

Product and Service Design

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Lecture 4



Design or Re-Design

Reasons Design or Re-Design

- The driving forces for product and service design or redesign are market opportunities or threats:
 - *Economic*
 - *Social and Demographic*
 - *Political, Liability, or Legal*
 - *Competitive*
 - *Cost or Availability*
 - *Technological*



"Design for production" considers the capabilities of the organization to produce or deliver a given product or service

Key Questions

❖ Is there a demand for it?

- Market size
- Demand profile



❖ Can we, do it?

- **Manufacturability** - the *capability* of an organization to produce an item at an acceptable profit
- **Serviceability** - the *capability* of an organization to provide a service at an acceptable cost or profit

Key Questions (contd.)

❖ What level of quality is appropriate?

- Customer expectations
- Competitor quality
- Fit with current offering

❖ Does it make sense from an economic standpoint?

- Liability issues, ethical considerations, sustainability issues, costs and profits



Legal Considerations

- Legal Considerations

- **Product liability**

- The responsibility a manufacturer has for any injuries or damages caused by as faulty product
 - Some of the concomitant costs
 - Litigation
 - Legal and insurance costs
 - Settlement costs
 - Costly product recalls
 - Reputation effects

- **Uniform Commercial Code**

- Under the UCC, products carry an implication of merchantability and fitness



Normative Behavior



- Produce designs that are consistent with the goals of the organization
 - e.g., Do not compromise on quality, or cut corners, even in areas that are not apparent to the customer
- Give customers the value they expect
- Make health and safety a concern
 - Do not place employees, customers, or third parties at risk because of faulty products and services

Sustainability

- **Sustainability**
 - Using resources in ways that do not harm ecological systems that support human existence
- Key aspects of designing for sustainability
 - Life cycle assessment
 - Reduction of costs and materials used
 - Re-using parts of returned products
 - Recycling

One approach to extending a product's life cycle is to promote alternate uses of the product

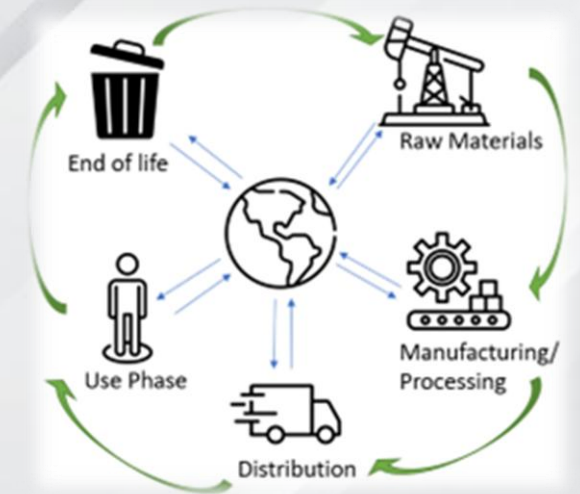


Life Cycle Assessment (LCA)

- **LCA**

- The assessment of the environmental impact of a product or service throughout its useful life

- Focuses on such factors as
 - Global warming
 - Smog formation
 - Oxygen depletion
 - Solid waste generation



- LCA procedures are part of the [ISO 14000](#) environmental management procedures

Reduce: Costs and Materials

1. Value analysis

- Examination of the function of parts and materials to reduce the cost and/or improve the performance of a product
- Common questions used in value analysis
 - Could a less expensive part of material be used?
 - Is the function necessary?
 - Can the function of two or more parts be performed by a single part?
 - Can a part be simplified?
 - Could product specifications be relaxed?
 - Could standard parts be substituted for non-standard parts?

