UNIVERSITI TEKNIKAL MALAYSIA MELAKA

OVERALL LABOUR EFFICIENCY IMPROVEMENT USING MAYNARD OPERATIONAL SEQUENCE TECHNIQUE AT SME AEROSPACE MANUFACTURING COMPANY

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BACHELOR OF MANUFACTURING ENGINEERING TECHNOLOGY WITH HONOURS

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A thesis submitted
in fulfillment of the requirements for the degree of
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2023

DECLARATION

I declare that this thesis entitled " Overall Labour Efficiency Improvement using Maynard Operational Sequence Technique at SME Aerospace Manufacturing Company" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : Siti Khadijah Bt Ismail

Date : 10/1/2023

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 (BMMW) with Honours.

Signature :

Supervisor Name : Ts. Dr. Rohana Binti Abdullah

Date : 10/1/2023

DEDICATION

This appreciation is dedicated to my beloved parents, siblings, friends and my special friend that is always been there for me spiritually and emotionally. Not to be forgotten, my supervisor, Ts. Dr. Rohana Binti Abdullah for her guidance and encouragement that motivate me to complete this thesis.

ABSTRACT

In the era of Industrial Revolution 4.0, the current levels of competition in the manufacturing industry make the organizations continue to meet the customer demand but due to the problems like process delays caused by labor, it has become difficult in meeting customer demand on time that will affect the productivity of an organization. This study used a tool quality management which is DMAIC (Define-Measure-Analyze-Improve-Control) to have clearer detail on the process that will lead to a reduction of defects and cycle time as well as improve the capability of processes. To boost productivity in Aerospace Manufacturing Industry (SME Aerospace Sdn Bhd), a thorough time study research was conducted to ensure the productivity is enhanced since there is a lack of exposure to other alternatives of time study measurement methods to be applied other than the conventional stopwatch study. The research therefore also aims to improve productivity by analyzing the standard time and analyzing the labor utilization in each process at the Assembly 6C Overwing Beam Section workstation using Maynard Operational Sequence Technique (MOST). Indirectly, the impact of MOST time study over the performance in the assembly line will automatically be known and the improvement is easily proposed due to the Non-Value Added (NVA) activities detected based on the highest standard time in a process. Based on throughput time analysis, it involves monitoring and standardization of cycle time for all processes using MOST and the huge differences between MOST data and SMEA data are proven. Work is further extended to identifying labour utilization based on the compliance of workers towards their work and whether their action influence production or otherwise. Due to the analysis that has been done, the focus then on the bottleneck process which is at Stage 3 (Secure IB/OB Brackets) that contributes to the highest cycle time. In stage 3 (Secure IB/OB Brackets), the cycle time is 0.38 hours lower than SMEA data which is 0.93 hours which shows the huge gap. Furthermore, the utilization of labor in stage 3 (Secure IB/OB Brackets) should approximately achieve 82% which is known as the target of labor utilization in this study. To improve the throughput time at Stage 3 (Secure IB/OB Brackets) process, the Fishbone Diagram and Why-Why Analysis were implemented. Through both methods, the root cause towards the huge gap in cycle time between SMEA data and MOST data is detected. In summary, the optimum labour utilization at the bottleneck process is achieved by 81.12% and throughput time increases by 33% due to a great reduction of cycle time. The control action using certain tools will be made towards the proposed improvement to ensure long-term organizational effectiveness and sustainability. The main contribution this article makes is that it provides SMEA organization with a user-friendly technique (MOST) to improve organizational effectiveness and productivity with minimal capital expenditures.

