DECLARATION

I hereby, declared this report entitled **"OVERALL LABOR EFFICIENCY STUDY AT MANUFACTURING COMPANY"** is the results of my own research paper except cited in reference.

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Date	:	14/01/2015

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor in Manufacturing Engineering Technology (Process & Technology) (Hons.). The member of the supervisory is as follow:

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ROHANA BINTI ABDULLAH

(Project Supervisor)

ABSTRACT

This project entitled Overall Labor Efficiency Study at Manufacturing Company was initiated when there was no effective work study being done yet in semiconductor company to determine the Overall Labor Efficiency (OLE) at the critical processes in the assembly line. The beneficial on the company chosen was the company is now able to focus on continuously improving the labor efficiency towards achieving their goal to be a world class lean manufacturing facility. Work study technique was utilized for this study since this method is a systemic examination to measure the current utilization and the optimum labor efficiency and man to machine ratio configuration in semiconductor assembly line. This study was conducted at Company XYZ. The result achieved from this study was used to propose the improvements in getting the optimum OLE. As a conclusion, an effective work study was implemented in the semiconductor assembly line to achieve optimum labor efficiency.

ABSTRAK

Projek bertajuk Kajian Keseluruhan Kecekapan Buruh di Kilang Pembuatan diajalankan sebagai satu inisiatif untuk mementukan kecekapan buruh kerana tiada kajian yang pernah dilakukan sebelum ini mengenai kecekapan buruh pada sesetengah proses kritikal di bahagian pemasangan di dalam sesebuah kilang. Salah satu keuntungan yang diperolehi syarikat ini adalah mereka dapat terus-menerus meningkatkan mutu kecekapan buruhnya kearah mencapai matlamat mereka sebagai satu kilang pembuatan yang mengamalkan sistem "*lean manufacturing*". Teknik kajian kerja telah digunakan untuk kajian ini kerasa kaedah ini adalah pemeriksaan sistematik untuk menganggarkan oenggunaan semasa dan kecekapan optimum buruh dan juga nisbah buruh kepada mesin di bahagian pemasangan semikonduktor. Kajian ini telah dijalankan di Company XYZ. Keputusan yang dicapai daripada kajian ini diperlukan untuk mencadangkan penambahbaikan dalam mendapatkan kecekapan buruh yang optimum. Sebagai kesimpulan, kajian kerja telah dilaksanakan secara meluas dalam industri pembuatan melalui pelbagai kajian lepas yang telah diluluskan.

DEDICATION

Specially dedicated to my beloved late father, mother and siblings

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It has been a roller coaster ride for me while completing this final year project report. However, with the helps from generous people, I am able to complete this report successfully. I am so honoured that I now have the opportunity to express my gratitude to all of them.

I am grateful and would like to express my sincere gratitude to my supervisor Puan Rohana Binti Abdullah for her invaluable guidance, continuous encouragement and constant support in making this research possible. I really appreciate her guidance from the initial to the final level that enabled me to develop an understanding of this report project thoroughly. Without her advice and assistance it would be a lot tougher to complete this report. I also sincerely thanks for the time spent proofreading and correcting my mistakes.

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LIST OF ABBREVIATIONS

BMT	-	Basic Motion Time study
GNI	-	Gross National Income
MITI	-	Ministry of International Trade & Industry Malaysia
MOST	-	Maynard Operating Sequence Technique
MTM	-	Methods Time Measurement
NKEA	-	National Key Economic Areas
OLE	-	Overall Labor Efficiency
PTS	-	Pre-determined Time Systems
IE	-	Industrial Engineer

CHAPTER 1
INTRODUCTION

The first section of this report explains the background of this research, problem statement, project objectives, work scope and project methodology as well as the expected result from this research project. Productivity itself will also be discussed in general including labor efficiency and labor effectiveness as these two are the most important elements in productivity. This report is to bring readers much closer in determining Overall Labor Efficiency (OLE) by using work study techniques to determine the optimum labor efficiency and to seek room of improvements in a manufacturing company.

1.1 Background

Manufacturing is categorized as one of the biggest sectors in Malaysia as this sector continued to be an important part of Malaysia's industrialisation efforts, attracting investments worth RM52.1 billion (24.1 per cent) in 787 approved projects in 2013, which is 26.8 per cent more than the RM41.1 billion achieved in 2012 (MIDA, 2013). In Malaysia, it involves a big investment between both local and foreign markets in supplying each other as a necessity to produce good products to fulfil customers' need. Figure 1.1 shows that, there are 17 sub-sectors included under manufacturing sector and electronics and electrical is listed as one of them. Electronics and electrical sector is an exported-based and is identified as National Key Economic Areas (NKEAs). An NKEA is a driver in contributing whether directly or materially to ensure an economic growth to the Malaysia economy (KADA, 2011).

