SUSTAINABLE OF PRODUCTION YIELD BY USING ATTRIBUTE STATISTICAL PROCESS CONTROL AT MANUFACTURING COMPANY

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(2022)

Faculty of Mechanical and Manufacturing Engineering Technology

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A thesis submitted
in fulfilment of the requirements for the degree of
Bachelor of Manufacturing Engineering Technology (Process and Technology) with Honours

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this thesis entitled " Sustainable of Production Yield By Using Attribute Statistical Process Control at Manufacturing Company" is results from my own research except as cited in the references. Therefore, the thesis has not been accepted for any degree and is not concurrently submitted in the candidature of any other degree.

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APPROVAL

I hereby declare that I have read 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 (Process and Technology) with Honours.

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DEDICATION

To my beloved family and friends who have been my source of strength and inspiration and gave me support in terms of moral, spiritual, and emotional.

To my supervisor Ts. Dr. Amir Hamzah Bin Abdul Rasib for guiding and supporting me in completing this thesis.

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ABSTRACT

Sustainable production yield is manufacturing processes that focus on improving production productivity in manufacturing industries. Since consumer quality expectations increase, manufacturers can no longer depend on conventional techniques mainly focused on corrective actions. Moreover, the primary objective of this research is to identify the factors that affect the sustainability of production yield. Secondly, is to apply and measure the attribute statistical process control technique in a manufacturing company. Lastly, the third objective is to propose an improvement and monitoring based on the attribute statistical process control. Therefore, attribute statistical process control is a tool used to monitor and control the product quality and discover a solution for a production process in a manufacturing company. Before conducting this research, the literature review based on the sustainable production yield and attribute statistical process control is collected and turned into knowledge information. Moreover, the techniques used to collect data for this research are interviews and evaluations. Data collected from the interview and assessment would be used to interpret and discuss to achieve the project results. The collected data is analysed with a spreadsheet, 7QC tools, and Why-Why Analysis to find the solutions to issues. The result can only be achieved after the data is evaluated in the food industry to discover a solution. Besides, the most effective improvement were suggested to the food industry based on the outcome results of these improvement suggestions. Thus, the company will understand how to use the right method to produce good product quality and solve the long-term challenge of manufacturing more products at the end of this research.

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ABSTRAK

Hasil pengeluaran mampan merupakan proses pembuatan yang berfokus kepada penambahbaikan mutu pengeluaran dalam industri pembuatan. Disebabkan prospek kualiti dalam kalangan pengguna kian meningkat, pengeluar tidak boleh bergantung kepada teknik pembuatan sedia ada terutama yang tertumpu pada tindakan korektif. Selain itu, matlamat utama kajian ini adalah untuk mengenal pasti punca-punca yang mempengaruhi kelestarian hasil pengeluaran. Kedua, mengenal pasti dan mengukur teknik pengendalian proses statistikal di sesebuah syarikat pembuatan. Matlamat ketiga adalah untuk mencadangkan penambahbaikan dan pemantauan berdasarkan pengendalian proses statistikal yang fleksibel. Oleh demikian, pengendalian proses statistikal yang bersifat fleksibel merupakan cara yang digunakan untuk memantau, mengawal kualiti produk dan mendapatkan solusi terbaik bagi proses pengeluaran di sesebuah syarikat pembuatan. Sebelum menjalankan kajian ini, tinjauan literatur berdasarkan hasil pengeluaran mampan dan pengenalan proses statistikal fleksibel telah dikumpul dan diubah menjadi maklumat pengetahuan. Tambahan, teknik digunakan untuk mengumpulkan data untuk kajian ini ialah wawancara dan peemerhatian. Data yang dikumpulkan daripada wawancara dan penilaian ini akan ditafsirkan dan dibincangkan demi mencapai hasil kajian. Data terkumpul dianalisis dengan perisian spreadsheet, teknik 7QC, dan Analisis Punca untuk mencari penyelesaian kepada isu-isu yang ditemukan. Hasil kajian hanya dapat dicapai setelah semua data dinilai untuk mendapat solusi terbaik bagi industri makanan secara umumnya. Langkah penambahbaikan yang paling berkesan akan disarankan kepada industri makanan berdasarkan hasil-hasil kajian ini. Maka, syarikat akan memahami cara melaksanakan kaedah yang paling tepat bagi menghasilkan kualiti produk yang lebih baik dan menempuhi cabaran jangka panjang dalam menghasilkan lebih banyak produk yang akan disebut pada akhir kajian ini.

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ACKNOWLEDGEMENT

First and foremost, I would like to take this opportunity to express my sincere acknowledgement to my supervisor Ts. Dr. Amir Hamzah bin Abdul Rasib from the Faculty of Mechanical and Manufacturing Engineering Technology Universiti Teknikal Malaysia Melaka (UTeM) for his essential supervision, support, and encouragement towards the completion of this thesis.

