

# Unit 1

## Introduction to Product Design & Development

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# Product Design

- **Product design** deals with the conversion of ideas into reality and as in other forms of human activity, aims at fulfilling human needs.

**Product**- any device or system that is designed and produced for use by a customer

**Customer** -Person who ultimately buys the product

- Another person in your company who may use the device you design
- Think broadly about who the customer is (who does the product affect)
- Chief objective of product design - Satisfying the customer(s)

# Factors affecting the Product

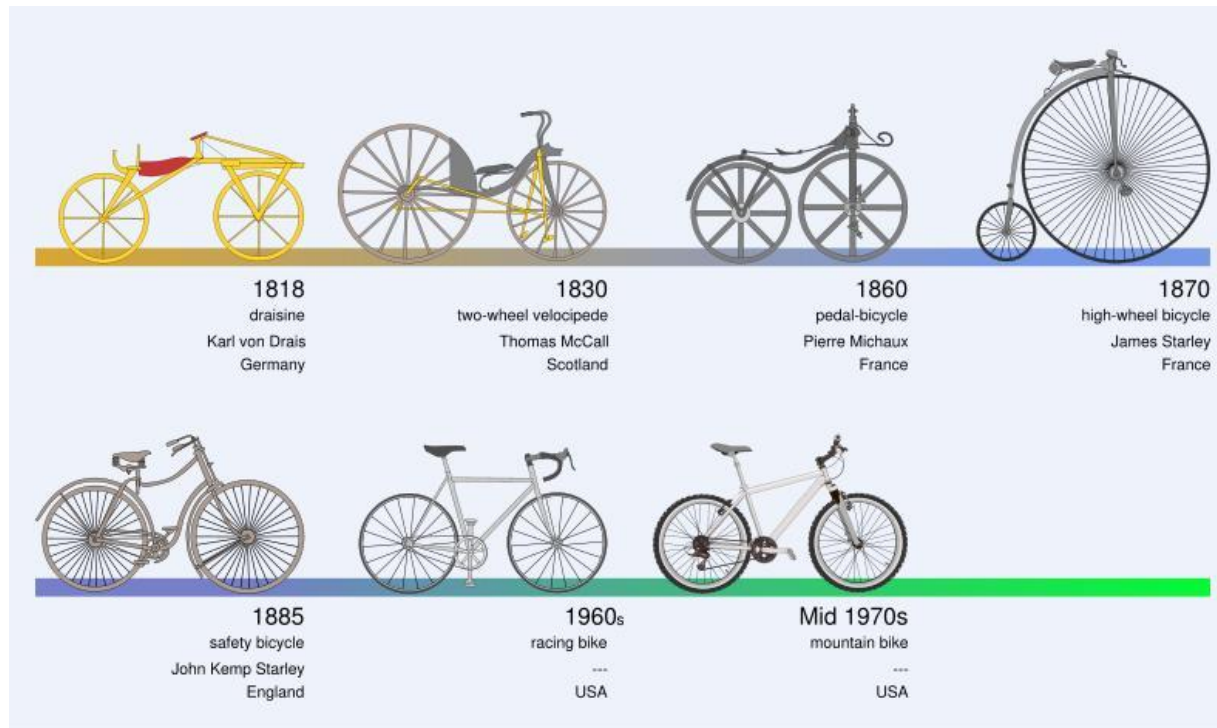
- Product Quality – How good is the product?
- Product Cost – What is the manufacturing cost?
- Development Time – How quickly was the product developed?
- Development Cost – How much was spent to develop the product?
- Development Capability – can the team be better able to develop future products?

# Factors affecting the Product



# Design by evolution

- Development of bicycle from its crank operated version to chain and sprocket version is best example of design by evolution.



