EDP

Session on

Engineering Design Process

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A Definition

- '**Engineering Design Process**' is a decision making process (often iterative) in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective.
- Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing and evaluation

—Accreditation Board for Engineering and Technology (ABET)* in USA

*ABET also provides leadership internationally through workshops, consultancies, memoranda of understanding, and mutual recognition agreements, such as the Washington Accord.

Engineering Design Process

- Engineering Design Process is a methodical sequence of steps that are deployed in creating functional products and processes.

- The steps get expressed and defined, subdivided, and/or characterised/described in a variety of different ways, but they follow certain rules regarding the underlying concepts and their respective sequence and interrelationship.

- **The engineering design process, as an umbrella covering several aspects, focuses on ideation, research, conceptual design, feasibility assessment, establishing design requirements, embodiment/ system-level design, detailed design, manufacturing planning, tool design, and production ramp up.**

Focus on Fuzzy Front End (FFE) of Product Development

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The Fuzzy Front End phase covers the generation of a new product idea to its approval for development or its termination. Cooper (1988) distinguishes four stages in the FFE: idea generation, idea screening, preliminary evaluation and new product concept evaluation.

According to Khurana and Rosenthal (1998), the FFE includes: the formulation and communication of new product strategy, opportunities identification, generation and screening of ideas, product definition and planning and design activities.

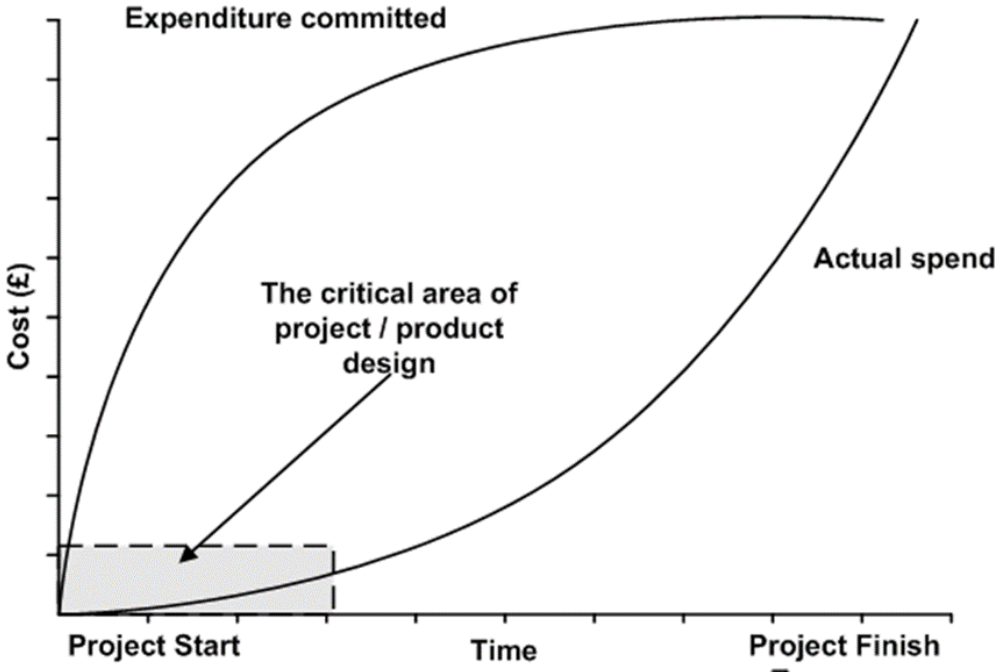
Therefore, it may be stated that the pre-development stages, including,