Re-Use: Remanufacturing

- **Remanufacturing**
 - Refurbishing used products by replacing worn-out or defective components
 - Can be performed by the original manufacturer or another company
- **Design for disassembly (DFD)**
 - Designing a product so that used products can be easily taken apart

Recycle

- **Recycling**

- Recovering materials for future use
 - Applies to manufactured parts
 - Also applies to materials used during production
- Why recycle?
 - Cost savings
 - Environmental concerns
 - Environmental regulations
- **Design for recycling (DFR)**
 - Product design that considers the ability to disassemble a used product to recover the recyclable parts
 - Consumers does not resist purchasing products containing recycled materials



Other Considerations

- Product or service *life cycles*
- *Standardization*
- Product or service *reliability*
- Product or service *robustness*



Product or service life stages

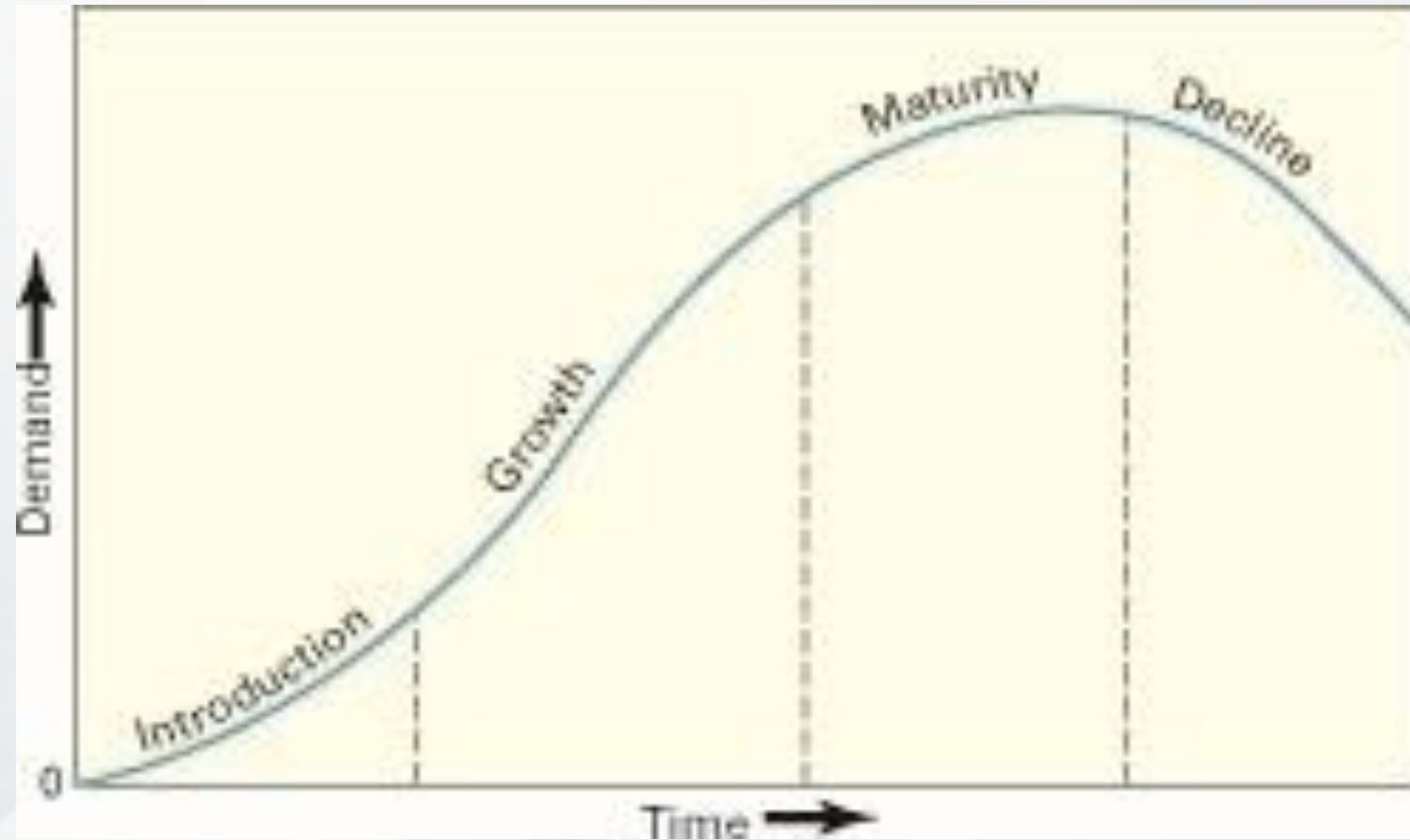
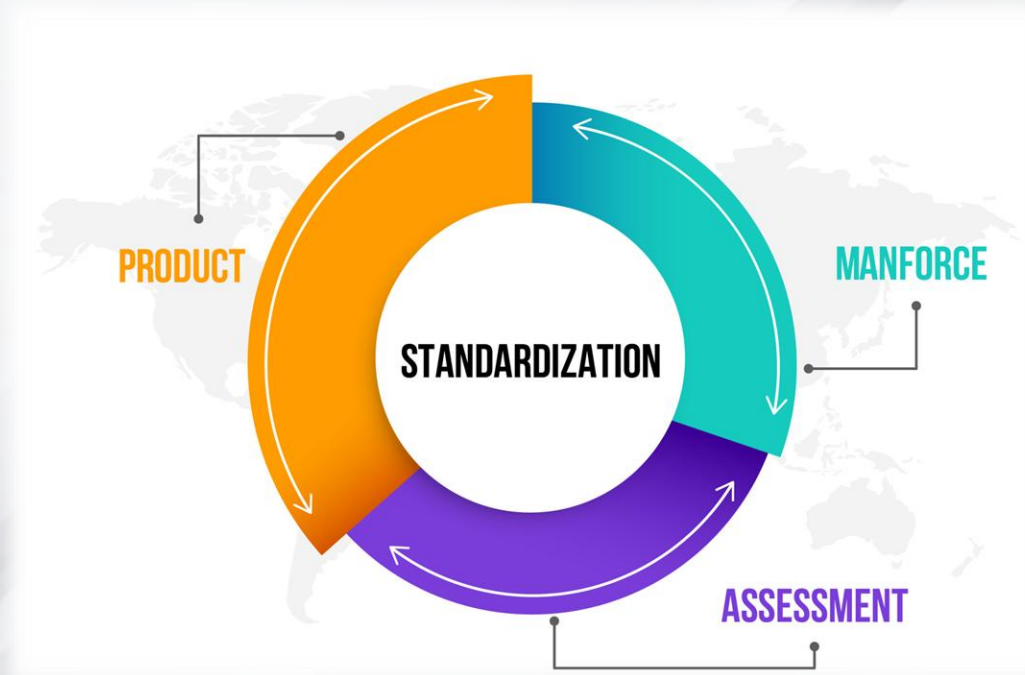


