Faculty of Manufacturing Engineering

INTEGRATION OF SIX-SIGMA AND KAIZEN APPROACHED FOR BALL PIN QUALITY IMPROVEMENT IN MALAYSIA HABERDARSHEY INDUSTRY

Nur Qurratul Ain Binti Adanan

Master of Manufacturing Engineering (Industrial Engineering)

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NUR QURRATUL AIN BINTI ADANAN

A thesis submitted in fulfilment of the requirement of the degree of Master of Manufacturing Engineering (Industrial Engineering)

Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DECLARATION

I declare that this thesis entitle "Integration of Six-sigma and Kaizen Approached for Ball Pin Quality Improvement in Malaysia Haberdashery Industry" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted to candidates of any other degree.

Signature : .....

Name : NUR QURRATUL AIN BINTI ADANAN

Date : 9 SEPTEMBER 2016

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DEDICATION

To my beloved mother Noraini Jamiah bin Haji Salihi, my father Adanan bin Mamat and all my siblings, I love you. Genuine thanks to my supervisors, Dr. Mohd Shukor bin Salleh and Dr. Effendi bin Muhammad for all knowledge. Special to all Palestinian people, all Muslims and all good people in the world who are living in the war, poverty and torture, I finished my Master Project is because of you. I really hope that I can help you with all the knowledge that I gain one day.

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ABSTRACT

This report is about a case study of quality improvement in haberdashery industry through integration of six-sigma and Kaizen approach. This researched is conducted due to the unsatisfactory of the quality performance of the product that causes the customer complaint and quality issues. In order to survive and be able to provide customers with good products, manufacturing organizations are required to ensure that their processes are continuously monitored and product quality is improved. The turnaround has to take due to internal changes to decrease waste and increase product quality. This is accomplished by using the quality control as a tool to aid manufacturing. So, an analysis and improvement has been taken for the quality improvement of the selected product of this case study. The quality control method applied in the chosen company is by sample inspection where they assume all the parts produce from the machine are exactly the same as the target requirement. Consequently, a clear understanding regarding the problem of this case study is deeply analyse using ANOVA regression analysis and Ishikawa diagram. By applying Kaizen approach of quality improvement through DMAIC approach, it can assist the enhancement and evacuation of quality issues in this company and decrease the lost where the quality performance is improved by 92% for hard steel ball pin and 75% for stainless steel ball pin with no implication cost. The study is indeed very useful to the company because the approach is a very effective tool, where it can continuously improve the quality performance of products.

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ABSTRAK

Laporan ini adalah satu kajian mengenai peningkatan kualiti produk dalam industri tekstil melalui integrasi 'six-sigma' dan Kaizen. Kajian ini dijalankan adalah kerana prestasi kualiti produk yang tidak memuaskan menyebabkan aduan pelanggan dan isu kualiti. Dalam usaha untuk terus bertahan dan dapat menyediakan pelanggan dengan produk yang baik, organisasi pembuatan dikehendaki memastikan bahawa proses mereka sentiasa dipantau dan kualiti produk bertambah baik. Langkah pemulihan perlu diambil oleh kerana perubahan dalaman untuk mengurangkan pembaziran dan meningkatkan kualiti produk. Masalah ini dapat ditangani melalui kaedah kawalan kualiti sebagai alat membantu pembuatan. Dengan itu, analisis dan penambahbaikan akan dilakukan untuk meningkatkan kualiti produk pilihaan dalam kajian ini. Kaedah kawalan kualiti yang digunakan dalam syarikat adalah dengan pemeriksaan sampel dimana mereka menganggap semua bahagian yang dihasilkan oleh mesin adalah sama seperti keperluan sasaran. Oleh itu, kefahaman yang jelas mengenai masalah kajian ini adalah dianalisa dengan mendalam menggunakan 'ANOVA regression' dan 'Ishikawa diagram'. Dengan menggunakan Kaizen, pendekatan peningkatan kualiti melalui kaedah 'DMAIC', ia membantu meningkatkan dan mengevakuasikan isu kualiti dalam syarikat ini dan mengurangkan kerugian. Prestasi kualiti bertambah baik sebanyak 92% untuk bola pin keluli keras dan 75% untuk bola pin keluli tahan karat tanpa implikasi kos. Kajian ini adalah amat berguna kepada syarikat itu kerana pendekatan ini adalah alat yang sangat berkesan, di mana ia boleh meningkatkan prestasi kualiti produk secara berterusan.

