### SOFTWARE DEVELOPMENT BY INTEGRATING THE INTEGRATED VALUE ENGINEERING (VE) AND BOOTHROYD DESIGN FOR ASSEMBLY (DFA)

### HASROL NIZAM BIN MD. HASAN

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> Faculty of Mechanical Engineering University Malaysia Pahang

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#### ABSTRACT

In the current tough competition of the global industries, the companies all over the world are trying to reduce the cost of product via design, development and manufacturing concurrently making profit. Value Engineering (VE) and Design For Assembly (DFA) is an alternative to solve this problem. Through the concept of VE and DFA the designed product could be manufactured at the lower cost and fast to reach market. By combination of VE and DFA philosophy, the software that developed by using Microsoft Visual Basic 6.0 has fully done. The result of this research is software named VE-DFA. This software able to help the designer to choose and selected the best and effective design by referring to the highest design efficiency. Using Wira Driver Seat as case study, experimental results of this research show that the actual value of design efficiency is equal to 4.4 and by using VE-DFA software the result is equal to 4.32. Actual value is determined by using DFMA software. The results show that, there are close difference between actual value and value from VE-DFA software. Another analysis has been done to prove that the value of design efficiency is appropriate to the actual value using stapler and Computer Mouse as case study. For the stapler analysis, the actual value of efficiency is 33.2 and VE-DFA value is 31.02 and for computer mouse analysis the actual and VE-DFA value is equal to 28.25 and 26.17. Therefore, it can be concluded that, this software is valid in terms of its design efficiency.

### ABSTRAK

Dalam persaingan hebat industri-industri sejagat, keseluruhan syarikatsyarikat di dunia cuba untuk mengurangkan kos produk melalui reka bentuk, pembangunan dan pembuatan serentak mendapatkan keuntungan. Kejuruteraan Nilai (VE) Dan Reka Bentuk Untuk Pemasangan (DFA) adalah satu alternatif untuk menyelesaikan masalah ini. Melalui konsep VE dan DFA produk bercorak boleh dihasilkan pada kos rendah dan cepat untuk mencapai pasaran. Oleh itu, gabungan VE dan falsafah DFA, perisian dengan menggunakan Microsoft Visual Basic 6.0 telah sepenuhnya dilakukan. Hasil penyelidikan ini adalah perisian yang bernamaVE-DFA. Perisian ini berupaya menolong pereka untuk memilih dan menetukan perancangan terbaik dan berkesan dengan merujuk kepada kecekapan reka bentuk tertinggi. Menggunakan tempat duduk pemandu Wira sebagai kes kajian, hasil-hasil percubaan penyelidikan ini menunjukkan bahawa nilai sebenar kecekapan reka bentuk sama dengan 4.4 dan dengan menggunakan perisian VE-DFA hasil sama dengan 4.32. Nilai sebenar adalah ditentukan dengan menggunakan perisian DFMA. Hasil-hasil ini menunjukkan bahawa, perbezaan antara nilai sebenar dan nilai daripada perisian VE-DFA adalah tidak jauh berbeza. Analisis satu lagi telah dijalankan dan membuktikan bahawa nilai kecekapan reka bentuk adalah menghampiri nilai sebenar apabila menggunakan Stapler dan Tetikus Komputer sebagai kes kajian. Untuk analisis Stapler, nilai sebenar kecekapan adalah 33.2 dan nilai VE-DFA adalah 31.02 dan untuk analisis tetikus komputer nilai sebenar dan nilai VE-DFA adalah sama rata iaitu 28.25 dan 26.17. Oleh itu, dapat disimpulkan bahawa, perisian ini adalah sah dalam terma reka bentuknya kecekapan.

### **CHAPTER 1**

#### **INTRODUCTION**

#### 1.1 Introduction

As the product life cycle is getting shorter and the producing cost is increase as well as to meet the global demands and remain competitive, the manufactures are pressured to produce the design that packaged with the low cost, short time to reach the market. Thus the manufacturers adopted various methodologies to deal with such pressure. These include Value Engineering (VE) and DFA. The Boothroyd Dewhurst DFA method is enhance the outcomes of VE, resulting in significant savings in materials, design costs, tooling, and processing of parts and assemblies.

**Value Engineering** (VE) can be defined as the systematic application of recognized techniques to identify function of a product or service, established a monetary value for that function, and provides the necessary function reliability at the lowest total cost. (Ellias, 1998, Fong, 1998)

The goal of VE is to eliminate unnecessary features and functions by optimizing the value. This process thus provides a simple but structured approach to optimizing design for both customer and manufacturer. It has been formulated as (Ellias, 1998, Fong, 1998):

$$Value = \frac{Function(F)}{Cost(C)} \dots (Equation \ 1)$$

**Design for Assembly** (DFA) is defined as a set of practices that aim to reduce the time and cost required to assemble a product by examining mating part features for improvements in part handling, insertion and fastening(Stoll, 1999). It is aim to design the product for ease of assembly. The Boothroyd-Dewhrust (1990) pointed out that DFA means

designing the product for ease of assembly that leads to improved design efficiencies with quality following.

Design evaluation is done by measuring the design efficiency using the formula below (Boothroyd et al, 1994):

This paper's aim to propose a framework of developing software that aids the designer as well as the manufacturer in decision making process during the early design stage. This paper is structured into five sections the problem statement, research objective and scope are discussed in section 1. The related literatures is discussed and tabled in section 2. The project methodology flow chart is discussed in section 3. Sections 4 are discussed about significant of this research and expected outcome from this research. The conclusion is discussed in section 5.

#### **1.2 Problem Statement**

The problem is to develop a computer based system for evaluating the design at the conceptual stage to increase the speed of the product development. The problem formulation is:

- 1. How to increase the speed of the product development?
- 2. How to accelerate the assembly cost and time estimation during the process?

#### **1.3** Research objective

The objectives of this project are:

To develop a software for assembly by using the integrated VE and DFA approaches to reduce the time and assembly cost.

### 1.4 Research scope

The limitations of the proposed research are as follows:

- 1. A wira driver seat component is selected as a case study.
- 2. The product that use VE and DFA concept in improving the selected product design for the ease of assemble.
- 3. Microsoft Visual Basic 2006 6.0 will be use to develop the software.
- Methodology is based from the previous developed PSM by Mgt Arnaz Bin Mgt Ramli.

#### 1.5 Significant of study

This significant of this study is aim to reduce the cost, time and maintain the efficiency of the product design assembly with the use of intelligent based system. This would lead to the reduction of human energy used and it will shorten the time to reach the market.

### **1.6** Expected output

The expected outputs of this study are:

- 1. A software to support in optimizing the efficiency of assembly process in the early stages.
- 2. An intelligent based software for assembly sequences in manufacturing sectors.

### 1.7 Summary

Chapter 1 has been discussed generally about project, problems statement, objective, scope of the project, significant of this study and expected output in order to achieve the objective as mention. This chapter is as a fundamental for this project and as a guidelines to complete the project research.

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