FIGURE 4.1

Products or services often go through stages over time

Standardization

- **Standardization**
 - Extent to which there is an absence of variety in a product, service, or process



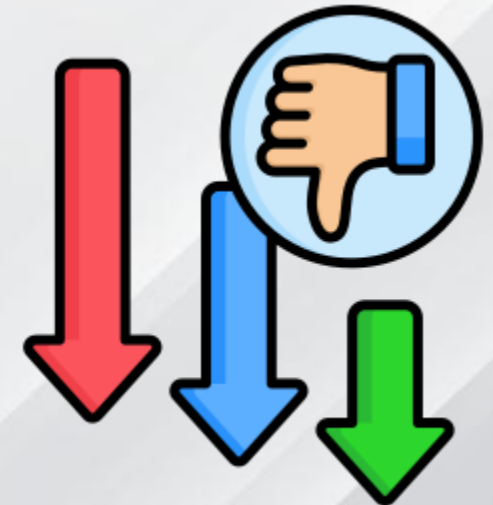
Advantages of Standardization



1. Fewer parts to deal with in inventory & manufacturing
2. Reduced training costs and time
3. More routine purchasing, handling and inspection procedures
4. Orders fillable from inventory
5. Opportunities for long production runs and automation
6. Need for fewer parts justifies increased expenditures on perfecting designs and improving quality control procedures

