

PRODUCT DESIGN IMPROVEMENT USING DESIGN FOR
MANUFACTURE AND ASSEMBLY (DFMA) METHODOLOGY

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SUPERVISOR DECLARATION

“I hereby declare that I have read this thesis and in my opinion this report is sufficient in term of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Design and Innovation).”

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**This report is submitted in
fulfillment of the requirements for the award of
Bachelor of Mechanical Engineering (Design & Innovation)**

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DECLARATION

“I hereby declare that the work in this report is my own research except for summaries and quotations which have been duly acknowledged.”

Signature : _____

Author : _____

Date : _____

DEDICATION

To my beloved parents

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ABSTRACT

This paper shows a detailed study to investigate the Design for Manufacturing and Assembly (DFMA) method to improve the product design process. Through the applied DFMA, the production cost of manufacturing and assembly can be reduced as well as improving the efficiency of the product. Amongst the methods that widely been used in the industry for the product design improvement, the most efficient and reliable way must be identified. A product with many part count numbers will effect the product designing process. This problem commonly occurs in assembly line as the rises of number of tasks, task times as well as cycle times which then affects the production cost. Due to that, the product takes more steps before entering the market. The main objective of this project is to reduce part count number in the existing product design by using DFMA method. This project will compare the product design by using DFMA techniques namely Boothroyd Dewhurst (BD. The approach is by using the software of Boothroyd Dewhursts. Other than that, CAD software has been used for the proposed new design. The CAD drafting tool used is CATIA as it represents the visual of part design in solid view as well as the material applying and mechanical properties of each part drawn. The result of this project can be used and applied in industry in order to improve their design effectiveness.

ABSTRAK

Kertas ini menunjukkan kajian terperinci untuk menyiasat kaedah *Design for Manufacturing and Assembly* (DFMA) untuk memperbaiki proses reka bentuk produk. Melalui penggunaan DFMA, kos pengeluaran pembuatan dan pemasangan boleh dikurangkan di samping meningkatkan kecekapan produk. Antara kaedah yang meluas digunakan dalam industri untuk penambahbaikan reka bentuk produk, cara yang paling berkesan dan boleh dipercayai mesti dikenal pasti. Produk dengan banyak kiraan bahagian akan mempengaruhi proses mereka bentuk produk. Masalah ini biasanya berlaku di bahagian pemasangan dengan kenaikan kadar tugas, masa tugas serta masa kitaran yang kemudiannya memberi kesan kepada kos pengeluaran. Oleh itu, produk akan mengambil masa lebih lama sebelum dapat memasuki pasaran. Objektif utama projek ini adalah untuk mengurangkan jumlah kiraan bahagian dalam reka bentuk produk yang sedia ada dengan menggunakan kaedah DFMA. Projek ini akan membandingkan reka bentuk produk dengan menggunakan teknik DFMA iaitu *Boothroyd Dewhurst* (BD). Langkah pendekatannya adalah dengan menggunakan perisian *Boothroyd*. Selain itu, perisian CAD telah digunakan untuk reka bentuk baru yang dicadangkan. Perisian CAD yang digunakan adalah CATIA kerana ia menunjukkan visual reka bentuk bahagian dalam bentuk pepejal serta bahan yang digunakan di samping sifat-sifat mekanikal setiap bahagian turut disediakan. Hasilnya kajian ini boleh digunakan dan diaplikasikan dalam industri untuk meningkatkan keberkesanan reka bentuk produk mereka .

TABLE OF CONTENTS

CHAPTER	CONTENT	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xiii
	LIST OF SYMBOLS AND ABBREVIATIONS	xvi
	LIST OF APPENDIX	xviii
CHAPTER 1	INTRODUCTION	1
	1.1 Introduction	1
	1.2 Background of the Project	2
	1.3 Problem Statement	3
	1.4 Objectives	3
	1.5 Scopes	4
	1.6 Significance of Project	4
	1.7 Summary	5

CHAPTER 2	LITERATURE REVIEW	6
2.1	Introduction	6
2.2	Product Design and Manufacturing	7
2.2.1	Product Design Process	7
2.2.2	Product Structure Tree	9
2.2.3	Part Count Number	10
2.2.4	Product Costing	10
2.2.5	Production Time	11
2.2.6	Design Efficiency	12
2.2.7	Product Redesign	13
2.3	Design for Manufacturing and Assembly	14
2.3.1	Design for Assembly (DFA)	14
2.3.2	Design for Manufacturing (DFM)	16
2.4	DFMA Methodologies for Design Analysis	18
2.5	Computer Aided Drawing – CATIA	20
2.6	Summary	21
CHAPTER 3	METHODOLOGY	22
3.1	Introduction	22
3.2	Product	23
3.2.1	Selection of Product	23
3.2.2	Part Disassemblies and Dimensioning	24
3.3	Computer Aided Drawing (CAD) Modelling	25
3.4	Boothroyd Dewhurst	26
3.4.1	Design for Assembly (DFA) Analysis	26
3.4.2	Design for Manufacturing (DFM) Analysis	27
3.4.3	Redesign Product Analysis	27
3.5	Simple Case Study	28
3.5.1	Product	28
3.5.2	Part Disassemblies and CAD Model	29