# Evolution of computer



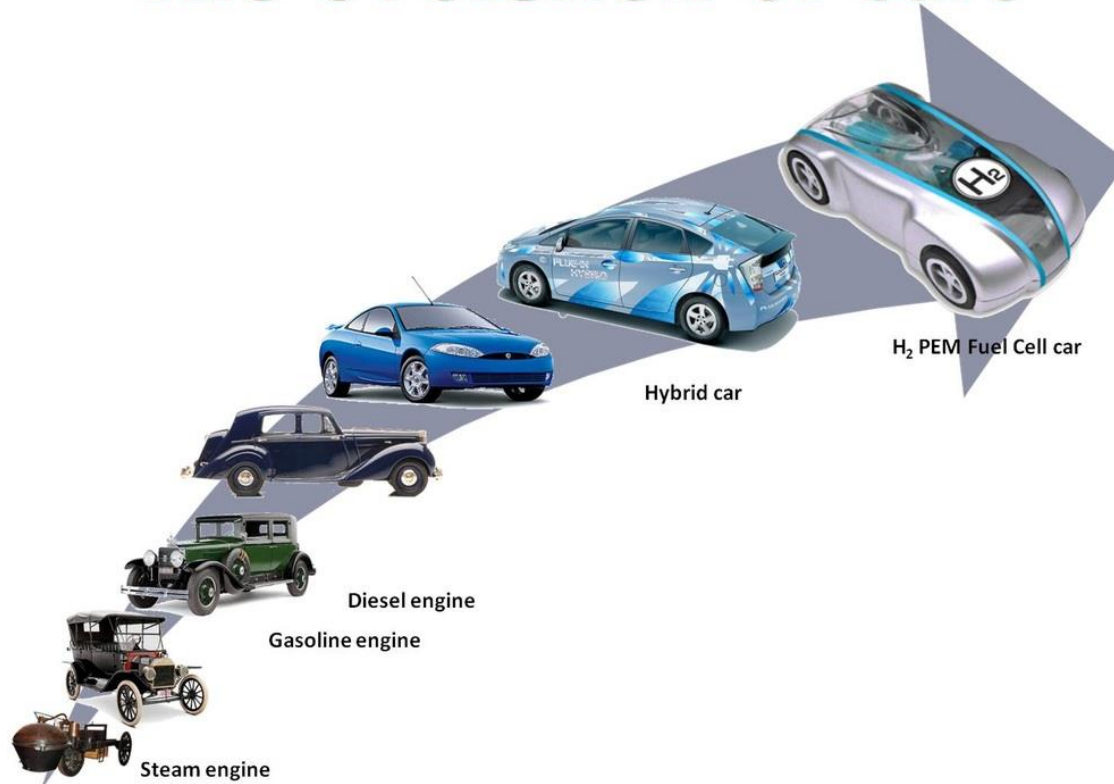
# Evolution of iPhone





# Evolution of Cars

## The evolution of cars



# Design by innovation

- Proper use of technical knowledge on a particular product which can be modified further for ease of usage is termed as design by innovation.





# Design by Innovation



# 3 S in Product design

- The 3's refer to **standardization** , **simplification** and **specialization** three related which are at the roof of any economic analysis of product design.
- First it is necessary to sort out the essential features ,define terms and then in scientific manner the minimum variety is required , to meet these essentials.

# Standardisation

- Standards are at the base of all mass production.
- When one purchases a new **spark plug** for a scooter or car, he knows that it will screw into the engine head all right. **Why?** Because **spark plug threads are standardized**
- Standardization means producing **maximum variety of products from the minimum variety of (i.e., standardized) materials**, parts, tools and processes.
- Standardization is the process of establishing standards or units of measure by which extent, quality, quantity, value, performance, etc., may be compared and measured.





# Standardisation

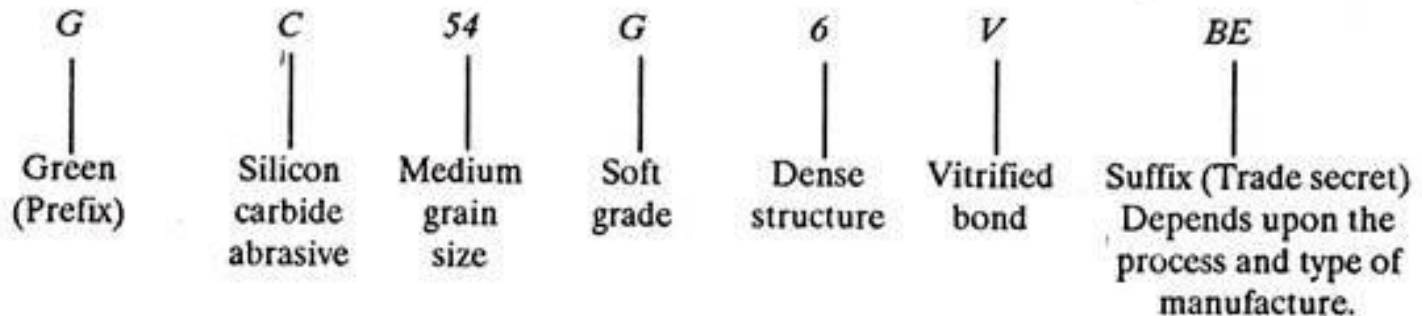
1. **PISTON INDUSTRY-** Standard sizes of piston are produced for different products . Like federal mougul is producing piston for many industries like maruti as well as the large scale manufacturers like bmw etc.

2. **NUT & BOLT INDUSTRY-** standard nut and bolts are produced so that they can be easily available in market in case of requirement



# Standardisation

- According to Indian Standard Specifications, for example, a grinding wheel is specified as follows:





# Advantages

- Better product deliveries.
- Easy availability of spare parts.
- Less time is wasted in resolving production snags such as wrong information's, faulty tooling, etc.
- Fewer specifications, drawings and part lists have to be prepared and issued.
- Better resources utilisation.
- Accurate delivery dates.
- Better methods and tooling.
- Better services of production control, stock control, purchasing, etc.

# Disadvantages

- **Reduction in choice** because of **reduced variety** and consequent loss of business or custom.
- It becomes difficult to **introduce new models** because of **less flexible** (existing) production facilities and due to the high cost of specialised production equipment.
- Standardization tends to favour **large famous companies**, because small or new concerns can rarely get much business even by producing same items and by selling them at the same price as the big companies.
- Standards once set, **resist change** and thus standardization may become an obstacle to progress.

