



**IMPROVEMENT OF PRODUCT RELIABILITY THROUGH
PRODUCTION PROCESS CAPABILITY STUDY AT FOOD AND
BEVERAGES INDUSTRY**



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TECHNOLOGY WITH HONOURS**

2021



**Faculty of Mechanical and Manufacturing Engineering
Technology**



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ZAHRI**

A thesis submitted
in fulfillment of the requirements for the degree of
Bachelor of Manufacturing Engineering Technology with Honours



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I declare that this Choose an item. entitled “ Improvement of Product Reliability Through Production Process Capability Study at Food and Beverages 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 in candidature of any other degree.

Signature



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: 17 January 2022



APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Manufacturing Engineering Technology with Honours.

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: 17 December 2022



DEDICATION

To my dear father, mother, siblings, and friends, who have always been there for me
spiritually and emotionally.

Ts. Dr. Amir Hamzah Bin Abdul Rasib, my supervisor, for mentoring, instructing, and
assisting me in finishing my thesis.



ABSTRACT

With the numerous obstacles encountered by rivals in the same sectors, particularly in the food and beverage industries, the manufacturing sectors are increasingly improving their performance. Process capability refers to the ability of a process to produce a product that can provide a service capable of meeting the customer's specifications. The issue here is that the manufactured items are supplied to customers, resulting in items or services that do not satisfy their expectations. Therefore, this research aims to improve product reliability through production process capability. The primary objective is to identify product reliability in ways similar to process capability. First, the literature review is done based on the product reliability, and Cp, Cpk is collected and turned into knowledge. Next, the collection of production data from the selected food sector as an actual case study is required at the start of developing a capability based on a production system. Hence, the second objective of this research is to conduct and analyze the Cp Cpk method to improve product reliability through process capability study in the food and beverages industry. The technique in data collection is gathered by using a spreadsheet and capturing the photo. Only after the data has been studied to identify solutions to challenges in the food sector can the desired outcome be achieved. The final goal of this research is to offer an improvement activity based on the Cp and Cpk studies. Analyses are carried out using data that has been acquired. Analyzing the product's reliability and conformance to customer specifications is critical to determining its value. Based on the examination of Cp and Cpk, the most impacted aspect was determined and used as a proposal for improvement. At the same time as presenting the findings to the industrial representative, these recommendations are discussed.

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ABSTRAK

Dengan pelbagai halangan yang dihadapi oleh pesaing dalam sektor yang sama, terutamanya dalam industri makanan dan minuman, sektor pembuatan semakin meningkatkan prestasi mereka. Keupayaan proses merujuk kepada keupayaan sesuatu proses untuk menghasilkan produk yang dapat menyediakan perkhidmatan yang mampu memenuhi spesifikasi pelanggan. Isunya di sini ialah barangan perkilangan dibekalkan kepada pelanggan, menyebabkan barangan atau perkhidmatan tidak memenuhi jangkaan mereka. Oleh itu, penyelidikan ini bertujuan untuk meningkatkan kebolehpercayaan produk melalui keupayaan proses pengeluaran. Objektif utama adalah untuk mengenal pasti kebolehpercayaan produk dengan cara yang serupa dengan keupayaan proses. Pertama, kajian literatur dibuat berdasarkan kebolehpercayaan produk, dan Cp, Cpk dikumpul dan dijadikan pengetahuan. Seterusnya, pengumpulan data pengeluaran daripada sektor makanan terpilih sebagai kajian kes sebenar diperlukan pada permulaan membangunkan keupayaan berdasarkan sistem pengeluaran. Justeru, objektif kedua penyelidikan ini adalah untuk menjalankan dan menganalisis kaedah Cp Cpk bagi meningkatkan kebolehpercayaan produk melalui kajian keupayaan proses dalam industri makanan dan minuman. Teknik dalam pengumpulan data dikumpul dengan menggunakan hampan dan menangkap foto. Hanya selepas data dikaji untuk mengenal pasti penyelesaian kepada cabaran dalam sektor makanan barulah hasil yang diinginkan dapat dicapai. Matlamat akhir penyelidikan ini adalah untuk menawarkan aktiviti penambahbaikan berdasarkan kajian Cp dan Cpk. Analisis dijalankan menggunakan data yang telah diperolehi. Menganalisis kebolehpercayaan dan pematuhan produk kepada spesifikasi pelanggan adalah penting untuk menentukan nilainya. Berdasarkan pemeriksaan Cp dan Cpk, aspek yang paling terkesan ditentukan dan digunakan sebagai cadangan penambahbaikan. Pada masa yang sama semasa membentangkan penemuan kepada wakil industri, cadangan ini dibincangkan.