Special thanks to my beloved family and friends for their moral support in this completion of program. Finally, thank you to everyone who has been at the crucial parts of this project's realisation.

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TABLE OF CONTENT

		PAGE
DECLARATION		
APPROVAL		
DEDICATION		
ABSTRACT		**i**
ABSTRAK		**ii**
ACKNOWLEDGEMENTS		**iii**
TABLE OF CONTENT		**iv**
LIST OF FIGURES		**viii**
LIST OF TABLES		**x**
LIST OF ABBREVIATIONS		**xi**
LIST OF APPENDICES		**xii**
CHAPTER 1	**INTRODUCTION**	**1**
1.1	Research Background	1
1.2	Problem Statement	3
1.3	Research Question	4
1.4	Research Objective	4
1.5	Research Scope	4
1.6	Expected Result	5
1.7	Thesis Frame	6
1.8	Summary	7
CHAPTER 2	**LITERATURE REVIEW**	**8**
2.1	Preliminaries	8
2.2	Production Yield	9
	2.2.1 Sustainability of Production Yield	10
2.3	Lean Manufacturing	11
2.4	Total Quality Management	13
	2.4.1 Integrated System	14
	2.4.2 Customer-Focused	14
	2.4.3 The Strategic and Systematic Approach	15
	2.4.4 Fact-Based Decision Making	15
	2.4.5 Employee Involvement	16
	2.4.6 Process Centred	16
	2.4.7 Continuous Improvement	17

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.4.8 Communication 17
2.5 Tools of Quality Control 18
2.5.1 Check Sheet 19
2.5.2 Histogram 20
2.5.3 Pareto Chart 21
2.5.4 Control Chart 22
2.5.5 Flow Chart 23
2.5.6 Cause and Effect Diagram 24
2.5.7 Scatter Diagram 25
2.6 Statistical Process Control 26
2.7 Statistical Process Control for Attribute 27
2.7.1 P- Chart 27
2.7.2 np- Chart 28
2.7.3 C- Chart 28
2.7.4 U- Chart 28
2.8 Statistical Process Control for Variables 29
2.8.1 Variable Control Chart 30
2.8.1.1 X-Bar 31
2.8.1.2 R- Chart 32
2.8.1.3 S- Chart 32
2.9 Summary 33

CHAPTER 3 METHODOLOGY 34
3.1 Preliminaries 34
3.2 Design of Studies 35
3.3 Flow Chart 37
3.3.1 Identify Research Problem and Question 39
3.3.2 Establish Research Scope and Objective 39
3.3.3 Identify the Factor That Affected the Production Yield from Literature Review 40
3.3.3.1 Search and Identify for Relevant Journal from Sources 41
3.3.3.2 A Study of Production Yield and SPC Component 41
3.3.3.3 Extract Information from Journal 41
3.3.3.4 Synthesis Data 42
3.3.4 Apply and Measure the Attribute 42
3.3.4.1 Data Collection 43
3.3.4.2 Spreadsheet 44
3.3.4.2 Capture Photos 45
3.3.4.3 Verify Collected Data 45
3.3.5 Propose an Improvement and Analyse Data Based on Attribute Statistical Process Control 46

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

3.3.5.1 Data Analysis 47
3.3.5.2 Why- Why Analysis 47
3.3.5.3 Measure Collected Data by Using SPC Component 48
3.3.5.4 Minitab 49
3.3.5.5 Seven QC Tools 50
3.3.5.6 Propose Improvement 51
3.3.6 Result and Discussion 51
3.4 Summary 52

CHAPTER 4 RESULT AND DISCUSSION 53
4.1 Preliminaries 53
4.2 Problem Definition 54
4.3 Data Collection 55
4.3.1 Primary Data 56
4.3.1.1 Process Flow of Soybean Production 56
4.3.1.2 Production Plan Layout 58
4.3.1.3 Data Collection Based on The Quality of Labelling on The Soybean Bottles 58
4.3.2 Secondary Data 60
4.3.2.1 Factor That Affecting the Sustainability of Production Yield Based on Literature Review 60
4.4 Data Analysis 62
4.4.1 Measure the Collected Data by Using Attribute Statistical Process Control 63
4.4.2 Analyse the Collected Data by Using Minitab 64
4.4.4.1 P-Chart 65
4.4.3 Cause and Effect Diagram 67
4.4.4 Why – Why Analysis 69
4.5 Improvement Proposal 71
4.6 Control the Improvement 72
4.6.1 Check Sheet 73
4.6.2 Maintenance Report 74
4.7 Summary 75
CHAPTER 5 CONCLUSION 76
5.1 Conclusion 76
5.2 Contribution 77
5.3 Suggestion for Future Research 77
REFERENCES 78
APPENDICES 85