# Simplification

- The process of simplification can be carried out with a view to reducing the variety of products or materials that are produced or purchased.
- This is both an economic and engineering process . Specialization is one of its natural outcomes.

# Simplification

- Simplification removes the superfluous. It decreases variety of sizes; for example a **garment factory** making t-shirts in sizes 16, 16 $\frac{1}{4}$ , 16 $\frac{1}{2}$ , 16 $\frac{3}{4}$ , 17, 17 $\frac{1}{4}$  etc., can eliminate superfluous sizes such as 16 $\frac{1}{4}$ , 16 $\frac{3}{4}$ , 17 $\frac{1}{4}$ , etc., and thus simplify its production line



adidas T-shirt

## SIZE GUIDE



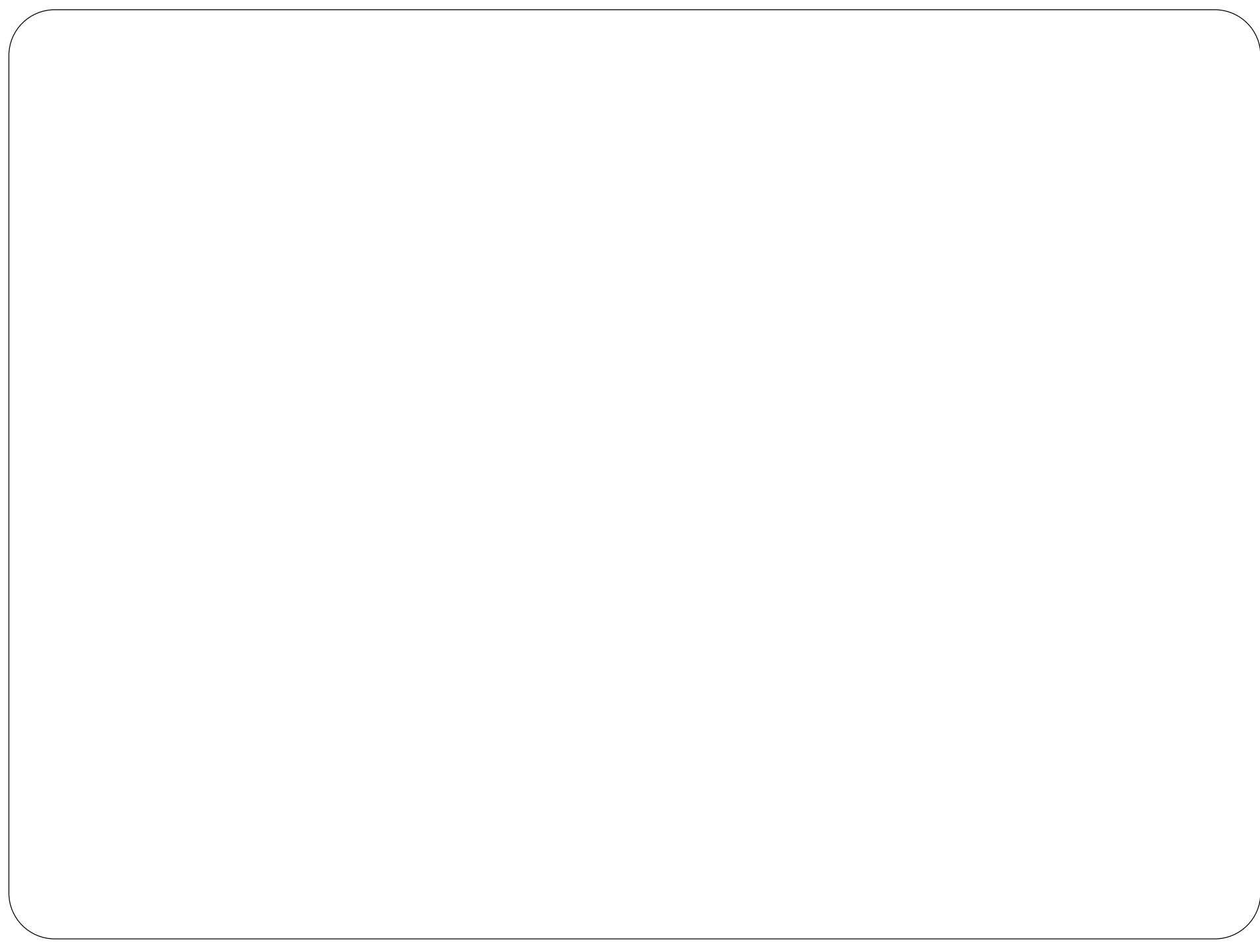
SIZE	CHEST / AGE
140cm	8-10 Years
152cm	11-13 Years
164cm	14-16 Years
XSmall	34-35"
Small	36-37"
Medium	38-39"
Large	40-42"
XLarge	43-44"
XXLarge	45-47"

# Advantages of simplification

- Simplification involves fewer parts, varieties and changes in products; this reduces manufacturing operations and risk of obsolescence.
- Simplification provides quick delivery and better after-sales service.
- Simplification reduces inventory and thus results in better inventory control.
- Since simplification reduces variety, volume of remaining products may be increased.
- Lower the production costs.

