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Work Study for Labor Productivity Improvement Utilizing Process Mapping and MOST

Thesis submitted in accordance with the requirements of the Universiti Teknikal
Malaysia Melaka for the Bachelor of Manufacturing Engineering
(Manufacturing Process)

By

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ABSTRACT

Productivity is being the most important thing in the manufacturing world. Generally, this study is about work study for labor productivity improvement utilizing Process Mapping and Maynard Operation Sequence Technique (MOST). Work study in productivity improvement could be done in two approaches; which are method study and time study. Thus, this research will use process mapping as the method study and Maynard Operation Sequence Technique (MOST) as the time study method. The aim for this research is to identify opportunities for improvement to current production system by performing work study on the manual operators' activities, determining current operator's utilization as well as establish standard time for manual process. All this initiated by performing work study on the manual operators' activities. This study is done at a SMI company which produce digital measurement device. From this study, the standard time, utilization and recommendation for man power planning could be established. These results could be used for improving the labor productivity at the company. So, the productivity improvement could be done via these methods and could benefit to student as well as to the company.

ABSTRAK

Produktiviti adalah perkara paling utama di dalam sektor pembuatan. Bagi melaksanakan peningkatan produktiviti, ia boleh dibuat dalam dua pendekatan; iaitu pemerhatian kaedah/cara kerja (method study) dan kajian terhadap masa kerja (time study). Oleh itu, kajian ini menggunakan kaedah pemetaan proses (process mapping) dan MOST (Maynard Operational Sequence Technique). Tujuan projek ini dijalankan adalah untuk mengenalpasti peluang untuk meningkatkan sistem pengeluaran sedia ada dengan melakukan kajian terhadap aktiviti manual yang dilakukan oleh operator. Selain itu, ia juga bagi mengetahui tahap penggunaan tenaga kerja (operator) serta menetapkan masa standard bagi proses manual. Kajian kes ini dilakukan di sebuah industri kecil dan sederhana yang menghasilkan alat pengukuran digital. Daripada kajian ini, waktu piawai (standard), penggunaan operator dan cadangan untuk perancangan tenaga manusia boleh dilakukan. Hasil dari projek ini boleh digunakan untuk meningkatkan lagi produktiviti pekerja di kilang tersebut. Kesimpulannya, peningkatan ini boleh dibuat melalui kaedah seperti yang dinyatakan dan boleh memberi manfaat kepada pelajar serta kepada syarikat.

DEDICATION

For my beloved family and friends.



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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMECLATURE

CAD	-	Computer Aided Design
CRN	-	Circle Ring Network
FOS	-	Fluidic Oscillator System
ICT	-	Information & Communication Technology
ILO	-	International Labor Office
KOSGEB	-	Small and Medium Industry Development Organization
MOST	-	Maynard Operational Sequence Technique
PCB	-	Printed Circuit Board
PMTS	-	Predetermined Motion Time Systems
SMI	-	Small and Medium Industrial Enterprise
TMU	-	Time Measurement Unit
UAE	-	United Arab Emirates
UK	-	United Kingdom
USA	-	United States of America

CHAPTER 1

INTRODUCTION

1.1 Introduction

For chapter 1, it provides comprehensive background; current issues of productivity, objectives, problem statement, and scope as well as the outline of the research. It is organized to disclose the originality of the research. It renders aspect of productivity and lean concept in today's manufacturing industries. Descriptive information is also given on productivity studies, aspects of labor productivity, labor productivity growth as well as increases in productivity.

1.2 Background of the study

The world of manufacturing is an ever-changing one. Technological changes have had considerable influence on the manner in which manufacturing concerns are managed; including the production scheduled, whether we are concerns with the productivity and whether we are producing with hands or with expensive automatic machine. The benefits of high productivity are generally accepted to include the ability to produce greater quantities with less effort and fewer resources, to be able to maintain or reduce selling prices and to improve our standard of living.

Hence, this study is to improve the labor productivity in a SMI (Small Medium Industrial Enterprise) company. As the productivity is needed to be increased, it is done by using the first phase of study which is process mapping. All data are taken

and analyzed using Maynard Operational Sequence Technique (MOST). During this phase also, time study data are taken. Then second phase is establishment of standard time, followed by third phase which is determining current utilization of operators in a shift. Productivity in a shift could be estimated when the utilization of operators are recognized. From all these phases, the recommendation for man power planning could be established.

