UNIT 9
Product and Service Design

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Reasons for Product or Service Design

- Be competitive through the introduction of new products
- Business growth & profits
- Alternative to downsizing through the development of new products

What Does Product and Service Design Do? (1 of 2)

- Translates customer wants and needs into product and service requirements (marketing)
- Refines existing products and services (marketing)
- Develops new products and/or services (marketing, operations)

What Does Product and Service Design Do? (2 of 2)

- Formulates quality goals (quality assurance, operations)
- Formulates cost target (accounting)
- Constructs and tests prototypes (marketing, operations)
- Documents specifications (engineering, operations)

Objectives of Product & Service Design

- Satisfy the customer while making a reasonable profit
- Other considerations include
  - development time and cost
  - product or service cost
  - product or service quality
  - design for operations (manufacturability)

The Design Process

- Motivation
- Customer
- Ideas
  - marketing
  - research & development
  - competitors
- Operations capabilities
- Forecasts

Identifying New Product Opportunities

- Factors influencing market opportunities
  - economic change
  - sociological and demographic change
  - technological change
  - political change
- Other sources of changes and opportunities
  - market practices
  - professional standards
  - suppliers
  - distributors

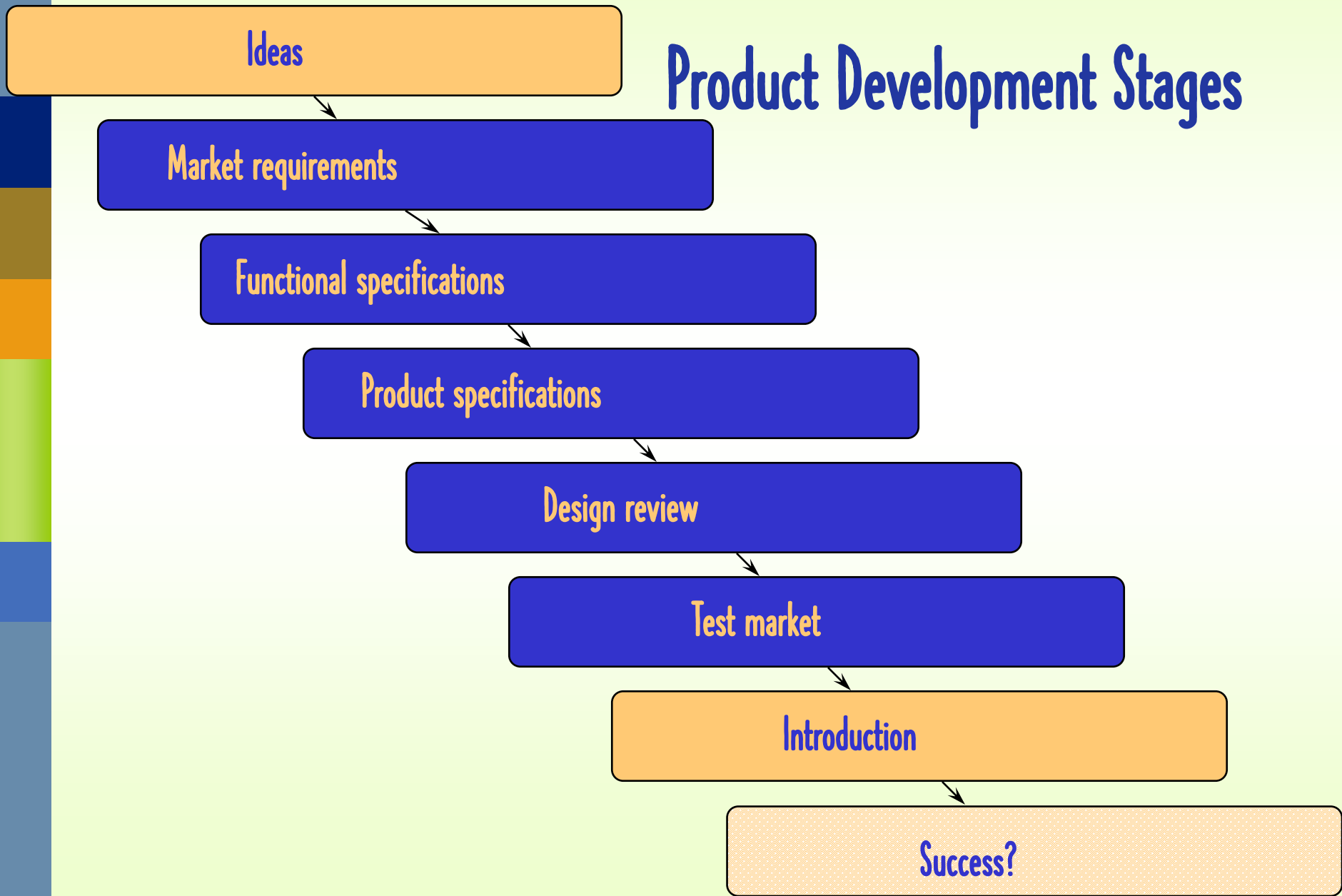
Example of How to Use the Competition

- *Reverse engineering* is the dismantling and inspecting of a competitor's product to discover product improvements