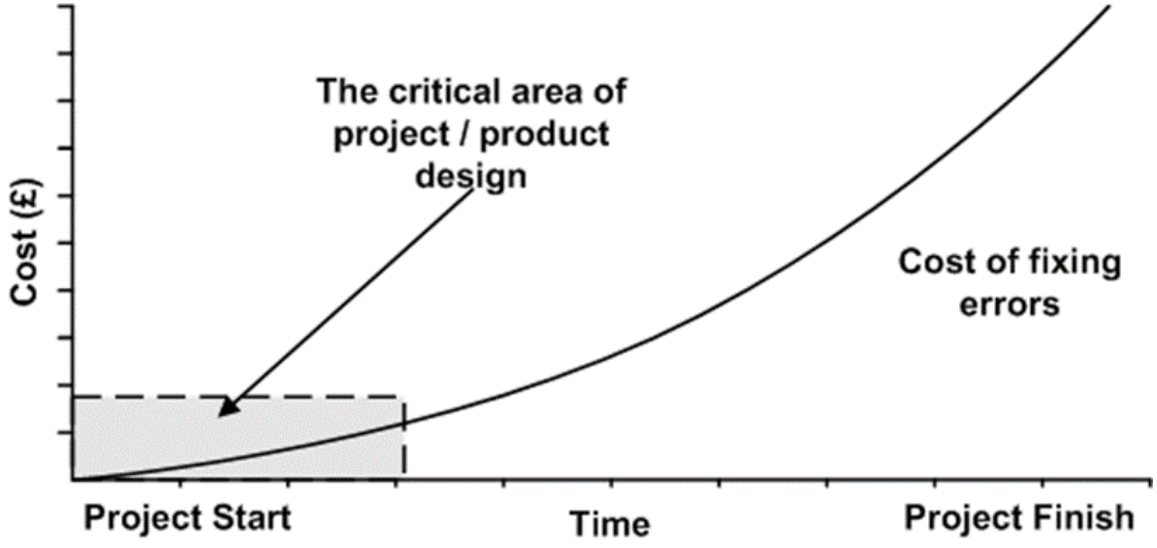
- Need Identification
- Idea Generation
- Idea Screening
- Concept Generation
- Concept Screening

as the vital elements of FFE.