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ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

First and foremost, I would like to thank and praise Allah the Almighty, my Creator, my Sustainer, for everything I received since the beginning of my life. I would like to extend my appreciation to the Universiti Teknikal Malaysia Melaka (UTeM) for providing the research platform.

My utmost appreciation goes to my main supervisor, Ts. Dr. Amir Hamzah Bin Abdul Rasib, Universiti Teknikal Malaysia Melaka (UTeM) for all his support, advice and inspiration. His constant patience for guiding and providing priceless insights will forever be remembered that who constantly supported my journey.

Last but not least, from the bottom of my heart a gratitude to my beloved parents, Radin Shamsul and Sarimah Jurimi, for her encouragements and who have been the pillar of strength in all my endeavors. Also, for their endless support, love and prayers. Thank you to all my colleagues for their helping, supporting and understanding. Finally, thank you to all the individual(s) who had provided me the assistance, support and inspiration to embark on my study.



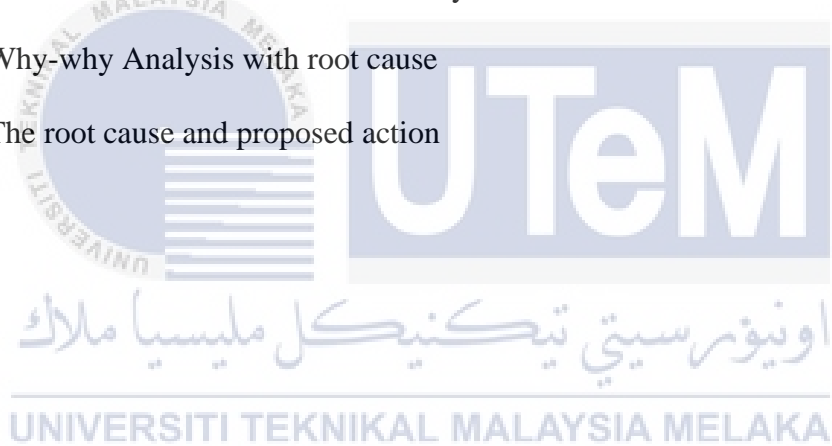
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LIST OF SYMBOLS AND ABBREVIATIONS

Cp	-	Process Capability
Cpk	-	Process Capability Ratio
Pp	-	Process Performance
Ppk	-	Process Performance Index
RQ	-	Research Question
SPC	-	Statistical Process Control
DfR	-	Design for Reliability
LCL	-	Lower Control Limit
UCL	-	Upper Control Limit
LSL	-	Lower Specification Limit
USL	-	Upper Specification Limit
±	-	Plus and Minus (average)
σ	-	Sigma or Standard Deviation
4M	-	Man, Method, Material & Machine
PCIs	-	Process Capability Indices
F&B	-	Food and Beverages
DMAIC	-	Define, Measure, Analyze, Improve and Control
Sdn. Bhd.	-	<i>Sendirian Berhad</i>
Mardi	-	Malaysian Agricultural Research and Development Institute
FAMA	-	Federal Agricultural Marketing Authority
SME	-	Small and Medium Enterprises
SIRIM	-	Standard and Industrial Research Institute of Malaysia
SMIDEC	-	Small And Medium Industries Development Corporation
MARA	-	<i>Majlis Amanah Rakyat</i>
Jakim	-	<i>Jabatan Kemajuan Islam Malaysia</i>