Research & Development (R&D)

- Organized efforts to increase scientific knowledge or product innovation & may involve
  - ***Basic Research*** advances knowledge about a subject without near-term expectations of commercial applications.
  - ***Applied Research*** achieves commercial applications.
  - ***Development*** converts results of applied research into commercial applications.

Product Development Stages

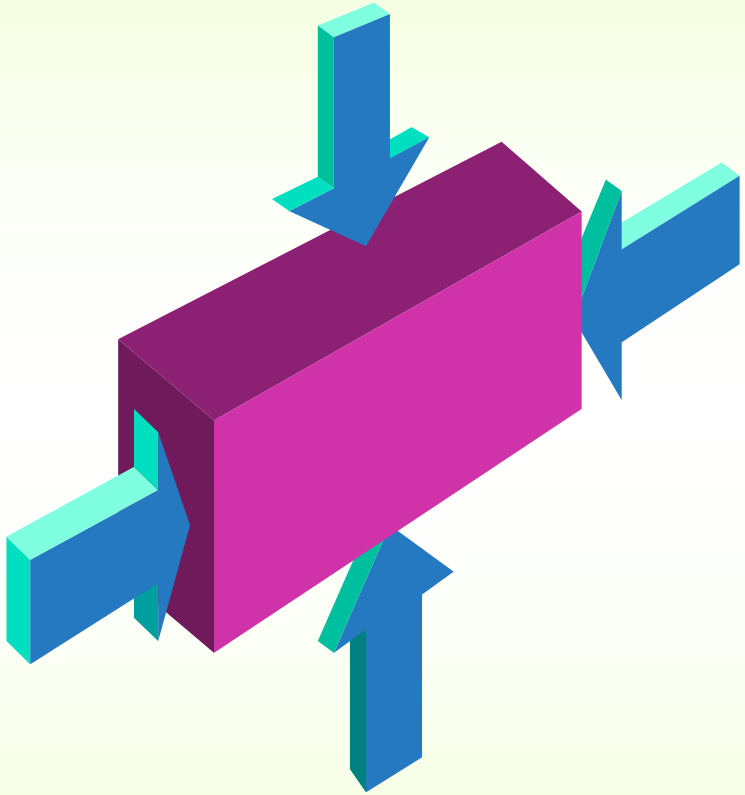


Legal, Ethical, and Environmental Issues

- Legal
  - FDA, OSHA, IRS
  - Product liability
  - Uniform commercial code
- Ethical
  - Releasing products with defects
- Environmental
  - EPA