# Specialisation

- A mechanic, brick-layer or an engineer is a specialist in his field.
- A factory producing spark plugs only is a specialist in its production.
- Specialization as applied to human activities on shop floor can be defined as 'Division of Labour'. This means that if a worker instead of completing the full product performs one small operation on the product and attains proficiency in that one activity, he becomes a specialist in that.



# Quality Function Deployment (QFD)

- QFD is a Quality tool that supports all parts of a quality system including documentation, tests and engineering guidance
- Voice of the Customer
- Using the sequential steps – customer wants and needs are converted into product characteristics
- Understand the customer
- How will customer judge the products value?

## **History of QFD**

- Ship building of Kobe shipyard in Japan
- Adopted by most of the western companies



# QFD Matrices

- QFD matrix is the main tool to bridge the customer requirement and process evaluation.
- This matrix helps in understanding customer voice and response and transformation of this voice into technical specification.
- The cascading of the information is achieved by a series of matrices (called house).

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RELATIONSHIP BETWEEN  
'WHAT & HOW'

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S

HOW?

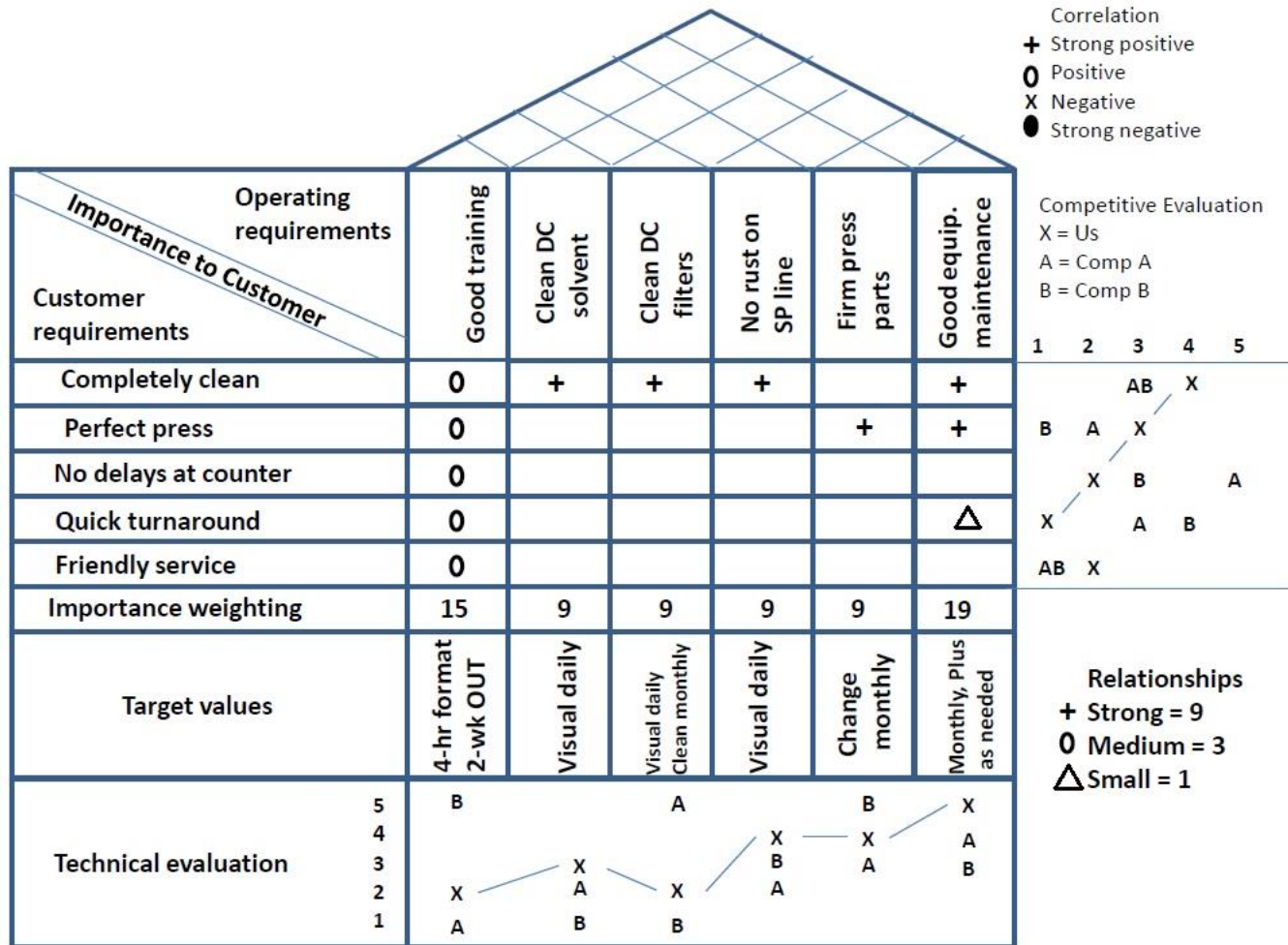
CORRELATION  
BETWEEN  
DIFFERENT  
HOUSESES

