UNIVERSITI TEKNIKAL MALAYSIA MELAKA

PRODUCTION LOSSES ANALYSIS OF AN AUTOMOTIVE COMPONENT USING GENERAL LINEAR MODEL

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

by

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management). The members of the supervisory committee are as follow:

En. Abdul Rahman B. Mahmood

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12 April 2010

ABSTRACT

This report describe the study and investigation of the dependent (factors) and independent (response) variables that have main effect on the percentage of the production losses at a production line of a local company manufacturing automotive parts and components. This project aims first to study the factors that have main effects on the responses and secondly to investigate the interaction between factors that have influence over the response. General Linear Model (GLM) will be used in order to achieved both objectives above. The data obtained will be analyzed by using Minitab software. The desired outcome for the study is to find the factors that have main effect towards the responses and the interaction between factors that affected the responses.

ABSTRAK

Laporan ini menggambarkan tentang kajian dan penyiasatan dari faktor bergantung dan faktor bebas (respon) yang mempunyai pengaruh utama pada peratusan kerugian pengeluaran pada lini produksi dari sebuah syarikat tempatan yang membuat komponen automotif. Tujuan dari projek ini adalah pertama untuk kajian faktor-faktor yang mempunyai kesan utama pada respons dan kedua untuk menyiasat interaksi antara faktor-faktor yang mempunyai pengaruh terhadap respon. General Linear Model (GLM) akan digunakan untuk mencapai kedua-dua tujuan tersebut. Data yang diperolehi akan dianalisis dengan menggunakan perisian Minitab. Hasil yang dikehendaki untuk kajian ini adalah untuk mencari faktor-faktor yang berpengaruh terhadap respon dan interaksi antara faktor-faktor yang mempengaruhi tanggapan.

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UTEM   -   Universiti Teknikal Malaysia

FKP   -   Fakulti Kejuruteraan Pembuatan

GLM   -   General Linear Model

AFTA   -   ASEAN Free Trade Area

ANOVA   -   Analysis of Variance

SMI   -   Small Medium Industries

MPS   -   Master Production Schedule

CRP   -   Capacity Requirement Planning

MRP   -   Manufacturing Resource Planning

WIP   -   Work-in-progress

PFD   -   Process Flow Diagram

PSPC   -   Production Shift Productivity Control

UPH   -   Unit per Hour

CHAPTER 1

INTRODUCTION

In this chapter, an introduction to the background of the project will be given. The project title is "Production Losses Analysis of An Automotive Component Using General Linear Model". Then it will be followed by problem statement, objective, and scope of the project.

1.1   Background of Study

In this era of globalization, competition is becoming ever more intense. Manufacturing companies must not only compete locally but also on a global basis. Reducing manufacturing costs without sacrificing product quality is vital for the survival of manufacturing companies in a global market. The automotive industry is not spared from the effects of globalization. The local Malaysian automotive manufacturers are faced with this tough competition as the selling price is not much different from foreign brands especially with the implementation of the ASEAN Free Trade Area (AFTA). Demand for foreign cars will probably soar; more so for cars that are assembled locally as the price becomes cheaper.

Therefore, local car component manufactures also are affected by the decision of the local car manufacturer to reduce manufacturing cost. Increasing productivity will be important to ensure survival of the numerous players in the automotive sector. Late delivery of cars components due to low productivity can cause companies losing customers as well as resulting in dissatisfaction. One of the ways to improve

productivity is through Industrial Engineering (IE). Industrial Engineering is concerned with the design, improvement, and installation of integrated systems of people, materials, information, equipment, and energy. It draws upon specialized knowledge and skill in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems. Some of the commonly used tools to solve productivity problems in IE include work study, line-balancing, quality control, production planning and control, simulation, facility planning, and others. These techniques are aimed at achieving smooth and undisrupted factory operation, increasing efficiency and effectiveness through better utilization of resources.

The processing capability of computers has increased by leaps and bounds over the past decades. Together with the improved visualization capabilities of graphic processing units, complex computer generated graphics, more and more software applications dedicated for solving industrial problems are available in the market. The use of statistical software to analyze problems as well as to generate complete analysis has risen significantly. Realizing the potential benefits of computer software in a manufacturing environment, statistical software called Minitab is used in this study to conduct analysis on the production losses.

This paper begins with a brief description of the case study company and followed by problem identification and descriptions of the problems. Based on the problems identified, the construction of the data matrix table is developed before identifying the dependent and independent variables that will be used for analyzing the losses. This is followed by discussions of the evaluation results and culminates with conclusions drawn from the findings of this study.

