Faculty of Manufacturing Engineering

AN APPLICATION OF STATISTICAL QUALITY CONTROL ON PROCESS IMPROVEMENT: CASE STUDY IN STAYROD MANUFACTURING

Norhidayah binti Mohamed Hussin

Master of Manufacturing Engineering (Industrial Engineering)

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NORHIDAYAH BINTI MOHAMED HUSSIN

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JUDUL: **An Application Of Statistical Quality Control On Process Improvement: Case Study In Stayrod Manufacturing**

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Alamat Tetap:
PETI SURAT 64-H, BATU3,
JALAN KUALA KRAI, 15050
KOTA BHARU, KELANTAN

Cop Rasmi:
PROF. MADYA DR. ADI SAPTARI
Pensyarah
Fakulti Kejuruteraan Pembuatan
Universiti Teknikal Malaysia Melaka
Karung Berkunci 1200, Ayer Keroh
75450 Melaka

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I hereby, declared this master project report entitled
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Date : 20/07/2010

APPROVAL

This master project report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirement for degree of Master of Manufacturing Engineering (Industrial Engineering). The member of the supervisory committee is as follow:

.....

(Main Supervisor)

20/7/2010

(Official Stamp & Date)

PROF. MADYA DR. ADI SAPTARI
Pensyarah
Fakulti Kejuruteraan Pembuatan
Universiti Teknikal Malaysia Melaka
Karung Berkunci 1200, Ayer Keroh
75450 Melaka

ABSTRACT

This project was conducted at Jati Beringin Sdn. Bhd (SME Industry). This company is one of the steel industries in Malaysia. This study identified the problems that face regarding quality control in the production. The primary data include gathering data from the production department while the secondary data are archival collections such as information from journals, reference books, internet resources, and articles. Statistical process controls such as control chart and process capability were applied to analysis the data collected. From the analysis, it showed that the first three processes i.e. cutting, forging and deburring were in control. In terms of process capability, these processes were capable to produce as specification required. This specification is based on the customer requirements. However, for pressing and threading processes, there are probability 0.25 out of 5 which roughly 5% for pressing product rejected and 0.5 out of 5 which roughly 10% of the threading product are rejected. If the quality control is used properly by the company and used as a feedback, it may contribute to company competitive advantages. Besides that, the company also can achieve the customer expectations and satisfaction by providing products with minimal defect, and good service.

ABSTRAK

Projek ini dilakukan di Jati Beringin Sdn. Bhd (Industri IKS). Syarikat ini merupakan salah satu industri pembuatan besi di Malaysia. Pengajian ini mengenalpasti masalah-masalah yang dihadapi tentang pengendalian mutu dalam penghasilan. Data primer merangkumi pengumpulan data dari jabatan pengeluaran manakala data sekunder seperti maklumat dari jurnal, buku rujukan, internet, dan artikel. Statistik proses kawalan seperti carta kawalan dan kemampuan proses yang diterapkan untuk analisis data yang terkumpul. Dari analisis, menunjukkan bahawa ketiga-tiga proses iaitu pemotongan, penempaan dan nyah-cebisan berada dalam kawalan. Dalam hal kemampuan proses, proses-proses yang mampu menghasilkan spesifikasi yang dikehendaki. Spesifikasi ini didasarkan kepada keperluan pelanggan. Namun, untuk proses menekan dan proses pengaluran, ada kebarangkalian 0.25 dari 5 yang secara kasarnya 5% adalah untuk proses menekan yang dibuang manakala 0.5 dari 5 yang secara kasarnya sekitar 10% adalah untuk proses pengaluran yang dibuang. Jika kawalan tinggi digunakan dengan baik oleh syarikat dan digunakan sebagai maklum balas, ini memberikan faedah kepada syarikat dalam persaingan. Selain itu, syarikat juga boleh mencapai harapan dan kepuasan pelanggan dengan memberikan produk dengan kelemahan yang minimum dan perkhidmatan yang baik.

DEDICATION

To my parents,
My siblings,
My Master Project Supervisor,
My fiance, Elyas bin Talib
and all my friends,
that involve in this study.

Thank You.