	3.5.3	DFA Analysis	34
	3.5.4	DFM Analysis	36
	3.5.5	Case Study Conclusion	38
	3.6	Summary	39
CHAPTER 4		DATA AND RESULTS	40
	4.1	Introduction	40
	4.2	Selection of Product	41
	4.2.1	Product Description	41
	4.2.2	Product Structure Tree	47
	4.2.3	Product Mechanism	48
	4.3	Part Modelling Using CATIA Software	50
	4.3.1	Detail Drawing of Original Product Design	50
	4.3.2	Assemble Drawing of Original Product Design	56
	4.4	DFMA Analysis on Original Product Design	58
	4.4.1	DFA Data Analysis Using Design for Assembly Software	58
	4.4.2	DFM Data Analysis Using Concurrent Costing Software	61
	4.4.3	Part Redesign Suggestion	76
	4.5	DFMA Analysis on Redesign Product	78
	4.5.1	Redesign Parts Based on Suggestion	78
	4.5.2	Part Modelling of Redesign Product Using CATIA Software	79
	4.5.3	DFA Data Analysis Using Design for Assembly Software	81
	4.5.4	DFM Data Analysis Using Concurrent Costing Software	84
	4.6	Summary	87

CHAPTER 5	DISCUSSION AND ANALYSIS	88
5.1	Introduction	88
5.2	Critics on Product Analysis	89
5.3	Comparison Between Original and Redesign Product	91
5.3.1	Comparison Based on CATIA CAD Modelling	91
5.3.2	Comparison Based on DFA Analysis	93
5.3.3	Comparison Based on DFM Analysis	97
5.4	Problem Encountered	103
5.5	Summary	104
CHAPTER 6	CONCLUSION AND RECOMMENDATION	105
6.1	Introduction	105
6.2	Conclusion	106
6.3	Recommendation	107
6.4	Summary	108
	REFERENCES	109
	APPENDICES	111
	Appendix A	111
	Appendix B	112
	Appendix C	114
	Appendix D	117

LIST OF TABLES

NO.	TITLE	PAGE
3.1	Product Part Separation	29
3.2	The Executive Summary for Both Design	35
4.1	Squeezable Mop Part List	42
4.2	Parts CAD Drawing Using CATIA	50
4.3	Assembly Drawing using CATIA Software	56
4.4	Redesign Parts CAD Drawing Using CATIA	79
5.1	DFA Executive Summary for Original and Redesign Product	93
5.2	DFMA Executive Summary for Original and Redesign Product	95
5.3	Overall DFA Comparison for Original and Redesign Product	96
5.4	DFM Summary for Squeezer Connector Original and Redesign Part	97

5.5	DFM Summary for Steel Connector Original and Redesign Part	98
5.6	DFM Summary for Steel Rod Original and Redesign Part	99
5.7	Overall Comparison for Original and Redesign Part	100
5.8	Overall Comparison DFM Analysis on Whole Product	101

LIST OF FIGURES

NO.	TITLE	PAGE
2.1	Assembly Flow Chart	8
2.2	The Process Flow Chart Example	8
2.3	Product Structure Tree	9
2.4	The Handling Difficulties	11
2.5	Redesign Phase in Product Life Cycle	13
2.6	The DFA Analysis Steps	15
2.7	The Method of Design for Manufacturing	16
2.8	The CATIA Software Interface	20
3.1	Measuring Tools Used for Dimensioning	24
3.2	Part Design Workbench	25
3.3	Design for Assembly Version 9.3 Interface	26
3.4	3-pin Multi Adapter	28

3.5	Product Structure Tree	31
3.6	Original Product Design	32
3.7	Redesign Product	32
3.8	Redesign Product Structure Tree	33
3.9	Assembly Time Breakdown	34
3.10	Product Cost Breakdown	34
3.11	Assembly Cost Comparison	36
3.12	Redesign Main Body (Cover)	37
3.13	Redesign Main Body (Housing)	37
4.1	The Squeezable Mop	41
4.2	The Product Structure Tree	47
4.3	The Mop Mechanism	48
4.4	The Mop Length Extension	49
4.5	Original Product Structure Tree	58
4.6	The Product Time Breakdown Chart	59
4.7	The Product Cost Breakdown Chart	60
4.8	DFM Data of Upper Hand Grip	61
4.9	DFM Data of Middle Hand Grip	62
4.10	DFM Data of Upper Steel Rod	63
4.11	DFM Data of Rod Connector	63
4.12	DFM Data for Rod Connector Hinge	64
4.13	DFM Data of Pull Handle Hinge	65