1.3 Current Issues with Productivity

Productivity is the relationship between output and input. It should be viewed as value adding in addition to optimizing. It is a total concept that addresses the key elements of competition, for example is innovation, cost, quality and delivery (Erlendsson, J. 2006). Therefore, an increase in productivity can be achieved by enhancing the value-added content of products/services, or by decreasing the unit cost of production, or a combination of both (Erlendsson, J. 2006). Productivity analysis is conducted to identify areas for potential productivity improvement projects based on statistical data collected during the analysis. The analysis also pinpoints areas of delays and interruptions that cause loss of productivity.

The first step in any productivity improvement initiative is to understand the current state of the operation. Productivity analysis provides baseline indicators that will also yield data which will be used to determine possible productivity improvement objectives and potential cost savings (Anonymous, 2000). Reliable data obtained from the productivity analysis also makes the following outcomes feasible. This includes the determination of productivity improvement goals and immediate elimination of non-value added activities. The ability to estimate potential savings based on the analysis results (Anonymous, 2000). As stated, productivity is defined as the amount of output created (in terms of goods produced or services rendered) per unit input used. For instance, labor productivity is typically measured as output per worker or per labor-hour.

1.3.1 Productivity Studies

Productivity studies analyze technical processes and engineering relationships such as how much of an output can be produced in a specified period of time, (Toronto Globe and Mail, 1995). It is related to the concept of efficiency, which is the amount of output produced relative to the amount of resources (time and money) that go into the production.

All else constant, it benefits a business to improve productivity, which over time lowers cost and (hopefully) improves ability to compete and make profit. Increases in productivity also influence society more broadly, by improving living standards, creating income and creating economic growth.

1.3.2 Increases in Productivity

Increases in productivity also can influence society more broadly, by improving living standards, and creating income. They are central to the process generating economic growth and capital accumulation. A new theory suggests that the increased contribution that productivity has on economic growth is largely due to the relatively high price of technology and its exportation via trade, as well as domestic use due to high demand, rather than attributing it to micro economic efficiency theories which tend to downsize economic growth and reduce labor productivity for the most part (Shim, J.K *et al.* 1996).

Many economists see the economic expansion of the later 1990s in the United States as being allowed by the massive increase in worker productivity that occurred during that period. The growth in aggregate supply allowed increases in aggregate demand and decreases in unemployment at the same time that inflation remained stable. Others emphasize drastic changes in patterns of social behavior resulting from new communication technologies and changed male-female relationships.

Productivity can be defined in two basic ways. The most familiar, labor productivity, which is simply output divided by the number of workers or, more often, by the number of hours worked. Measures of labor productivity, however, actually capture the contribution to output of other inputs than hours worked (Nasar, S., 1996). Total factor productivity, by contrast, captures the contribution to output of everything except labor and capital: innovation, managerial skill, organization, even luck.

Labor productivity is generally speaking held to be the same as the "average product of labor" (average output per worker or per worker-hour, an output which could be measured in physical terms or in price terms) (Karr, K. 2006). It is not the same as the marginal product of labor, which refers to the increase in output that result from a corresponding increase in labor input.

However, some aspects of labor productivity may be very difficult to measure exactly, or in an unbiased way, such as:

- The intensity of labor-effort, and the quality of labor effort generally.
- The creative activity involved in producing technical innovations.
- The relative efficiency gains resulting from different systems of management, organization, co-ordination or engineering.
- The productive effects of some forms of labor on other forms of labor.

One important reason is that these aspects of productivity refer mainly to its qualitative, rather than quantitative, dimensions. We might be able to observe definite increases in output, even though we do not know what those increases should be attributed to (Taj, S. et al., 2006). This insight becomes particularly important when a large part of what is produced in an economy consists of services. Management may be very preoccupied with the productivity of employees, but the productivity gains of management itself might be very difficult to prove (Karr, K. 2006).

This may mean that a lot of what is said about productivity is based on opinion, rather than empirical evidence. Modern management literature emphasizes the important effect of the overall work culture or organizational culture that an

enterprise has. But again the specific effects of any particular culture on productivity may be unprovable.

The two productivity concepts are related. Increases in labor productivity can reflect the fact that each worker is better equipped with capital or, alternatively, gains in total factor productivity. Some big companies had a productivity turnaround when it required its workers to use Japanese manufacturing methods (Nasar, S. 1996).