IMPORTANCE

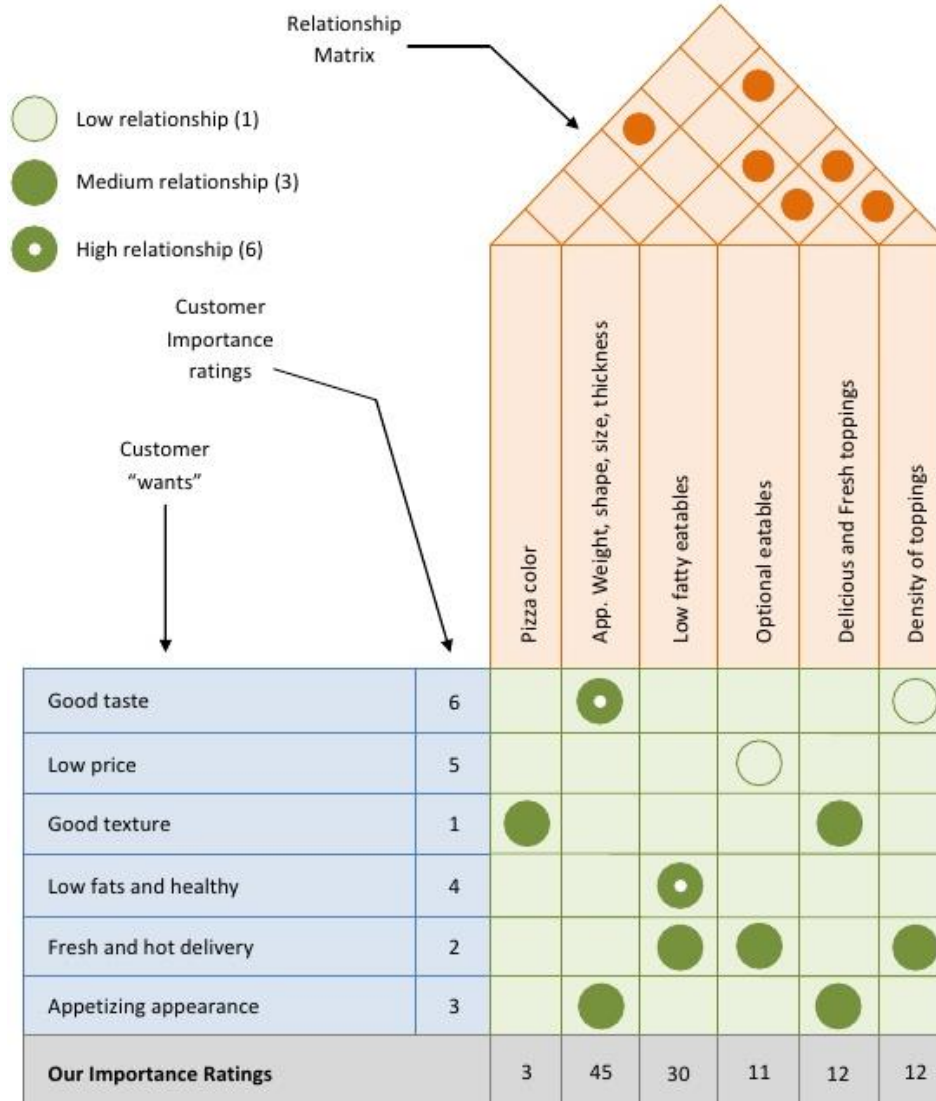
TARGET

EVALUATION

# QFD – House of Quality for dry cleaning



# House Quality of Pizza





# Phases in QFD

- 1.Product Planning (House of Quality):** Translate customer requirement into product technical requirement to meet them.
- 2.Product Design:** Translate technical requirement to key part characteristics or systems.
- 3.Process Planning:** Identify key process operations necessary to achieve key part characteristics.
- 4.Production Planning (Process Control):** Establish process control plans, maintenance plans, training plans to control operations.