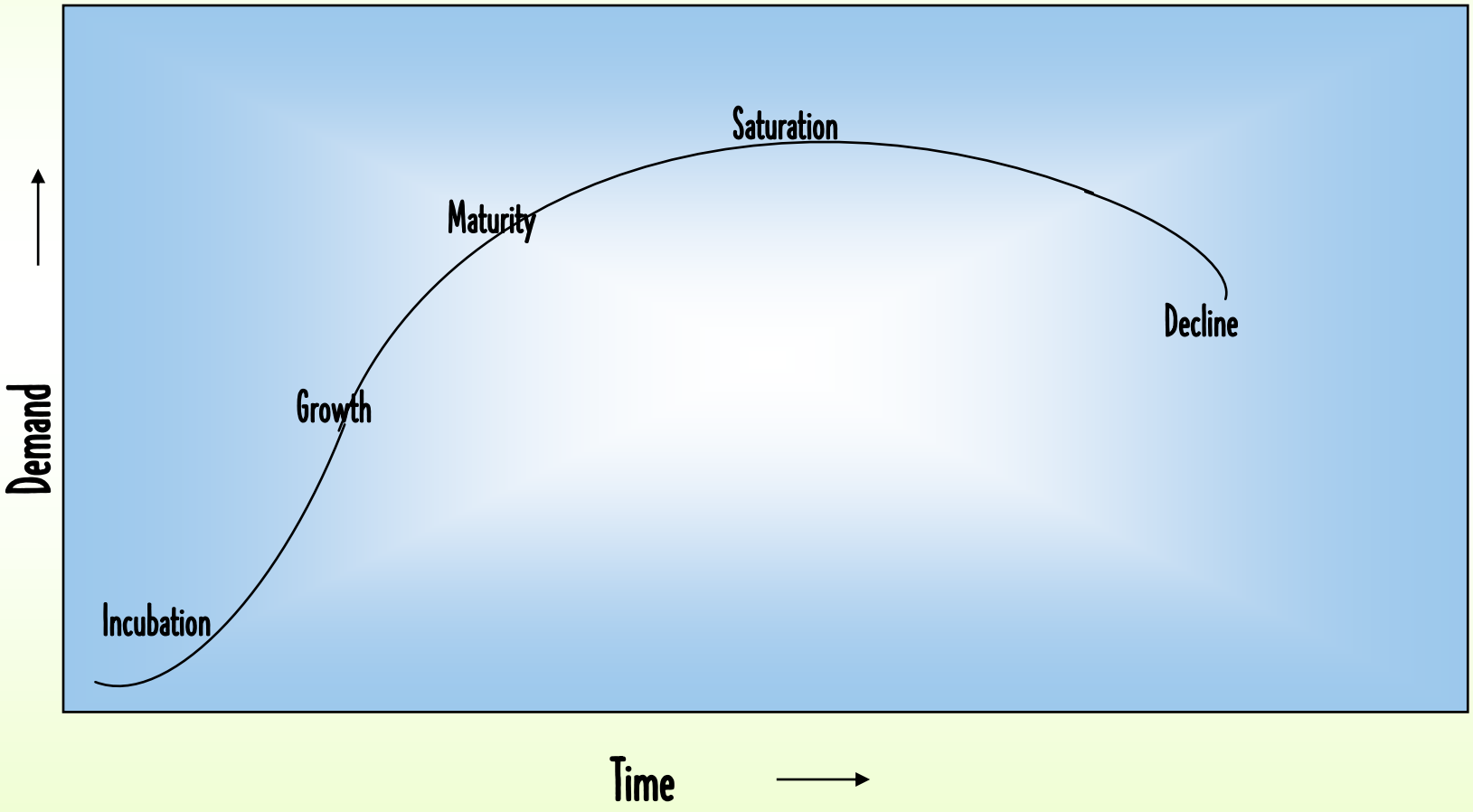
Other Issues in Product Design

- Product Life Cycles
- Standardization
- Mass Customization
- Reliability
- Robust Design
- Concurrent Engineering
- Computer-Aided Design



Life Cycles of Products or Services

Figure 4-2



Degree of Standardization

- *Standardization* is the extent to which there is absence of variety in a product, service, or process
- This results in interchangeable parts

Advantages of Standardization (2 of 2)

- Orders fillable from inventory
- Opportunities for long production runs and automation
- Need for fewer parts justifies increased expenditures on perfecting designs and improving quality control procedures.

Disadvantages of Standardization

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

Mass Customization

- A strategy of producing standardized goods or services, but incorporating some degree of customization

Delayed Differentiation

- Delayed differentiation is a postponement tactic
- Producing but not quite completing a product or service until customer preferences or specifications are known

Modular Design

- A form of standardization in which component parts are subdivided into modules that are easily replaced or interchanged.
- It allows
  - easier diagnosis and remedy of failures
  - easier repair and replacement
  - simplification of manufacturing and assembly

