalous and problematic situations in the work station flow. Because, each work station is supposed to have the same cycle time, although having various capabilities, in order to avoid idle time, bottlenecks and any waste. A bottleneck is a stage in a production system that has the greatest impact on slowing or stopping the entire system. Although most manufacturing systems typically have a single bottleneck, in all but the simplest applications bottlenecks are not static but rather shift between different machines (Roser et al., 2002). As can be seen, the bottleneck tends to result in a longer cycle time. When a bottleneck occurs in production, it causes a delay in the completion of the product, as well as the appearance of idle time. In fact, this could affect the productivity improvement.

However, the fundamental of time study technique could be used to improve production productivity. The time study technique, which is performed with a stopwatch, is one of the most effective tools used by process engineers in the production line to perform

work measurement analysis. This concept creates a smooth and easy motion while also improving worker capability. As stated by Al-Saleh, (2011), the time study method has been used by more than 89 percent of the industry to complete work measurement. Even though technology has evolved rapidly, there are no significant tools that can replace the advantageous time study method.

Thus, this research takes initiative to used Time Study and Work Measurement methods to improve the productivity process in order to reduce the idle time and the bottleneck that occurring in production. Time study is one of the oldest fundamental methods that has ever been used to increase productivity (Murali and Prabukarthi, 2020; Nallusamy and Saravanan, 2016). The Time Study and Work Measurement will examine the work process and eliminate non-productive process, which can reduce number of process, space utilization and production and operation time. According Talib Bon and Ariffin, (2008) time is important and it is money because the time tells us exactly how much money was spent.

1.2 Problem Statement

Most manufacturing systems usually have at least one bottleneck either in big or SME's industry. A bottleneck can appear to the difference in cycle time at each workstation production system. Cycle time is the time interval between completing two units or the maximum amount of time required for the production of any work piece at any workstation (Emeke Great, 2013). As a result, they will face problems completing the product during production which causes delays due to extended the time in production.

The same goes for the company of small and medium enterprises (SMEs) that are located at Batu Berendam, which has been chosen to conduct this project. This SME industry manufactures goat milk soap bar. The significant issue in this soap bar production is that apparently the flow processes for stations are unbalanced and some will be idle for a long time while others will experience bottlenecks, especially in the refining process. Currently, the production line consists of eight major process steps which some of process combine together to produce the goat milk soap. Each main process step was divided into the desired job elements. Through this process flow, the production is semi-automated, which means the

process is performed by the combination of machine operation and manual handling by workers. This activity will take a long time, which may result in wasted time, in fact no standard time has been set for the eight main process steps in the soap production process.

Besides that, Figure 1.1 clearly states the observed time of the soap bar production. Throughout the observed time, it is obvious that the refining process has the highest cycle time, which shows the main cause of the bottleneck. The refining process is a semi-automated machine operation, then to complete one cycle will take a long time to complete. Not to mention that this company also have problem on the capacity of plodder machine in which it has always had problems. As a consequence, this causes delays in timely delivery and sometimes reduces the production capacity.

