UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ZERO-DEFECT PROGRAM IN AEROSPACE MANUFACTURING TO REDUCE REPETITIVE CUSTOMER COMPLAINT WRONG PART MARK ISSUES

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MASTER OF MANUFACTURING ENGINEERING
(QUALITY SYSTEM ENGINEERING)

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Faculty of Industrial & Manufacturing Technology & Engineering

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NOR AFIFAH BINTI BASERI

A master project submitted
in partial fulfillment of the requirements for the degree of
Master of Manufacturing Engineering (Quality System Engineering)

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2024

DECLARATION

I declare that this master project entitled “Zero-Defect Program In Aerospace Manufacturing To Reduce Repetitive Customer Complaint Issues“ is the result of my own research except as cited in the references. The master project has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :.....

Name : Nor Afifah Binti Baseri

Date :.21 July 2024

APPROVAL

I hereby declare that I have read this master project and in my opinion this master project is sufficient in terms of scope and quality as a partial fulfillment of Master of Manufacturing Engineering (Quality System Engineering)

Signature	:.....
Supervisor Name	: Professor Ts. Dr. Effendi B. Mohamad
Date	:11 July 2024

DEDICATION

To my Dearest Husband Nuh Hazim Bin Sidit,

Your unwavering support, love, and encouragement have been my pillars throughout this challenging study journey. Thank you for standing by me and being my constant source of strength. This achievement is as much yours as it is mine.

To my Son Nuh Hadif Bin Nuh Hazim,

Your bright eyes are embers of curiosity, your laughter, the rhythm of a joyful heart. This dedication is a promise, a vow to walk beside you as you explore the world's endless wonders, nurturing your dreams and celebrating your unique brilliance.

To my Loving Parents Mr. Baseri & Mrs.Puan Suzana,

Your sacrifices, guidance, and boundless love have shaped me into the person I am today. This study endeavor is a testament to the values and lessons you instilled in me. I dedicate this accomplishment to you with heartfelt gratitude.

To my Respected Parents-in-law Mr.Sidit & Mrs.Rahmah,

Your warmth and acceptance have enriched my life in ways I cannot express. Thank you for being a source of inspiration and for your unwavering belief in my abilities. This achievement is dedicated to you with deep appreciation.

To my Cherished Friend Alia,Atiqa,AfidaAimi,Zulhilmi,Zafran,Azreen,Syazwani

Your laughter, encouragement, and understanding have been a constant source of joy in my life. Thank you for being my confidant and cheering me on. This success is shared with you, my dear friend.

To my Esteemed Leaders in Mr.Bakhtiar & Mr Syazwan,

Your guidance, expertise, and commitment to advancing knowledge have been a beacon for me in this academic pursuit. I am grateful for the opportunities to learn and grow under your mentorship. This achievement is dedicated to you as a token of my respect and gratitude

ABSTRACT

One of the aerospace companies located in Malacca implement a ZDP to reduce repetitive customer issues in their company. To reduce repetitive customer complaints in an aerospace company, the implementation of a ZDP is crucial because Zero-defect manufacturing aims to achieve defect-free production through continuous improvement, ultimately enhancing customer satisfaction and reducing waste.In 2022, the aerospace company experienced a significant number of repeated consumer complaints. Ensuring consumer satisfaction is important for the long-term profitability and viability of the company. The repeated occurrence of problems in customer complaints is a major barrier to delivering a satisfactory customer experience. In the aerospace industry, communication channels regarding corrective actions are often fragmented, hindering the efficient exchange of information between different departments or teams. This lack of integrated communication impedes the dissemination of insights gained from resolving specific incidents, limiting the organization's ability to implement comprehensive and systemic changes. The Pareto chart identifies the primary customer complaint concern as the Wrong Part Mark. By analyzing the Pareto chart, researchers can thoroughly examine which customer are responsible for the issue of the wrong part mark. This analysis reveals that there is a repeated customer complaint connected with these projects, the obejective of this study to design the Customer Complaint database management system for customer complaint issue and then to replicate corrective actions across different programs within the company. Lastly to verify implementation of corrective actions into the relevant project or process. The 8D methodology provides a structured framework with eight disciplines, each having specific tasks and goals to effectively recognize, rectify, and prevent issues. This method is widely used to handle quality and continuous improvement efforts in various industries, including aerospace, automotive, and manufacturing. Recent study has showcased how the 8D methodology is applied to address manufacturing defects and cut down on customer complaints. Lastly, to makes sure the action is implemented in production floor, Gemba at production floor shall be conduct when the action closed. Grmba activity lead by QA personnel and support by committee. The Customer Complaint Zero Defect Program (CQ-ZDP) resulted in a clear reduction in repetitive customer complaints, with a 4% decrease from 2021 to early 2024. By systematically addressing the root causes of these issues through the 8D methodology, the aerospace company significantly improved product quality, as evidenced by the decrease in part marking issues. This success highlights the importance of a proactive and structured approach to defect management, which not only resolves immediate issues but also prevents their recurrence.