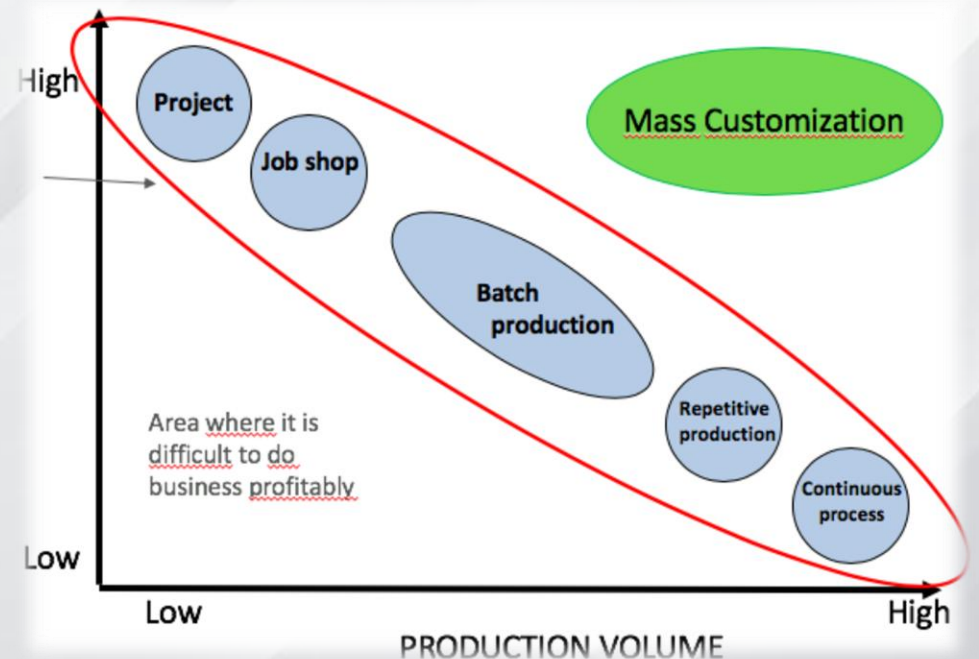
Disadvantages of Standardization

1. Designs may be frozen with too many imperfections remaining.
2. High cost of design changes increases resistance to improvements
3. Decreased variety results in less consumer appeal.



Designing for Mass Customization

- **Mass customization**
 - A strategy of producing basically standardized goods or services, but incorporating some degree of customization in the final product or service
- Facilitating Techniques
 - Delayed differentiation
 - Modular design



Delayed Differentiation

- Delayed Differentiation
 - The process of producing, but not quite completing, a product or service until customer preferences are known
 - It is a postponement tactic
 - Produce a piece of furniture, but do not stain it; the customer chooses the stain

Modular Design

A form of standardization in which component parts are grouped into modules that are easily replaced or interchanged

- **Advantages**

- easier diagnosis and remedy of failures
- easier repair and replacement
- simplification of manufacturing and assembly
- Decreases costs of purchasing and controlling inventory compared to non-modular

- **Disadvantages**

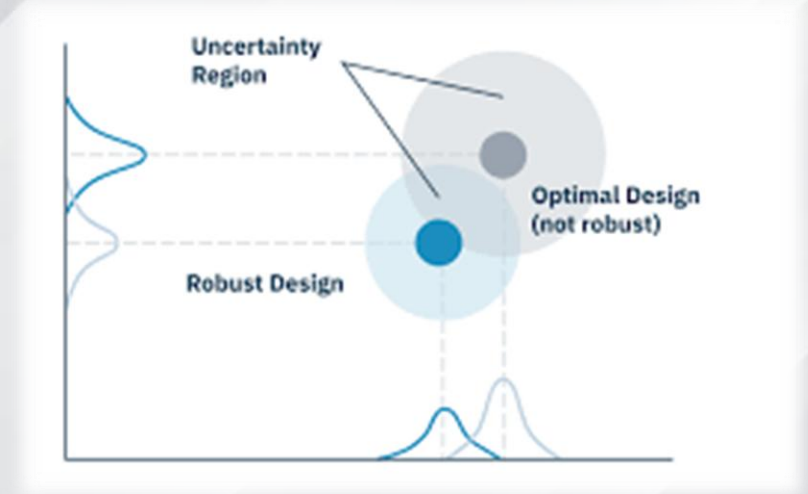
- Limited number of possible product configurations
- Limited ability to repair a faulty module; the entire module must often be scrapped

Reliability

- **Reliability**
 - The ability of a product, part, or system to perform its intended function under a prescribed set of conditions
- **Failure**
 - Situation in which a product, part, or system does not perform as intended
- **Normal operating conditions**
 - The set of conditions under which an item's reliability is specified

Robust Design

- A design that results in products or services that can function over a broad range of conditions
- Pertains to product as well as process design
 - Consider the following automobiles:
 - Ferrari 599
 - Toyota Avalon
 - Which is design being more robust?