4.14	DFM Data of Middle Grip Tighter	66
4.15	DFM Data of Lower Steel Rod	66
4.16	DFM Data of Right Steel Connector	67
4.17	DFM Data of Right Steel Connector	68
4.18	DFM Data of Squeezer Main Body	69
4.19	DFM Data of Squeezer Connector	69
4.20	DFM Data of Sponge Holder	70
4.21	DFM Data of Sponge Holder Connector	71
4.22	DFM Data of Sponge Bracket	72
4.23	DFM Data of Sponge	72
4.24	DFM Data of Long Dowel Pin	73
4.25	DFM Data of Short Dowel Pin	74
4.26	DFM Data of Pull Handle	75
4.27	CATIA Drawing of Redesign Product	80
4.28	Redesign Product Structure Tree	81
4.29	The Redesign Product Time Breakdown Chart	82
4.30	The Redesign Product Cost Breakdown Chart	83
4.31	DFM Data of Redesign Squeezer Connector	84
4.32	DFM Data of Redesign Steel Connector	85
4.33	DFM Data of Redesign Steel Rod	86

LIST OF SYMBOLS AND ABBREVIATIONS

BD	=	Boothroyd Dewhurst
CAD	=	Computer Aided Drawing
DFA	=	Design for Assembly
DFM	=	Design for Manufacturing
DFMA	=	Design for Manufacturing and Assembly
EFA	=	Effort Flow Analysis
<i>E_{ma}</i>	=	Design Efficiency
g	=	grams
h	=	hours
kg	=	Kilogrammes
LH	=	Lucas Hull
mm	=	milimetres
<i>N_{min}</i>	=	Theoretical Minimum Part
RM	=	Ringgit Malaysia
s	=	seconds

T_a = Theoretical Lowest Assembly Time

T_{ma} = Estimated Assembly Time

LIST OF APPENDIX

NO.	TITLE	PAGE
A	Project Flow Chart	111
B	Project Gantt Chart	112
C	Redesign DFA Report	114
D	Redesign DFM Report	117

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In this chapter, the project background is being explained. This is followed by the identification of problem statement. The problem statement will be solved by which then comes up with the objectives to be achieved and also the scope of project which act like a guidance for the project line. The significance of the project will be explained too.

1.2 BACKGROUND OF THE PROJECT

In this era of rapid industrial, designing field is really crucial as every basic released product involve with designing process. Designing is a set of decision making processes and activities to determine the form of an object which given the customer's desired function. It is also the improvement of the product's aesthetics, ergonomics, functions, marketability as well as the production line itself. A designer needs to identify the problem and overcome with any possible execution of solutions in order to redesign or getting a better improvement.

Normally, design engineers use Design for Manufacturing and Assembly (DFMA) as the method to improve their products. DFMA is used in engineering by providing guidance to the engineers to simplify the design structure and proces. Through the applied DFMA, the production cost of manufacturing and assembly can be studied to be reduced as well as improving the efficiency of the product. The DFMA can be divided into two separations which the first is Design for Assembly (DFA) and the second is Design for Manufacturing (DFM). The separation makes the engineering studied for both field can be done efficiently and in more detail. The DFA is the process of redesign part of product and also improving the assembly line. Meanwhile, the DFM is the process to facilitate the manufacturing process in order to reduce the cost and also improve the materials usage of the product.

There are several ways or methods in DFMA that has been used in industry. The common method that widely applied in product improvement is Boothroyd-Dewhurst (BD) throughout the software. Another methods that been used are Lucas Hull (LH), Effort Flow Analysis (EFA), Hitachi Assembleability and others.

Amongst the methods that widely been used in the industry for the product design improvement, the most efficient and reliable ways must be identified. Due to that, the methods need to be compared as the result after applying different methods may be varied to each other. It is best to determine the most applicable methodology as it affects the product design process.

1.3 PROBLEM STATEMENT

A product with many part count numbers will effect the product designing process. This problem commonly occurs in assembly line as the rises of number of tasks, task times as well as cycle times which then affects the production cost. Due to that, the product takes more steps before entering the market. Therefore, by applying the DFMA method on design process will help to improve the product design and the most important is they can reduce the cost affect in product assembly and manufacturing.

1.4 OBJECTIVES

There is a purpose of carrying this study on the methodology of DFMA. The objective of the study is to reduce part count number in the existing product design by using DFMA method. Plus, it is essential to carry CAD drawing for the new proposed design.