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LIST OF ABBREVIATIONS

ANOVA	–	Analysis of Variance
DMAIC	–	Define-Measure-Analyse-Improve-Control
DMADV	–	Define-Measure-Analyse-Design-Validate
DoE	–	Design of Experiment
FMEA	–	Failure Mode and Effects Analysis
IDDOV	–	Identify-Define-Develop-Optimise-Verify
QFD	–	Quality Function Deployment
QC	–	Quality Control
SOP	–	Standard Operating Procedure

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CHAPTER 1

INTRODUCTION

The first section of this report is the overall view of the study that describes on what the research is about, the purpose of the study as well as the limitations or the boundary of the respected study. The structure of the report for the subject area is briefly explained on top to ensure a better visualization of the successions of the entire study.

1.1 Background of Study

The stunning growth of the Malaysian textile production network has been moderating a modest of bunch scholarly study in the range of worldwide inventory network for the abilities and performance. The textile manufacturing industry is most needed in worldwide industries. Escalating in this demanding industry requires synergistic production planning and routine analysis, letting in all levels of operations. Simultaneously, the quality of the product produced is one of the most important concerns in industrial activity. The interest in quality has become so acute that nearly all countries have set as an objective to increase quality. Modern production is no longer possible without an efficient and permanent search for better quality.

The development of technical solutions and the permanent changes in manufacturing are based on the continuous improvement of qualitative aspects both economically and functionally. Quality control is defined as a series of operational techniques and activities applied in order to meet quality requirements. Quality control is a managerial function used to check the functionality of standards regarding services, processing and manufacturing processes, and respectively their capacity to prevent flaw occurrence. Any organization must

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make use of all means to prevent, detect and correct errors that appear in different working stages. In order to achieve this, variables that can affect quality and are a result of the human factors' action must be kept in check together with the material used, the performance of the equipment and the tools used within the production line.

1.2 Problem Statement

The selected Malaysian company, Company XYZ Sdn Bhd, is a company that produce various haberdashery product such as ball pin, safety pin and straight pin. The company supply finish goods for many companies locally and this situation makes them give particular attention for quality control. The company committed to providing quality choice and value to money in the products and services they deliver to the customer. The objectives of implementation quality in this company are to meet customer expectations and continuous improving of a production issues.

In the meantime, the quality of products for this company are ineffectively controlled especially for ball pin. This company implement manual inspection for random sampling of finish goods for both process. The first and second inspection was done after preliminary production and after finishing process respectively. However, the approach unable to detect the defect of selected product. Since the size of selected product is small and have huge mass production per batch, full inspection approach cannot be implement as it needs vast of time to be done.

Indeed, the company still comfortable with hardcopy files and manual method producing documentation for defect of product. Because of this, the company unable to perform data analysis and poorly monitor quality issues that exist in production line of selected product. With unreadable incoming material quantity and tight schedule, the quality awareness is decreasing and passive response worsening the condition. Hence, the products that arrived at the hand of customer are defective or out of spec products. Because of that, the company received several complained from the customer regarding the unsatisfactory product.

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In every single minor problem, the company had to face costly consequence. Even it looks like small amount of loss, it still can bring impact to the company and may damage the company's image. The inefficient quality control of product symbolizes a considerable financial burden for the company. To enhance the quality performance of the company, the improvement will be done in this study. The quality issues of the company need to be analysed thoroughly using quality control tools in order to have clear understanding of this issues. By applying Kaizen approach of quality improvement, it can assist the enhancement and evacuation of quality issues in this company and decrease the lost.

1.3 Objectives

For this study, the objectives are:

i. To study the quality issues exist in the production line

ii. To propose and implement the integration of six-sigma and Kaizen approach in the production line

iii. To validate the implementation of quality improvement in the production line

1.4 Scope

This study concentrates on the understanding of integration of six-sigma and Kaizen approach at selected company where it is a textile company that engaged in production of various product families. However, this study only focuses on ball pins production line. At this stage, the study is focusing on improvement of quality performance for selected product in production line. To start with, it is important to understand the general process flow of the product in the company's production line. The current quality performance within the whole production process required of ball pin will be defined. The result later will be measured by a set of experimental study and then will be analysed with ANOVA regression analysis. The causes of the problem that effected quality performance of selected product will be discussed through Ishikawa diagram together with Engineer personnel of this company. The

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improvement is proposed and implemented through Kaizen approach before validating it with a same set of experimental study in order to measure the performance of quality of product after implementation.