Justification for Focusing on FFE

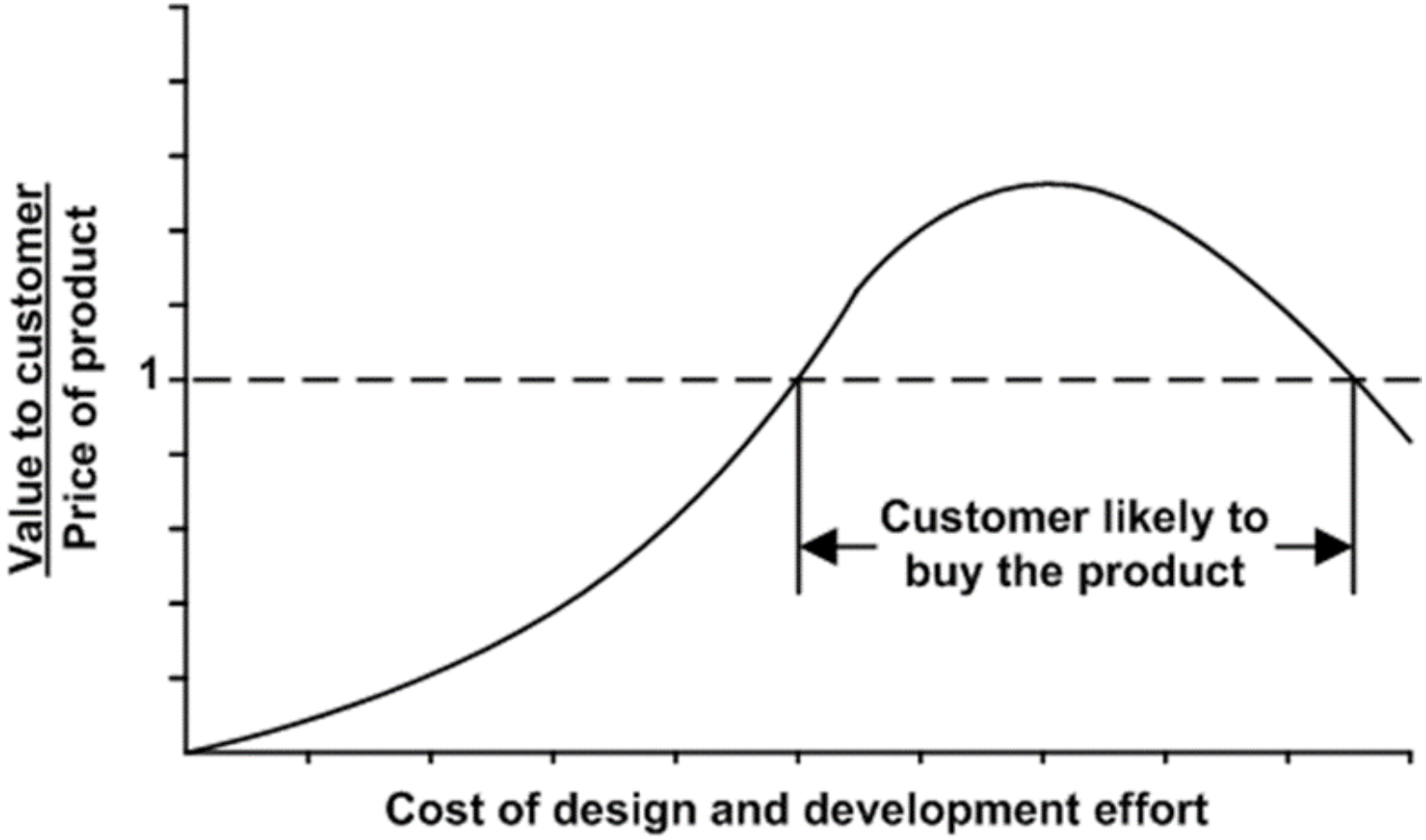
(Tangram Technology presents the following)





Value to Customer is Important

Value is Defined as ‘Utility or Function/ Cost’



The steps of the Engineering Design Process

- **Defining the Problem**
- **Conducting Background Research**
- **Specifying Requirements**
- **Brainstorming Solutions**
- **Choosing the Best/Workable Solution**
- **Performing Development Work**
- **Building a Prototype**
- **Testing and Redesigning**

- The above steps are not always followed in the given order. It is common to design a product, conduct testing, detecting a problem, and then revert to an earlier step to make a modification or change to the design. This type of working is called iteration**.**

NASA's BEST Engineering Design Model (designed to teach students the EDP)

