QUALITY IMPROVEMENT IN RICE PRODUCTION INDUSTRY USING DMAIC APPROACH

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

by

NUR IFFAH SYAMIMI BINTI ROSLI

B051810087

970713-38-5244

FACULTY OF MANUFACTURING ENGINEERING

2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: **QUALITY IMPROVEMENT IN RICE PRODUCTION INDUSTRY USING DMAIC APPROACH**

Sesi Pengajian: **2021/2022 Semester 2**

Saya **NUR IFFAH SYAMIMI BINTI ROSLI (970713-38-5244)**

mengaku membenarkan Laporan Projek Sarjana Muda (PSM) ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. *Sila tandakan (√)

☐ SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysiasebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)

☑ TERHAD (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/ badan di mana penyelidikan dijalankan)

☐ TIDAK TERHAD

Disahkan oleh:

Iffah

Alamat Tetap:
Lot 1961, Jalan Kuala Kerpan
Kg. Spg Empat Kerpan,
06150 Alor Setar, Kedah
Tarikh: 25 June 2022

Cop Rasmi:

NUR AKRAMIN BIN MOHAMAD
Senior Lecturer
Faculty of Manufacturing Engineering
Universiti Teknikal Malaysia Melaka

Tarikh: 30.6.22

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI KEJURUTERAAN PEMBUATAN
Tel: +606 – 270 2571 / Faks: +606 – 270 1047

Rujukan Kami (Our Ref) : UTeM.
Rujukan Tuan (Your Ref) :

Ketua Pustakawan
Perpustakaan Laman Hikmah,
University Teknikal Malaysia Melaka
Hang Tuah Jaya, 76100 Durian Tunggal
Melaka.

20 Jun 2022

Tuan/Puan,

PENGKELASAN LAPORAN PSM SEBAGAI SULIT/TERHAD LAPORAN PROJEK SARJANA MUDA KEJURUTERAAN PEMBUATAN.

NAMA: NUR IFFAH SYAMIMI BINTI ROSLI

Sukacita dimaklumkan bahawa Laporan PSM yang tersebut di atas bertajuk "*Quality Improvement in Rice Production Industry using DMAIC Approach*" mohon dikelaskan sebagai *SULIT / TERHAD untuk tempoh LIMA tahun dari tarikh surat ini.

2. Hal ini adalah kerana ianya merupakan projek yang ditaja sepenuhnya oleh syarikat luar (Syarikat Kilang Beras Perlis) dan hasil kajiannya adalah sulit.

Sekian dimaklumkan. Terima kasih.

Yang benar,

MUHAMMAD AFIF BIN NAZRI
Pengurus
SYARIKAT KILANG BERAS PERLIS SDN. BHD.
Batu 5, Jalan Kaki Bukit, Paya,
02400 Kangar, Perlis.

Tandatangan dan Cop Penyelia

NOTA: BORANG INI HANYA DIISI JIKA DIKLASIFIKASIKAN SEBAGAI SULIT DAN TERHAD. JIKA LAPORAN DIKELASKAN SEBAGAI TIDAK TERHAD, MAKA BORANG INI TIDAK PERLU DISERTAKAN DALAM LAPORAN PSM.

DECLARATION

I hereby, declared this report entitled "Quality Improvement in Rice Production Industry using DMAIC Approach" is the result of my own research except as cited in references.

Signature : .....

Author's Name : NUR IFFAH SYAMIMI BINTI ROSLI

Date : 25 June 2022

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of Universiti Teknikal Malaysia Melaka as a partial fulfilment of the requirement for Degree of Manufacturing Engineering (Hons). The member of the supervisory committee is as follow:

.....

(EN. NOR AKRAMIN BIN MOHAMAD)

NOR AKRAMIN BIN MOHAMAD
Senior Lecturer
Faculty of Manufacturing Engineering
Universiti Teknikal Malaysia Melaka