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.1	Lean Manufacturing Waste	12
2.2	Check Sheet	19
2.3	Types of Histograms	20
2.4	Pareto Chart	21
2.5	Control Chart	22
2.6	Flow Chart	23
2.7	Cause and Effect Diagram	24
2.8	Types of Scatter Diagram	25
3.1	Design of Studies	35
3.2	Flow Chart of Research Methodology	37
3.3	Flow Chart of Objective 1	40
3.4	Flow Chart for Objective 2	42
3.5	Spreadsheet of Microsoft Excel	44
3.6	Flow Chart for Objective 3	46
3.7	Example of Why-Why Analysis	47
3.8	Example of Minitab Data Analysis	49
3.9	Basic 7 QC Tools	50
4.1	Process Flow Chart of Soybean Production	57
4.2	Process Layout of Soybean Production	58
4.3	Data Analysis Using Minitab Software	64

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

4.4	P-Chart of sample	66
4.5	Test Result of P-Chart	66
4.6	Cause and Effect Diagram	68
4.7	Example of Routine Maintenance Report	73
4.8	Example of Machine Maintenance Report	74

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF TABLES

TABLE	TITLE	PAGE
2.1	Lean Manufacturing Waste	12
4.1	The Primary Data of The Condition of Soybean Drinks Bottle Labels at the F&B Company	59
4.2	Factor That Affecting the Sustainability of Production Yield	61
4.3	Why-why analysis	70
4.4	Solutions based on Defined Root Cause	72

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF ABBREVATIONS

SPC	-	Statistical Process Control
TQM	-	Total Quality Management
TPS	-	Toyota Production System
QC	-	Quality Control
CL	-	Central Limit
UCL	-	Upper Control Limit
LCL	-	Lower Control Limit
F&B	-	Food and Beverages
SOP	-	Standard Operating Procedure

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LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	K- Chart	85
B	Gantt Chart for PSM 1	86
C	Gantt Chart for PSM 2	87
D	Soybean Production	88

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 1

INTRODUCTION

1.1 Research Background

In the era of globalisation, Malaysia faces a challenging economic period to become a developed country, especially in manufacturing industries. In comparison, developed countries have a sovereign state with a swift economy and modern technological infrastructure than other less developed countries—the developed countries such as Japan, Germany, The United States, and so on. Moreover, developed countries can attract customer loyalty for the long term because they have improved the efficiency in manufacturing operations, developed technology, and, most importantly, fulfilled customer satisfaction. According to Obradovi et al. (2021), the rapid development in technology intensity has raised the value and importance of open innovation (OI), which has been identified as a significant element.

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Manufacturing processes that focus on reducing resource use by improving manufacturing process productivity, minimising excessive resource usage, and reducing waste and pollution generated by manufacturing activities are examples of sustainable production yield. Thus, improving the quality of living without worsening environmental pollution or negatively impacting future generations' capital needs (Akenji et al., 2015). Besides, the manufacturing sector is facing various difficulties that require the idea of sustainability. Furthermore, many industries are equally involved in product redesign and innovation that lead to increased production yield efficiencies and, in some instances, directly increase protection or environmental performance and improve their brand and

public image. Moreover, the rising production volumes and high-quality standards, mainly in the food industry, present complex challenges in a market that is often competitive with other companies. To be efficient, manufacturers must first design a front-end product and focus on solid production technologies for back-end products (Lin et al.,2009).

Hence, the data need to be collected and analysed. Madanhire and Mbohwa (2016) stated that statistical process control (SPC) techniques come into the function to aid in decision-making. The SPC mechanism is used to evolve an industry's quality controls from diagnosis to prevention. Before implementing SPC, the manufacturing process must be evaluated to determine the significant causes of waste. SPC data may be in the type of a constant variable or an attribute. Furthermore, the SPC data is obtained in the form of product dimension measurements or process instrumentation measurements. The data obtained is then plotted on a graph with predefined control limits.

Thus, this research aims to study the sustainability of production yield by using a manufacturing company's attribute statistical process control. Furthermore, this study will emphasise manufacturing production regarding quality issues relating to part dimensions that affect overall production quality and yield. Hence, the specific instrument SPC for the attribute will be used and implemented to monitor and optimise purposes.

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1.2 Problem Statement

The manufacturing companies face tough competition from other countries, owing to increasing consumer demands for higher product quality, increased prices, and lower production costs. The issue in manufacturing is the sustainability of production yield decreasing due to losses during production, which results in goods and services not satisfying customer expectations. Since customer quality expectations increase, manufacturers can no longer rely on the conventional quality control technique, which focuses heavily on corrective action.