Gains in living standards are tied to productivity gains. There are only three ways that a nation can enjoy a rising level of per capita consumption. First, a bigger proportion of the population can go to work. Second, a country can borrow from abroad or sell assets to foreigners to pay for extra imports. Third, the nation can boost productivity—either by investing a bigger share of national income in plant and equipment or by finding new ways to increase efficiency.

In fact, the all these three ways are being done at different times. But there are limits on how many of us can join the labor force and on how much foreigners will lend. For most countries most of the time, the "lever of riches," to use a term coined by economist Joel Mokyr, is rising output per hour of work.

Nowadays, if labor productivity growth has averaged about 2 percent a year for the past century, that means living standards have doubled, on average, every thirty-five years (Nasar, S. 1996). The number one country in the world at any given time has always been the productivity leader. It was northern Italy from the thirteenth to the sixteenth centuries, the Dutch republic in the seventeenth and early eighteenth, Britain in the late eighteenth and most of the nineteenth, and the United States for the entire twentieth century (Nasar, S. 1996).

Now the United States faces two productivity problems. First, its productivity growth has slowed sharply since 1973, part of a puzzling worldwide productivity slowdown. Second, although U.S. productivity is still the highest in the world by a wide margin—\$45,918 of GNP per worker in 1990, 25 percent ahead of Japan and 35 percent ahead of Germany—its productivity growth trailed that of other nations in most years since World War II. That has stoked fears that the United States will

eventually fall behind. After all, British productivity from 1880 to 1990 grew just 1 percentage point more slowly than that of its trading partners—hardly a huge shortfall, but enough to transform the once proud empire into a second-rate economy in little more than a lifetime (Economic Report of the President, 1992).

"Compared with the problem of slow productivity growth," wrote Paul R. Krugman in *The Age of Diminished Expectations*, "all our other long-term economic concerns—foreign competition, the industrial base, lagging technology, deteriorating infrastructure and so on—are minor issues."

Economists caution that lagging productivity growth is, by its nature, a long-run problem. "The tyranny of compounding manifests its full powers only in longer periods," write Baumol, Blackman, and Wolff, who maintain that it is not yet clear whether the productivity slowdown in the United States and elsewhere since the early seventies represents a long-term shift to a lower growth path or a temporary aberration.

According to the Economic Report of the President (1992), U.S. productivity growth can be divided into three distinct phases. After averaging 1.9 percent a year from 1889 to 1937 and an even stronger 3 percent during the twenty-five-year boom that followed World War II, productivity growth has averaged a mere 1 percent since 1973. In spite of the supply-side revolution of the early eighties (which brought, among other things, lower inflation and lower marginal tax rates), productivity growth failed to revive in the past decade.

As a consequence of slower productivity growth in the past two decades, average compensation has edged up only slightly faster than the price level. Living standards have increased largely because more Americans, especially mothers, have been working, and because the United States has been able to attract capital from abroad to offset a persistent trade deficit. "Most of the growth slowdown [in per capita income]," states the Economic Report of the President, "can be traced to a slowdown of productivity growth."

1.4 Problem Statement

Among the industry's key performance measures includes labor, productivity, efficiency and employee turnovers. Due to the rising labor cost factor in this country, labor is now becoming more valuable asset to an organization and has a big opportunity to be improved. Many companies now are starting to adopt Lean culture where the drive is to eliminate waste everywhere in the organization. In Lean Manufacturing, labor contributes to the motion, waiting and overproduction types of waste. Companies that are systematic and continuous in their effort to eliminate waste will enhance their competitiveness in the market due to the increased in efficiency and improved productivity. The needs of improving the productivity lead to this study. As the utilization of the operator usually difficult to determine accurately, this could be a way of getting the effective result. When using time study to get the standard time for a process, it might be not so precise. As MOST could provide more accurate result, it has implemented through this study.

1.5 Objective of Study

According to the problem stated, it is essential to adopt the correct and accurate approach in method study and work measurement. This is to manage the suitable recommendations for 100% (or may be 85 to 95%) utilization of operators. Specifically the project tries to achieve the objectives as listed below:

1. To perform work study on the manual operators' activities.
2. To establish standard time for manual process.
3. To determine the current operator's utilization.
4. To make recommendations to achieve efficient man power planning.