# Advantages of QFD

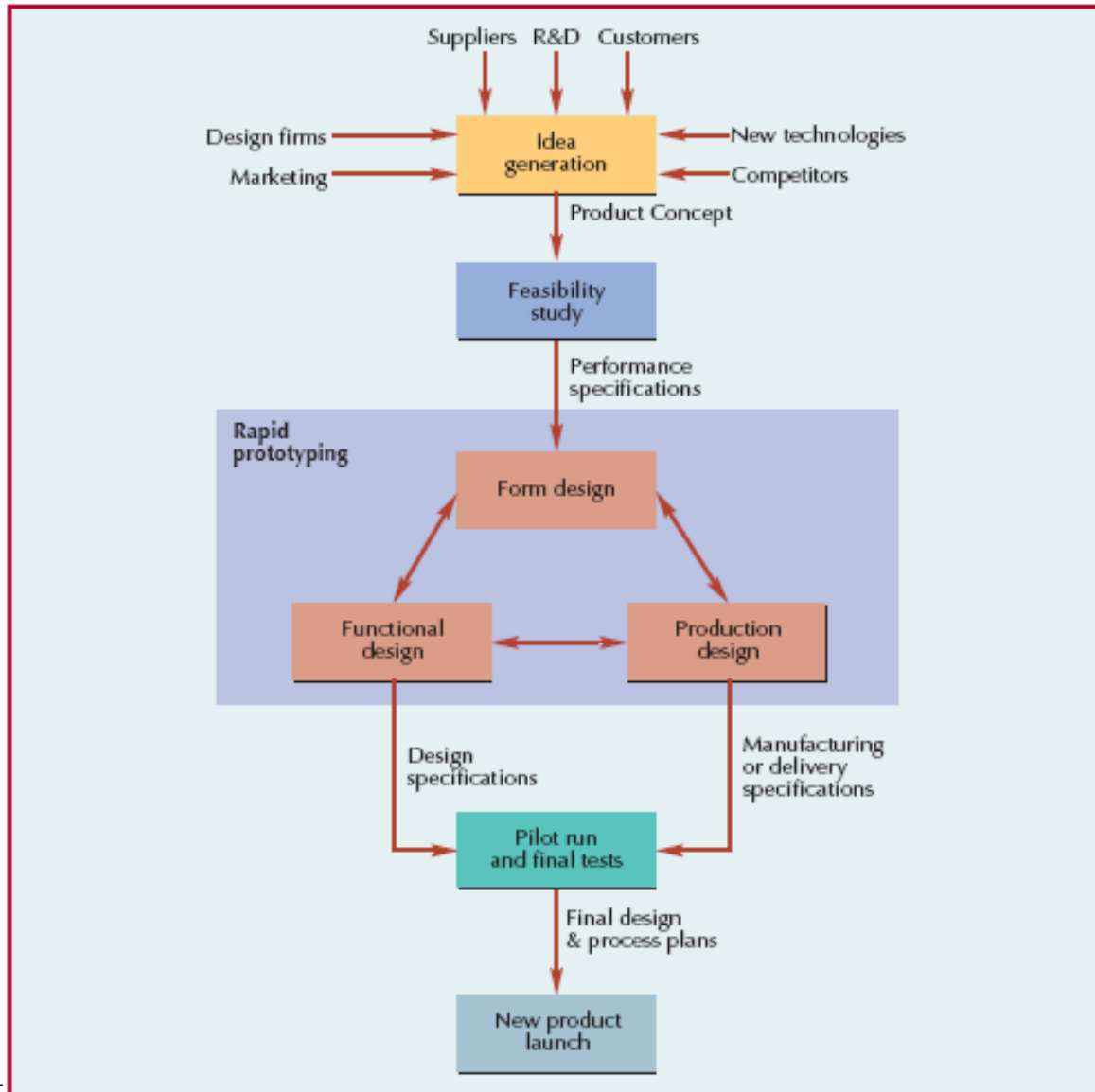
- The companies, which use this methodology benefits in the following ways:
- Reduction in product development time by 30 to 50 percent.
- Reduced complaints during warranty period.
- Reduction in number of design changes.
- Increased customer satisfaction.

# Concurrent Engineering

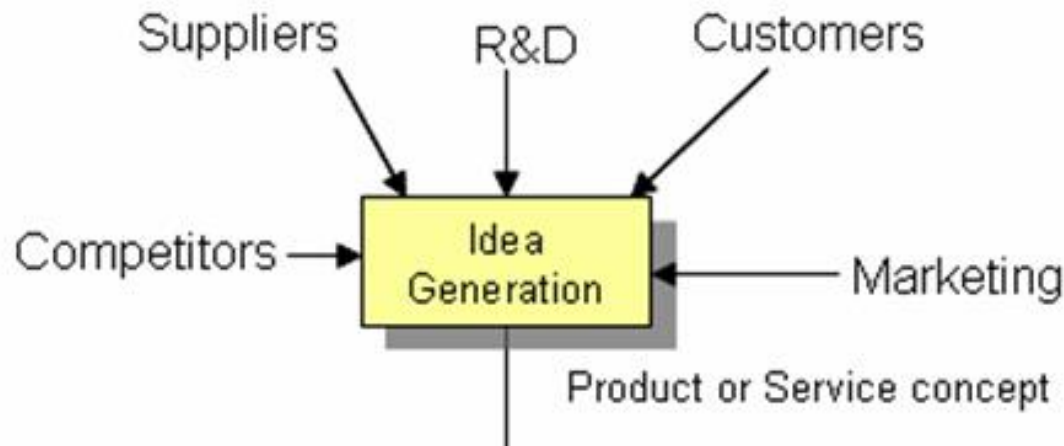
- Concurrent Engineering is a strategy where all the tasks involved in product development are done in parallel.
- Collaboration between all individuals, groups and departments within a company.
  - Customer research
  - Designers
  - Marketing
  - Accounting
  - Engineering