ABSTRAK

Salah satu syarikat aeroangkasa yang terletak di Melaka melaksanakan ZDP untuk mengurangkan isu-isu pelanggan yang berulang dalam syarikat mereka. Pelaksanaan ZDP adalah penting dalam syarikat aeroangkasa untuk mengurangkan aduan pelanggan yang berulang kerana pembuatan tanpa kecacatan bertujuan untuk mencapai pengeluaran bebas kerosakan melalui penambahbaikan berterusan, dengan akhirnya meningkatkan kepuasan pelanggan dan mengurangkan pembaziran.Pada tahun 2022, syarikat aeroangkasa tersebut mengalami jumlah aduan pengguna yang berulang yang signifikan. Memastikan kepuasan pengguna adalah penting untuk keuntungan jangka panjang dan kebolehcapaian syarikat. Kejadian berulang masalah dalam aduan pelanggan merupakan penghalang utama dalam memberikan pengalaman pelanggan yang memuaskan. Dalam industri aeroangkasa, saluran komunikasi mengenai tindakan pembetulan sering tercicir ,ini menghalang pertukaran maklumat yang cekap antara bahagian atau pasukan yang berbeza. Ketiadaan komunikasi yang bersepadu menghalang penyebaran pandangan yang diperolehi dari menyelesaikan insiden tertentu, yang membataskan keupayaan organisasi untuk melaksanakan perubahan yang menyeluruh dan sistematik. .Dengan menganalisis carta Pareto, penyelidik dapat menyelidiki dengan mendalam pelanggan yang bertanggungjawab atas masalah tanda part yang salah. Analisis ini mendedahkan bahawa terdapat aduan pelanggan yang berulang yang berkaitan dengan projek-projek ini, objektif kajian ini adalah untuk merancang sistem pengurusan pangkalan data Aduan Pelanggan bagi isu-aduan pelanggan dan kemudian menggandakan tindakan pembetulan di seluruh program-program berbeza dalam syarikat. Akhir sekali, untuk memeriksa pelaksanaan tindakan pembetulan ke dalam projek atau proses yang berkaitan. Metodologi 8D menyediakan kerangka yang terstruktur dengan lapan disiplin, setiap satu mempunyai tugas dan matlamat yang khusus untuk mengenali, membetulkan, dan mencegah masalah dengan berkesan. Kaedah ini banyak digunakan untuk mengendalikan usaha-usaha kualiti dan penambahbaikan berterusan dalam pelbagai industri, termasuk aeroangkasa, automotif, dan pembuatan. Kajian terkini telah menunjukkan bagaimana metodologi 8D digunakan untuk mengatasi kecacatan pembuatan dan mengurangkan aduan pelanggan. Akhir sekali, untuk memastikan tindakan diimplementasikan di lantai pengeluaran, aktiviti Gemba di lantai pengeluaran akan dijalankan apabila tindakan ditutup. Aktiviti Gemba dipimpin oleh staf QA dan disokong oleh jawatankuasa. Program Zero Defect Complaint Customer (CQ-ZDP) telah menghasilkan pengurangan yang jelas dalam aduan pelanggan yang berulang, dengan penurunan sebanyak 4% dari tahun 2021 hingga awal tahun 2024. Dengan mengatasi punca utama masalah ini secara sistematik melalui metodologi 8D, syarikat aerospace telah meningkatkan secara signifikan kualiti produk, seperti yang dibuktikan dengan penurunan masalah penandaan bahagian. Kejayaan ini menunjukkan kepentingan pendekatan yang proaktif dan terstruktur dalam pengurusan kecacatan, yang tidak hanya menyelesaikan masalah segera tetapi juga mencegah kejadian semula jadi mereka

