REVEAL HIDDEN WASTE THROUGH MAYNARD OPERATION SEQUENCE TECHNIQUE (MOST): A CASE STUDY

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

by

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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 (Manufacturing Management) (Hons). The member of the supervisory committee is as follow:

…….....

(Assoc. Prof. Ir. Dr. Puvanasvaran A/L A. Perumal)

ABSTRAK

Sisa tersembunyi tidak dapat dikenal pasti melalui cara biasa kerana mereka tersembunyi dalam satu keseluruhan masa operasi. Projek ini menekankan penggunaan *Maynard Operation Sequence Technique (MOST)* untuk mendedahkan sisa tersembunyi pada operasi pembungkusan kering dalam industri elektronik. Pendekatan kajian masa dengan menggunakan jam randik diambil untuk menentukan masa kitaran sebenar operasi. Kemudian, analisis MOST dijalankan untuk menganalisis operasi dengan cara perincian yang memberi tumpuan kepada pergerakan objek. Perbandingan antara hasil kajian masa dan analisis MOST didirikan untuk menyiasat operasi tersebut. Selepas itu, peningkatan produktiviti dalam aspek masa kitaran dan jumlah pengeluaran dinilai untuk kedua-dua hasil kajian masa dan analisis MOST. Pengiraan masa standard dan kenaikan pengeluaran telah didirikan. Peningkatan produktiviti menunjukkan bahawa pelaksanaan MOST mendapat keputusan yang positif sekiranya dibandingkan dengan hasil kajian masa sebenar. Dapatan kajian menandakan sebanyak 19.35 % dan 19.98 % dalam aspek peningkatan masa kitaran dan pengeluaran masing-masing. Projek ini membuktikan bahawa analisis MOST merupakan satu kaedah yang berkesan untuk menganalisis setiap langkah tindakan operasi dan menyeragamkan masa operasi seterusnya menuju kepada pencapaian produktiviti.

ABSTRACT

Hidden waste cannot be identified through normal way as they are concealed within a total time of an industrial operation. This project highlights the usage of Maynard Operation Sequence Technique (MOST) to reveal hidden waste on the dry pack operation in an electronic industry. Time study approach by using stopwatch was applied to determine the actual cycle time of operation. MOST analysis which focused on the operation's movement of object in a detail way was then presented. Comparison between time study result and MOST analysis was conducted to investigate the operation. After that, productivity improvement in terms of cycle time and production was evaluated for both time study result and MOST analysis. The standard time was computed and the production increment was calculated. The productivity improvement demonstrated a positive result towards the implementation of MOST when compared to actual time study result. The findings presented 19.35 % and 19.98 % in cycle time and production improvement respectively. This project significantly shows that MOST is an effective method to analyse each action step of operation and standardize the operation time which leads to an accomplishment of productivity.

DEDICATION

For

my appreciated mother

my lovely sisters

ACKNOWLEDGEMENT

I would like to pay special thankfulness and appreciation to my respected supervisor, Assoc. Prof. Ir. Dr. Puvanasvaran A/L A. Perumal. His kindness, sage advice, insightful criticisms and mentorship guided me through the process. His vital support and encouragement assisted me to achieve my goal and turned my project a success.

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LIST OF ABBREVIATIONS

awt	-	Awaiting
BSI	-	British Standard Institute
DoSM	-	Department of Statistics Malaysia
FYP	-	Final Year Project
GDP	-	Gross domestic product
HIC	-	Humidity Indicator Card
ILO	-	International Labor Organization
IPI	-	Industrial Production Index
IT	-	Information Technology
MATRADE	-	Malaysia External Trade Development Corporation
MBB	-	Moisture Barrier Bag
MIV	-	Material Intransit Validation
MODAPT	-	Modular Arrangement of Predetermined Time Standards
MOST	-	Maynard Operation Sequence Technique
MTM	-	Methods time measurement
NVA	-	Non value added
PFD	-	Personal, fatigue and delay
PO	-	Operator
PPE	-	Personal protective equipment
PTMS	-	Predetermined Motion Time System
SWAG	-	Sophisticated Wild Ass Guess
WIP	-	Work in Progress
WPL	-	World Procurement and Logistics
WS	-	Workstation

LIST OF SYMBOLS

%	-	Percent
k	-	Kilo
RM	-	Ringgit Malaysia
TMU	-	Time measurement unit
min	-	Minute
s	-	Second
Rs	-	Rupee
in	-	Inch
rev	-	Revolution

CHAPTER 1
INTRODUCTION

Chapter 1 of this report provides a concise introduction of the project. The introduction begins with a background of study which brings the sufficient information to understand the study context. Then, a problem statement is presented to explain the current problem that the research company facing. It is followed by the objectives and project scope. By the end of this chapter, the project significance is presented to state the importance of this study.