Therefore, the use of SPC is emphasised. It is also a standard requirement for the majority of contract manufacturers. The attribute statistical process control method is used to continuously enhance output volume and efficiency, contributing to manufacturing excellence (Sultana et al., 1970). However, the implementation of SPC in most manufacturing companies is not satisfactory even though the function of SPC is vital in achieving higher product quality.

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The SPC approach has several possible limitations because the workers are involved in the manual data collection and data entry stages. Manual data entry is time-consuming, labour-intensive, and errors are common. Hence, the attribute control chart method is the best way to use SPC in enhancing the sustainability of production yield in the manufacturing company.

1.3 Research Question

Based on the problem statement, there are three research questions are recognised.

RQ1: What are the factors that affect the production yield?

RQ2: How to improve sustainability in production yield?

RQ3: How attribute statistical process control can be affected to production yield?

1.4 Research Objective

The main objective of the research is to achieve long-term production yield by using attribute statistical process control in manufacturing companies. The general of this research are:

i. To identify the factors that affected the sustainability of production yield.
ii. To apply and measure the attribute statistical process control technique in a manufacturing company.
iii. To propose an improvement and monitoring based on the attribute statistical process control.

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1.5 Research Scope

This research will focus on the long-term sustainability of production yield in a manufacturing company using attribute statistical process control. The primary goal in the manufacturing industry is to sustain production yield. Therefore, attribute statistical process control is used to achieve production yield in a systemic approach and continuous improvement in a company. Appendix A shows the K-chart for this research process flow.

1.6 Expected Result

The expected result for this research is to identify the factors that affect the production yield in manufacturing. Implementation of the attribute statistical process control concept can control and improve productivity in manufacturing. It is also a mandatory requirement for the majority of manufacturers. Moreover, after defining and having solutions to refine the production yield, validate new improvement ideas using attribute statistical process control.

Furthermore, the expected outcome of this research is to implement attribute statistical process control in a manufacturing company. The attribute statistical process control is used to measure the variance in an attribute analysis process based on the obtained data. Besides that, the expected outcome is to maintain the production yield using attribute statistical process control, which is then presented to the respective company.

This research aids in gaining the ability to apply the experience and analysis in an actual scenario. This is an excellent opportunity to gain exposure outside of the classroom. This research aids in understanding the use of the SPC technique in the industry. Identify the strengths and weaknesses of the method based on the implemented procedure in the manufacturing industry and improve based on the findings. Besides, this research should help enhance the importance of SPC implementation in the industry.

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1.7 Thesis Frame

In this chapter, chapter one focuses on the introduction of this study. Then, the research background described the details in this research. Next, the problem statement of this research is stated in this chapter. Next, the problem statement is used to describe the research problem. Finally, in addition to the research question, the research objectives are listed in this chapter. Moreover, the research scope is also explained in this chapter. The expected result of this research and the thesis frame are also stated. Finally, this chapter concludes with a summary of this research.

Next, chapter two focuses on the literature review of this research revised and reviewed. It is to get extra information and knowledge relevant to this research. Then, the literature that has been created is based on reliable previous journals. This chapter emphasises the case study, such as production yield and the SPC control charts. Writing in the literature review is more on reading and selecting the appropriate key point in other journals.

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In chapter three, the methodology launch in this research is also implemented. In this chapter, the tools and techniques were defined and had the guideline on doing this research. The tools and techniques will give a detailed explanation in this research. The problem-solving techniques are also explained in this chapter.

After that, chapter four will show the result and discussion of this study. In this chapter, the tools and techniques are explained in chapter three will be used in this research. Then, further information on applying the tools and techniques is described. Next, the result of using these tools and techniques will be discussed in this chapter. Finally, the discussion will base on the findings result and achieve the objectives of this research.

Finally, in chapter five, the conclusion of this research will be implemented. In this chapter, the finding of the fundamental study will be summarised. Then, the improvement of this research will present. The future proposals on launching a modified system to smooth the production line are submitted. Then, the simulation result of the proposal showed as the supporting documents to improve the system. Finally, the enhancement will illustrate, and the overall conclusion is written in this chapter as concluded in the thesis.

1.8 Summary

In conclusion, this chapter gives an overview of the project, problem statement, research question, objective, scope, expected result, and thesis frame. The chapter overall comprises the main elements discussed in the whole study. This research aims to sustain the production yield in manufacturing companies by using an attribute statistical process control. The implementation of the SPC is to monitor and control the quality of a product. Also, it is used to discover a solution for production problems in manufacturing processes.

Simultaneously, identifying objectives for this study would enhance SPC implementation in the manufacturing industry to achieve production yield by using an attribute statistical process control tool. Based on the expected result, SPC is used to identify the strengths and weaknesses of the method based on the implemented procedure in the manufacturing industry. Attribute statistical process control is used to assess the variation in an attribute analysis process based on the collected data in a manufacturing company.