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CHAPTER 1

INTRODUCTION

1.1 Background

Quality in aerospace manufacturing is of paramount importance due to the critical nature of aerospace products and the stringent safety requirements (Țîțu & Pop, 2021). Even minor imperfections can have significant implications, including compromising safety, leading to catastrophic failures, and causing substantial financial losses (Huszák et al., 2023). The implementation of a Zero Defect Program (ZDP) has emerged as a strategic approach to address these challenges and achieve operational excellence (Yusuf et al., 2019).

One of the aerospace companies located in Malacca implement a ZDP to reduce repetitive customer issues in their company. To reduce repetitive customer complaints in an aerospace company, the implementation of a ZDP is crucial because Zero-defect manufacturing aims to achieve defect-free production through continuous improvement, ultimately enhancing customer satisfaction and reducing waste (Yadav et al., 2023).

The ZDP is a quality control program that seeks to minimize manufacturing faults with the ultimate goal of achieving a zero-defect product.The concept of zero defects was initially developed in the 1970s by Philip Crosby (Kamaruddin et al., 2021).

1.2 Problem Statement

In 2022, the aerospace company experienced a significant number of repeated consumer complaints. Ensuring consumer satisfaction is important for the long-term

profitability and viability of the company. The repeated occurrence of problems in customer complaints is a major barrier to delivering a satisfactory customer experience (Lowenstein, 2020). This situation highlights a basic systemic issue that demands immediate action and a complete resolution. Figure 1.0 shows the Pareto chart of customer complaint data for aerospace.

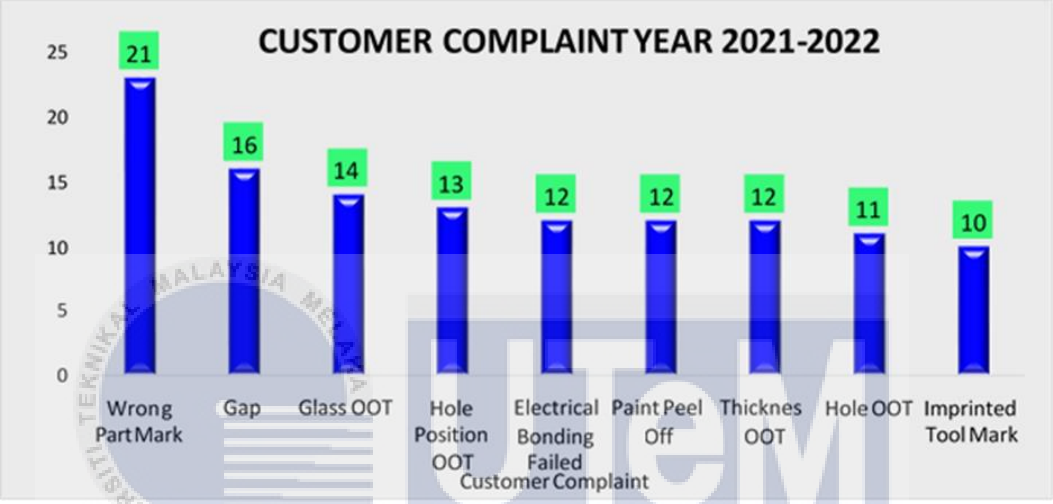

Figure 1.0 Customer Complaint Pareto Chart in Aerospace Company

In the aerospace industry, communication channels regarding corrective actions are often fragmented, hindering the efficient exchange of information between different departments or teams. This lack of integrated communication impedes the dissemination of insights gained from resolving specific incidents, limiting the organization's ability to implement comprehensive and systemic changes (Derkatsch et al., 2022).