1.2   Problem Statement

The next step in this project involved identifying the problems that occurred in the selected production line. Selected IE tools and techniques together with the basic problem identification methodology were employed.

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The automotive component manufacture company is part of small medium industry (SMI) that produces automotive components parts to local car manufacturers. In order to establish good partnerships with the local car manufacturers, the company needed to be able to supply and meet the customers' demands over the years.

However based on the problem identification process, it can be seen that there is machining problems that led to productivity losses in terms of quantity units produced per hour (UPH). The machining problems affected the total units produced which didn't achieve the target UPH and thus led to overtime and increase costs of operators, machines and also reworks of defects products.

There are actually some rooms for improvement that need to be done and require personnel to focus on this issue. However the SMI owner is not capable to resolve this particular issue due to lack of resources and knowledge. Thus the objective of this project is to help the relevant SMI to cope with this problem.

1.3 Objectives

This project is based on the relevant SMI issues regarding the machining line for Proton BLM car components. The purpose of this study is stated as below:

a) To study the effect of experimental dependent variables (Month, Week, Shift, and Hour) over independent variables (Percentage of production losses) on the production losses.

b) To investigate the significance of dependent variables (Month, Week, Shift, and Hour) over the independent variables (Percentage of production losses) using General Linear Model approach.

1.4 Scope

This project presents a case study of productivity losses in an automotive component manufacture of brake disc by identifying causes of productivity problems especially the losses, gather the data needed and then entered the data into the Minitab software in order to evaluate the situation. The analysis and evaluation of the current situation are based on the data obtained from productivity reports. The study also will investigate the dependent and independent variables that have interaction so that further improvement can be made after identifying the interaction between them. This project will only focus on Hicom machining line and the duration of the project is from July 2009 until April 2010.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In this second chapter, the report will includes details on the theories and scholarly details that had been derived from various sources such as journals, books, and case studies. The following theories that were included are related with the title of the project which is the investigation of factors influencing machining loss time in production.

The study is about the investigation of factors influencing machining loss time in production at a manufacturing company producing automotive parts. The project will cover the study of factors that influence machining by using the approach of General Linear Model (GLM) a sub component in Analysis of Variance (ANOVA) from Minitab software.

2.1 Productivity

In 2008, based on Malaysia Productivity Corporative Annual Report, Small and Medium industries (SMIs) constitute 99.2% of total business establishments in Malaysia. It is therefore important for the nation to build available SMI sector in order to broaden the sources of economic growth and sustain the growth momentum.

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The development of SMIs is top on the national development agenda, as reflected in the Ninth Malaysia Plan and the Third Industrial Master Plan.

Productivity is define as the total output over total input in the organization in which it has becomes the measurement of how well resources are combined and used to accomplish specific, desirable result. Such measurement will set that low productivity is bad while high productivity is highly valued and more sought after. However, since the term is widely used in industry, many researchers seem to be having different opinion and their own definition. Argument about productivity as one of the most important basic variables as basic variable governing economic production activities also had been addressed. More different terms can also be referred in journal of "Demystifying productivity and performance" by Stefan Tangen (2003).

Productivity always synonym with profitability in organization, thus making it harder to be neglected as the link between productivity and profitability is significant. However due to some circumstances, profitability also can changed for reasons that have to do with productivity as for instance cost or price inflation or external condition that may bear no relationship to efficient use of resources (Stefan et al, 2005). But still, increasing productivity doesn't necessarily lead to increased profitability in short term but usually effective in long term (Tangen, 2002).

Other than profitability, productivity also looks after performance issues as well. The performance mentioned covers both overall economic and operational aspect in the organization.

Besides profitability, the performance issues are actually also looking to the productivity. The performance covers both overall economic and operational aspect in the organization. Nevertheless, the types of performance that particular company to strive to fulfill are vary case specific. According to Slack et al, (2001), the high performance operations that most company to accomplish are:

1) High-quality operations do not waste time or effort having to re-do things, nor are their internal customers inconvenienced by flawed service.

2) Fast operations reduce the level of in-process inventory between micro operations, as well as reducing administrative overhead.

3) Dependable operations can be relied on to deliver exactly as planned. This eliminates wasteful disruption and allows the other micro operations to operate efficiently.

4) Flexible operations adapt to changing circumstances quickly and without disrupting the rest of the operation. Flexible micro operations can also change over between tasks quickly and without wasting time and capacity.