ABSTRAK

Dalam pembuatan, kualiti adalah salah satu elemen yang paling penting. Ia adalah penting untuk menjamin bahawa pelanggan menerima produk yang tidak mempunyai kecacatan dan memenuhi keperluan mereka. DMAIC mewakili lima fasa iaitu mentakrif, mengukur, menganalisis, menambah baik dan mengawal. DMAIC ialah metodologi enam sigma yang digunakan untuk menambah baik proses dalam industri atau perkhidmatan pembuatan. Kajian ini bertujuan untuk menggunakan pendekatan DMAIC sebagai salah satu kaedah bagi mencapai sasaran iaitu meningkatkan kualiti dalam industri pembuatan. Contoh kaedah yang digunakan dalam setiap fasa juga akan diterangkan secara terperinci. Kajian kes telah dijalankan di sebuah kilang pengeluaran beras yang terletak di Perlis. Berdasarkan pengumpulan data dan perbincangan bersama pekerja, industri ini mempunyai kecacatan kualiti beras. Kaedah yang telah digunakan dalam fasa menentukan dan mengukur ialah pengenalpastian masalah, pengumpulan data, carta alir proses, pemetaan proses dan rajah sebab akibat. Didapati terdapat tiga kecacatan berkaitan kualiti produk dalam pengeluaran. Analisis keseluruhan yang dijalankan dengan menggunakan kaedah seperti gambarajah tulang ikan, 5 Analisis Mengapa dan analisis mod kegagalan dan kesan bagi mengenal pasti faktor dan punca masalah. Dalam fasa penambahbaikan, dua kaedah seperti senarai semak latihan teknikal dan poka yoke telah dicadangkan untuk meningkatkan kualiti produk. Akhir sekali, helaian semakan pelan kawalan telah dicadangkan sebagai jaminan untuk mengawal proses penambahbaikan.

ABSTRACT

In manufacturing, quality is one of the most significant elements. It is important in order to guarantees that customers receive products that are does not have defect and satisfy their requirements. DMAIC represent the five phase which is define, measure, analyse, improve and control. DMAIC is a six sigma methodology that used to improves process in the manufacturing industry or services. This study aims to use DMAIC approach as one of the methods in order to achieve the target which is improve the quality in manufacturing industry. The example of method that use in every phase also will be explain in details. The case study was conducted at a rice production industry located in Perlis. Based on data collection and discussions with employees, the industry has problems in terms of rice quality defects. The method that has been used in the define and measure phase were problem identification, data collection, process flow chart, process mapping and cause effect diagram. It was found there are three defects regarding the quality of product in the production. The throughout analysis conducted by using methods such as fishbone diagram, 5 Why analysis and failure mode and effect analysis in order to identify the factor and root cause of the problem. In improve phase, two methods such as technical training checklist and poka yoke were suggested to improve the quality of product. Finally, control plan check sheet was suggested as the guarantee to control the improve process.

DEDICATION

Only

my beloved father, Rosli Bin Bakar @ Samat

my appreciated mother, Noor Eini Binti Mat Isa

my adored sister and brother, Fadhil, Fadhilah, Fatin, Naufal, Izzuddin and Izzat

for giving me moral support, money, cooperation, encouragement and also understandings

Thank You So Much & Love You All Forever

ACKNOWLEDGEMENT

In the name of ALLAH, the most gracious, the most merciful, with the highest praise to Allah that I manage to complete this final year project successfully without difficulty. I am thankful to Allah for letting me through all the difficulties.

I would like to acknowledge and give my special thanks to my supervisor, Encik Nor Akramin Bin Mohamad who help me to make this final year project possible. His guidance and advise helped me get through all of the chapters of my final year project writing.

I would like to give warmest thanks to my friends for their help and support. Thank you for always checking up on me and give a lot of moral support that help to brighten my days. Finally, I want to thanks myself for believing in myself and never give up. Indeed, all the hard work and effort during this project never betray me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

DMAIC	-	Define, Measure, Analyze, Improve, Control
SMEs	-	Small and Medium Enterprise
5S	-	5 Steps (Sort, Set in Order, Shine, Standardize, Sustain)
QC	-	Quality Control
DMADV	-	Define, Measure, Analyze, Design
VOC	-	Voice of Customer
SIPOC	-	Suppliers, Inputs, Process, Outputs, Customers
CTQs	-	Critical to Quality
FMEA	-	Failure Modes and Analysis Effect
GAGE R&R	-	Gage Repeatability and Reproducibility
DOE	-	Design of Experiments
SOP	-	Standard operation procedure
CED	-	Cause and Effect Diagram
BE	-	Broken End
VSM	-	Value Stream Map
QC	-	Quality Control

LIST OF SYMBOLS

%	-	Percent
Cp	-	Process Capability
Cpk	-	Process Capability Index
pH	-	Potential of hydrogen