The aerospace industry grapples with the challenge of encountering recurring incidents without achieving long-term resolution. The existing corrective action measures tend to address only the specific instances, leading to a cycle of repetitive problems. This results in a drain on resources and a failure to address the underlying systemic issues.

The organization also faces a challenge in capitalizing on the knowledge gained from previous incidents. The absence of a structured approach to learning from past corrective actions hampers the ability to implement preventive measures and improvements systematically. As a result, similar issues may resurface, leading to inefficiencies and potential risks.

The management has identified that customer complaint is leading to high Cost of Poor Quality (COPQ). COPQ is an expression for Cost of Poor Quality and it involve the entire cost spent by an organization for poor-quality issues (Hassan et al., 2023). This study, explores the interconnected relationship between repetitive customer complaints and the resulting increase in the Cost of Poor Quality (COPQ) in companies (Hassan et al., 2023).

Organizations looking to improve customer satisfaction, streamline operations, and save costs must comprehend this ripple effect (Hassan et al., 2023) .Figure 1.1 show what is Cost of Poor quality.

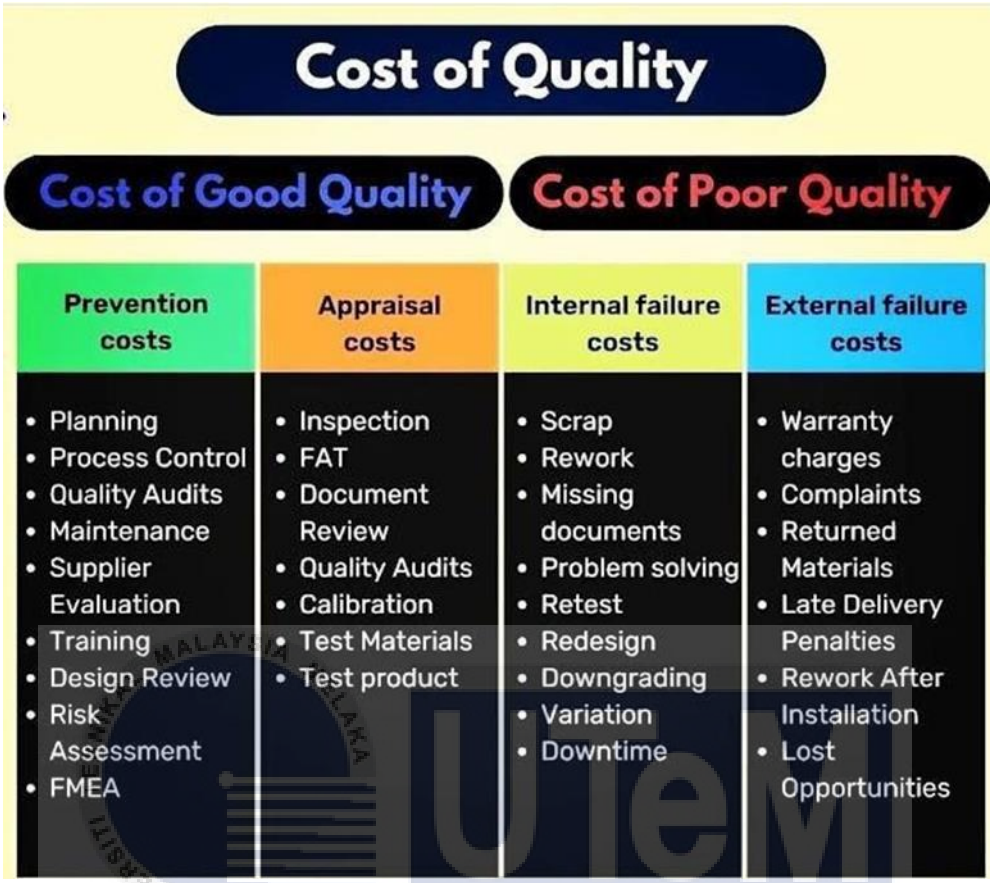

Figure 1.1 Cost of Poor Quality (Hassan et al., 2023)