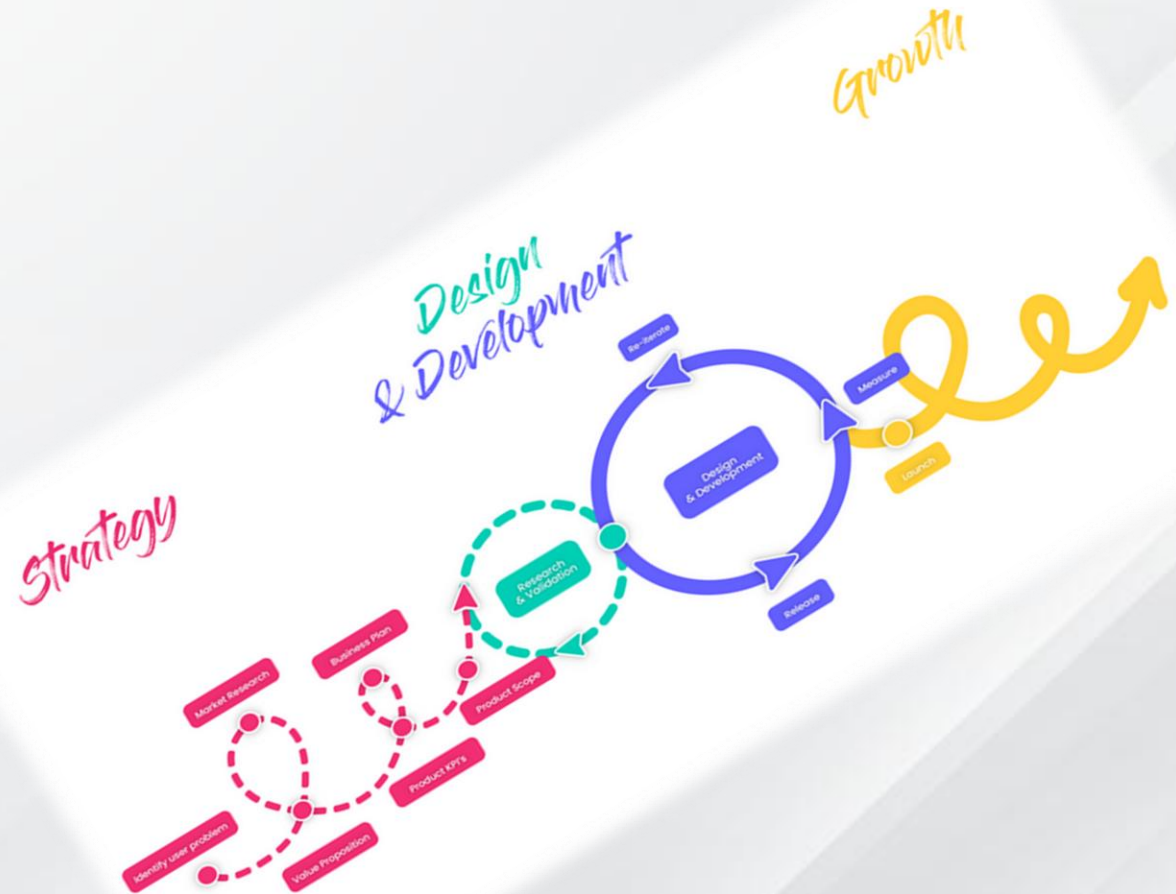


Degree of Newness

- Product or service design changes:
 - Modification of an existing product or service
 - Expansion of an existing product line or service offering
 - Clone of a competitor's product or service
 - New product or service
- The degree of change affects the newness of the product or service to the market and to the organization
 - Risks and benefits?

