

ENGINEERING DESIGN PROCESS INVOLVED IN PRODUCTION

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Abstract

The design process is a structured and iterative approach that creative professionals employ to conceive, develop, and refine ideas into tangible solutions. It encompasses a sequence of stages, including recognition of need, problem definition, synthesis, analysis, evaluation and documentation. This cyclic process allows for continuous improvement and adaptation, fostering innovation and problem-solving in fields like product design, engineering, architecture, and user experience. The nature of the design process lies in its ability to guide creators through a strategic journey, resulting in effective and novel outcomes that address a wide array of challenges.

Keywords: Design, Design process, Engineering.

1. Introduction

Design is a series of activities to gather all information from the designer's idea as a real product. Figure 1 represents the conversion of design to real product. Classifications of designs are (i) Embodiment design, (ii) Innovative design/Development design, (iii) Adoptive design (iv) New design/inventive design.



Figure 1. Way to design to real product

2. Design Process

A design process is a systematic problem-solving strategy, with criteria and constraints, used to develop many possible solutions to solve or satisfy human needs or wants and to narrow down the possible solutions to one final choice. Figure 2 shows the steps involved in the design process.

Following steps are involved in design process.

- Recognition of need
- Definition of problem

- Synthesis
- Analysis and optimization
- Evaluation
- Documentation

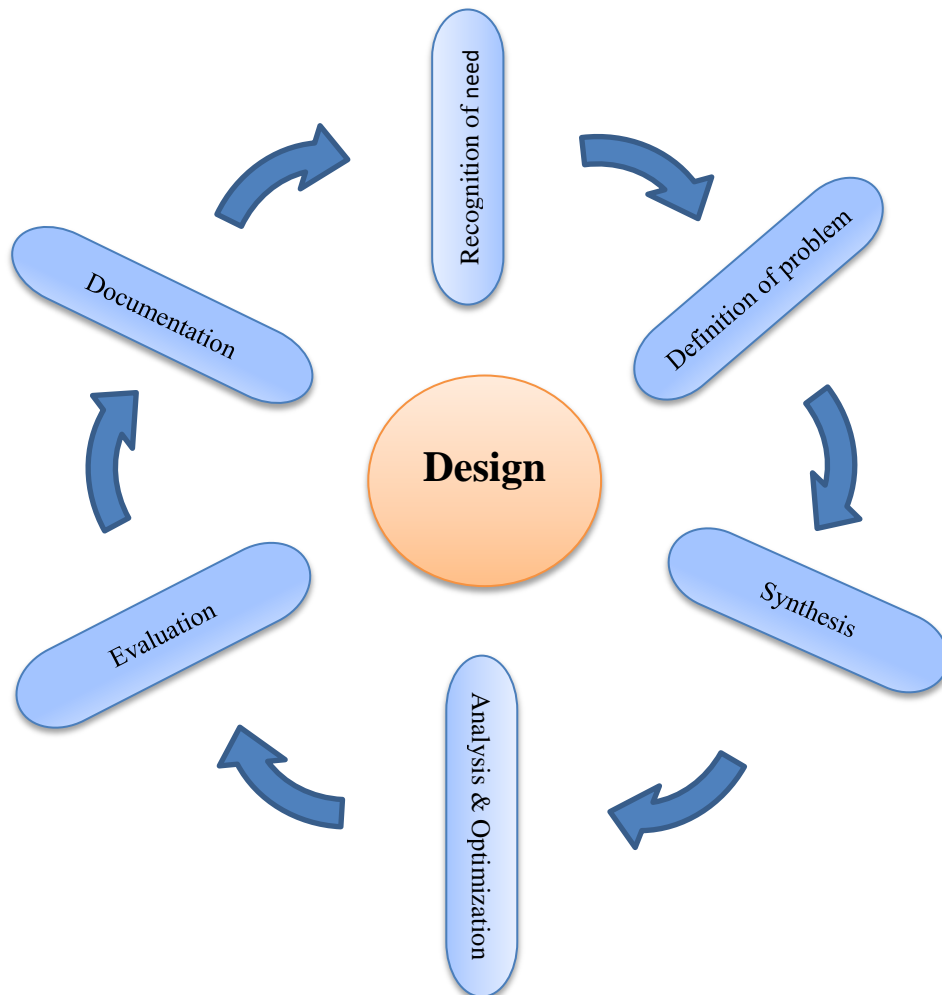


Figure 2. Steps involved in design

2.1 Recognition of need

Recognition of need involves the realization by someone that a problem exists for which some feasible solution is to be found. This might be the identification of some defect in a current machine design activity by an engineer or the perception of a new product marketing opportunity by a salesman. At the beginning of each activity, customers are asked to identify the problem that their designs will address.