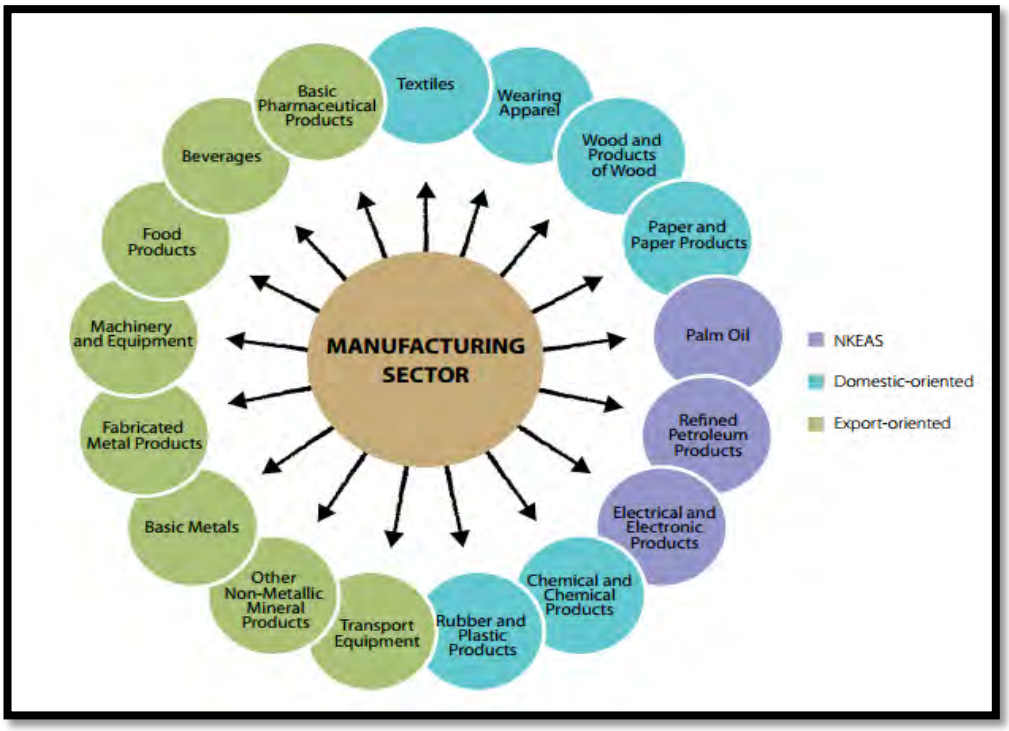

Figure 1.1: Malaysia's manufacturing sub-sectors. (Malaysia. Productivity Report 2012/2013, 2012)

On 2nd November 2010, in Economic Council Meeting, Datuk Seri Dr Zambry, Chief Minister of Perak stated that even in Ipoh Perak, electronics and electrical sub-sector is becoming one of the most important sectors in Perak as 5 over 10 of huge industries there involve a big contribution of the sector itself (Khairul, 2010). Therefore, if the number of this industry is summed up all over Malaysia, it is proven that this industry is bringing a big contribution to this country. To support the idea, in Utusan Online 17th January 2011, Ministry of International Trade & Industry Malaysia (MITI) had identified 15 types of Entry Point Projects (EPPs) in Electric and Electronic industry that potentially could contribute RM50 bilion to Gross National Income (GNI). The minister, Datuk Seri Mustapa Mohamed said, if the project could be attained, high possibility it can create almost 157, 000 employment opportunities by the year of 2020. MITI had identified five small major sectors in this sector that is highly potential can be expanded in 2011. Four of the small sectors are semiconductors, household amenities, solar and electronic industries (Khairul, 2011).

Semiconductor manufacturing sector is developing rapidly over the years in Malaysia due to the high demand in electronics industries and as a fact that it is accounting for more than a third of total electronics exports (Chee et al., 2004).

Rapid enhancement of technology in Malaysia also is one of the factors that contribute to this speedy development. Semiconductor production process mainly is divided into three sub processes which are front of line work section, middle of line and end of line work section (Chee et al., 2004). These processes are classified as complex and require sophisticated engineering and manufacturing expertise.