Reliability

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

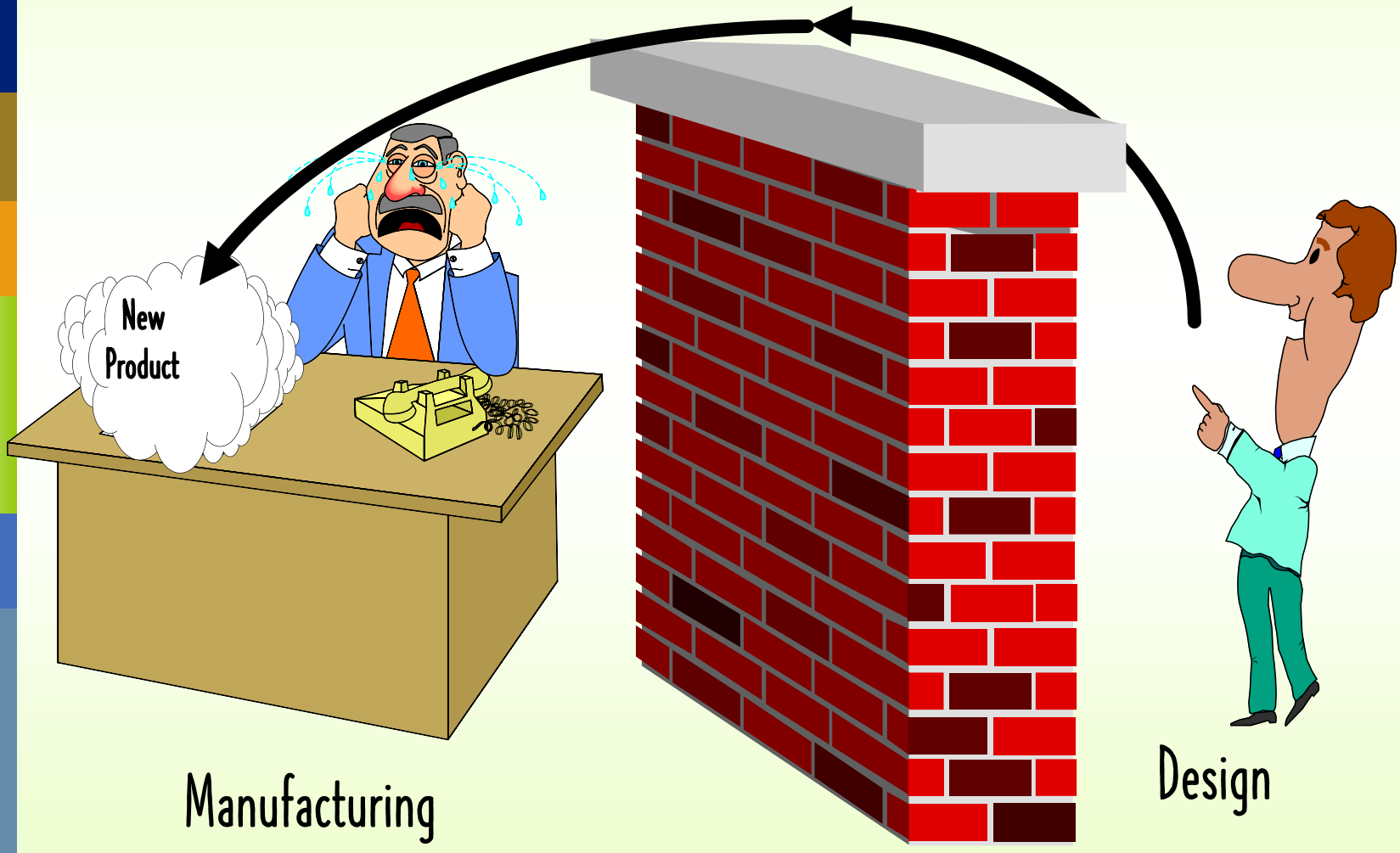
Improving Product Reliability

- Component design
- Testing
- Redundancy
- Preventive maintenance procedures
- User education
- System design

Robust Design

- Product performs as designed over a broad range of conditions
- Less likely to fail due to a change in the environment
- A similar approach can be used for manufacturing processes
- Taguchi's approach involves determining the specifications that will result in a robust design

