PRODUCT DESIGN IMPROVEMENT THROUGH DESIGN FOR ASSEMBLY (DFA) AND THEORY OF INVENTIVE PROBLEM SOLVING (TRIZ) OF HAIR CLIPPER

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ABSTRACT

The project aims to improve the design of products using the Boothroyd-Dewhurst Design for Assembly (DFA) and the Theory of Inventive Problem Solving (TRIZ). Design for Assembly (DFA) was used initially to improve the efficiency of product designing and also simplify the structure of the product. Application of TRIZ approach was used to improve the design qualitatively. There are various methods that can be used in TRIZ method such as Trimming, Contradiction and 40 Inventive Principles. As a result, both methods have produced a product that has been successful in reducing the cost of installation and produce a new product design.

ABSTRAK

Projek ini bertujuan untuk meningkatkan reka bentuk produk dengan menggunakan kaedah *Boothroyd-Dewhurst Design for Assembly* (DFA) dan *Theory of Inventive Problem Solving* (TRIZ). *Design for Assembly* (DFA) digunakan pada awalnya untuk menambah baik produk dengan meningkatkan kecekapan rekabentuk produk kepada yang lebih baik. Konsep TRIZ digunakan untuk penambah baikkan dari segi kualiti. Terdapat pelbagai kaedah yang boleh digunakan didalam kaedah TRIZ antaranya ialah *Trimming*, *Contradiction* dan *40 Inventive Principles* juga telah digunakan untuk penambah baikan reka bentuk. Hasil dari penggunaan kedua-dua kaedah berjaya menghasilkan satu produk yang telah berjaya mengurangkan kos pemasangan dan menghasilkan satu reka bentuk produk yang baru.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Design is the first step in manufacturing, and it is where most of the important decisions are made that affect the final cost of a product. Since 1980, analysis techniques have been made available which can guide designers towards products which are easy to manufacture and assemble. The availability of these techniques has created a revolution in manufacturing industry, especially in the USA, leading to reduced product cost, better quality, and shorter time to market, lower inventory, few suppliers, and many other improvements. (Geoffrey Boothroyd at all 1994).

Nowdays, product design simplification is important due to the rapid changing of customer demands, more competition and so on. Yet, manufacture is being forced to produce product that meet the customer requirement with high expectation such as product functionality but in lower cost. So, designer needs to design product with maximize value in order to fulfill that requirement. In recent decades the search for significant cost-saving effects that characterize major process

innovations has driven manufacturers towards simplifying their products. (G. Lucchetta at all 2002).

Design for Manufacturing and Assembly (DFMA) which became increasingly popular among designers. In order to ensure method of DFMA effectively produce high quality design other tool have been introduced such as Theory of Inventive Problem Solving (TRIZ). Generally, integration of TRIZ and DFMA enhance the design capability and quality. Both of these techniques promise very impressive results which finally contribute to the reduction of manufacturing costs.

1.2 Objective of Project

To integrate Design for Assembly (DFA) methodology and Theory of Inventive Problem Solving (TRIZ) approach, in order to improve and add value to the current design of hair clipper.

1.3 Scope of Project

This study will focus on the:

a. Application of DfA methodology to identify detailed design problems and generate remedial design solutions.
b. Application of TRIZ method to improve the value added product development.
c. Consumer product as case study, Hair clipper.