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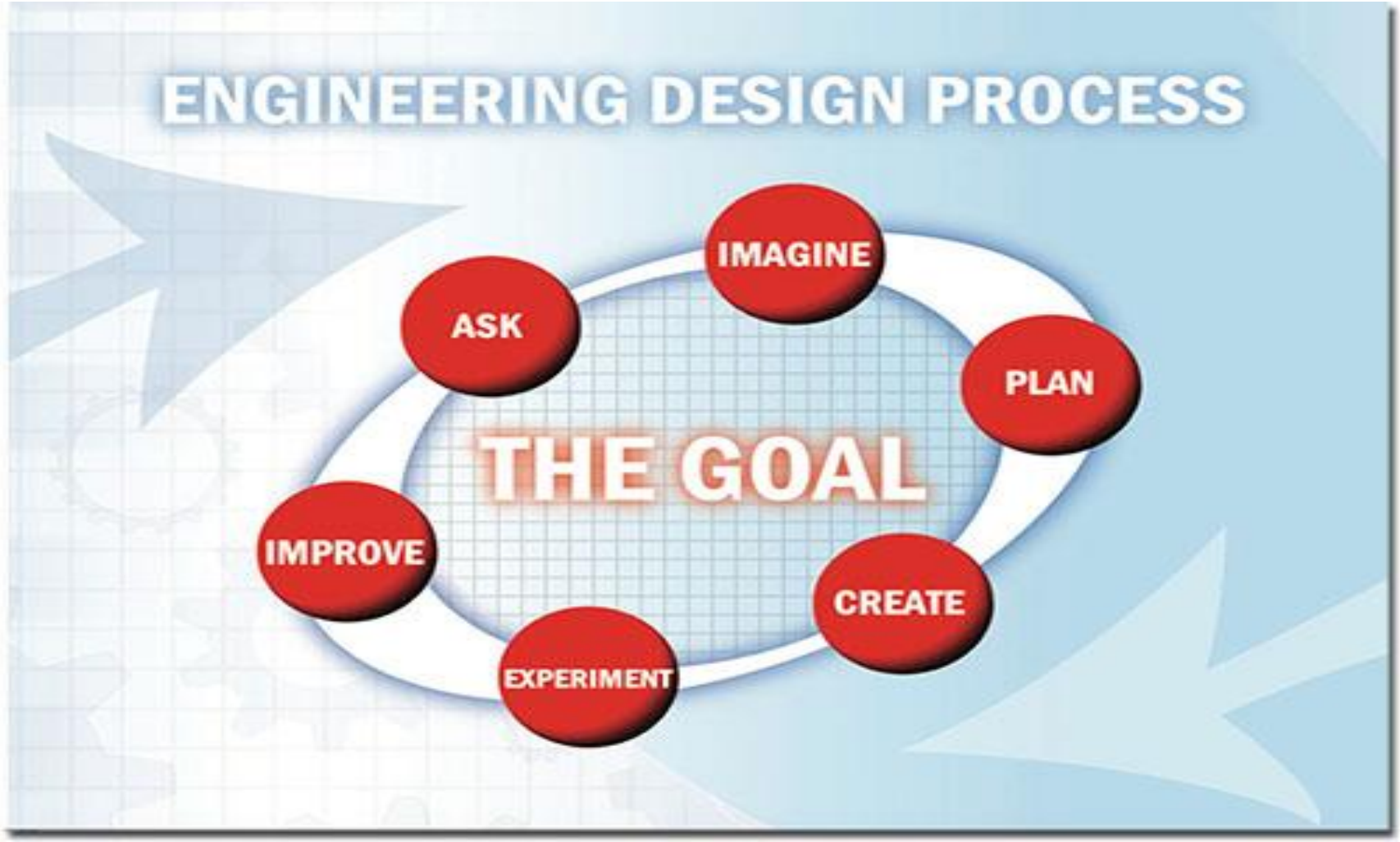

