

CHAPTER 1 DESIGN PROCESS: AN INTRODUCTION

Nor Fasiha Mohd Yusof and Khairul Anwar Hanafiah

1.1 INTRODUCTION

Engineers bring never existed things into reality. They serve society by creating engineering solutions to many problems. Engineers created electric ovens because the old baking method was difficult to control, unsafe, and not environmental-friendly. They created Maglev because people needed to reach destinations faster. Both electrical ovens and Maglev were nowhere on earth before; they were created by engineers based on people's needs.

Why is an engineer necessarily needed to solve these problems? In other words, what enables an engineer to practically bring the 'never existed things' into existence? Secondly, how possibly the 'never existed things' be created? If an invention or a novel idea is novel, where does it come from?

This introductory chapter will discuss the above questions while explaining the systematic design process by revisiting a story about a product's invention and development.

1.2 THE DESIGN PROCESS: WHY?

In early 1986, the explosion of a space shuttle orbiter, Challenger about one hour after taking off killed all its crew members. The incident took place when a joint in the right solid rocket booster failed due to the failure of O-ring seals that were not designed to handle the extreme cold temperature that emerged during the launch.

In the same year, the world was again shaken by the Chernobyl disaster. It is rated at maximum severity and reported as the worst nuclear energy accident in history. The catastrophe occurred due to an uncontrolled nuclear chain reaction caused by design flaws combined with unstable conditions. Besides immediate explosions and fatalities, the impacts on the human and environment chain remain for decades; even the nuclear clean-up is scheduled for completion in 2065.

The above incidents are only two alarming examples of how a small fault in design could cause huge damage, and thus, suggest that the task of designing is very important and challenging.

1.2.1 The Importance and Challenges

The main importance and challenges in design are discussed.

1.2.1.1 Knowledge and Creativity

The first challenge is correlated to the designers themselves. Design is a process that consists of two essential components: (1) A scientific process that requires knowledge and (2) A creative process that requires creativity and critical thinking. To design well, an engineer must possess these finite and infinite elements—The former is gained from knowledge and experience, while the latter is a skill.

1.2.1.2 Prediction of Future

Design is a process of creating a solution to be applied in society. The process starts from visualising the solution and realising it, to disposing (or recycling) it. If the solution is designed to stand for five years, the designer must be able to picture what would happen then. In other words, designers must be able to in some ways, predict the future.

Secondly, any product is created for future uses. For that reason, for instance, a company has to know the market demand, say, five years ahead in order to plan for its future products. Design engineers play important roles in planning for future products.

1.2.1.3 Humans' Preferences

Even if the design is technically successful without any fault, still, some products failed to achieve the goals, i.e., to be profitable. It is simply because people have preferences—That vary or change without any pattern or rule.

1.2.2 Summary

Engineers serve society by creating engineering solutions. The solutions link directly to the users in many aspects including safety, and thus, the role of engineers is important. Besides being important, the above discussion shows that the process is also challenging. For that reason, a systematic guideline for engineers in creating engineering solutions is necessary.

1.3 A STORY OF AN INVENTION

The design process is mainly divided into two stages. In the first stage called conceptual design, designers create the concept of how the solution will work. The focus is on functions and solutions. Then, having the final design concept, designers need to refine the concept to make it practically work.