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Last, I would like to thank my family whose endless encouragement and support gave me added strength and inspiration to carry out this project to the best of my ability. At the same time, I would like to thank my course mates for sharing their ideas and comments in order to accomplish my project.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

ISO	-	International Organization for Standardization
SPC	-	Statistical Process Control
PDCA	-	Plan / Do / Check / Act
CL	-	Center Line
UCL	-	Upper Control Limit
LCL	-	Lower Control Limit
UTeM	-	Universiti Teknikal Malaysia Melaka
TQM	-	Total Quality Management
JBSB	-	Jati Beringin Sdn.Bhd
g	-	Gram
б	-	Sigma
d_2	-	Factor for Central Line
Min	-	Minimum
Z	-	Standard normal value
Xi	-	Individual value
μ	-	Mean
б	-	Population standard deviation

CHAPTER 1

INTRODUCTION

1.1 Background

The word 'Quality' has difference meanings and definition under difference situation, condition or circumstances. The quality of a product or service may have greater or lesser meaning depending on the requirement of the user or consumer. The easiest way to define the word 'Quality' is the degree to which a product meets the requirements of a customer or the fitness of a product or service for its intended use. Quality control needs all effort from the various departments in the organization to manage quality and maintain assurance of continued high quality of product or service.

This phenomenon is widespread, regardless of whether the consumer or customer is individual, organization, manufacturing industries, and program or project. Understanding, improving, and implementing quality is the key factors which can lead the business success, growth, and an enhanced competitive position. Improve the return on investment from improved quality and from successfully employing quality as an integral part of overall business strategy. (Montgomery, 2001)

Quality also can be defined as the ability of a product or service which can meet or exceed the customer's expectation or requirements. Quality is a system, when implemented, yields increased market share and reduced scrap and rework. Quality can be a process improvement techniques and theories that start with a company's vendors and extend beyond the sales of that company's product and services to the customer. Quality is a system that built on these provable process improvement techniques, which serve as components under the products and services.

Quality control conveys an idea about determining and maintaining the quality of product or service which will satisfy the consumer, customer, and user by its performance, cost and delivery. Customer will not appreciate an item or product which has a level of quality higher than the demanded by the customer if the product has a high cost or late delivery. Customer satisfaction is the key to effective quality assurance.

Quality control is an activity which to provide a service by the product that manufactured which quality is designed, built and maintained at an economic level, which meets the requirement, satisfaction and expectation of the customer. There are 3 purpose of quality control, which are:

a) Ensure that the product conforms to be prescribed requirements of design, as it comes out of the production line.
b) Provides information needed for long term planning and control.
c) Gives a warning about problems of quality expected to occur so that preventive action can be taken in time and any consequential losses can be avoided.

1.2 Problem Statement

Jati Beringin Sdn.Bhd is one of the small medium enterprise (SME) produces metal parts. The company was incorporated on 2 September 1997 and operated at Alor Gajah, Melaka. Current practice in the company under study, they do not implement quality control system. The management of company cannot detect how far their product comply to the standard. The management also cannot identify their process capability of their production. Due to this problem, they could not know their status capability in production and also to do further improvement.

1.3 Objectives

a) To understand the production process of one of the products i.e. Stayrod.

b) To apply the statistical quality control technique in production of Stayrod.

c) To analysis the process capability of Stayrod production.

1.4 Scope of Study

The area of research in this project is focus on the quality control of one product produces by Jati Beringin Sdn.Bhd. Normally, inspection of quality control can be performed at three main points during the production line which are:

a) Raw material or input entering to production line;

b) Production process ;

c) Finished product before delivery to the customer.

Among these three inspection points during the production line, the study focused only on production line. The others two inspection points just as the additional information to enrich the information embodied in the project. The techniques discussed in the study which were focused on process control chart, process capability and cause and effect diagram.

1.5 Organizations of reports

In the Chapter 1 is an introduction of the master project's title which is "An Application of Statistical Quality Control on Process Improvement: Case Study in Stayrod Manufacturing". The project background has been explained very clearly and some of problem statements have been identified in previous journals that related to this title. Then, to find the solution for this title, some objectives must be achieved.

Chapter 2 elaborated more closely at understanding of fundamental of quality and summary of journals which related to the master project's title.

Chapters 3 described the flow chart that carried out for the whole process of the methodology. The analysis technique and tools also summarized in this chapter.

Chapter 4 shows the result and discussion. In this chapter, the data collected based at in line process and after that, analyzed section by section to show the good result. The process capability also calculated in this chapter.

Chapter 5 discuss the conclusion and recommendation of the project which summaries of the report and suggest the other improvement can be including in the future, thus of that this chapter reference to the objective and scope of project.

CHAPTER 2

LITERATURE REVIEW

2.1 Development of Quality

From the history of human evaluation, it shows the quality has always been integrated into the history of human society. This observation may cause of the ancient builders were more skilled and quality conscious than what we belong today (Jarrett, J.E., 2007). However, quality was restricted to manual skills, experiences and proficiency. The entire work of building houses, halls, or temples, producing agricultural, implements, as well as arms and ammunition was taken as a matter of art.