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CHAPTER 1

INTRODUCTION

1.1 Research Background

In the present era of competitive manufacturing, the challenge is to be on the cutting edge of producing excellent products at the lowest possible cost. This is unlikely without a detailed approach, which can be found in what is known as statistical quality control or Industrial Statistics. As identified by Rastogi et al. (2016), process capacity of analysis is a part of quality management that can be observed and discussed with the product. Nothing is more dominant than ensuring certification that the procedure can fulfill the specific process capability when organizing the quality aspects of operations. The concept of process capability is crucial for mechanical directors to comprehend (Pawar et al., 2016).

In production, process Capability (Cp) is known as an appropriate compensation of a process capable of consistently producing parts within given parameters. By focusing on the range of products and, the procedure used to calculate the standard deviation or sigma value there have several methods that can be calculated. Developers can measure to see just how their method is functioning with Cp (Process Capability), Cpk (Process Capability Ratio), or Pp (Performance Index) and Ppk (Performance Centering Index).

Inside of reasonable categories, sample, variance, or deviation mean are used in the Cp and Cpk measurements. Coefficient of variation or standard deviation is used in the Pp and Ppk measurements, which are based on observed results on the whole population. The Cp and Cpk indices are used when a sample, not the population, and are testing the potential capability of a process to meet customer needs. The Pp and Ppk indices are used when the entire population and are testing the performance of a system to meet customer needs (QI Macros, 2018).

Based on the capability of the process, there will include many product requirements for their needs. Here, to know the reliability of products is to improve the production process in the F&B industry. The capacity of a device or component to operate under specified conditions over a given period is referred to as reliability. It was founded by IEEE (1990) that efficiency, which is commonly characterized as a components or platforms ability to operate at a particular stage or interval of period, is genetically similar to reliability.

Process reliability refers to the consistency as to how far a process's production separates from any predetermined values. In most cases, high reliability is the goal, particularly when the output quality is critical for a subsequent process. Process efficiency can be improved in a variety of ways, but the most common one is to monitor past output and change certain factors appropriately.

1.2 Problem Statement

Process capability indices are a way of measuring how well an in-control process adheres to a collection of specifications. Process Capability Studies are used to determining the processes are capable of under controlled environments. Moreover, it is because of the water volume is inconsistent at the F&B industry. The research examines how efficient a method is under optimal conditions for a short period. The advantages of performing a processing capacity assessment are that it helps to evaluate a process's short-term reliability and capability.

The issue that arises in F&B industry is the quality in which is manufactured products are delivered to products, resulting in products or services that do not satisfy their requirements. Most organizations believe in development activities without even considering anything like a well-thought-out strategy. Reliability is a metric that assesses the consistency or accuracy of test results. The capability to replicate a test or research results.

The use of process capability indices in production to meet product requirements is a way to increase product reliability through process capability in the F&B industry. A process-capability inspection is used to evaluate a method that ability to meet requirements. As a result, this method would aid in maintaining that product reliability improves in the F&B industries.

1.3 Research Question

Three research questions are identified based on the problem statement.

RQ1: What is the root cause that related on product reliability on the F&B industry?

RQ2: What is the technique that applied to solve product reliability?

RQ3: How process capability helps in making sure product reliability in production at the F&B industry?

1.4 Research Objective

The overarching goal of this case study is to improve product reliability in the F&B industry by studying production process capability. This project has a set of underlying objectives:

- i) To identify product reliability in ways similar to process capability.
- ii) To conduct and analyze Cp Cpk method to improve product reliability through process capability study at food and beverages industry.
- iii) To propose an improvement activity based on process capability study.

1.5 Research Scope

This research will concentrate on process improvement, often known as the production process in F&B industry production assembly procedures. The major strategy is to enhance the product reliability of the industry's F&B process. Process capability has become one of the key goals for ensuring that products' requirements are fulfilled. As a result, utilizing process capability indices such as C_p and C_{pk} makes the study scope quite appropriate, methodical, and dependable.