ABSTRAK

Dalam era Revolusi Perindustrian 4.0 kini, tahap persaingan dalam industri pembuatan telah menjadikan sesebuah organisasi terus berusaha memenuhi permintaan pelanggan tetapi disebabkan masalah seperti kelewatan proses yang disebabkan oleh pekerja, ia menjadi sukar untuk memenuhi permintaan pelanggan tepat pada masanya dimana ianya telah menjejaskan produktiviti sesebuah organisasi. Kajian ini menggunakan pengurusan kualiti alat iaitu DMAIC (Define-Measure-Analyze-Improve-Control) untuk mempunyai perincian yang lebih jelas tentang proses yang akan membawa kepada pengurangan kepada masalah dan masa kitaran sesuatu proses serta meningkatkan keupayaan proses. Bagi meningkatkan produktiviti dalam Industri Pembuatan Aeroangkasa (SME Aerospace Sdn Bhd), sebuah kajian berkaitan dengan kajian masa telah dijalankan untuk memastikan produktiviti dipertingkatkan memandangkan terdapat kekurangan pendedahan kepada kajian masa yang lain selain daripada kajian masa melalui jam randik konvensional. Oleh itu, penyelidikan ini juga bertujuan untuk meningkatkan produktiviti dengan menganalisis masa standard dan menganalisis penggunaan pekerja dalam setiap proses di stesen kerja 'Assembly 6C Overwing Beam Section' menggunakan 'Maynard Operational Sequence Technique' (MOST). Secara tidak langsung, kesan kajian MOST time ke atas prestasi stesen kerja akan secara automatik diketahui dan penambahbaikan mudah dicadangkan kerana aktiviti Tanpa Nilai Tambah (NVA) dikesan berdasarkan masa standard tertinggi dalam sesuatu proses. Berdasarkan analisis masa pemprosesan, ia melibatkan pemantauan dan penyeragaman masa kitaran untuk semua proses menggunakan MOST dan perbezaan yang ketara antara MOST data dan data SMEA adalah terbukti. Kerja diperluaskan lagi untuk mengenal pasti penggunaan pekerja berdasarkan pematuhan pekerja terhadap kerja mereka dan sama ada tindakan mereka mempengaruhi pengeluaran atau sebaliknya. Oleh kerana analisis yang telah dilakukan, tumpuan kemudiannya kepada proses yang menyumbang kepada kelambatan proses (Bottleneck) iaitu pada Peringkat 3 (Secure IB/OB Brackets) yang menyumbang kepada masa kitaran tertinggi. Pada peringkat 3 (Secure IB/OB Brackets), masa kitaran adalah 0.38 jam lebih rendah daripada data SMEA iaitu 0.93 jam yang menunjukkan jurang yang besar. Tambahan pula, penggunaan tenaga buruh di peringkat 3 (Secure IB/OB Brackets) sepatutnya mencapai lebih kurang 82% yang dikenali sebagai sasaran penggunaan buruh dalam kajian ini. Untuk menambah baik masa pemprosesan pada proses peringkat 3 (Secure IB/OB Brackets), Gambarajah Tulang Ikan dan Analisis Mengapa-Mengapa telah dilaksanakan. Melalui kedua-dua kaedah, punca ke arah jurang yang besar dalam masa kitaran antara data SMEA dan kebanyakan data dikesan. Secara ringkasnya, penggunaan pekerja optimum pada proses kesesakan dicapai sebanyak 81.12% dan masa pemprosesan meningkat sebanyak 33% disebabkan pengurangan masa kitaran yang banyak. Tindakan kawalan menggunakan alat tertentu akan dibuat ke arah cadangan penambahbaikan untuk memastikan keberkesanan dan kemampanan organisasi jangka panjang. Sumbangan utama artikel ini ialah ia menyediakan organisasi SMEA dengan teknik mesra pengguna (MOST) untuk meningkatkan keberkesanan dan produktiviti organisasi dengan perbelanjaan modal yang minimum.

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LIST OF SYMBOLS AND ABBREVIATIONS

PMTS	-	Predetermined Motion Time System
MOST	-	Maynard Operation Sequence Technique
MTM	-	Methods Time Measurement
MODAPTS	-	Modular Arrangement of Predetermined Time Standards
sec	-	Seconds
rf	-	Repeat frequency
cf	-	Cycle frequency
TMU	-	Time Measuring Unit
VA	-	Value Added
NVA	-	Non-Value Added
DMAIC	-	Define-Measure-Analyze-Improve-Control

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CHAPTER 1

INTRODUCTION

1.1 Project Background

Manufacturing is a critical aspect of the production chain from raw materials to a finished product that has existed since the 19th century and contributes to global employment in today's competitive manufacturing environment. However, in the field of manufacturing, there must be 8 types of waste produced along with the product. The most significant loss as a result of inefficiencies was not monetary, but rather a waste of human effort. Due to that, the implementation of productivity is being done. Bhatti and Qureshi (2017) in Pourmola et al. (2019) stated that productivity is normally considered to be a performance indicator, which consists of efficiency and effectiveness.

Therefore, the aim of this study is to conduct a time study investigation in a manufacturing industry which was conducted in the assembly department work station of a selected aerospace manufacturing organization (SME Aerospace Sdn. Bhd.). More importantly, this research study offers the organization a globally accepted, user-friendly technique for improving the effectiveness and overall efficiency which is MOST that divides tasks done into categories of Value Addition (VA), Essential Non-Value Addition (ENVA) and Non-Value Addition (NVA).

The information on the current manufacturing performances of SMEA is gathered as preliminary data for this study such as the background of the company, job scope, components involved, assembly process and facility layout. However, through the factory visit, a quick

observation of the assembly department indicated ineffective operational processes. The problem that has been identified is the utilization of the workers. There is no proper study is being done to know the accurate utilization of these workers based on standard time and labor utilziation. In addition, the standard time of the processes is being identified using a conventional stopwatch study that will affect the preciseness of the data obtained. Through literature review, this can be overcome by performing MOST analysis to analyze each method described in a detailed way with every single motion (Puvanasvaran et al., 2019). This establishes the aim of this study which is to obtain the overall labor efficiency at the selected aircraft assembly line which is the Assembly 6C Overwing Beam section.