1.3 Research Question

The main aim of this study is implementation of Zero-Defect Program to reduce the repetitive customer complaint issue. Specifically, the objectives are

i. How far does the implementation of a Zero-Defect Program (ZDP) in aerospace manufacturing reduce the frequency and intensity of repetitive customer complaints.

ii. Which components of a The Customer Complaint Zero Defect Program (CQ ZDP) are most efficient in reducing the repetition of specific sorts of customer complaints in the aerospace manufacturing industry?.

iii. What are the most effective methods for evaluating the effectiveness of a The Customer Complaint Zero Defect Program (CQ ZDP) in reducing repeated customer complaints in the aerospace manufacturing industry?.

1.4 Research Objective

i. To design the Customer Complaint database management system for customer complaint issue.

ii. To replicate corrective actions across different programs within the company.

iii. To verify implementation of corrective actions into the relevant project or process.

1.5 Scope of Research

The Pareto chart in Figure 1.0 identifies the primary customer complaint concern as the Wrong Part Mark. By analyzing the Pareto chart, researchers can thoroughly examine which programs are responsible for the issue of the wrong part mark. This analysis reveals that there is a repeated customer complaint connected with these projects.

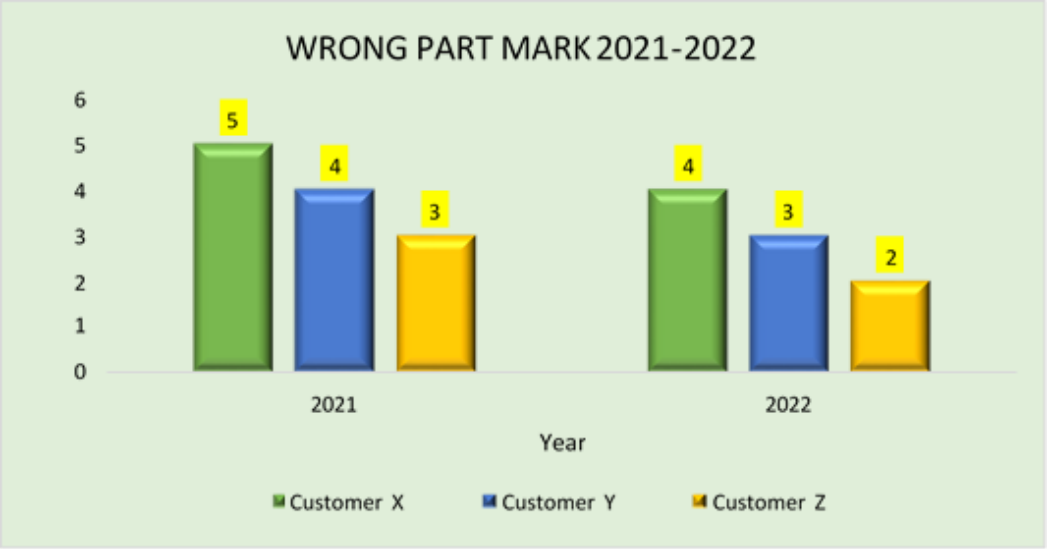

Figure 1.2 Repetitive customer complaint wrong part mark issue from year 2021 to 2022

The Pareto chart shown in Figure 1.0 guides the researcher to investigate the details and identify the program contributing to the occurrence of customer complaints regarding incorrect part marks. After determining the program associated with the incorrect part marking issue, the researcher observes repetitive customer complaints. Figure 1.2 presents the data recorded for repetitive customer complaints related to incorrect part marks.

In the years, 2021 and 2022, repetitive customer issues were identified with customers X, Y, and Z. These observations served as the basis for selecting customers X, Y, and Z for further investigation in this project.

1.6 Thesis Outline

Based on the objectives previously presented and on the approach proposed before, this thesis is made up of five (5) chapters, which contents are summarized as follows:

Chapter 1: Introduction.

