



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**A STUDY ON PRACTICE OF DESIGN FOR SUSTAINABILITY
AND DESIGN FOR ENVIRONMENT PRACTICES IN
AUTOMOTIVE INDUSTRIES IN MALAYSIA**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Design) with Honours.

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FACULTY OF MANUFACTURING ENGINEERING

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I hereby, declared this report entitled “A Study on Practice of Design for Sustainability and Design for Environment in automotive industries in Malaysia” is the result of my own research except as cited in references.

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APPROVAL

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ABSTRACT

At present, product development process in automotive industry in Malaysia is characterized by the increases of complexity and frequent changes caused by frequent innovations, fast-growing system complexity, expanding role of software and changing business relationships. This study is based on Design for Sustainability (DFS) & Design for Environment (DFE) and spread out the principle of sustainable and environmental in product design concept. Environmental and sustainable product is a goal to be achieved in every manufacturing process. In way to achieve the goal, many practice or instruments had been introduced and developed. DFS and DFE are the practice or approach that had been used widely in many sectors. This study also attempts to clarify the issues which are liable to influence the outcome of the development of new products or redesign of an existing product. This report describes research to establish a set of sustainable and environmental characteristics for product design as early as at development stage. It goes into detail how the characteristics can be used as a methodology or tools to guides the design process. At the end, a set of information or model on related to DFS and DFE to be developed according to this study.

ABSTRAK

Pada masa kini, proses pembangunan produk di dalam industri automotif di Malaysia amnye sangat dipengaruhi oleh peningkatan kadar kompleks dan kekerapan perubahan disebabkan oleh beberapa faktor seperti kemajuan system perisian dan perubahan perhubungan perniagaan, kadar kematangan sistem yang cepat dan perubahan yang kerap terhadap inovasi. Kajian ini adalah berdasarkan dua kaedah rekabentuk iaitu rekabentuk untuk kestabilan dan rekabentuk untuk persekitaran. Lebih mendalam lagi, ia juga cuba merungkai beberapa prinsip dan elemen untuk kedua-dua kaedah rekabentuk itu. Produk yang memiliki cirri-ciri yang stabil dan mesra alam adalah sesuatu yang perlu dicapai didalam setiap proses pembuatan. Untuk tujuan itu, perlbagai kaedah dan pendekatan telah diperkenalkan. Kaedah rekabentuk untuk kestabilan dan rekabentuk untuk persekitaran adalah antara pendekatan yang tepat bagi tujuan melawan masalah pemanasan global yang semakin menjadi- jadi. Kedua-dua kaedah ini telah lama digunakan di luar negara di dalam pelbagai sektor tetapi masih baru di Malaysia. Proses pengenalpastian prinsip-prinsip dan elemen-elemen adalah satu cubaan untuk memberi kesedaran kepada umum bahawa semua ini berkaitan secara langsung dengan kehidupan seharian. Seterusnya bagaimana prinsip dan elemen itu boleh diamalkan sebagai garis panduan di dalam proses mereka bentuk. Akhir sekali satu rangka atau model dibangunkan sebagai memberi gambaran secara yang lebih jelas untuk kesimpulan kajian ini.

DEDICATION

Specially dedicated to my beloved father HJ. SKH ABD RAHIM SKH ALI and my mom HJH. HABIBAH BINTI AMAT who had been so consistently and patiently supporting me in this research. I also dedicated this to and car manufacturer in Malaysia and all my colleagues who interested in this research.

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CHAPTER 1

INTRODUCTION

1.1 Background

Companies all over the world increasingly need to build their products and process to keep up among competition. The same environment goes into automotive industries in Malaysia. Our Malaysian first car manufacturer and always competes together with Malaysia's second car manufacturer. This two car manufacturer always tried to increase their productivity within the region and worldwide.

