

Design

Design by evolution

Disadvantages

- Unsuitability for mass prodn
- Difficulty in modification
- Inability to tap new technologies

Examples

- Development of bicycle
- Development of computers

Design by innovation

Examples

→ Invention of laser light

→ Invention of solid-state electronic devices and computers

Essential factors of product design

→ **Need** :- Must be in response to technological or social needs.

→ **Physical** :- Should be convertible to realizability material goods and services.

→ **Economic** :- Exceeds the limit of worthiness total cost-making them

→ **Financial** :- Must be financially feasible

→ **Optimality** :- Design concept must be optimised amongst the available alternatives.

→ **Design criterion** :- Represents the designer's compromise among conflicting judgements.

→ Morphology : - Chronology of design process

→ Design : - Iterative problem-solving process.

→ Sub problems :- Sol'n of original Problem is dependent on the sol'n of the sub problems

→ Red" of uncertainty :- Transition from uncertainty about the success or failure of a design towards certainty.

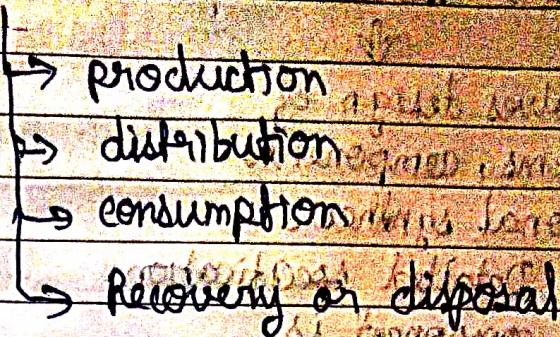
→ Economic worth of evidence :- Authentic information should be gathered to make the design project a success.

→ Basis for decision : - Confirmation of a design project depends whether confidence is high or low in design project

→ Min^m commitment : - Commitments must not be made beyond what is ~~necessary~~ necessary to execute the immediate sol'n.

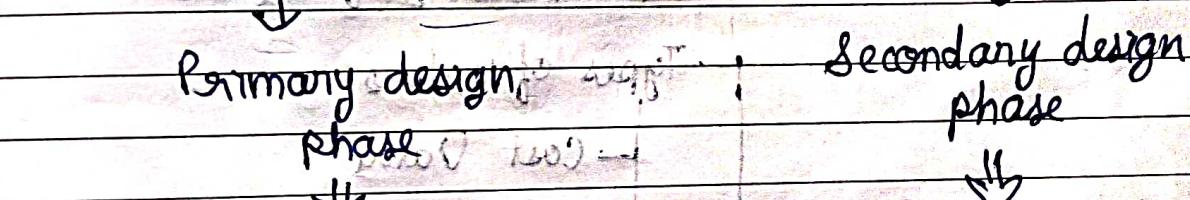
→ Communication ; - Best way to communicate a design is through 3D renderings, CAD models, drawings.

Production-Consumption cycle



Note :- TIFAC at New Delhi → Information storage centre

Morphology of Design



• Phase 1 : Feasibility Study

Involves understanding of opportunity, generate feasible sol's. Check potential needs exists. Need, physical realizability, economic worthwhileness, financial feasibility.

• Phase 2 : Preliminary Design

Involves steps of design process such as specifying constraints, closer examination on best soln among feasible sol's are chosen. Variety of analysis and tests performed. Refinement of design

• Phase 4 : Planning the production

Regarding decision about production on a large scale.

• Phase 5 : Planning for distribution

Regarding packaging, storage and promotional activity of a product.

• Phase 6 : Planning for consumption

Maintenance, Redesign safety, reliability, convenience

- Phase 3 :- Detailed Design

This involves design of subsystems, components. Provisional synthesis is made. Detailed specification of component is initiated.

- Phase 7 :- Planning for retirement

Regarding disposal of product.

Value

- Function-oriented
- Monetary value for the function
- Appropriate performance and cost

Types of values

Cost Value

Economic value

Esteem value

Exchange value

Function value

V = Function

Cost

Objectives

Extend use of resources

Obtain better value for resources

Timely completion and cost effectiveness

Steps in value engineering

Information phase \rightarrow Function phase \rightarrow Creative phase

Brainstorming

- **Process of generating ideas and concepts**
- **Individual brainstorming** ↳ wider range of ideas
- **Group brainstorming**
 - ↳ deeper ideas
- **Usually group brainstorming is more efficient**

Roles in brainstorming

- | | |
|--|--|
| Leader → good listeners
↳ help team members to focus on the reason | Scribe |
| Team member | ↳ follow brainstorming rules and procedure |

Rules of brainstorming

- All ideas are welcome.
- Be creative
- Generate high quantity of ideas in a short amount of time
- Build upon others' ideas
- Participants should be no less than 5 and no more than 10.
- Usually a time limit of 25 to 30 mins is fixed.

→ Analysis phase → Evaluation phase → Recommendation phase → Implementation phase

Concept generation

- Making several ideas
- Through transforming
- Through biasing method

Concept selection

- Consensus on criterion
- 1) alternatives
- Ranking the alternatives
- Evaluating the alternatives
- Attacking negatives

Concept embodiment

- DFMA
- DFM
- DFA
- DFE
- FMEA