Phases in Design & Development

1. Idea generation
2. Feasibility analysis
3. Product specifications
4. Process specifications
5. Prototype development
6. Design review
7. Market test
8. Product introduction
9. Follow-up evaluation



Idea Generation

1. Supply-chain based
2. Competitor based
3. Research based



Supply-Chain Based

- Ideas can come from anywhere in the supply chain:
 - Customers
 - Suppliers
 - Distributors
 - Employees
 - Maintenance and repair personnel

Competitor-Based

- By studying how a competitor operates and its products and services, many useful ideas can be generated
- **Reverse engineering**
 - Dismantling and inspecting a competitor's product to discover product improvements

Research Based

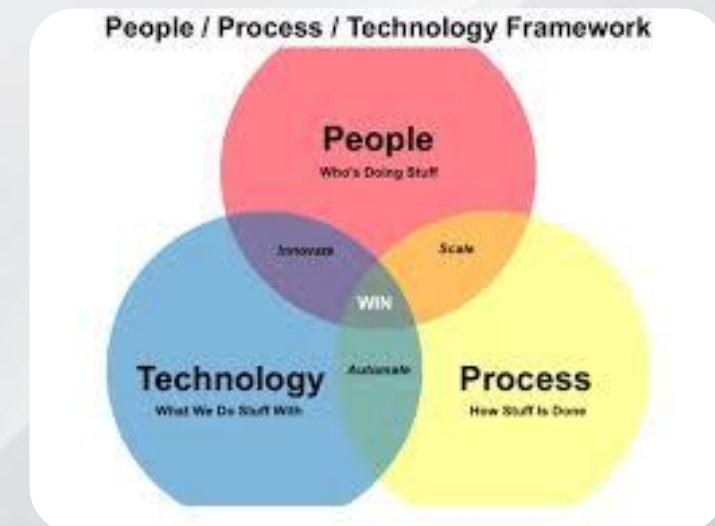
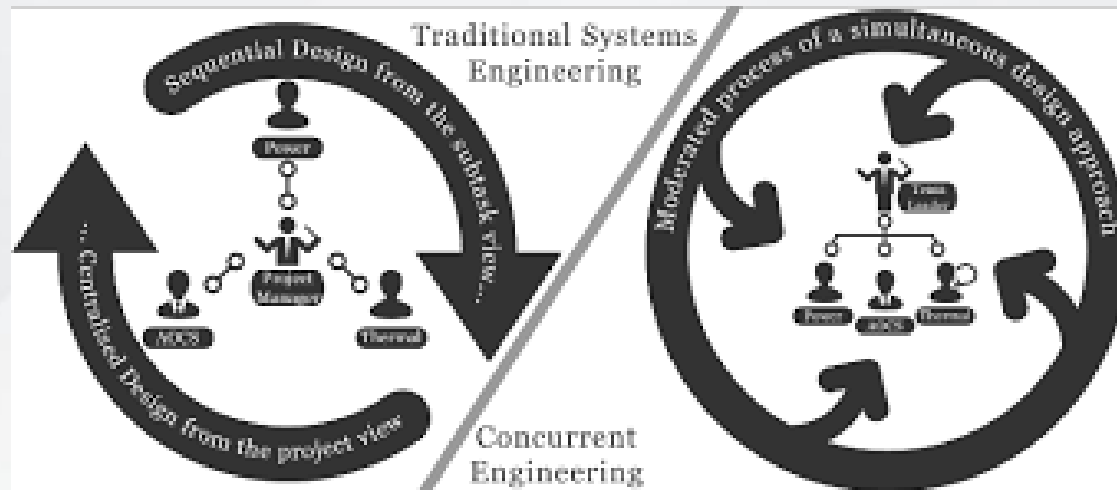
- **Research and Development (R&D)**
 - Organized efforts to increase scientific knowledge or product innovation
- **Basic research**
 - Has the objective of advancing the state of knowledge about a subject without any near-term expectation of commercial applications
- **Applied research**
 - Has the objective of achieving commercial applications
- **Development**
 - Converts the results of applied research into useful commercial applications.