1.1 Background of Study

Manufacturing involves in process of converting raw materials, components or parts into outputs of finished products by the use of various inputs including labor and capital in order to fulfil customers' satisfactions and requirements. As the global development, human aspirations have been extended so that their standard of living can be raised and thus improve their quality of life. Kanawaty (1992) emphasized that a society or a country has to put effort to improve the productivity or maximize the return from its resources in order to sustain a better quality of life.

Based on the report by Department of Statistics Malaysia (DoSM), Malaysia's GDP marked a growth of 4.0 % in the second quarter of 2016, with RM 298.50 billion at current prices. Manufacturing sector is one of the key contributors that drives the positive growth. Furthermore, the Index of Industrial Production (IPI) registered 4.9 % grow in August 2016 as compared to August 2015, where manufacturing sector output expanded by 4.6 %. According to the Malaysia External Trade Development Corporation (MATRADE), manufacturing accounted for more than 80 % of total Malaysia's total exports in 2016.

With today's increasing global competition among producers of products, it is a challenge for manufacturer to secure its own market share and maintain competitiveness. Thus, there is a need for manufacturing industry to assure that the process is carried out in an effective and efficient way. A business has to achieve a higher yield in profitability based on enhancement of productivity (Tuan *et al.*, 2014).

Among the activities involved in a manufacturing system, the level of resource allocation and labor utilization largely influence the overall productivity. Productivity can be defined as the ratio of outputs in goods or services to the dollar input, both direct and indirect. When output per dollar spent is increased, productivity is improved (Aft, 2000). It measures the extent to which a certain output can be extracted from a given resource input (Kanawaty, 1992). However, a non-optimal labor utilization and other resources problem can affect the profitability of a business due to more capital cost is required but in return there is no any proportional profit. In this situation, manufacturing industry faces difficulties to sustain in the competitive market.

In order to cope with this key issue, lean manufacturing philosophy is widely accepted and best to be implemented due to its effectiveness and significance. It is an operational strategy oriented that focusing on elimination of wastes to achieve the shortest possible cycle time (Puvanasvaran, 2014). It is essential to systematically examine the way and analyze the time required to complete a task in order to optimize a work system. In this context, work study is useful to help manufacturer to investigate, reduce and subsequently eliminate ineffective time. This approach leads to a reduction of work content and achieve an efficient production system. The reason behind is simple. As stated by Zaidin (2002), if a production system needed to be efficient, then its individual operations must be efficient and optimized because a production system comprises of its individual operations.

In this context, MOST is a breakthrough work measurement technique that measures both repetitive and non-repetitive works in the field of manufacturing, engineering and administrative service activities quickly with ease and accuracy (Chaudhary *et al.*, 2008). The key point of MOST is it concentrates on movement of objects. The time taken of the series of operations is measured in such a way that ineffective time is shown up and can be separated from effective time (Kanawaty, 1992). All the ineffective time contributes to the formation of wastes that bring losses to a

manufacturing company. Elimination in any form of wastes is emphasized to reduce the production time, increase value added works and therefore improve productivity. As a result, a manufacturing company may increase the profitability and at the same time meet the customer satisfaction. It can maintain a well-placed position in the open and competitive global market.

This project has been undertaken to investigate the scope of making possible improvement in productivity of an operation in production line. In this project, the current operation is first validated by conducting a time study. This is done by direct observation to obtain a real time data. Then, the elemental activities of the operation are being analyzed by implementing MOST. MOST is able to show when and where the waste is occurred within an operation. Consequently, unnecessary wastes are eliminated, time is saved and thus improve overall operation performance.

1.2 Problem Statement

With the fierce competition among manufacturers, a manufacturing company must always strive to move forward and improve operations. Moreover, customers have the choices on hand to purchase products from different manufacturing company. In order to keep track of customers' needs and wants, a manufacturing company must has intention to investigate and optimize its operations so that an efficient and effective performance can be delivered and supplied to the marketplace. In short, the profitable growth of a company is ensured by maintaining a progressive increase in productivity.