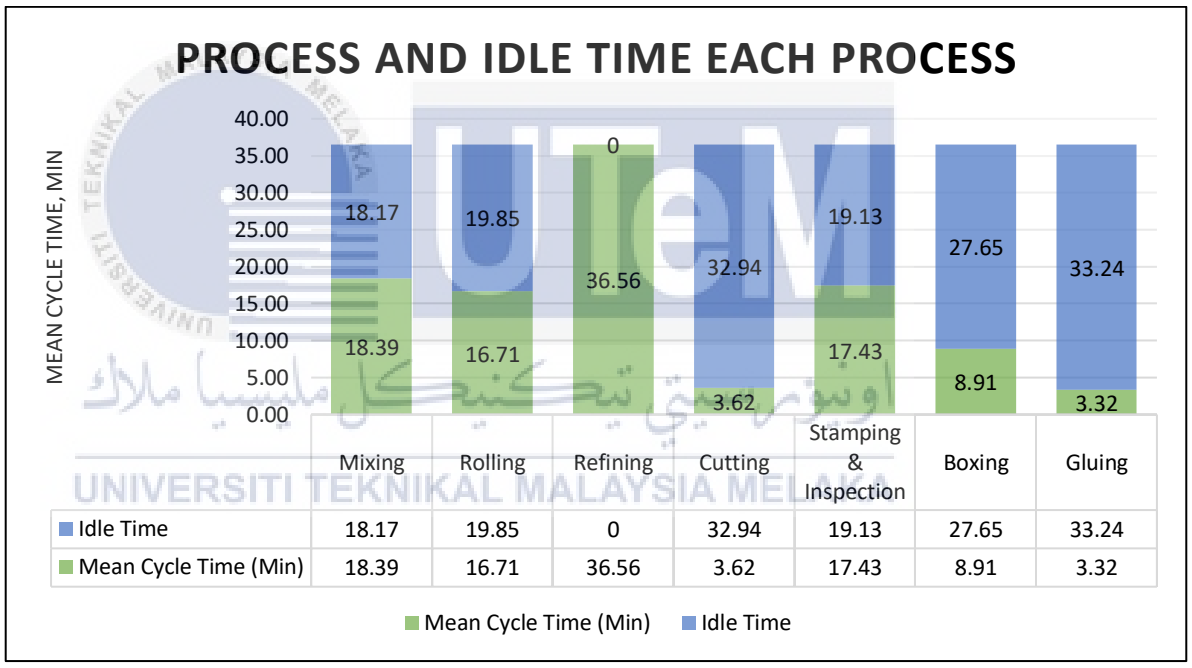

Figure 1.1: Process and Idle Time for Each Workstation

As can be seen, the bottleneck has an effect on the operation by increasing the cycle time, slowing down the process system and decreasing efficiency in the production process (Kahraman, Rogers and Dessureault, 2020). As a result, this research will concentrate on improving the production process, which has the longest cycle time due to bottleneck and may cause idle time.

1.3 Objectives

The main objective of this study and research are:

i. To implement the Time Study Analysis and Work Measurement method in production SME soap manufacturing industry

ii. To analyze the problem encountered in current soap bars production flow

iii. To proposed an alternative for process flow to improve production time

1.4 Scopes of the Project

The justification of this study are as follows:

i. This project will concentrate on implementing Time Study Analysis and Work Measurement to determine the standard time to complete each

ii. This study only focus on one model that contain 8 processes at soap manufacturing industry

iii. This project focus on identify critical issues that may affect productivity improvement

1.5 Significant of Study

Time study methods and work measurement analysis are both widely used in the manufacturing industry and are recognized as fundamental tools for increasing productivity. It serves as a catalyst for the company's continued growth and profit margin expansion. This method will be applied to a wide range of procedures in order to determine the standard time and standardize working methods, with the goal of this study to reduce bottleneck activity and idle time in the production line. The leans tools will be utilized in order to eliminate the waste activities in the long soap production process

1.6 Organization of Report/Thesis

The following is how this report is organised. The Chapter 1 begins with a background of study, problem statements, objectives, project scopes, and significance of study. This chapter focuses on clearly introducing the topic. It also provides a general research observation. The following chapter (Chapter 2), Literature Review, aids in understanding more about the project based on previous studies or research done by other researchers regarding the Time Study and Work Measurement analysis. The previous journal's information will be cited to support the stated description. It also contributes to a better understanding of the study. Then, in Chapter 3, methodology describes the step-by-step process that will be used in project development to achieve the goal of this case study. Just after that, Chapter 4 focuses primarily on the data collection process. The time value will be gathered, analysed, and discussed following the implementation of the Result and Discussion time study method. Based on the related analysis, a possible solution to improve the production line of the soap production process will be presented. Finally, Chapter 5 (conclusion and recommendations) summarises the overall findings of the case study and suggests some methods or techniques for continuous improvement.

CHAPTER 2
LITERATURE REVIEW

This chapter mainly emphasis on the review of the previous studies regarding the time study and work measurement analysis in manufacturing industry. Different techniques for proposing time studies and work measurement have resulted in various productivity improvements in order to reduce bottlenecks and idle time in the manufacturing industry. The information of the previous journal will be cited for supporting the stated description. Furthermore, the various manufacturing methods toward the causes that could affect productivity improvement are reviewed.

2.1 Productivity in SMEs Industry

$Productivity = \frac{Output}{Input}$ May have been used to define productivity. The term "productivity" can be used to estimate or measure the amount of output that can be obtained from a given input (Duran, Cetindere and Aksu, 2015). In other words, productivity reflects the ability (Sauian, Kamarudin and Rani, 2013) to generate higher income or value-added for the organization, and labor performance is influenced by a various factors, and most of those are related to time, cost, and quality constraints (Soekiman et al., 2011. A common goal is to establish a continuous improvement process that achieves the same added value while using fewer resources (Womack and Jones, 2003). According to Meena et al., 2014, the working environment is the most important factor that influences worker work quality, which is related to organizational productivity. Because productivity is the single most important factor in increasing the prosperity of any organization in terms of cost-return analysis, profitability, and operational efficiency. The integration of various functional groups within a manufacturing organization can boost both productivity and quality (Jain et al., 2016).