Traditional "Over the Wall" Approach to Design



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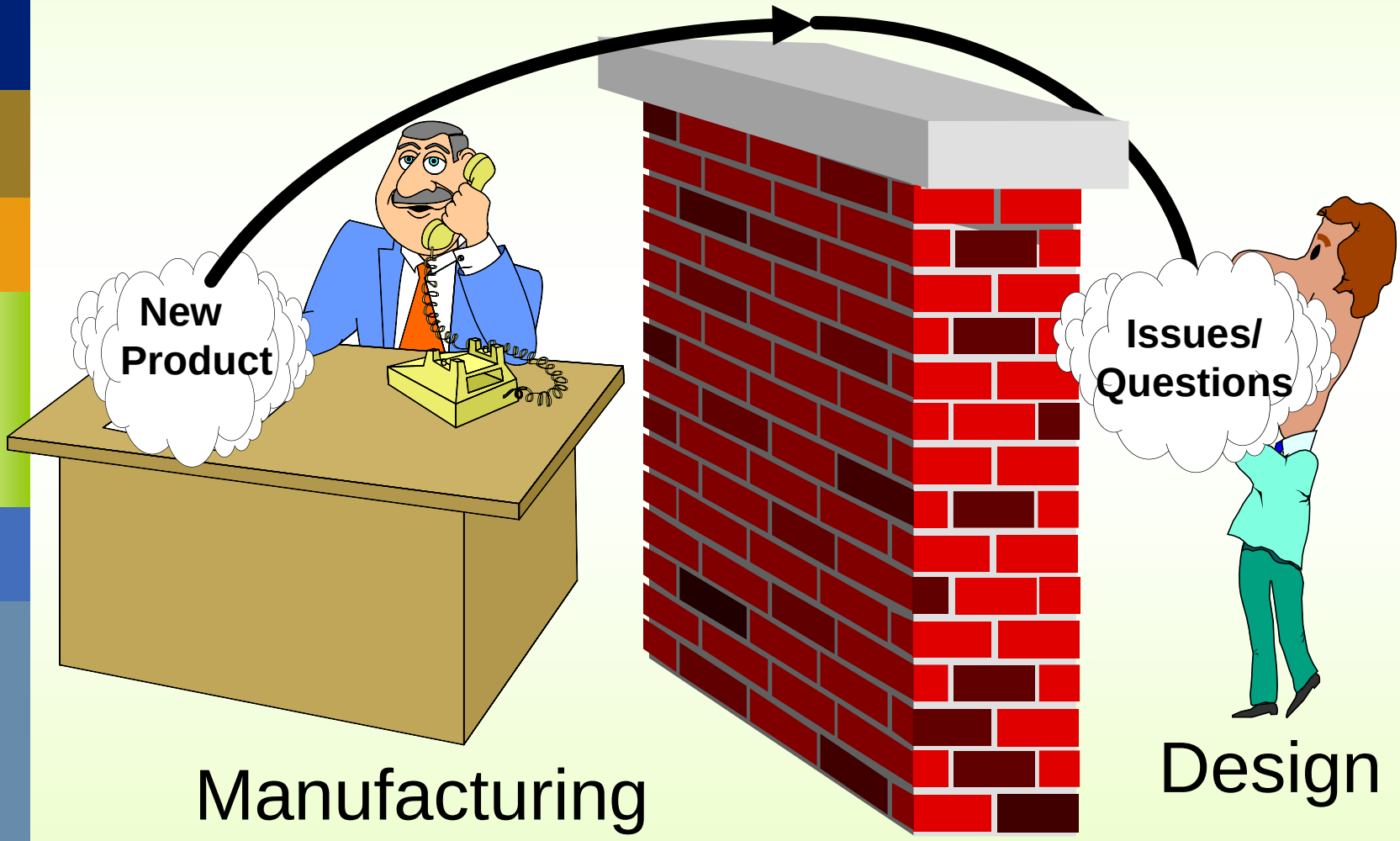
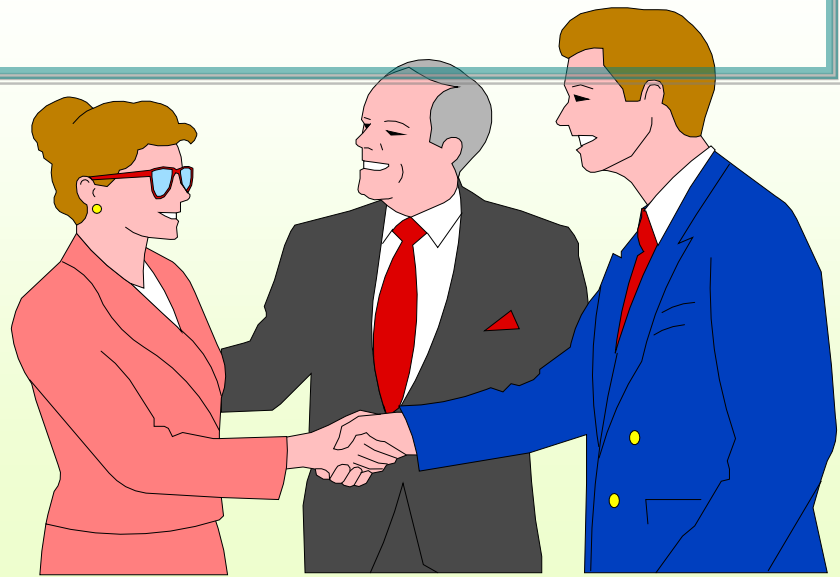


Concurrent Engineering Approach (1 of 3)

Concurrent engineering is the bringing together of design, marketing, accounting, manufacturing and other relevant personnel early in the design phase

Allows certain design and development activities to go on simultaneously



Concurrent Engineering Approach (2 of 3)

- Advantages
  - manufacturing able to identify operations capabilities and capacities
  - early opportunities to procure critical resources with long lead times
  - early consideration of technical feasibility of the design
  - emphasis on problem resolution, not conflict resolution

Concurrent Engineering Approach (3 of 3)

- Difficulties
  - long-standing existing boundaries can be difficult to overcome
  - there must be extra communication and flexibility