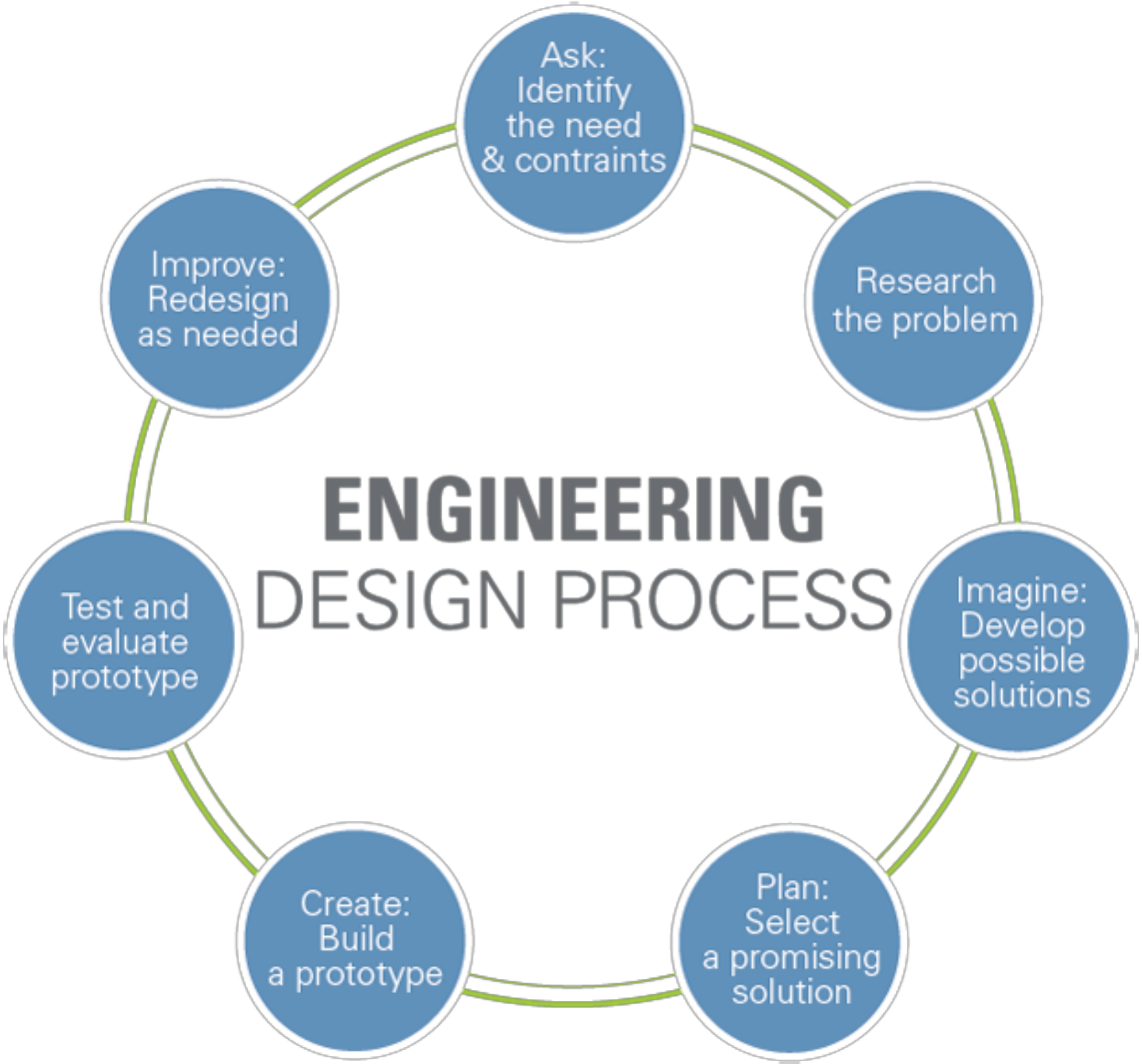
Ask:
Identify
the need
& contraints
Research
the problem
Imagine:
Develop
possible
solutions
Plan:
Select
a promising
solution
Create:
Build
a prototype
Test and
evaluate
prototype
Improve:
Redesign
as needed
ENGINEERING
DESIGN PROCESS

Engineering Design Process (NASA): The steps are described as follows:

- ASK (Identify a need): Identify the problem, **requirements** that must be met, and **constraints** that must be considered.
- IMAGINE (To develop possible solutions)**: Brainstorm** solutions and **research** ideas including **exploring what others have done**.
- PLAN (To decide best course)**:** Choose two to **three best ideas** from brainstormed list and sketch possible designs, **ultimately selecting one to prototype.**
- CREATE (To develop a Prototype- a test model of the product: **Build** a working model, or prototype, that aligns with **design requirements** and that is **within design constraints**.
- TEST/ Experimrent (To evaluate the prototype and Cost-Benefit Analysis) **:** Evaluate the solution through testing; **collect and analyze data;** summarize strengths and weaknesses of the design, revealed from testing.
- IMPROVE (To modify and retest the solution): Based on the results of tests, to make improvements on the design, also **identify changes to make** .