1.4 Methodology of Project

The research is conducted in two consecutive semesters namely Master Project 1 in the first semester and Master Project 2 in the second semester. Project activities during the first and second semester were summarized in the flow chart as shown in Figure 1.1 while the research planning schedule is shown in Table 1.1 and Table 1.3

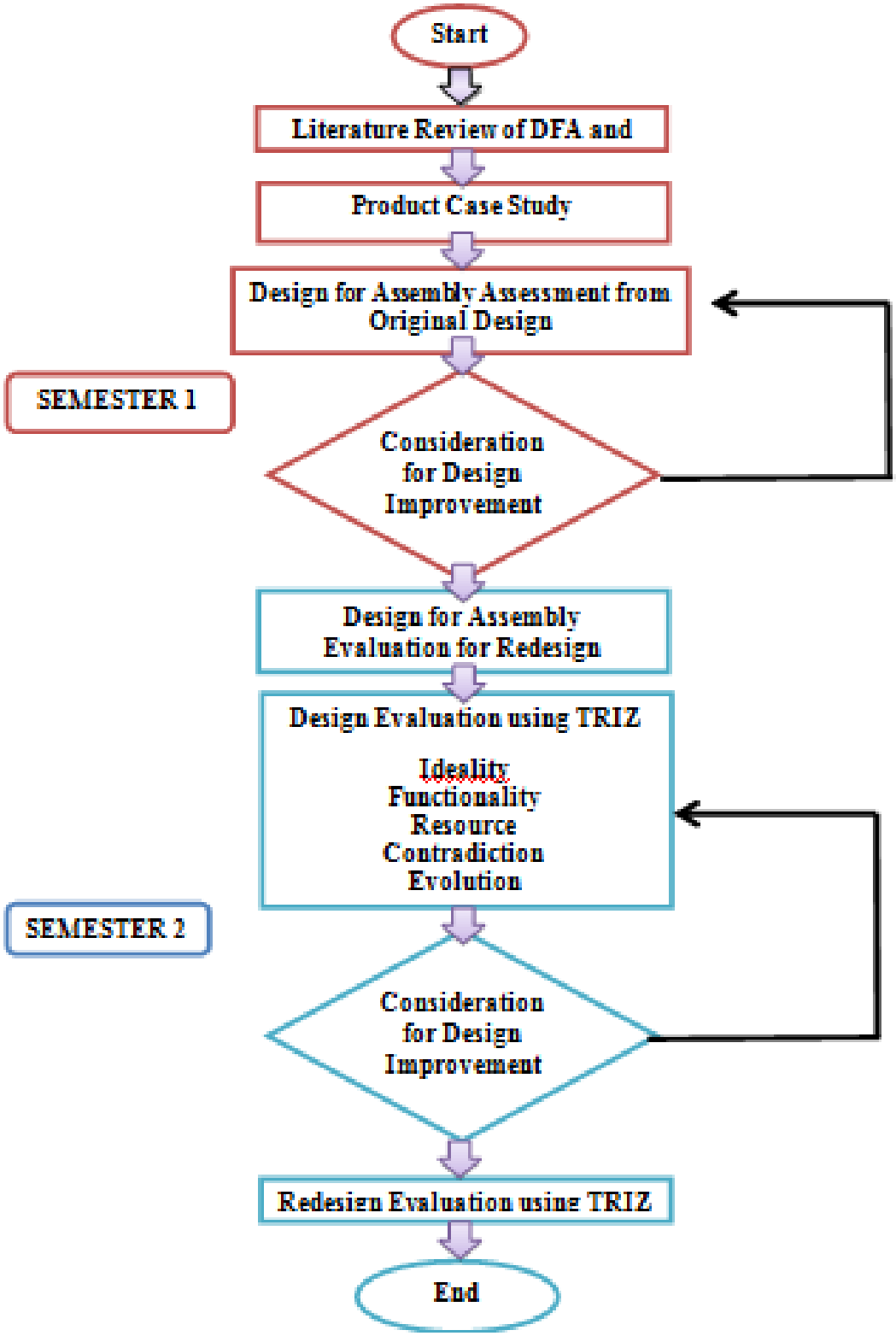

Figure 1.1 Flow chart of project activity

Table 1.1 Gantt Chart of Master Project I activity

ACTIVITIES	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Date	20-26/2	27-4/3	5-11/3	12-18/3	19-25/3	26-1/4	2-8/4	9-15/4	16-22/4	23-29/4	30-6/5	7-13/5	14-20/5	21-27/5	28-1/6	4-10/6	11-17/6	18-24/6	25-1/7
Subject Registration, Master Project 1 Briefing & Title Selection	Plan																			
	Actual																			
Literature Review	Plan																			
	Actual																			
Selection of Product Case Study	Plan																			
	Actual																			
Design for Assembly (DfA) Evaluation for Original Design	Plan																			
	Actual																			
Consideration for Design Improvement	Plan																			
	Actual																			
Design for Assembly (DfA) Evaluation for Redesign Design	Plan																			
	Actual																			
Draft / Report Writing	Plan																			
	Actual																			
Seminar - Master Project I Presentation	Plan																			
	Actual																			

Table 1.2 Gantt Chart of Master Project II activity

ACTIVITIES	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Date																			
Design Evaluation using TRIZ	Plan																			
	Actual																			
Design Improvement using TRIZ	Plan																			
	Actual																			
Comparison of DFMA & TRIZ Results	Plan																			
	Actual																			
Report Writing	Plan																			
	Actual																			
Seminar - Master Project II	Plan																			
Presentation & Report Submission	Actual																			

** Date will be filled based on schedule determined by Faculty of Mechanical Engineering, UTM*

1.5 Significant of Study

Result of study will prove the use of integration of TRIZ and Boothroyd-Dewhurst DFMA methodology can give a better result of design efficiency. This integration is believed able to ease assembly and reduce assembly time, reduce the number of part. This study will prove the DFA and TRIZ integrating were helpful in problem solving tools for better product development.