Computer-Aided Design

- Computer-Aided Design (CAD) is product design using computer graphics.
  - 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

Manufacturing Design Considerations (1 of 2)

- Design for manufacturing (DMF)
  - design compatible with operations capabilities
  - manufacturability – ease of fabrication and/or assembly which impacts cost, productivity and quality
- Design for assembly (DFA)
  - reduce the number of parts in an assembly
  - assembly method and sequence
- Design for recycling (DFR)
  - allows for dis-assembly of used products to recover components and material for reuse

Manufacturing Design Considerations (2 of 2)

- Design for remanufacturing
  - Refurbishing used by replacing worn out or defective components
  - Reasons for remanufacturing
    - can be sold at a much reduced price
    - requires mostly unskilled and semi-skilled workers
    - becoming a requirement
  - Design for dis-assembly (DFD)
    - product can be easily taken apart
    - use fewer parts and less material

Service Design

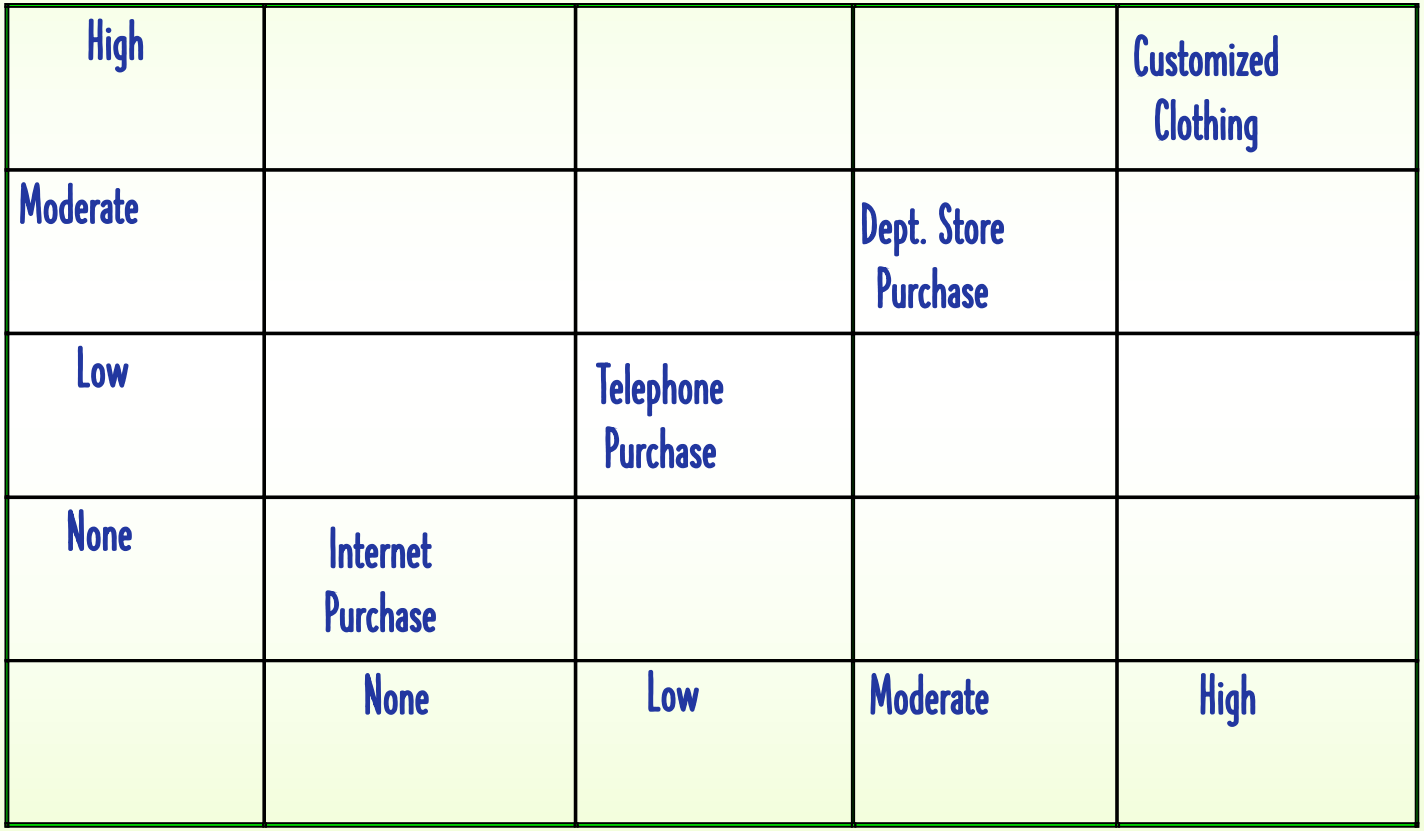
- Differences between service design and product design
- Overview of service design
- Design guidelines