1.2 Problem Statement

Recently, companies are becoming more concerned with achieving leaner manufacturing and increasing productivity. To secure maximum profit and to sustain in the dynamic market, being able to produce to outperform the competitors is the only key for any organization (Kaka et al., 2019). Performing time study at the problematic assembly work station areas would help to increase the productivity.

For the selected work station at SME Aerospace, there are some issues with workers' utilization when performing their work. This is due to the lack of exposure to other time study measurement methods to be applied other than the conventional stopwatch study. This is a critical thing to be achieved to move along achieving drastic changes in the method of performing work. Failure to address the wastes that might arise from workers themselves will result in loss to the organization since it is affecting the production line. This happens due to the unwanted movements made by workers that might increase the inefficiency.

A thorough study must be carried out to determine non-value-added activirties by implementing MOST. This vital information will be used to determine the accurate utilization

of the workers and improve the labor productivity based on standard time and their labor utilization for Aerospace Manufacturing Industry at the selected assembly work station.

1.3 Research Objective

The primary objective of this study is to improve labor efficiency in the assembly department of the 6C Overwing Beam section to have an effective required level of manpower. In regard to the primary objective, there are several specific objectives that need to be accomplished in this study.

i. To perform MOST time study at the Assembly 6C Overwing Beam Section work station of SMEA.
ii. To identify standard time and operator utilization using MOST time study.
iii. To propose improvement opportunities at the bottleneck process with the aim to achieve higher labor productivity.

1.4 Scope of Research

This research will concentrate on individual operations of labors that can affect the efficiency of the production system. Their performance is measured using the MOST standard time to increase productivity by defining the proper working method and the way of maximizing the labor's utilization. In addition, the involvement of machine or material processes is not a priority in this research scope. Thus the result of before and after productivity improvement will be present.

1.5 Structure of Report

The report structure explains the flows involved in this research study. All chapters presented in this report show a steps flow in achieving overall labor efficiency. The first chapter known as the Introduction chapter is all about elaborations detail of the study conducted at

SMEA Manufacturing Industry including project background, problem statement, objective, research scope and structure of the report. This study's expected outcome and the study's summary will be presented.

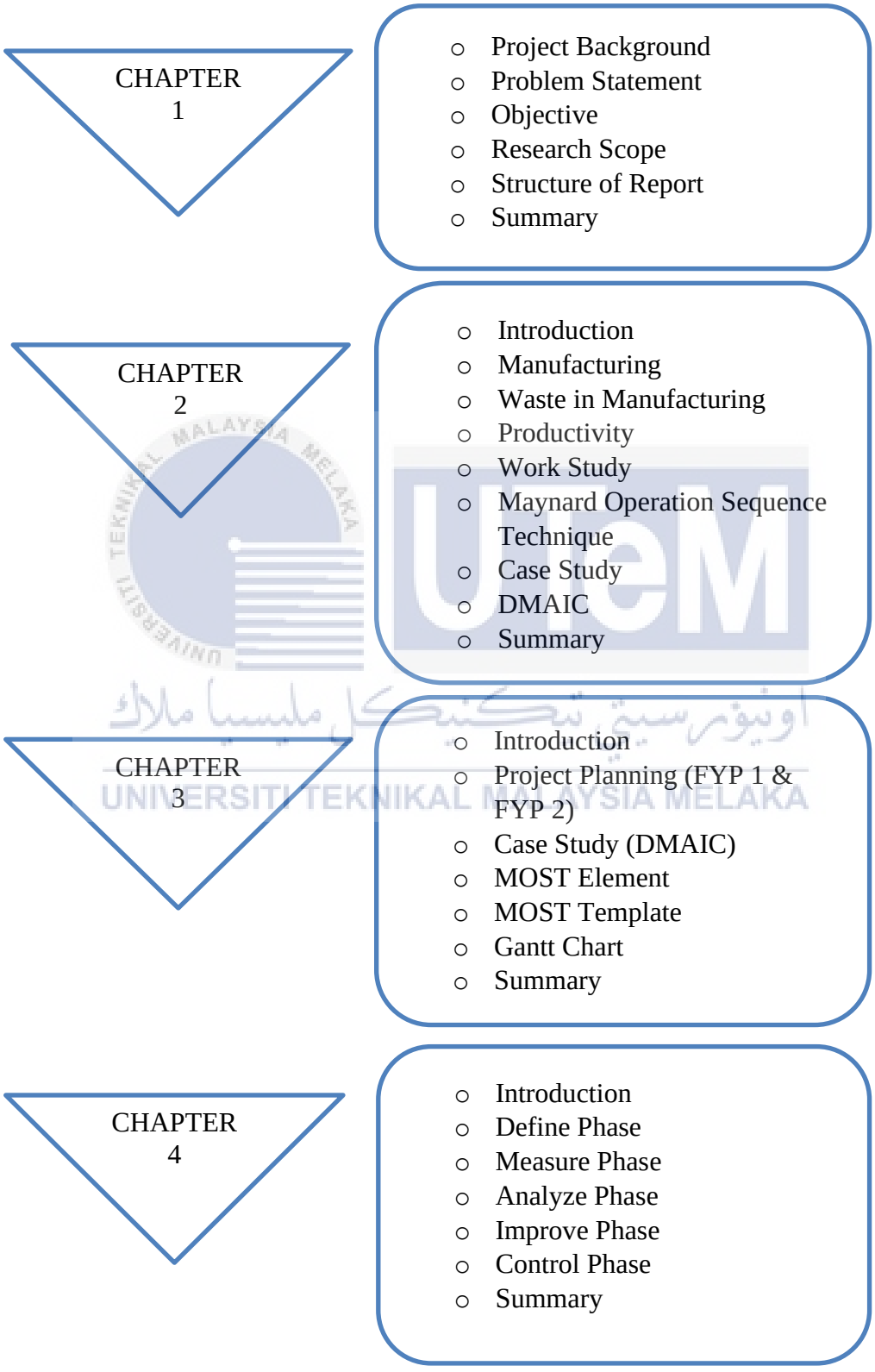
Chapter 2 is all about preparing all research journals for literature review to identify the suitable methodology to be used in this study. To prepare for this chapter, all relevant theories and information regarding manufacturing, waste in manufacturing, productivity, work-study, Maynard Operation Sequence Technique and DMAIC as a problem-solving approach should be explored. Furthermore, selected case studies on the implementation of MOST need to take into account to have a better insight in a further chapter which is about research methodology.