2.1.1 Productivity Improvement

Productivity defined as the ratio between output of wealth and the input of resources used in the process of production. Productivity can be used to determine how much of a specific output can be extracted from a given input. Productivity measurement is essential in any manufacturing industry. Increasing productivity is one of the most important issues in order to generate more profits from the same resources. Productivity improvements help to satisfy customers while also reducing the time and costs required to develop, produce, and deliver products.

Productivity can be assumed as profit growth. Then, according to Moktadir et al., (2017), productivity can be increased by eliminating inefficient processes, simplifying methods, optimizing systems, reducing variation, maximizing quality or responsiveness, and shortening setup time. Increasing the value-added content of the product while using the same resources can reduce the cost of production units as well as the work content of the production cycle time/process, which can have a good impact on productivity increasing. Productivity improvement is the process of continuously improving any type of activity in manufacturing industry.

Meanwhile, Mittal, Tewari and Khanduja, (2017) state that productivity growth is influenced by the industry's ability to optimally use available resources, innovate, improve operational efficiency, and adopt environmentally friendly and adaptable scenarios. Various quality improvement tools and techniques, as well as their integration, have previously been tried to boost productivity levels in large-scale organizations around the world. Process improvement is an equally important aspect of increasing productivity and can be accomplished by employing some appropriate management techniques.

2.1.2 Causes Slow Productivity Improvement

In the manufacturing industry, managers and engineers strive to find methods to eliminate common problems in production lines, such as bottleneck and 7 waste. This is due to the fact that all of these issues impose additional costs on the company. Furthermore,

manufacturers will strive on improving productivity, efficiency and good product quality as a measure to maintain competitiveness among other industry. It can be obtained by identifying solutions to various industrial problems that have affected the productivity of manufacturing systems such as high idle time caused by waiting times. In addition, several parameters, such as machine capacity and resource availability have a significant impact on aspects such as processing power, cycle time and average delay in a continuous production system. Some of them may have a greater impact on system performance than others.

2.1.2.1Bottleneck

The bottleneck problem can cause the manufacturing process to slow down and in some cases, stop completely thus limiting manufacturing capacity. A bottleneck is a work stage that receives more work requests than it can process at full capacity. According to Lenort and Samolejová, (2007), all manufacturing systems are constrained by one or more bottleneck problems, no matter how well a manufacturing system is designed, it cannot be free from bottlenecks, including digital manufacturing systems or the 4.0 industrial revolution. As a consequence, the challenge is to identify the key variables among the many that cause problems, sharpening the focus of process improvement and minimizing manufacturing losses. Any component of the manufacturing process can become a bottleneck by causing congestion, slowing or stopping the manufacturing process. A bottleneck is inevitable when there are differences in work arrival and processing rates. The problem of bottleneck in the manufacturing system will result in a loss of economic value as it defines the volume of manufacturing output. Thus, it might be difficult for some manufacturing industry to increase productivity and competes with other rivals. Table 2.1 below concisely describes 5 different bottleneck variables that can be found from previous case study.

Figure 2.1 : Different Bottleneck Variables from Previous Case Study

Bottleneck variable	**Reference**
Manually production	(Talib Bon and Ariffin, 2008); (Mishan and Tap, 2015)
Machine breakdown	(Wazed, Ahmed and Nukman, 2010)
Quality variation	(Wazed, Ahmed and Nukman, 2010)
Scheduling policies	(Zhang and Wu, 2012)
Machine layout	(Samson, Sunday and Babalola, 2019)

2.1.2.2Idle Time

Idle time is defined as a period of time when an asset (machine or worker) is ready and available but does not do anything productive due to production, economic, or other factors. That is why sometimes, idle time can be referred as a "waiting time". At the same time, idle time is also known as downtime. However, idle time and downtime are not the same thing. In both cases, it is an unproductive period, which means the company loses money because expenses continue to accrue even though production has suddenly stopped. In other words, it will have an effect on slowing down the productivity improvement as well.

As an example, according to a study conducted by Mishan and Tap, (2015) the workload between stations is unbalanced and some stations are idle for extended periods of time. The result will be a slowing of production. What's more, bottleneck is associated with idle time. Where and when a bottleneck occurs, it can result in longer cycle times and product completion delays (Syahputri *et al.*, 2018). Delays in the delivery of goods are definitely detrimental to the industry.

2.1.2.3Seven Waste

One of the most effective ways to improve productivity is to get rid of waste. In Lean, waste is any activity that uses resources but doesn't benefit the customer. The concept of the seven wastes originated in Japan, where waste is known as "muda." As mention by El-