APPROVAL

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THE STUDY OF COMPARATIVE ANALYSIS OF BOOTHROYD DEWHURST (BD) DESIGN FOR MANUFACTURE AND ASSEMBLY (DFMA) METHOD

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DECLARATION

"I hereby, declared this thesis entitled
THE STUDY OF COMPARATIVE ANALYSIS OF BOOTHROYD DEWHURST (BD) DESIGN FOR MANUFACTURE AND ASSEMBLY (DFMA) METHOD

is the results of my own research except as cited in the references".

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ABSTRACT

Projek Sarjana Muda (PSM) interested to study on Comparative analysis of Boothroyd Dewhurt (BD) Design for Manufacture and Assembly (DFMA) method. There are two different analysis approached were used to determined the design performance of noodle maker machine. The result from both methods shows a different value in result. Then, new concept was generated to improve the current product and have evaluated by Pugh Concept. Again, the design performance is analyzed. The outcome still shows the different result even though the analysis was conduct by same people. The detail drawing of the new concept is generate by using CAD software. Finally, the new model was fabricated by used foam modeling technique

ABSTRAK

Projek Sarjana Muda (PSM) ini menjurus kepada kajian mengenai perbandingan analisis dengan menggunakan kaedah BD. Kaedah BD boleh dilakasanakan dengan dua cara iaitu menggunakan analisis manual atau berbantu komputer. Mesin pembuat mee dijadikan bahan kajian. Hasil analisis, ia menunjukkan kedua-dua keadah ini gagal memberikan bacaan yang sama. Siasatan dilakukan untuk mengenal pasti punca ianya berlaku. Kemudian, satu konsep baru akan dipilih bagi menggantikan produk sedia. Model ini dibina menggunakan kaedah pembentukkan gabus.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

y	=	Input signal
M	=	Output responce
N_m	=	The minimum number of theoretically
T_m	=	Operation time
E_d	=	Design Efficiency
A	=	Number of the important components
B	=	Number of not important components
M_i	=	Manufacturing cost index
Rc	=	Relative cost
C_c	=	Complexity factor
C_{mp}	=	Material factor
C_s	=	Minimum section
C_t	=	Tolerance factor
C_f	=	Finish factor
P_c	=	Processing cost
M_c	=	Material cost
V	=	Volume (mm^3)
C_{mt}	=	Material cost
W_c	=	Waste coefficient

LIST OF APPENDIXES

CHAPTER 1

INTRODUCTION

Design for Manufacturing and Assembly (DFMA) is a design philosophy used by engineer and designer when a reduction in a part count, a reduction in assembly time or simplification of the design is needed. Many of international companies likes Dell, Motorola, Texas Instrument, Brown & Sharpe and Ford Motor have successfully reducing their manufacturing costs through eliminating the unwanted parts inside the product thus lets their products be more competitive in the market

1.1 Problem Statements

Every engineer and company dreams to develop and achieve a robust engineering in their production. There are several criteria to define and measure what is robust engineering. One solution how to achieve the robust engineering is reducing the

manufacturing cost. To be more specific, the cost can be cut by eliminate the unwanted part in the design concept or product.

The intention in this problem is how to reduce the total part without block or limit the mechanism movement. Boothryod Dewhurst (BD) is one of DFMA methodologies available in the market. It have a two different methods to analysis the design. The first is, the manually approach. It will start with the reverse engineering, just to understand closely about the product and it mechanism. The component of the product will be reassemble and redraw. This is the initial step to investigate on how to reduce the total part of the product so it can be simplest product.

The second approach is by software analysis assistant. The recommended software is from Boothroyd Dewhurst (BD). BD is a systematic and effectively tool for engineer to analyze and understand the cost effects on the design decisions. The working principle of software actually based on the manually method. From the earliest conceptual stages of design, BD software equips the engineer with quick and accurate cost information.

Because both methods will end at the finish line with same target, the outcome should be same. However, there are no facts to prove that statement. A study is construct to learn about the process and present the final result after the analysis be done by both methods.

1.2 Objective of project

The research considers the possibilities for reduce the number of parts and redesign the product in order to reduce manufacturing costs and to increase the likelihood of the product. The research will be carrying out and to achieve the following target which is to analyze and compare the B-D DFMA method using manual analysis and software analysis that addressing the parts counts reduction of a product

1.3 Title of project

Comparative analysis of Boothroyd Dewhurst (BD) Design for Manufacture and Assembly (DFMA) method.