STEP 1- ASK: The Engineering Design Process

- **The 1st step is to identify a need.**
- Engineers define and research a need or problem they are trying to solve.
- Example: The problem may be to provide prosthetic devices to people who are missing limbs, enabling them to perform everyday activities. Engineers might need to research the person's needs, limitations of current prosthetic devices, and the biomechanics of limbs.

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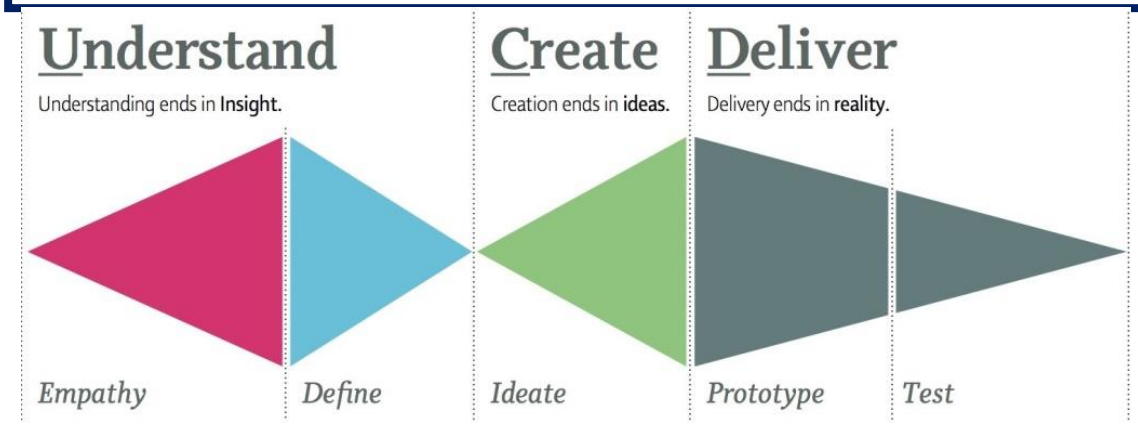
STEP 2- IMAGINE: The Engineering Design Process

- **The 2nd step is to develop possible solutions.**
- **This step includes brainstorming for ideas.** Engineers discuss and share ideas in order to promote additional ideas.
- Example: A type of prosthetic foot was designed similar to the springs in a car.



STEP 3- PLAN: The Engineering Design Process

- **The 3rd step is to begin making a prototype.**
- **<u>Prototype-</u> a test model of the product.**
- Building a prototype will allow engineers to see if their design works the way they expect it to.

STEP 4- CREATE: The Engineering Design Process

- **The 4th step is to test and evaluate the prototype.**
- Engineers need to make sure that the technology does the job that it was designed to do.
- **<u>Cost-Benefit Analysis</u>**
  Engineers make sure that the cost of designing and producing the new product is worth the benefit.

STEP 6- IMPROVE: The Engineering Design Process

- **The 5th step is to modify and retest the solution.**
- If the prototype is unsuccessful or did not work well, the engineers would use this step.
- Engineers can modify the 1st model or try a new solution.
- Engineers will also look for other possible uses for the new product.
- Example: Computerized Tomography (CT) scanning is used to see internal structures in the body. Scientists are now using CT scanning to help model limbs for improved fit of prosthetics.