Furthermore, chapter 3 refers to the methodology of this study that detailed the techniques and tools used for problem-solving and achieving the objectives. The guideline of the research is then presented in a flow chart form for both project planning (FYP 1 and FYP 2) and case study using DMAIC (Define-Measure-Analyze-Improve-Control) as a guideline throughout the chapter. The conclusions and recommendations of this analysis will be presented in chapter 4.

Subsequently, in chapter 4 the preliminary results obtained from SMEA is present in this chapter to provide insights into the factory process and expected result to be achieved at the end of FYP 2. This phase will utilize the techniques described in chapter 3 and one of it is the MOST template to be used during the data gathering phase of this study. Once results are gathered, a discussion is made based on the result to tell on the effect of implementing the tools and technique for this study.

Lastly, in Chapter 5 the overall studies and findings will be summarized in this chapter. The standard time and labour's utilization will be discussed. To improve the framework, the data gathering technique from the MOST template was shown as a supporting document. The

improvement will be proposed and the accurate understanding as mentioned in the thesis will be described. All of the project frameworks involved in this thesis are explained in Figure 1.1 below.



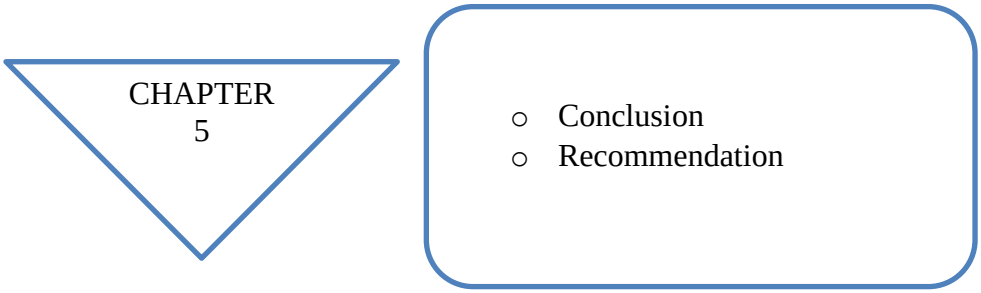


Figure 1.1 Project framework

1.6 Summary

In summary, due to tight competition in the manufacturing industry, every organization has to do re-engineering which is one of the established options that could be adopted to increase productivity and outperform the competitors. However, in this research study, the re-engineering is being done by investigating the standard time and labor utilization when performing their task in the assembly department at SMEA to detect any non-added value wastes. Due to that, it became an objective to be achieved in this research study which the scope is to implement MOST to increase the productivity by defining the proper working method.