Chapter 1 presents the background of the study, research problems, objectives, scopes, contributions and significance of the research.

Chapter 2: Literature Review.

Chapter 2 present information research is arranged connected fields of study needed for this research. General concepts, pertinent facts, past research papers, and journal articles by researchers are utiliz. This chapter covers the complete research process, from the methodological phase through the completion of the Master Project.

Chapter 3: Methodology

Chapter 3 described the methodologies employed to collect data for this study. The methodology of this study provides an extensive description and validation of the theoretical methods, research designs, and core conceptual basis for and simulation methods utilized in achieving the objectives of this study. It will be clearly outlin so that the reader may reproduce the study via only the knowledge in this chapter.

Chapter 4: Result and Discussion

Chapter 4 provides a detailed report of the results and findings obtained through the experimental process. The information will be present in written form, along with figures or tables. The data collected and analyzed will be organiz into separate sections based on the objectives outlined earlier. Additionally, this chapter briefly discusses the progress of the entire project, particularly focusing on the experimental analysis, to enhance comprehension. It also connects the interpretations of the results with the conclusions drawn. Furthermore, it will examine how the hypotheses and objectives align with existing knowledge. The importance and implications of the main findings will be emphasize.

Chapter 5: Conclusion

Chapter 5 summarizes the study, including the methods used, solutions implemented, and data obtained. These findings can serve as references for future researchers. Additionally, recommendations and suggestions for further improvements are provide.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The aerospace manufacturing sector is known for its strict quality standards and dedication to delivering products free of defects (James & Cervantes, 2019).However, the challenge of dealing with repetitive customer complaints stands as a significant hurdle to achieving this high standard (Yusuf et al., 2019). In response to this challenge, the adoption of a Zero-Defect Program has emerged as a crucial strategy to minimize customer complaints and elevate the overall quality of products (Psarommatis et al., 2020). This literature review seeks to delve into the implementation of zero-defect programs in aerospace manufacturing and how they impact the reduction of repetitive customer complaints.

The review will examine recent study and scholarly articles specifically concentrating on the application of zero-defect programs, root cause corrective action (RCCA), and related methodologies within the aerospace manufacturing industry. The chosen references encompass a wide array of topics, spanning quality enhancement, defect management, customer complaint resolution, and the integration of advanced technologies in aerospace manufacturing (Psarommatis et al., 2023).

2.2 Quality Management

Quality management plays a crucial role in the aerospace industry due to its strict standardsfor safety, reliability, and precision in aerospace products (Pop et al., 2023). The

industry has consistently been a leader in developing high-quality management systems, surpassing standards in other sectors, emphasizing the paramount importance of safety in aerospace activities (Yusuf et al., 2019). The demand for top-notch equipment in aerospace has pushed manufacturing technology towards intelligent manufacturing and ecological production, highlighting the role of quality management in improving productivity and flexibility (Ma et al., 2022). The assembly process, crucial for delivering aerospace products, further emphasizes the importance of quality management in achieving high- quality outcomes (Zhang et al., 2022).

Effective quality management is vital for improving the quality and productivity of manufacturing SMEs in aerospace, highlighting its critical role in supply chain-oriented quality assurance systems (Manville et al., 2019). Applying strategic quality management principles, such as integration-in-totality, within a system thinking framework, can enhance understanding aerospace systems, such as aircraft and aero engines (Thomas et al., 2020).Additionally, suggesting the implementation of quality management systems, such as AS9100, serves as a conceptual framework to ensure the quality and reliability of aerospace products (Oschman, 2019).

The aerospace industry's dedication to quality management is evident in the critical success factors studied in ISO 9001-certified companies, emphasizing the importance of quality management practices and the motivation to investigate possible causes for continuous improvement (Oschman, 2019). Furthermore, recognizing the impact of the development level of corporate information systems on the quality of aerospace instrumentation underscores the need for a proactive approach to developing aerospace instrumentation systems for quality improvement (Ovodenko et al., 2020). The commitment