# Commercial Design



# Concurrent Engineering

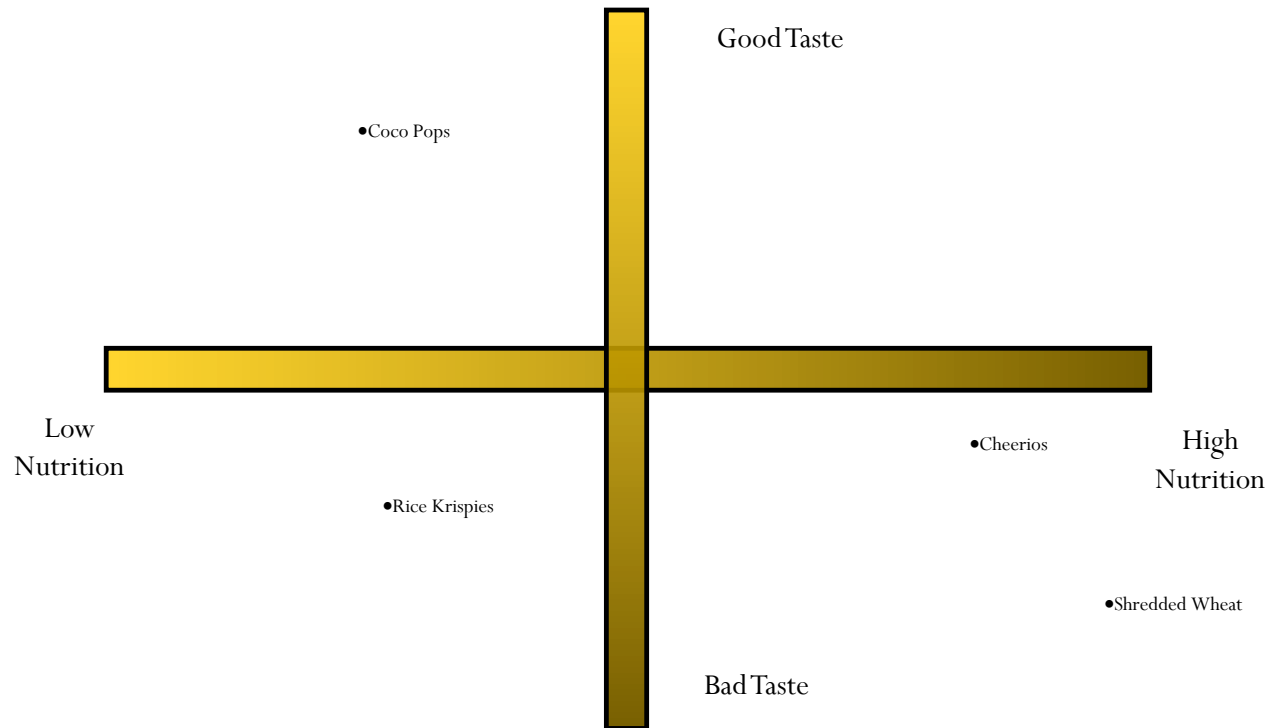


Techniques for designing a product:

- Perceptual mapping
- Benchmarking
- Reverse Engineering

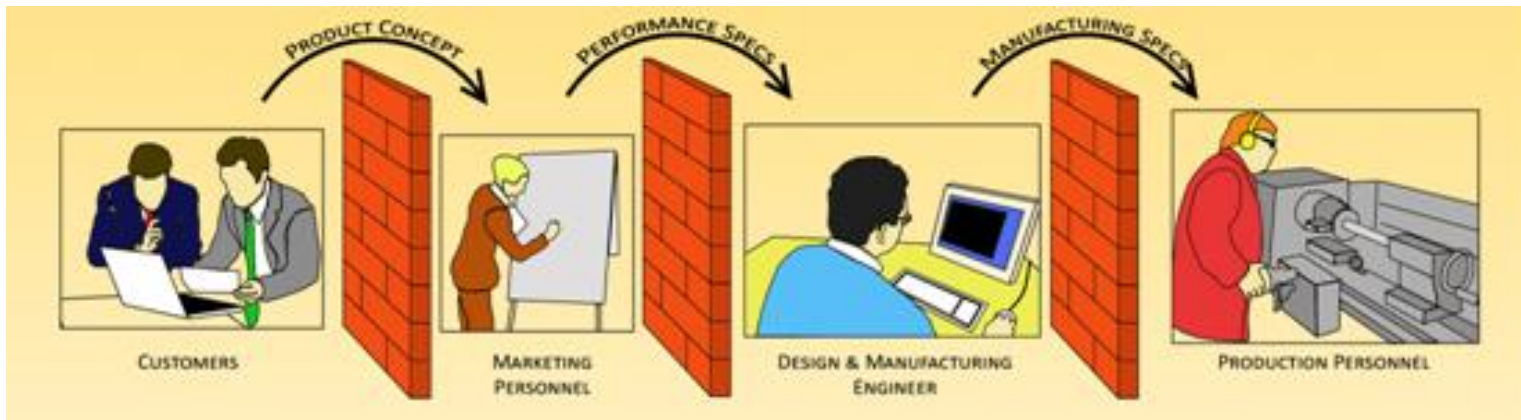
# Perceptual mapping

- Compares customers perception of available products
- Identifies gap in market



# Concurrent Engineering

- Benchmarking
  - Get the best product available
  - Base performance specifications for new product on it
- Reverse Engineering
  - Dismantle and inspect competitors product(s)
  - Select features to incorporate into new product



Traditional Process = Linear

Vs

Concurrent Engineering = Team collaboration

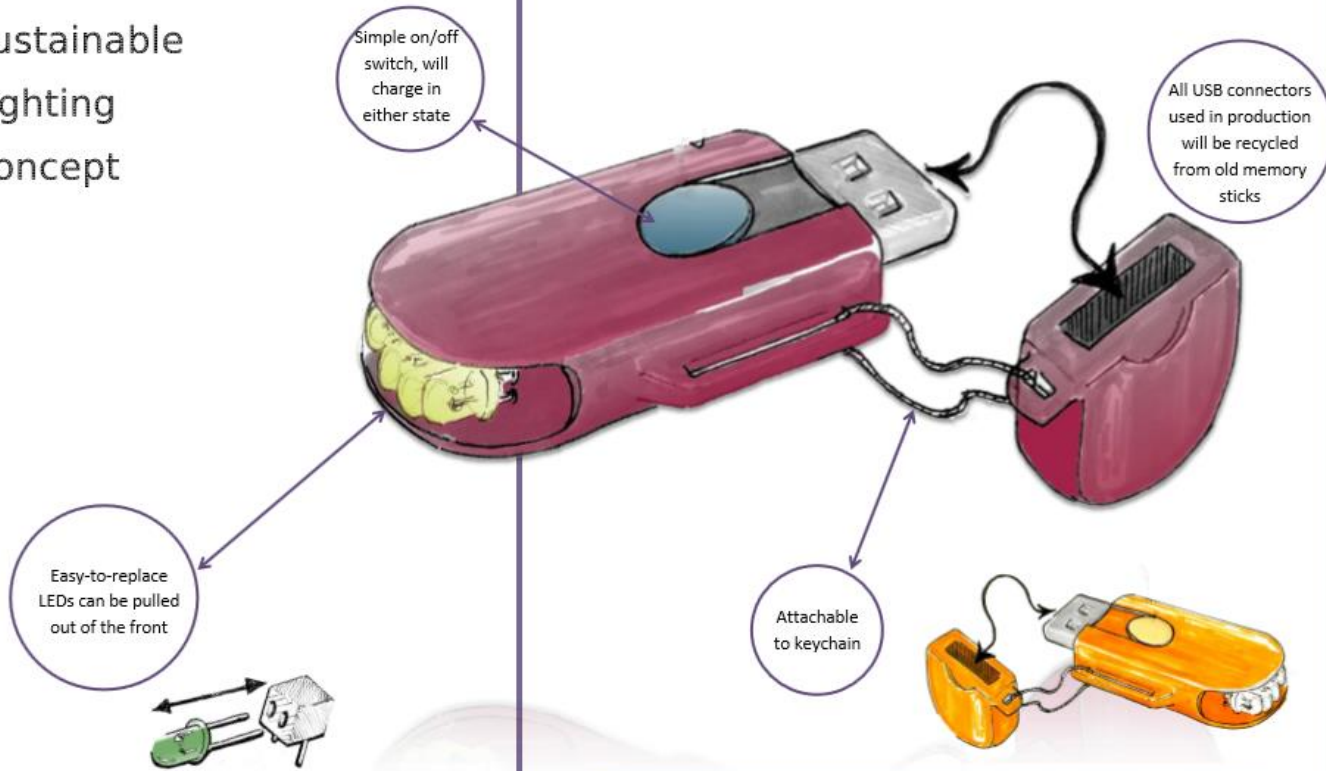


# Reasons for implementing Concurrent Engineering

- Pace of market change has increased
- Companies must keep pace with changing markets
- Decisions made sooner rather than later
- Reduces/eliminates repetition of tasks
- Reduces waste and reworking of design
- Product quicker to market
- Maximises company profit
- Company operates more efficiently

# Sustainable RE-Design Portable Lighting

## USB LIGHT Sustainable Lighting Concept



The portable USB torch concept relies upon available USB outlets such as laptops to charge and can be easily carried around, on a keychain for example

They are made using recycled USB ports and feature easily replicable components and allow the user to easily recycle and replace components when damaged or at the end of their lifecycle

## USER INTERACTION CYCLE



Highly Recyclable MALE TYPE A USB connector as found in most Flash drives