Differences Between Product and Service Design

- Tangible - intangible
- Services created and delivered at the same time
- Services cannot be inventoried
- Services highly visible to customers
- Services have low barrier to entry
- Location important to service

Service Variability & Customer Influence Service Design

Figure 4-3



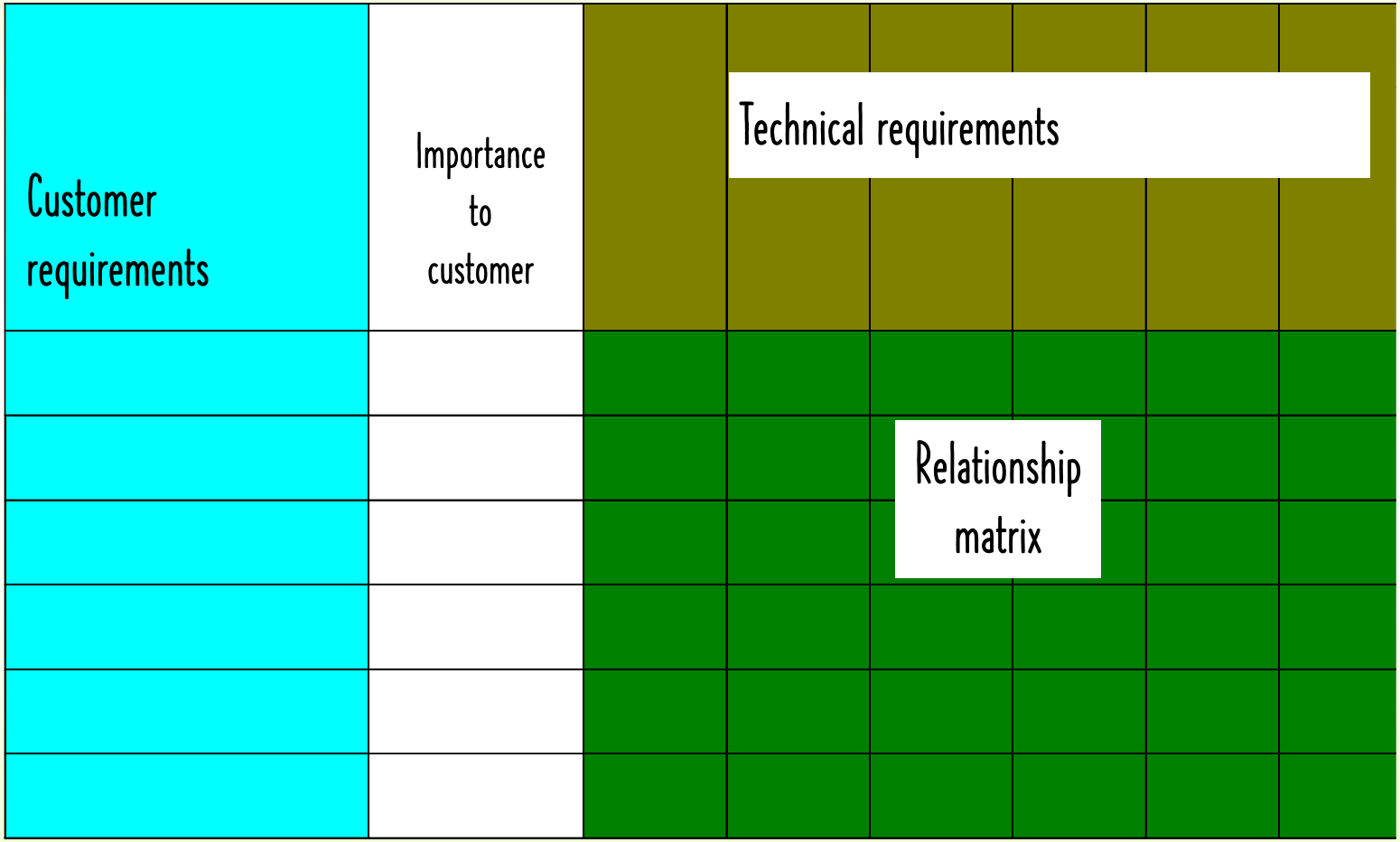
Design Guidelines

- Have a single, unifying theme
- Make sure the system has capability to handle variability in demand
- Include design features to ensure quality
- Design system to be user friendly