1.4 Scopes of the project

The scope for this project is used Boothroyd Dewhurst (BD) Design for Manufacture and Assembly (DFMA) for:

1. To study and analyze manually B-D's DFMA method
2. To apply and analyze B-D's DFMA software
3. To compare both design performances
4. To generate conceptual design and detail design
5. To fabricate mock up for the new design

1.5 Expected result

By the end of the analysis, it is expected to gain the same result from the manual and software aid of BD method. Otherwise, an investigation to find the error will be conduct if the result is shows the different value.

1.3 Summary

Chapter 1 was discussed about the problem statement. From the problem statement, the research continues with identifying the project objective, project title and the scopes. The project also was organized so that the works can be finish on time.

CHAPTER II

LITERATURE REVIEW

This chapter is a part where explain about the information, procedure, and all points the related to the research activities. The data collected from published literature, article, magazine, journal, and etc which give attention on the DFMA and outlines the power of the DFMA methodology. Some of the results are reduction in manufacturing cycle time, part count reduction, and part cost reduction, time to market improvement, quality and reliability improvements and reduction in assembly time.

2.1 Background

Design of Manufacture and Assembly (DFMA) is a methodology that stresses evolving a design concept to its absolute simplest configuration [1]. DFMA was the combination method of Design of Manufacture (DFM) and Design of Assembly (DFA). Each of them has different function, approach and guidelines. DFA is focusing on the

attention on part count reduction and easy process to handle and insert the part. The analysis helps the designer to determine the minimum part need in the design with the same product function requirement. Eliminating the unnecessary part will reduce the manufacturing costs.

Meanwhile, DFM continue the process by give the input or information about the estimation cost and manufacturing process involved. DFM guide the designer to understand the suitable process and material selection in order to achieve the objective to choose effective shape forming processes. Consideration and modification about the several points such as the tolerance, surface finish and other part detail can give reduction in cost and establish the benchmark for what the product should cost.

1. Jack B. Revelle, Manufacturing Handbook of Best Practices, pg. 69

DFMA not only represent about single method to provide the product simplification and cost reduction. Under DFMA, there a lot of method and approach depend on the designer interest and environment. The examples of DFMA's method are Boothroyd Dewhurst (BD), Lucas, Design Profit, Design Function Deployment, Design to Target Cost (DTC) and etc. BD is the most systematic system to perform DFMA and it was registered trademark of Boothroyd Dewhurst, Inc. It was introduced by Dr Boothroyd and Dr Dewhurst in 1983. Until now, there are thousand international and domestic company implement DFMA in their production such as Harley Davidson, Motorola, Abbott Laboratories and etc.

Hundreds of leading companies use DFMA methods and tools to make their products lean from the start. Since the methodology and tools were introduced to the marketplace by Dr. Boothroyd and Dr. Dewhurst in 1983, these companies including Harley-Davidson, John Deere, and Abbott Laboratories have cut millions of dollars from their product manufacturing costs while creating products that are easier to manufacture and maintain.

2.2 DFMA methodologies

As state in the background, the methodologies of DFMA are different with each other. DFA and DFM which work together to develop a total product cost by optimizing the design using the best materials and processes in an effort to meet the customer functions at the lowest possible cost [2]. Even though these methodologies will be discussed separately at the beginning, they will be merged at the end to derive the maximum value for the engineer team or client involved.

DFA methodology is useful for evaluating the overall design of components and/or assemblies/processes and allows one to identify as well as quantify the unnecessary components for any given product or process by determining the optimum design solution based upon functional requirement [3]. The minimum number of parts that are required is the key to development of the most cost effectively product based upon the required functions that the product must meet. DFA can be done and available in manual and software assist method to achieve the target of arriving at the most competitive product.

As DFA, DFM uses a structured approach which helps with consistency and improves the ability of being able to repeat the analysis at a later point in time or with a slightly different group of people.

In this chapter, it will list up three different methods of DFMA methodologies. The reason is to see differences and study the procedure to apply those methods. Usually each method has own characteristic and strength but still aim to achieve the same target, to produce the most perfect and competitive product. The methods that will be highlight are Taguchi, Boothroyd Dewhurst (BD) and Lucas Method.