1.6 Structure of Thesis

This thesis consists of several titles. They are the introduction in Chapter 1, Literature review on Design for Assembly (DfA) will be discuss in Chapter 2. Literature review on TRIZ is discussed in Chapter 3. This report continues with the determination f product as case study in Chapter 4. In Chapter 5, the Design for Assembly (DfA) analysis for original design will be discussed . It will be continued by Design for Assembly (DfA) for new design in Chapter 6. In Chapter 7 consist the analysis for improvement design by using the TRIZ approach. Discussion for this report and the Chapter 8. The last chapter is conclusion and it will be covered in Chapter 9.

1.7 Summary

The aim for this study is to improve the design of consumer product using integration of DFA method and TRIZ approach by simplifying product structure and increasing the design efficiency. The integration of methodologies would provide a better coverage of knowledge in term of ease of manufacturing, ease of assembly and innovative solutions.

REFERENCE

1. Geoffrey Boothroyd, Product Design For Manufacture And Assembly, Computer-Aided Design Volume 26 Number 7 July 1994.

2. Robert B. Stone, Daniel A. McAdams, Varghese J. Kayyalethekkel, A Product Architecture-Based Conceptual DFA Technique, Design Studies 25 (2004) 301–325.

3. Peter Dewhurst, Manufacturing Engineering Handbook, Design For Manufacture and Assembly, McGraw Hill, Available: http://www.digitalengineeringlibrary.com, [2004].

4. G. Lucchetta', P.F. Bariani' (I), W.A. Knight 2(1),Integrated Design Analysis for Product Simplification(2002).

5. Boothroyd. G, Dewhurst P, Knight W., *Product Design for Manufacture and Assembly*, Marcel Dekker, Inc., [1994].

6. Altshuller, G. (1997). 40 Principles: TRIZ Keys to Technical Innovation. Translated by Lev Shulyak and Steve Rodman. Worchester, Massachusetts: Technical Innovation Center.

7. Mann, Darrel L. (2001). An Introduction of TRIZ : The theory of Inventive Problem Solving Volume 10.

8. Mann, Darrel L. (2002). Integration and Application of TRIZ and DFMA. Clevedon: Systemic Innovation.

9. Zhongsheng Hua, J. Y. (2006). Integration TRIZ with problem-solving tools: a literature review from 1995 to 2006. Business Innovation and Research, 111-128.