1.6 Expected Result

The study's expected outcome is to identify the factors that affect product reliability as a result of process capability in the F&B industry. Validate new ideas for improvement through process capability studies after redefined and found solutions for improving reliability and production. Present the method of change to the F&B industry sector after completed the verifiable evidence. This research aids in the application of information and research in a real-world situation. This is an excellent opportunity to gain experience outside of the college. This research aids in determining the production process in the industry, identifying its flaws, and making improvements derived from the findings.

Into the bargain, the expected result for this study is to measure a process capability to evaluate a process's ability to meet product reliability requirements in production. Based on the findings, a process capability study in the F&B industry was conducted to strengthen, develop, and approach product reliability. Last, but not least, the expected outcome is to recommend an improvement activity based on process capability study on the F&B industry.

1.7 Thesis Frame

The first chapter of this study is devoted to its introduction. This chapter describes the research history that informed into this report essay. Moreover, in this chapter, the research of problem statements is discussed. The research issue is then described using the problem statement as a guideline. Although the research question is clearly stated in this document, the research objectives are also written down, and the research scope is also described in this chapter. This study's expected outcome as well as the thesis frameworks is mentioned and the study's summary will be present.

The second chapter is all about preparing the studies of literature review. To prepare for the writing of this chapter, all relevant information about this study, such as reliability, product, production, and process capability study is found and read in this chapter. Discovering historical journals and articles, as well as gaining knowledge from these recent journals and articles, was true as the method used to write this thesis essay. Then, for the topic by topic, write down what individuals learned in this chapter. As a result, there will be several sub-topics in this chapter, each of which is related to this research.

Next, the methodology introduced in this analysis is then applied in the third chapter. The methods and tools were described in this chapter, as well as the guidelines for conducting the research. In this analysis, the processes and approaches will be thoroughly explained. In this chapter, individually also learn about major issue strategies to perform. The conclusions and recommendations of this analysis will be presented in chapter four.

This analysis will use the methods and techniques described in Chapter 3 in this chapter. There is more detail on how to use skills and methodologies. This chapter would analyze the outcomes of using these methods and techniques. The discussion will be based on the results which will help to achieve the study's goals of the thesis requirement.

Eventually, in chapter five, the report's thesis will be applied. The findings of the overall research will be summarised in this chapter. This report's progress will be visible. The future for launching an updated F&B industry of process and management system of production is discussed. The proposal's procedure results were shown as supporting documents to strengthen the framework. The improvement will be demonstrated, and the accurate understanding, as mentioned in the thesis, will be described in this article.

1.8 Summary

In the nutshell, because of product demands and competition with other industries, F&B industry development is increasingly accelerating. By the same token, efforts should be made to improve the quality and efficiency of the F&B industry process. Besides, to maintain the industry's efficiency and productivity on processing a product on production stage. Applications of reliability, such as process capability, are one method of improving product reliability. The method of reliability is to optimize and accurately produce a product that will meet the needs of the consumer. This approach is derived from quality management and Cp Cpk, which are especially useful in F&B industry environments.

CHAPTER 2

LITERATURE REVIEW

2.1 Preliminaries

Today's engineers must perform in the production industry and determine if the product can give the same parameterized outcomes or supply inadequate faulty components to consumers. However, there seems to be a unique impact of process capabilities on the cost of production in every F&B industry sector. Process capability is needed to ensure that the output and machineability are within identified tolerances (Pawar, 2010). In process capability, reliability is the phrase that relates towards the uniformity of either a research study or measuring test in psychological studies. Hessing (2015) identified that, the intrinsic statistical variability of an idiosyncratic mixture of instruments, materials, procedures, and require collaboration in making a quantifiable development may be measured using statistical methodologies.

The quality proceeding has evolved into one of the widest market decision factors when deciding between competing goods and processes (Mbohwa, 2016). As a direct consequence, the method has been assessed as important to maintain production efficiency. The totality of all qualified as well as organizational efforts to regulate the F&B industries skills to improve and maintain efficiency is known as statistical process control (SPC).