Prototype Example: Car Manufacturing

AFTER

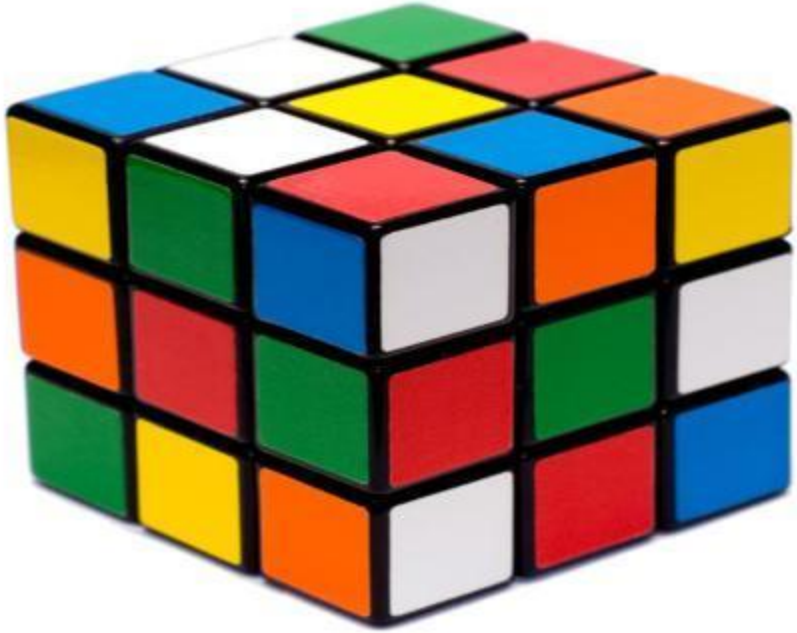
BEFORE

Prototype Example: Mobile Phone

AFTER

BEFORE

Prototype



AFTER

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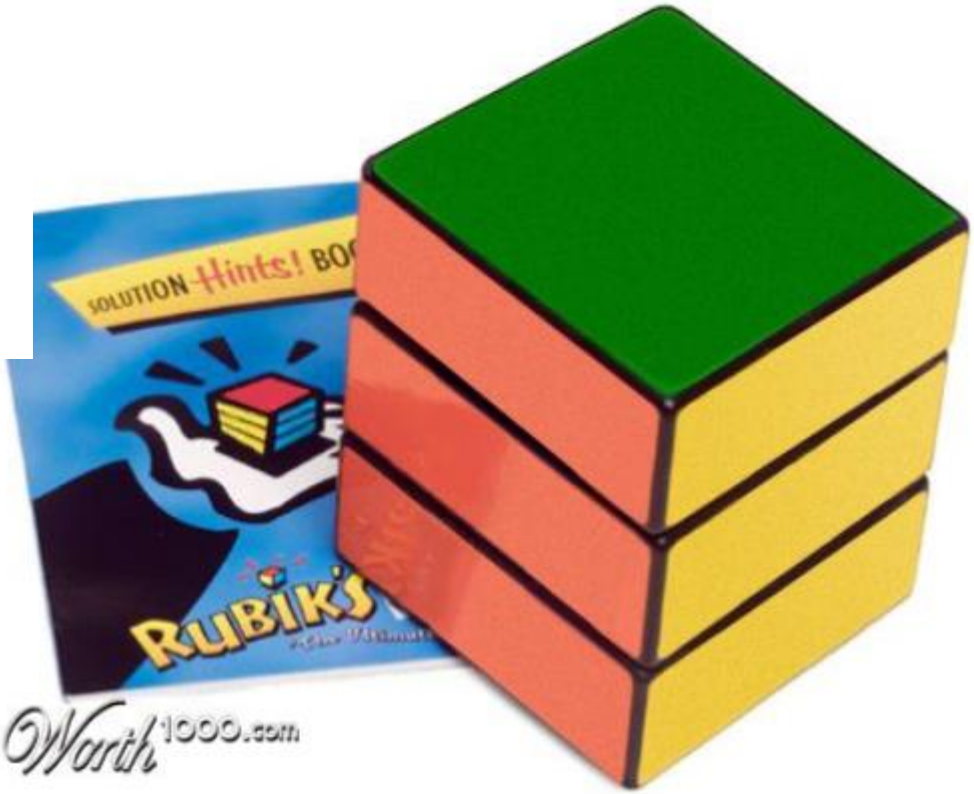


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Thank You!