Designing for Production

- Concurrent engineering
- Computer-assisted design
- Designing for assembly and disassembly
- Component commonality

Concurrent Engineering

- Bringing engineering design and manufacturing personnel together early in the design phase
 - Also, may involve marketing and purchasing personnel
 - Views of suppliers and customers may also be sought



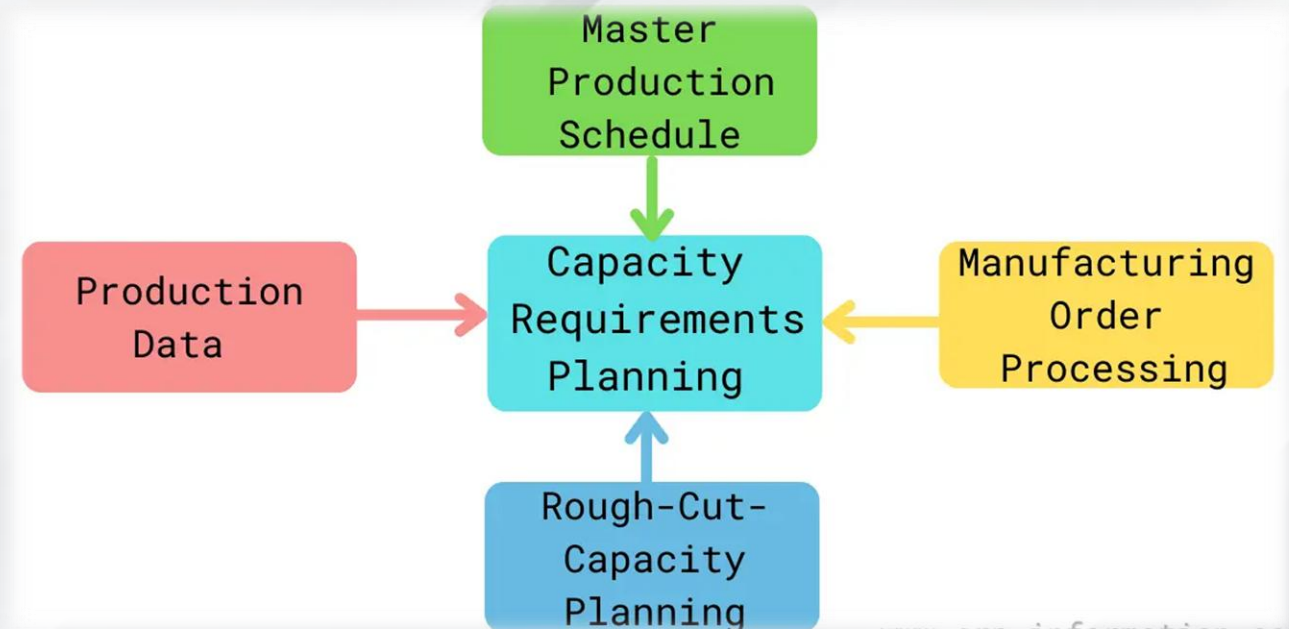


Computer-Aided Design (CAD)

- Product design using computer graphics
- Advantages
 - increases productivity of designers, 3 to 10 times
 - creates a database for manufacturing information on product specifications
 - provides possibility of engineering and cost analysis on proposed designs
- CAD that includes finite element analysis (FEA) can significantly reduce time to market
 - Enables developers to perform simulations that aid in the design, analysis, and commercialization of new products to save time.