It is crucial for every company to produce a good finishing product as well as improving their productivity to ensure a positive feedback to the company itself. In general, productivity is defined as an output-input relationship and as a measure of the efficiency of inputs to produce useful outputs (Tangen, 2004). To produce high quality products, it involves a good amalgamation of inputs such as materials, capital, energy and labor force in order for a good output to be obtained. As in today competitive manufacturing world as well as an initiative taken by Malaysia to achieve a high income economy by the year of 2020, it is very important for industries to find solutions in minimizing the inputs to obtain an optimum outputs. One of the ways to minimize the input is by focusing on the labor itself as labor is becoming the most expensive expenses industries need to pay and as the necessity of the fact that manufacturing has been listed as the biggest contributor to Malaysia's economy. It is important to control and find ways to get effective labor efficiency in order to get a high value of productivity as well as to bring profit to the manufacturing industry.

Even though electric and electronic industries are mushrooming in Malaysia but as can be seen in Productivity Report 2012/2013 (2012), it shows a drop of -4.4% in terms of employment growth in the manufacturing sector as can be seen from Figure 1.2. Due to the decrement in percentage, this industry has been transformed into a high added value industry, thus a market for highly skilled labors are created.

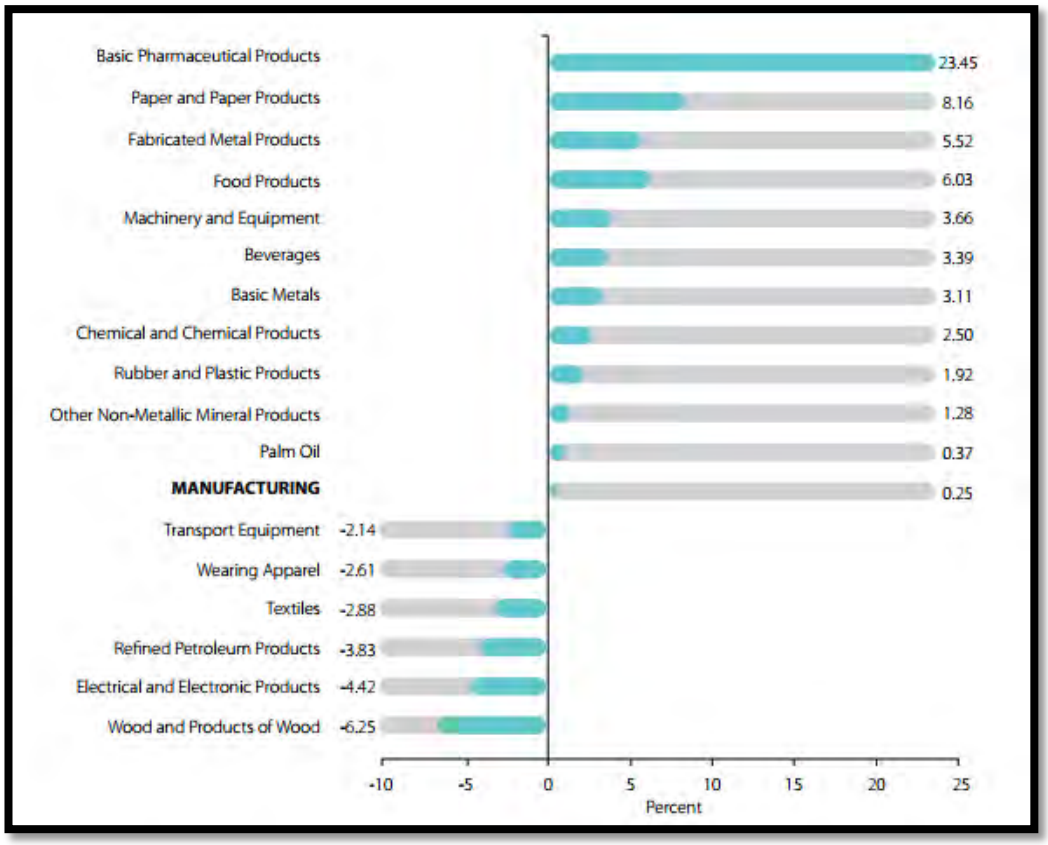

Figure 1.2: Employment growth of the selected manufacturing sub-sectors 2012 (Malaysia. Productivity Report 2012/2013, 2012)

Labor efficiency can be described as how efficient and how right will the labor perform the productive task to produce a given amount of products or services with a smaller number of labor hours. It is a technique applied in manufacturing sectors in order to measure the actual hours needed to produce products then to be compared to the standard that usually required. If the labor force is producing products below the usual standard, thus the company is operating with high efficiency in the production line. Most companies have taken the initiative to identify weak points in the labor force and seek room for improvement of their labors by assessing their labor efficiency sporadically with the aim to improve its quality and productivity. This leads to less costs being spent on wages and overhead, and therefore contribute to a significant savings and profit to the company itself.