The lack of work measurement analysis and implementation of task time standardization leads to a non-optimization of a work system. While finding the way to improve the work system, a common and obvious option is to investigate the current performance which looks into the ineffective time to seek for possibilities of reducing and eliminating them for productivity enhancement.

In the company under study, there are four operators perform their works at the dry pack operation. The time required for them to perform the task for a box of product is taken. Based on Figure 1.1, the result of stopwatch reading shows that there is a variance of time

among these four operators even they are doing the same nature of work. In other words, this indicates that the time required for the operators to complete the dry pack operation is not standardized and there are losses within their job elements. Besides that, the total number of boxes packed is different for each operator as shown in Figure 1.2. This shows that the productivity is not constant due to the variation of time. In that, there are wastes occur in the operation and lack of time standard which require further investigation.

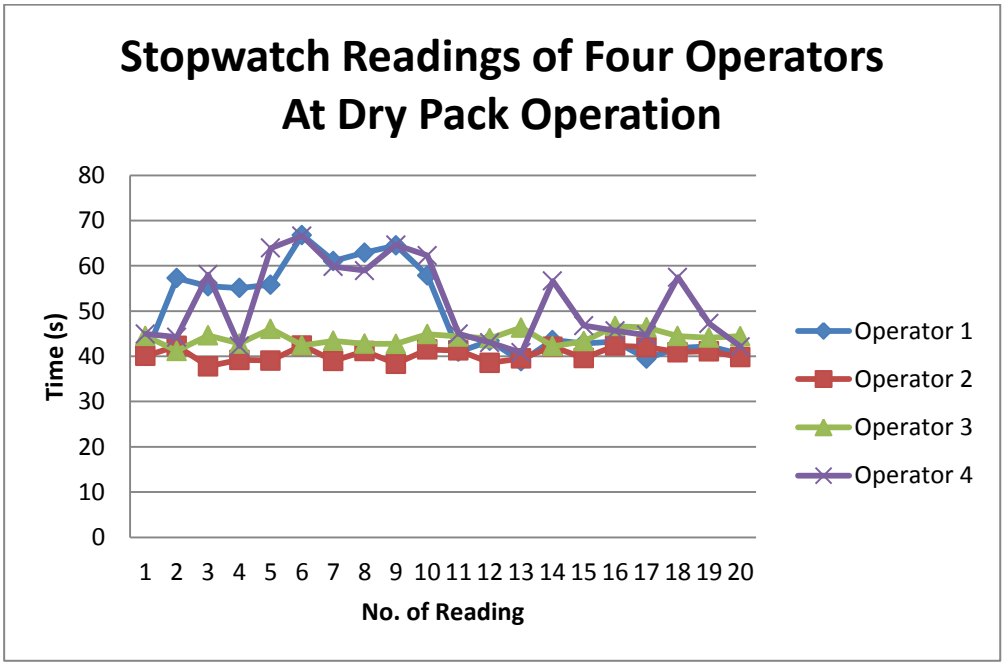

Figure 1.1: Stopwatch readings of four operators at dry pack operation.

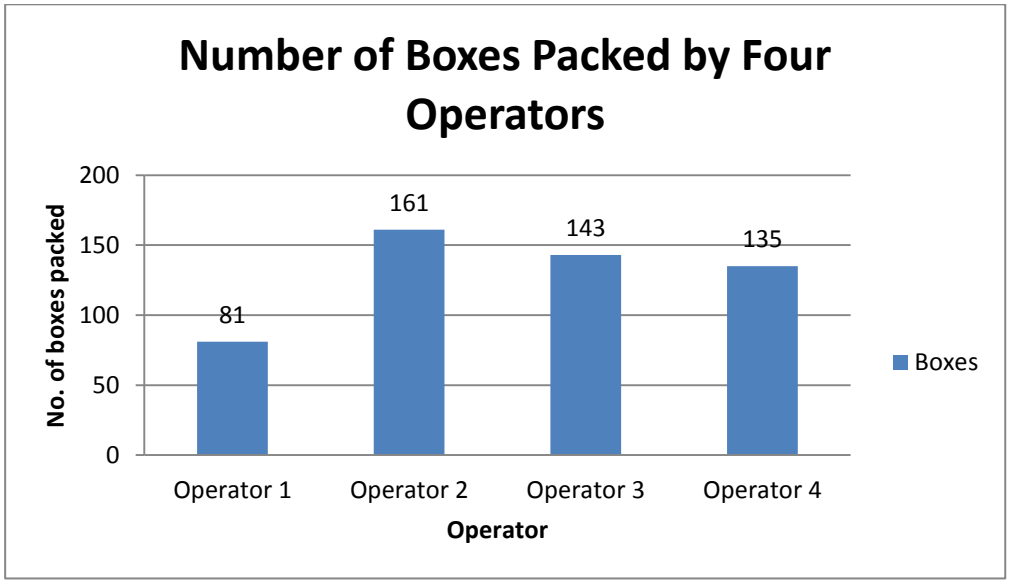

Figure 1.2: Number of boxes packed by four operators.