Quality is a system, when implemented, yields increased market share and reduced scrap and rework. Quality can be a process improvement techniques and theories that start with a company's vendors and extend beyond the sales of that company's product and services to the customer (Tapiero, C.S., 2007). Quality is a system that built on these provable process improvement techniques, which serve as components under the products and services. The quality system is continuously improved by people who expert in quality such as W. Edwards Deming, and Joseph M. Juran, Genichi Taguchi (Stevenson, W.J., 2007).

2.2 The Quality of Gurus

2.2.1 W. Edwards Deming

W. Edwards Deming (1900-1993) made it his mission to teach optimal management strategies and practices for organizations focused on quality. Deming encouraged top-level management to get involved in the process of creating an environment that supports continuous improvement. A statistician by training, Deming graduated from Yale University in 1928. He first spreads his quality message shortly after World War II. In the face of American prosperity following the war, his message was not accepted in the United States. His work with the Census Bureau and other government agencies led to his eventual contacts with Japan as that nation was beginning to rebuild. There he helped turn Japan into an industrial force to be reckoned with.

Deming considered quality improvement activities as the catalyst necessary to start an economic chain reaction. Improving quality leads to decreased costs, fewer mestakes, fewer delays, and better use of resources, which in turn leads to improved productivity, which enables a company to capture more of the market, which enables the company to stay in business, which results in providing more jobs. He felt that without quality improvement efforts to light the fuse, this process would not begin.

Deming, who described his work as "management for quality", felt that the consumer is the most critical aspect in the production of a product or the provision of a service. Listening to the voice of the customer and utilizing the information learned to improve products and services is an integral part of his teachings. Deming's theories focus heavily on management involvement, continuous improvement, statistical analysis, goal setting, and communication. His message is aimed primarily at management. With his 14 points as a

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guideline, Deming's philosophy encourages company leaders to dedicate themselves and their companies to the long-term improvement of the quality of their products or services.

Table 2.1 Deming's 14 Points (Besterfield, D.H., 2004)

a)	Create a constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business and to provide jobs.
b)	Adopt the new philosophy
c)	Cease dependence on inspection to achieve quality
d)	End the practice of awarding business on the basis of price tag alone. Instead minimize total cost.
e)	Constantly and forever improve the system of production and service
f)	Institute training on the job
g)	Institute leadership.
h)	Drive out fear
i)	Break down barriers between departments
j)	Eliminate slogans, exhortations, and targets for the work force
k)	Eliminate arbitrary work standards and numerical quotas. Substitute leadership.
l)	Remove barriers that rob people of their right to pride of workmanship
m)	Institute a vigorous program of education and self-improvement.
n)	Put everybody in the company to work to accomplish the transformation

Deming's influence continues today. Many of the concepts and ideas he espoused can be found in today's continuous improvement programs and international standards. For example, the 2000 revision of ISO 9000 places significant emphasis on management involvement and responsibility, include communicating customer requirements, developing an integrated overall plan to support meeting customer requirements, measuring key product and service characteristics, ongoing training, and demonstrating leadership.

2.2.2 Joseph M. Juran

Born in 1904, Joseph M. Juran immigrated from Rumania to the United States in 1912. Juran's approach involves creating awareness of the need to improve, making quality improvement an integral part of each job, providing training in quality methods, establishing team problem solving, and recognizing results. Juran emphasizes the need to improve the entire system. To improve quality, individuals in a company need to develop techniques and skills and understand how to apply them. Juran's definition of quality goes beyond the immediate product or moment of service.

The Juran trilogy makes use of three managerial processes: quality planning, quality control, and quality improvement (Table 2.2). By the following Juran's approach companies can reduce the costs associated with poor quality and remove chronic waste from their organizations. Quality planning encourages the development of methods to stay in tune with customers' needs and expectations. Quality control involves comparing products produced with goals and specifications. Quality improvement involves the ongoing process of improvement necessary for the company's continued success.

Table 2.2 The three universal processes of managing for quality (Besterfield, D.H., 2004)

Quality Planning	Quality Control	Quality Improvement
Determine who the customers are	Evaluate actual product performance	Establish the infrastructure
Determine the needs of the customers	Compare actual performance to product goals	Identify the improvement projects
Develop product features that respond customers' need	Act on the difference	Establish project teams
Develop processes able to produce the product features		Provide the teams with resources, training and motivation
Transfer the plans to the operating forces		