Labor remains cheap only if the country failed to develop as expected but in todays era, every country is succeeding in their development thus, leads to a high market of

labor employment (Baudin, 2012). It is known that labor input is becoming one the most expensive expenses in manufacturing world due to the high demand from the customers in coping with their daily life and therefore it is needed to produce a large number of products in a certain number of time. To meet this requirement, more labors are needed to be hired, but excessive labor employment leads to waste and this could bring loss to the company. It is very important for a company to have highly skilled labors but in a minimized number, to avoid any excessive expenses being invested only on the labors themselves. To ensure an optimized number of skilled labors can be achieved, labor efficiency method is being concerned.

Today, in this competitive manufacturing world, industries are striving hard to ensure their system is operating well by downsizing, with cost reduction on the inputs to gain an optimum productivity. These actions are being taken as the necessity for our country to prevent economic crisis as manufacturing sector is listed as the main contributor to the Malaysia's economy. This is also a step taken earlier by industries in order to achieve a sustainable economic growth by the year of 2020.

1.2 Problem Statement

Labor efficiency and labor effectiveness are being the most important elements in productivity (Tangen, 2004). It is argued that productivity improvement is one of the basic variables governing economic production activities and act as the key competitive. As an intensity taken to focus on the economic crisis world is having now, it is crucial for each industry to adapt to lean culture so that waste could be eliminated. Materials, capital, energy and labor force are the example of inputs involved in producing the required number of output. Capital is needed by industries to be invested on the materials, wages, overheads and labor force in order to keep the production line continuously operating. Capital invested on the inputs is actually affected on how good a company can manage its inputs to an optimized number and how well the company practises lean culture to eliminate waste. However, there is no an effective work study or systemic approach being applied yet in semiconductor assembly line in order to obtain the optimum labor efficiency and also man to

machine ratio configuration. Therefore it is important to determine the current utilization and man to machine ratio configuration in the assembly line.

The efficiency of the labors affects the effectiveness of the product to be produced. However, some companies are being too dependable on the standard output that is usually applied without considering the other way to improve it to a better number of quantities. Since labor efficiency is becoming the most crucial element in minimizing the cost, a work study technique need to be applied in order to obtain the optimum man to machine ratio configuration.

It is found that labors that are working without a controlled supervision tend to do unnecessary and repetitive task that leads to the reduction of the daily rate production of the company. Some of the labors that operate semi-auto machines tend to be idle while waiting for the machines to complete its process. Besides that, most labors experience muscle-fatigue due to long hours of working in production line and this indirectly affects the production of the company due to the decrement of the productivity. Therefore, it is important for manufacturing company to propose some improvements so that labors will only perform productive tasks and therefore will improve the cycle time and the average output rate in the production line.

1.3 Project Objectives

To get the ideal labor efficiency it is necessary to perform the work study needed precisely and accurately so that an optimized labor efficiency can be obtained. The purpose of this research writing is to:

i. To perform work study on labors activities in order to measure the current utilization of labor and man to machine ratio configuration in semiconductor assembly line.
ii. To determine the optimum labor efficiency and man to machine ratio configuration.
iii. To propose improvements in getting the optimum overall labor efficiency.

1.4 Work Scope

The project scope is mainly aiming on the labor efficiency as well as the productivity improvement since efficiency is one of the important elements in productivity. This research focuses on the Overall Labor Efficiency (OLE) and the data needed will be collected at Company XYZ. It is a semiconductor-based industry and is semi-automatic in nature. The data collected for the current labor efficiency will be collected by using MOST study technique and the data will be analyzed manually based on the summary in e-MOST. At the end of this task, some improvements will be proposed in order to increase the labor efficiency and man to machine ratio configuration.