The interest in producing better product has grown rapidly during the past decades. Industrialization, open markets, higher (quality) requirements from customers and an increase in competitiveness between companies locally and globally have created a serious demand for a structured process for product innovation within industry. Industrial cannot survive in the long term/run without product innovation as an integral part of the company management and development process. Small- and medium-sized industries (SMEs) will need to focus on product development as well. (Robert Hill, 2001)

Working on global concerns about environmental problem such as climate change, pollution and biodiversity loss and about social problems related to poverty, health, working circumstances, safety and inequity has fostered sustainability approaches for industry. Improved product design which applies sustainability criteria (Design for Sustainability) is one of the most useful instruments available to enterprises and

governments to deal with these concerns. Design for Sustainability includes the more limited concept of Ecodesign or Design for Environment. DFS is closely linked to wider concepts such as sustainable product-service system innovations and other life cycle based efforts. (UNEP, 2006)

“DFS” is one of the most often used practice or approaches in the length. The approach of sustainability has been introduced to combine for the well-being of the planet with continued growth and human development. Sustainability is “*Meeting the needs of the present without compromising the ability of future generations to meet their own needs.*” In its original context, the definition was stated solely from the human point of view.(The World Commission on Environment and Development seminar)

This approach is becoming more popular and widely used among developers since it been introduced. DFS is based on combination of product innovation and sustainability. It goes beyond how to make a green product- the concept now embraces how best to meet consumer needs; social, economic and profit. These 3 key elements also referred to as *people, planet* and *profit*.

To be sustainable, a product must meet number of challenges linked to people, planet and profit. Social expectations and equitable distribution of value along the global value chain, and the innovation must work within the carrying capacity of the supporting ecosystems. These challenges overlap each other and distributed differently over the economic spheres in the world. During development of a new product or the redesign of an existing one, the product development team is confronted with a variety of design criteria such as quality, ergonomics, safety and aesthetics. With DFS indices, environmental and social criteria are implemented into the product development process as well and minimizing the impacts throughout to the product life cycle.

Another approach that closely related to sustainable design is Design for Environment (DFE). DFE is a systematic application of environmental and human health considerations at the product design stage. Avoiding or minimizing significant

environmental impacts and increase resource efficiency at all stages of a product's life cycle. There are several stages of product life cycle associated environmental impacts such as raw material extraction and process, manufacturing, packaging and distribution, product use, and end-of-life. (Robert Hill, 2001)

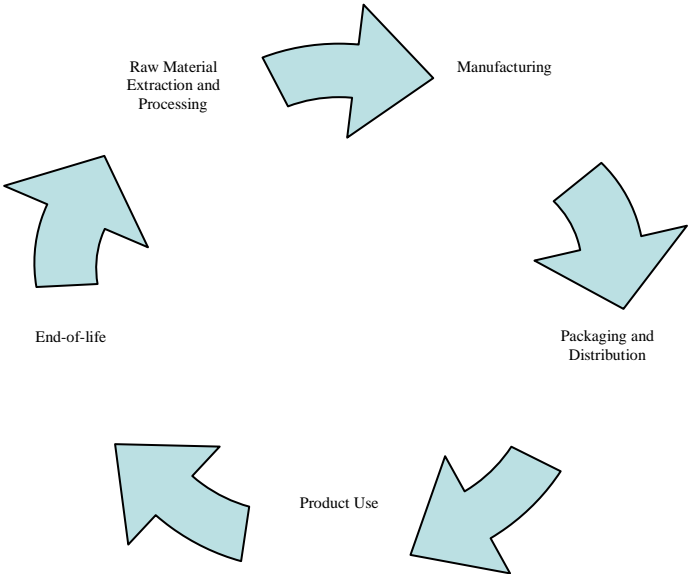


Figure 1.1 : Product Life Cycle (Robert Hill, 2001)

DFE gives a lot of benefit to company in developing new products or redesign an existing product. When look into economic field, DFE can gives opportunity in maintaining global competitiveness, reducing production costs, improved strategic decision-making, improving company value and identifying new business opportunities. It is also offers benefits on operational side. Operational will improve their relationships with regulators and liability management. It wills also an increasing on staff morale which will be a motivation to work out more on their field. In marketing side, addressing customer needs will become easy and improved products and give differentiation on products. At the end, all listed factors will improve public relations by presenting clear, accurate and reliable environmental information to customer.