2.2 Definition of problem

A problem statement identifies the gap between the current problem and the desired goal of a process or product. Crucial to solving any design problem is to begin by asking the right questions. Use the following questions to formulate answers.

- What are the main goals of this project?
- Who is the end user of this project?
- What is the pain point that this product will address?
- How will this product address the pain point?
- What resources will need to complete this project?
- How will measure success?
- Are there similar products on the market?
- How will this be better than similar products on the market?

2.3 Synthesis

Design synthesis is concerned with generating solutions that act on the insights developed in design analysis. These solutions can be a combination of new products, services, interactions, and communications. Design synthesis is the process of translating research data into actionable knowledge and is a critical part of the design methodology. The goal of this process is to find relationships between different pieces of data to uncover meaning in the behaviours that were observed during the research phase. This understanding allows us to identify opportunities and constraints that will set the space in which we'll generate solutions.

2.4 Analysis and optimization

After defining the basis of the project and its specific requirements, ideas will begin to form. Come together with the project team to brainstorm and compare ideas to decide on the best features for the product. Design requirements state the important characteristics that the solution must meet to succeed. One of the best ways to identify the design requirements for the solution is to analyze the concrete example of a similar, existing product, noting each of its key features. There are always many good possibilities for solving design problems. If one concentrates solely on a single option before considering alternatives, it's highly likely that a better solution will be overlooked. Good designers try to generate as many possible solutions as they can. Look at whether each possible solution meets the design requirements. Some solutions probably meet more requirements than others. Reject solutions that do not meet the requirements. Choose best solution form the analysis solutions. The engineering analysis and optimization stages of the engineering design process provide the designer with decision-

making “tools” for making informed decisions about design solutions before a final design is selected and a prototype is built.

2.5 Evaluation

Design evaluation is a function that is carried out at various stages of the design process. Its purpose is to check that the design solution is in accordance with the original design objectives. Test the concepts by creating a prototype that mimics the finished product. Throughout this process, find new areas of improvement as well as user experience validation of the existing concepts. User testing of prototype will clarify answers to important questions as well as identify potential flaws or drawbacks. This feedback will help the troubleshoot and reiterate the prototype as many times as needed to produce a final product. Review all the feedback gathered from prototype testing and building the 'final' product. When the finished product is ready to be released to the public, it's time to prepare for the next step, which is product analysis. Gather all user feedback, prototype testing, competitor analysis and market sales to inform and improve upon the product. Use this information to create a more customized solution to the market's unique problem or need.

2.6 Documentation

Finally, create a detailed drawing about the optimized design of the product. This is to communicate the knowledge from designer to manufacturing people. All the drawings are documented and the process drawing to each process involved in the real product. The purpose of the design is to satisfy the needs of the client. The designer must provide oral presentations and written design reports. To acquire drawing ability, pencil sketching should be employed to illustrate every idea possible. Importance of sketches, drawings, visual aids, computer graphics and models in the communications process. One of the most important activities in design is documenting the work, and clearly communicating the solution to design problem so someone else can understand what was created. Usually, this consists of a design or technical report. Communicating the solution to a design problem through language, both written and oral, is a vital part of the implementation phase. Many people will be communicating with do not have technical training and competence. They may be the general public, government officials, or business leaders. Successful engineers must possess more than just technical skills. Summarize the solution process by using graphs, charts, and other visual materials and present the work to others. Multimedia techniques, including Power Point presentations, slides, sounds, videos, and computer-generated animations, are often used to clearly communicate the solution to a design problem.

3. Conclusion

The design process serves as a dynamic framework that empowers creative individuals to navigate the complexities of problem-solving and innovation. It is characterized by its iterative nature, guiding designers through a series of interconnected stages, from identifying challenges to crafting tangible solutions. Through synthesis, analysis, evaluation and documentation, the design process fosters a systematic approach that balances creativity with practicality. By embracing adaptability and continuous refinement, designers are able to create outcomes that are not only functional and efficient but also innovative and user-centric. The design process's significance extends across various domains, enabling professionals to address diverse problems, improve existing solutions, and contribute to the advancement of technology and human experience. Ultimately, the design process encapsulates the essence of creativity, strategy, and collaboration, driving the evolution of industries and shaping a more effective and aesthetically pleasing world.

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