1.5 Project Methodology

First and foremost, title of the research is defined to ease the writing of this report followed by the search of project sources which include the primary and secondary sources. The primary sources are from the selected company to determine the current labor efficiency together with the work measurement and also the standard output that usually being applied. While secondary sources come from journals, articles, newspapers as well as trusted sources from the internet. Next, related case studies regarding the research will be included in the literature review. Labor activity time will be collected by using MOST study technique then the data is analyzed to determine the current labor efficiency and also the optimum labor efficiency together with the man to machine ratio configuration. After all data gathered is sufficient, final report on this study will be done.

1.6 Result Expectation

This study focuses on labor efficiency, therefore MOST study technique will be applied to measure labor activity time. The activities done by the operator, the lot cycle time and the frequency per lot are among the major input to analyze the current utilization and optimum labor efficiency or man to machine ratio configuration. Last but not least, some improvements involving labor efficiency will be proposed to get the optimum result of Overall Labor Efficiency (OLE).

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

While the first chapter of the research describes background; current issues of productivity, objectives, problem statement as well as the expected result of the research, this chapter proceeds with referenced review from the relevant literature. Generally, this chapter contains a literature review on work study, which includes both the method study and work measurement. Sources of information were obtained from secondary sources which are books, journals, reports and electronic-media publications. The primary objective of this review is aiming at searching the current status and history of work study itself and its function as tools for productivity improvement. Hence, this chapter will narrow the topic into types of methods study and work measurements that commonly used for improving productivity as well as efficiency. It also explains elements related to productivity such as rating and allowances. After explaining both types of studies, this chapter enlightened the tools that will be used for this research, which is process mapping and Maynard Operation Sequence Technique (MOST).

2.2 Productivity

According to Singh (2000) productivity is defined as the relation between outputs and input that has been applied over the past two centuries. To strengthen the validity of this statement, Tangen (2004) comes out with an illustration as can be seen from Figure 2.1 regarding the ratio of output to input of the manufacturing transformation process.

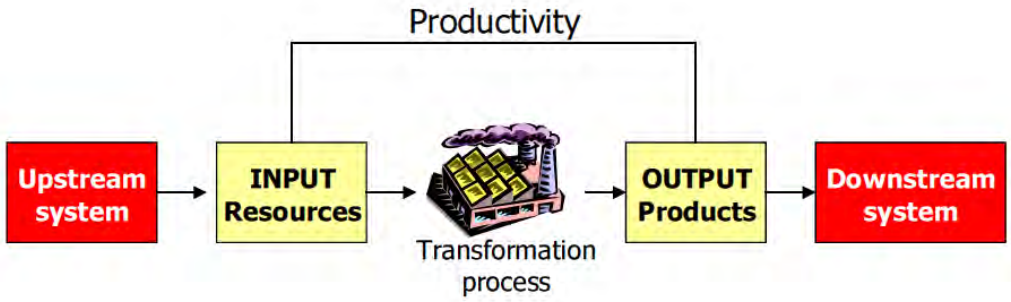

Figure 2.1: Productivity (Tangen, 2004)

In order to understand the meaning of productivity, one must first be able to separate verbal definitions from mathematical definitions (i.e. productivity measures), which are two separate things. A verbal definition aims to *explain* what the concept of productivity means while mathematical definitions, on the other hand, can be used as performance measures, which major aim is to *improve* (not to explain) productivity (Tangen, 2004).

Table 2.1 Examples of verbal and mathematical definitions of productivity (Thomas and Baron, 1994)

TYPE OF PRODUCTIVITY DEFINITIONS	DEFINITION	REFERENCE
Verbal Defintions	Productivity is a comparison of the physical inputs to a factory with the physical outputs from the factory.	(Kaplan and Cooper, 1996)
	Productivity is defined as the ratio of what is produced to what is required to produce it. Productivity measures the relationship between output	(Hill, 1993)

	such as good and services produced, and inputs that include labor, capital, material and other sources	
Mathematical Definitions	Productivity = Efficiency * Effectiveness = Value adding time / Total Time	(Jackson and Petersson, 1999)
	Productivity = Units of output / units of input	(Chew, 1968)

2.2.1 Output and Input

Almost any transformation process within a manufacturing company is fed with several types of input (e.g. labour, capital, material and energy) and emits more than one output (e.g. product A, product B), which in turn makes the calculation of productivity very difficult (Kurosawa, 1991). Figure 2.2 is referred as Kurosawa (1991) came out with an illustration of transformation process to show a clearer relationship between input and output.