1.5 Report Structure

The study is executed for the completion of Project Master One and Two which shows a better flow of what the report must have, which is defined in Table 1.1. It indicates a summary of the chapters' content in the study.

Table 1.1: The Structure of Report

Chapter	Topic	Description
Chapter 1	Project Background Problem Statement Objective Scope	- Elaborate on overall of the study involving the quality issues as well as the Kaizen approach applied in constructing organizations. - Describe about the problem that occurs in this study. - Setting the purpose of the study. - Calls for the scope of the work, the bounds and the assumption made.
Chapter 2	Literature Review	- To be exposed to the concept, theories and the previous studies made from various sources and to identify the gap in the study.
Chapter 3	Methodology	- Explain on the method and process used for the study such as collection of data as well as the steps involved in proposing the Kaizen approach.
Chapter 4	Result and Discussion	- Describes the systematic steps used in designing the implementation of improvement. - Highlights the crucial point in designing the implementation of subject area. - Discussed on the causes and effect of the current quality performance for the selected product in the production line. - Provides result of the study for the implementation and validation of implementation for quality improvement of selected product.

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Chapter 5	Conclusion and Recommendation	- Consist of the overall description mainly on the achievement of the objectives of the study, the recommendation for future work as well as the important lesson learnt from this study.

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CHAPTER 2

LITERATURE REVIEW

In this chapter, the literature review explores the dominant themes consist of the studies as well as research from various published materials. The materials, namely journals, articles, books and online resources are used as guidance for the next phase of this study. Furthermore, this chapter also includes some discussion of the gaps that have been identified in the existing literature and the details briefly elaborated to support this study. Specifically, this chapter will cover the areas that are in relation with quality issues, DMAIC and Kaizen approach worldwide. This indeed is an effective mode of carrying on the study on what has been made out and what has yet to be done regarding the area of study is on.

2.1 Introduction

As market enjoying strong growth, industry faces new challenges especially for small industries (Choudhary, 2015; Arya and Jain, 2014). Strong competition from foreign markets and rising log prices are reducing product margins and forcing companies to think lean, while improving product quality and reducing the cost (Prashar, 2014). Most companies start widen their step on satisfying their customer needs by emphasise new manufacturing practices which helps the improvement of manufacturing processes is continuously and faster (Malviya, 2015). Because of the pressure from globalization, many manufacturing company start to compete with three major factors which are quality, cost, and responsiveness of product (Judi et al., 2011). Nonetheless, quality has been typically considered as the most important strategic element of competitive advantage (Jozsef and Blaga, 2014; de Carvalho et al., 2014; Singh and Singh Ahuja, 2015).

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2.2 Quality in Manufacturing Industry

In the eyes of manufacturing, quality is defined as the standard specification of each product which followed with appropriate test procedures in order to verified the quality is in a good condition (Hofer and Bach, 2015; Judi, 2009; Jozsef and Blaga, 2014). With no defect, a high quality product is expected functioning and reliable which controlling it through achieving the specific standard that given by the company (Judi, 2009). At this point in time, incalculable manufacturing companies facing almost similar complications which are high defect product, low production, high stock list, high manufacture cost, and lacking of skill in achieving customer demands (Choudhary, 2015; Shettar et al., 2015).

Nowadays, it has been seen as a necessary to have advanced quality improvement practice as a requirement to have goods in demand (Dwivedi et al., 2014). So that, the survival step need to be taken in order to provide high quality product to customer where the company have to ensure they continuously monitor the processes involved and improve the quality of product simultaneously (Judi et al., 2011). With the intention of improvement of production outcomes, there were various applicable approaches to helps quality control manufactured products (Jozsef and Blaga, 2014). Quality can be control in almost all levels which helps to decreasing the production costs (Molina-Azorín et al., 2015).

2.2.1 Quality Control Application in Industry

As the aim for most industry is to produce a good quality product, the occurrence of defect is controlled by managerial function where the functionality of standards services, processes involved and its capacity are verified (Jozsef and Blaga, 2014). Quality control is applied widely in most industries as a significant approach to observe the continuous improvement process and find the causes factor of defect before eliminate it (Patel et al., 2014). With the help of quality control tools, it is easier the improvement of quality process by way of processing numerical data which great in tracking process and analysis data (Magar and Shinde, 2014). In real site, the company had to throw as soon as possible if the product is below standard requirement and encourage performance losses in production line

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