CHAPTER 1
INTRODUCTION

1.1 Research Background

Quality defines as the level with which a product meets the customer's requirements at the beginning of its life. It is the outcome of a clear and constant dedication to a particular standard which is results in product consistency in order to keep up with certain customer or user expectations. The letter of DMAIC was represent the five phase that make up the process. DMAIC stands for define, measure, analyze, improve and control. In manufacturing processes, DMAIC was used to improve the existing processes (Piotr Nowotarski, 2019). Six Sigma is a technique that aims to enhance quality of the product by maximizing the efficiency and productivity of all operational processes in order to meet customer requirements and satisfaction utilising the DMAIC five-stage process (Biena and Ong, 2019). Six sigma is an incredibly effective managing tool in achieving process excellence (Legesse and Geremew, 2021). In the DMAIC improving process, the first thing to do is define project goal and customer deliverables. The voice of customer is necessary to fully understand the feedback from current and future customers suggesting offerings that satisfy, captivate and dissatisfy them. Next is measure the process which is to determine current performance, verify the problems and including of developing and implementing a structured data collecting strategy for the specified process key measurements (CTQs) (Gupta, 2013). After that, analyse and also identify the root cause of the problems and improve the process by reducing or eliminate the defects. Finally, control the future process performance with the aim of the improved process does not degrade.

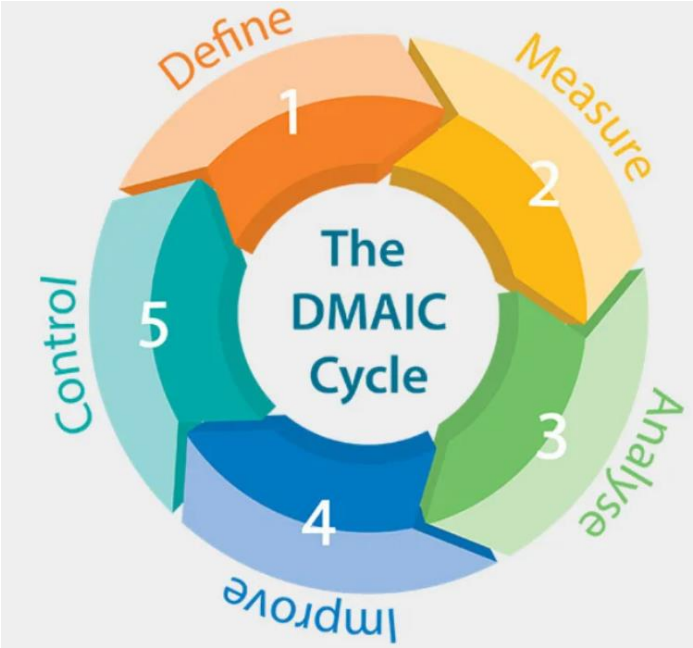

Figure 1.1: DMAIC phase (Sodhi, 2020)

DMAIC approach is one of the best ways to use in manufacturing process. It can improve the quality and reduce the waste by helping industries to produce their products and services with the excellence quality, quicker and also affordable (Lokpriya M. Gaikwad, 2017). DMAIC also presents a stage in detecting the issue, determining the root of the issue, and eventually developing a way to resolve it (Kartini and Syarief, 2018). As the company initiate to increase their production with the fewer defects, they will start to bring in more earnings.

The main goal with using the DMAIC approach, it can allow a company to find the problems and solve the problem in easier way. It also can identify problems that which is can be ineffective (Jeroen de Mat, 2012). It is a systematic and structured system for decreasing process variance in order to guarantee customer happiness, cost savings, and the company profitability (Srinivasan et al., 2014).

1.2 Problem Statement

There are many problems and solving that is being use by the engineers and other professional worldwide. As a company there must be common problem with the quality of the products and the satisfaction of the customers. It is an important thing to maintaining control over the level of quality of a product. A set of effective quality control performance and also improvement models need to be established.

The external elements that contributed to the process inefficiency and then focused on the internal ones. As a result, there are some bottlenecks in the production process that are associated with observable downtime (Smetkowska and Mrugalska, 2018). The quality control that carried out by looking into the company total production system, with the goal of eliminating manufacturing defects (Agustiandi, Madelan and Saluy, 2021). Next, with the help of DMAIC strategy will be effective identification to discover the root cause of the problems in products and also services (R.S Barot, 2020). If the problems have been found, it can improve for the better of current process performance.