5) Low cost operations lead to higher profits as well as allowing the company to sell their products to a competitive price.
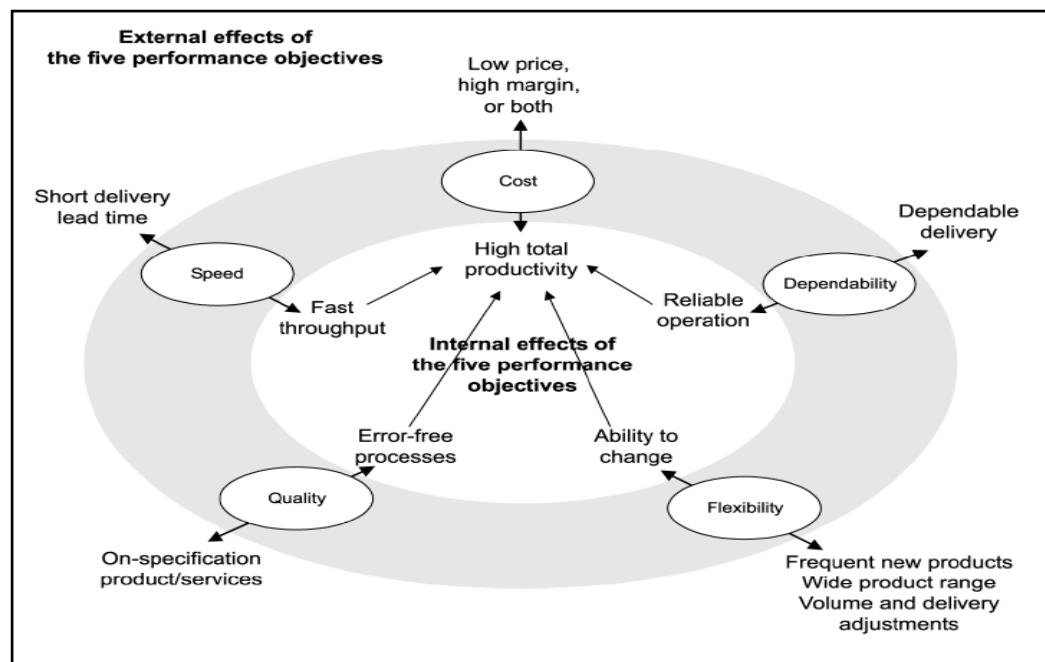
Figure 2.1: External effect of the five performance objectives (Slack et al, 2001)

More often than not, productivity also is usually explained as the simple ration of output to input. Meaning to say that, the term best be explained as the end product produces from the resources put in. productivity considered increase when the output is higher for the same resource input or the same output with a lower resource input.

However there are still some difficulties to be dealt with as well. These difficulties are best describes as the input part of the productivity ratio. In a manufacturing

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environment the input will comprise elements such as: materials, labour, energy, capital use and so on. The use of these items has to be established and combined in some way.

Based on the elements, labour productivity had been covered vastly throughout the years as researchers and industries had tried to maximize the labours capabilities and resources. In order to measure the reliability of the labour, hence labor productivity had been used to shows it. In its simplest form, labor productivity could be defined as the hours of work divided by the units of work accomplished (Enshassi et. al, 2006). Although it was defined like this, there are still other factors that influence it as well. Factors such as site conditions, workers' competence, materials availability, weather, motivation, supervision can influence the labour's productivity. Recent studies also indicate that job satisfaction as one of the main factors now.

Besides that, since most of recent manufacturing organization operates in globally competitive environment, be it as suppliers of parts or assembling the parts, room for improvement must be put into priority. Pressures of reducing costs while improving customer satisfaction and service as well as improving cycle time and quality improvement really create pressures in order to perform.

Thus, opportunity that comes from improving labor productivity based on line balancing to improve cycle time and outputs is regard highly by company. However, since the products also are produced by machining, reduced production losses and machining loss time are also critical in improving productivity.

All these different definitions of productivity have one thing in common: there is an input and that there is an output. The critical issue that needs to be determined is what the inputs for a specific output are. It is believed that the cause of productivity level is the direct result of factors such as:

1) Choice of technology- Firms opting for machinery with narrow product focus, high output and low manufacturing flexibility or machinery with wide product focus, reasonable output and high manufacturing flexibility.

2) Capital/Labor employed for cost/effectiveness- The amount of capital invested in a process is a vital input measure. The capital is in the form of