The work and time measurement technique helps the manufacturer to increase the productivity by defining the proper working method, standard time and the way of maximizing the resource utilizations (Tuan *et al.*, 2014). According to Zaidin (2002), work measurement is an essential tool for planning and scheduling purpose, evaluation of performance and cost estimation. By knowing the time to manufacture a product, the management can achieve and maintain a high utilization of manpower, material and equipment.

MOST is a work measurement technique which can be applied to improve the productivity. It focuses on the movement of objects. In the manufacturing company under studied, the operators are required to perform a daily repetitive task. According to Shikdar and Das (2003), repetitive tasks are monotonous, boring, fatiguing and demotivating require primary concern from management as this will affect the worker satisfaction and consequently affect the productivity. By implementing MOST, the task is broken down into elemental activities for further examination. Without MOST, the ineffective time cannot be shown up since they are being contained within the total time and not separated from the effective time.

The result of implementation of MOST brings benefits to an operation without additional cost. The working practice becomes more productive. After the work being standardized, a good quality result can be achieved. This measure leads towards the accomplishment of productivity. The limitation regarding MOST implementation is a complete and accurate description of the method of operation is required to achieve a level of accuracy and reliable data.

1.3 Objectives

There are three objectives that needed to be achieved to complete this project:

a) To determine the actual cycle time of operation by conducting time study
b) To investigate operation by implementing MOST analysis
c) To evaluate productivity improvement

1.4 Project Scope

This project involved in an electronic industry and conducted at a semiconductor manufacturing company which focused on productivity improvement using MOST analysis. The project was carried out in Post Test department and focused at dry pack operation. The data obtained in this project was from operator in morning shift. The scope of this study started from the observation of the dry pack operation to conduct the time study for determining the actual cycle time. Then, the current method of operation was analyzed by using MOST. MOST depends on the nature of the basic human motions and the conditions under which it is made. It concentrates on the movements of objects. Based on the data collection and analysis, the productivity improvement was evaluated and a time standard was established.

1.5 Project Significance

This project brings multiple impacts to company. The utmost goal is to reduce production cycle time for productivity improvement. In management aspect, the effective use of resources input is improved including optimal utilization of manpower. Besides, work system is being optimized in terms of standardization of task time and proper operation sequence. Elimination of waste leads to the reduction of cycle time towards achieving productivity and satisfy customer demands. The knowledge and experience gained in productivity enhancement can be applied in other similar industries fields for economy development of a country.

CHAPTER 2
LITERATURE REVIEW

In this chapter, a review of previous similar studies has been done. A summary of information research from books, journals, articles and related website is gathered and presented. It is used to support the discussion on the problem issue, research objectives and the methodology used. Generally, this chapter provides the introduction to wastes with how the wastes bring negative impacts to a manufacturing system. Then, human efficiency is briefly explained. After that, the chapter is continued by providing research on several techniques for waste identification including Maynard Operation Sequence Technique (MOST) which will be applied in this project.

2.1 Waste (Muda)

It is necessity to understand what waste is about so that it can be identified and eliminated. In conjunction with lean manufacturing, waste is referred to activity that consumes resources but does not create value to the product. Dahlgaard and Dahlgaard-Park (2006) defined waste is everything that increases cost yet without adding value for the customer. Pieńkowski (2014) described waste as uselessness, which consists of all factors that cause a company fails to achieve a perfectly efficient production system. It is also described as Muda in Japanese word, originally developed by Taiichi Ohno (Toyota executive 1921 – 1990), the father of Toyota Production System. Womack and Jones (2003) added the eighth waste, which is underutilization of human resource. In addition, the authors claimed that value can only be defined by customer yet it is created by the producer. On the other side, Douglas *et al.* (2015) stated that value judgement by customer is based on their perception of the usefulness or necessity of a service or product.