1.2 Problem Statements

Product design stage is one of the most important and critical stage in developing a product. Some manufacturer did not notice the design that they are developed is not meeting customer needs until the product been consider as scrap by customer. In this case, the product is assumed as a failure product. In automotive (car) industry, a failure will give bad impression to the car manufacturer and indirectly it will also affect customer's confident level on their product. In the other words, failure is not necessary. To avoid this problem and minimizing the risk of failure, some design tool is worthy to be used in automotive industry in Malaysia. Production of cars nowadays is such a rapid process and many changes can be done in a short time. Some users getting confuse on what model of car they preferred when there are so many choices give to them. But the most important thing is they look for a sustainable design and environment friendly car in a way to reduce number of accident and reduce percentage of pollution. Our earth had been polluted from hundreds of years ago. Now, our earth cannot withstand for more pollutants. So that we need more green product to help our earth last longer.

1.3 Objectives of Study

- ✚ To understand the concepts and principles of DFS and DFE.
- ✚ To know how far the implementation of DFS and DFE had been done at various car manufacturer in Malaysia in general.
- ✚ To collect data from various types of car manufacturer in Malaysia and come out with an analysis on selected topic. (DFS and DFE)

1.4 Scope

Scope of this study is limited to 2 main approaches which are DFS and DFE on how it had been applied in automotive industries in Malaysia. Carry out a questionnaire for data

collections and car manufacturer in automotive industry in Malaysia are the respondent. Scope of the questionnaire will cover into several sections such as exhausts emissions & noises, types of engine and materials used.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Design usually gives meaning in the context of applied arts, engineering, architecture and other creative endeavors. A term of "to design" refers to the process of originating and developing a plan for a product, structure, system, or component. While a term; "a design" is used for either the final plan (e.g. proposal, drawing, model, description) or the result of implementing the plan. More recently, processes (in general) have also been treated as products of design, giving new meaning to the term "*process design*". (Ivar H., 2006)

Engineering is often viewed as a form of design which then defined design as; "*To conceive or fashion in the mind; invent,*" and "*To formulate a plan*", and defines engineering as: "*The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.* Both are forms of problem-solving with a defined distinction being the application of "scientific and mathematical principles". (The America Heritage Dictionary@Dictionary of the English Language, Fourth Edition Retrieved January 10, 2007).

There are many fields in engineering that put design as a main consideration or elements. It is the same when talking about manufacturing engineering. According to some economists, manufacturing is a wealth-producing sector of an economy, whereas a

service sector tends to be wealth-consuming. Emerging technologies have provided some new growth in advanced manufacturing employment opportunities in the Manufacturing Belt in the United States. Manufacturing provides important material support for national infrastructure and for national defense. Design for Manufacturing provides many product design tools that help design engineers quickly produce designs that meet design for manufacturability standards.

In a crucial transition from short term environmental management to long term systems design, ecological principles and concepts are becoming increasingly integrated into our everyday lives, influencing where and how we live. DFS is an inspiring, radical and detailed collection of the eco-solutions that can be applied to a range of design challenges. The ideas as on offer integrate social, political and economic factors, and promise a substantial reduction of resource depletion. Their application not only gives benefits to the environment but also improves overall quality of life, raising standards of health and bringing about greater social and environmental equity. (Anonymous 2006).

Many companies will struggle to win customer's needs to make their product to be accepted. This is not as easy as many people thought. It involves many aspects and a number of design tools. New product may required design tools such as design for sustainability and design for environment to help in terms of successfulness of the design and to meet customer needs in way not to harm the environment.

2.2 Design for Sustainability

Growing in global concerns about environmental problems such as climate change, pollution and biodiversity loss and about social problems related to poverty, health, working circumstances, safety and inequity has fostered sustainability approaches for industry. A serious attention is essential to improve product design which some sustainability approach can be used such as DFS. DFS is one of the most useful instruments available to enterprises and governments to deal with these concerns. DFS is

includes a more limited concept of Ecodesign or DfE. In some developed economies, DFS is closely linked to wider concepts such as systems innovations and other product life cycle.