Organizations are struggle due to increasing competition as to stand competitive in the market (Srinivasan et al., 2016). According to a study, the implementation of DMAIC approach to the casting process by SMEs in India to lessen the rejection rate caused by blowing holes in a stroke engine oil pump body. With the application of DMAIC approach the rejection hole was reduced from 17.22% to 4.8% (Shanmugaraja et al., 2011). Besides that, it is crucial for the company to work strategically to maintain competitive and increase the customer satisfaction by maximizing their profit with removing the waste that exists throughout the manufacturing process. The reduction of errors and process variability that enables companies to enhance their efficiency and performance over time (C.Ferreira, 2019). By implementing this strategy, it will be reducing the lead time, increase the productivity, reduce the cost and improve the efficiency.

For this project, a rice manufacturing industry was chosen that located in Perlis. Based on the site visit and discussion with the supervisor of industry, there are problem that have been identified such as the quality of products in the rice production that did not meet the expectation. Additionally, it was discovered that there are three types of defects which is

whitening, big broken rice and small broken rice that exceeds the expectation. The defects also can affect the productivity of the industry. Besides that, the industry also faced a problem where the workers that lack in monitoring and causes problem such as machine that not maintenance regularly and the tools that usually falls. This issue should be solved and the industry should maintain their improvement in order to increase their productivity by using the DMAIC approach.

1.3 Objectives

There are three objectives aiming to achieve the goals of this project which is:

1. To analyse the current process problem in manufacturing industry by using DMAIC.
2. To analyse the root cause of defects in the quality of product.
3. To propose alternatives for quality improvement.

1.4 Scopes of the Research

The main scope of this project are:

1. To focus on improvement in the quality of the products or a service in manufacturing process.
2. The strategy to analyse the effective results between the previous method with DMAIC method.

1.5 Significant of Study

Many advantages can be gain from this study, especially focusing on DMAIC approach. The result of the recent study show how implementing DMAIC can be effective

to a manufacturing process. It also shows the goal which is to lessen the waste and can improve the current process. On top of that, it also had significant impact on the profitability of the company such as lowering waste cost, decreasing man-hour on rework and also increase the production. The application of define, measure, analyse, improve and control in industry can improve the process performance. As an outcome, resources are managed efficiently, variances are reduced, and quality is guaranteed.

1.6 Organization of the Report

In this report, there are five chapters which is an introduction, literature review, methodology, result, discussion and the conclusion. In chapter one, it has the background of study, problem statement, objectives, scope of work, significant of study, organization of the report and summary. It explains the details explanation of the title.

For the chapter two, it is the literature review which is to gain understanding of the existing research. In the literature review, summarizes and evaluates the literature based on the study and considered the strength and weakness of the previous study. The next chapter is methodology which the section explains the data that was gathered and analyzed. Chapter four is the results and discussion that provide more details and discussion on the research. Lastly chapter five is the conclusion which is provides a summary of the topic that study.

1.7 Summary

Based on this study, I can learn about how the DMAIC method works and the result by implementing this method. DMAIC method can improve the quality of a product or services, reduce quality cost, reduce defects and more. It is the most effective and best way to use in manufacturing process in order to solve the problem in industry.

CHAPTER 2
LITERATURE REVIEW

In this chapter, the description of DMAIC or known as define, measure, analysis, improve and control was explained. It is one of the strategies that used in manufacturing industry in order to improve the quality. The five phases of the DMAIC also will be briefly discuss. The discussion including the other six sigma tools which is also a set of technique and tools for the process improvement. It highlighted cycle time improvements while reducing the manufacturing defects. The tools in six sigma including DMAIC, 5S, seven wastes, value stream mapping, and others. Six sigma discovers and eliminate costs that are of no value to customer, such as waste expenses.

2.1 Six Sigma through DMAIC

In manufacturing industry, it is crucial for the company to high performance in order to compete effectively and hence resist the continuous change. Six sigma approach is based on DMAIC which consists five cycle stages of analysis and improvement processes that allows for defects removal and also the reduction of process variability (C.Ferreira et al., 2019). According to Amir Yadav et al., (2016), six sigma is a tool that can be utilised in order to acquire positive results in process improvements. It will be even more valuable to the company if the process is implemented throughout all production lines, since it would lead to huge cost reductions. Six sigma approaches, such as the DMAIC methodology, provide a framework for enhancing manufacturing quality and productivity.

It lets the company to improve their bottom line by planning and monitoring day-to-day company activities in a way that saves waste and improves customer satisfaction. (Rahul