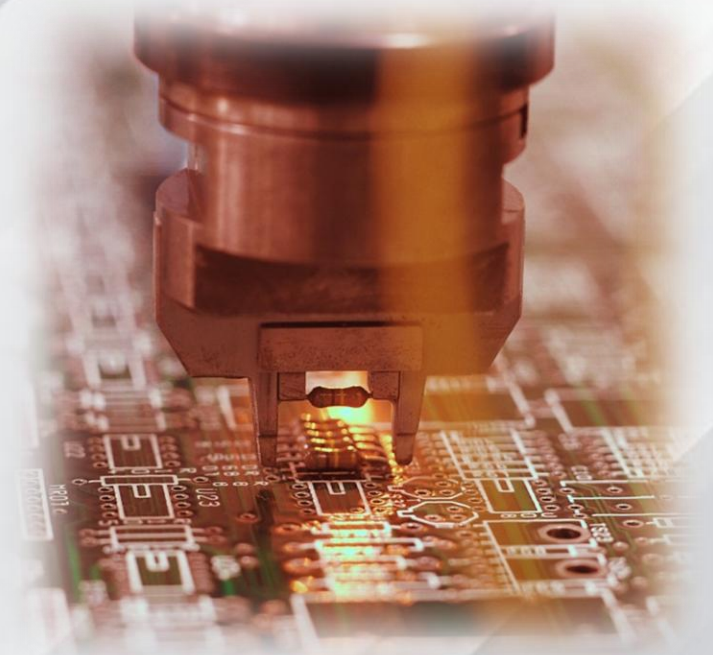
Production Requirements

- Designers must consider production capabilities
 - Equipment
 - Skills
 - Types of materials
 - Schedules
 - Technologies



Manufacturability

- **Manufacturability**
 - Ease of fabrication and/or assembly
 - It has important implications for
 - Cost
 - Productivity
 - Quality



DFM and DFA



- **Design for manufacturing (DFM)**
 - The designing of products that are compatible with an organization's abilities
- **Design for assembly (DFA)**
 - Design that focuses on reducing the number of parts in a product and on assembly methods and sequence

Component Commonality

- When products have a high degree of similarity in features and components, a part can be used in multiple products
- Benefits:
 - Savings in design time
 - Standard training for assembly and installation
 - Opportunities to buy in bulk from suppliers
 - Commonality of parts for repair
 - Fewer inventory items must be handled

Kano Model

- **Basic quality**

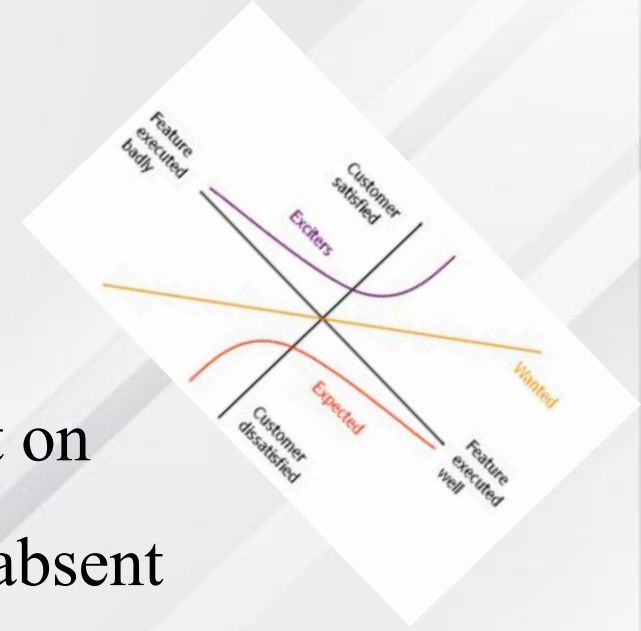
- Refers to customer requirements that have only limited effect on customer satisfaction if present, but lead to dissatisfaction if absent

- **Performance quality**

- Refers to customer requirements that generate satisfaction or dissatisfaction in proportion to their level of functionality and appeal

- **Excitement quality**

- Refers to a feature or attribute that was unexpected by the customer and causes excitement



Service Design Definitions

- **Service**

- Something that is done to, or for, a customer

- **Service delivery system**

- The facilities, processes, and skills needed to provide a service

- **Product bundle**

- The combination of goods and services provided to a customer

Service Design

- Begins with a choice of service strategy, which determines the nature and focus of the service, and the target market
 - Key issues in service design
 - Degree of variation in service requirements
 - Degree of customer contact and involvement

Reducing consumer choices makes service more efficient

Service Blueprint

FIGURE 4.7 A simple service blueprint for a restaurant

Customer actions	Arrive	Seated	Order	Eat	Pay and leave	
line of information						
Contact persons	Greeted by hostess Hostess checks reservation Hostess escorts customers to their table	Greeted by server Server provides menus Server fills water glasses	Server describes specials Server takes orders	Dinners are served	Server occasionally checks to see if any problems Server brings the check Server receives payment	Busboy clears table
line of visibility						
Backstage contacts			Kitchen staff prepares food			Dishes are washed
line of internal interaction						
Support	Reservation system		Ordering food		Cashier	Laundry service



Thank You