There are many organizations have developed various tools and approaches to help companies to rethink how to design and produce products to improve profits and competitiveness and also reduce environmental impacts at the same time. In 1997 UNEP(United Nations Environment Programme), in conjunction with Delft University of Technology in Delft, the Netherlands and other experts such as in Ecodesign, published the ground-breaking manual “Ecodesign: A Promising Approach to Sustainable Production and Consumption”. The concept of product ecodesign has since then spread as seen in the number of manuals and sector-specific supporting materials that are available in many languages. (Delft University of Technology., 1997)

Sustainability is concern with the well-being of the future. For a product to be sustainable, a product must meet a number of challenges linked to people, planet and profit. All elements of sustainability challenges are overlap to each other in terms of product as shown in figure 2.1. Therefore, the goals and targeted elements of a DFS project need to be clearly defined. A business that wants to become or remain competitive will need to address sustainability issues.

DFS goes beyond how to make a ‘green product’ and now embraces how best to meet consumer needs more sustainable on a systematic level. These profit-driven strategies go by many names such as Sustainable Product Design. Many product innovation ideas would never be implemented if they were required to meet all criteria such as people, planet and profit.

Through extraction from many sources, DFS can be defined as a primary design tool which provides a substrate design tool called DfE. This proves by many findings, it shows that a number of the elements of sustainability and environment are overlapping

each other. So that environmental factors is relevant to sustainability. That's means industries take environmental and social concerns as a key element in their long term product innovation strategy. This tells that, company implies environmental and social factors into product development throughout the life cycle of the product, throughout the supply chain and with respect to their socio-economic surroundings to ensure the sustainable of the product.

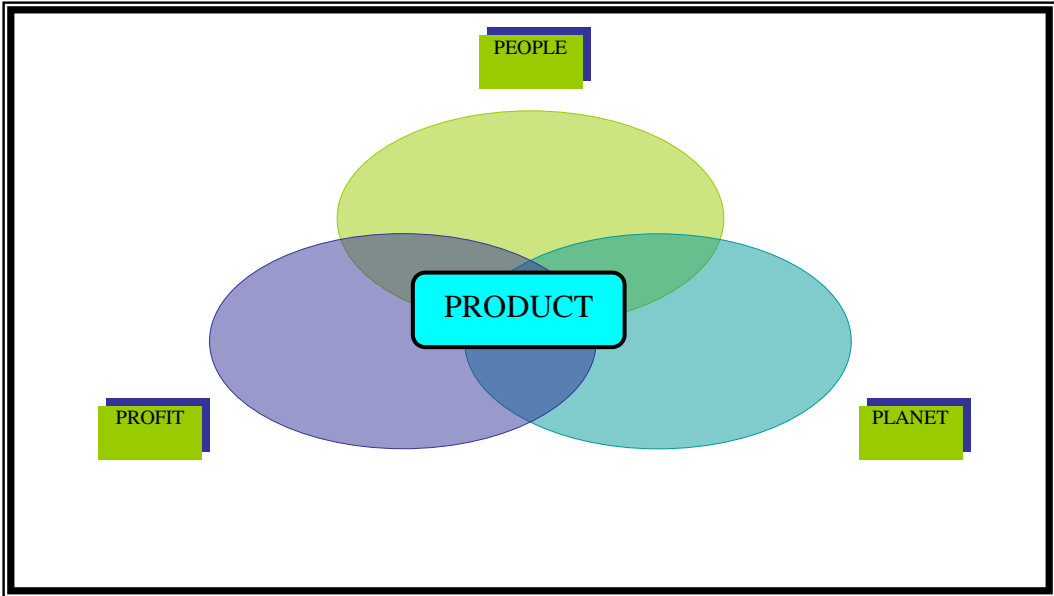


Figure 2.1: PEOPLE, PLANET AND PROFIT challenges

A success sustainable design is the conception and realization of environmentally sensitive and responsible expression as a part of development matrix of nature. Human society needs to aspire to an integration of its material, spiritual and ecological elements. (McDonough W., 2002). Current technologies, processes and means tend to separate these facets rather than connect them. Nature uses the sun's energy to create interdependent systems in which complexity and diversity imply sustainability. In contrast, industrialized society extracts energy for systems designed to reduce natural complexity. The challenge for humanity is to develop human design processes which enable us to remain in the natural context. Almost every phase of the design, manufacturing and construction processes requires reconsideration. Linear system of thought or short-term programs which justify ignorant, indifferent or arrogant means are