Quality Function Deployment

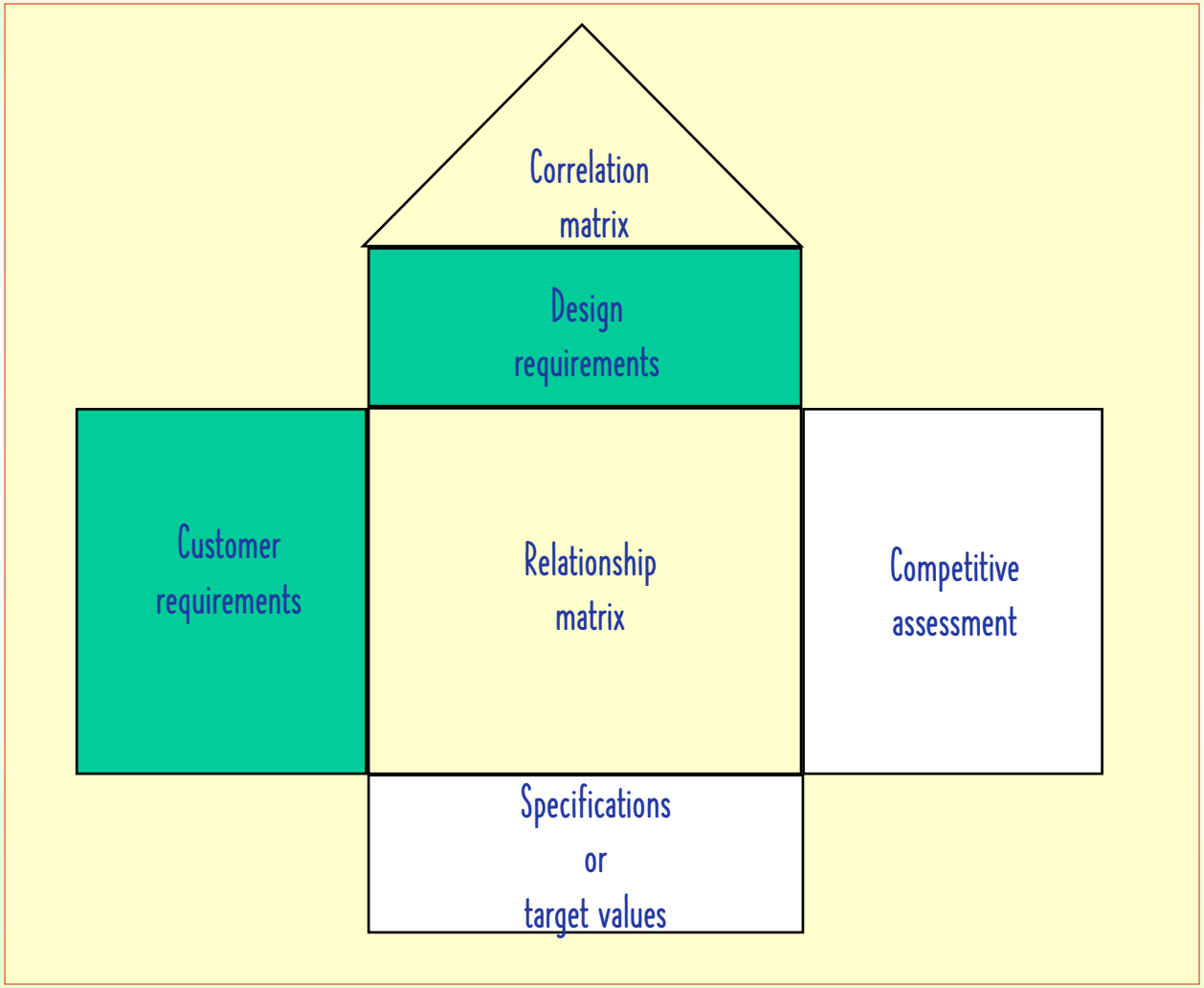
- A structured approach for integrating the "voice of the customer" into the product or service development process
- Ensure that customer requirements are translated into technical terms related to the product or service
- Based on a set of matrices
  - main QFD matrix
  - house of quality

The Main QFD Matrix

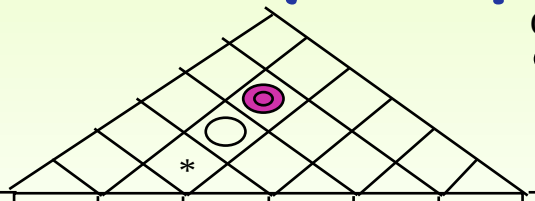


The House of Quality

Figure 4-5



House of Quality Example



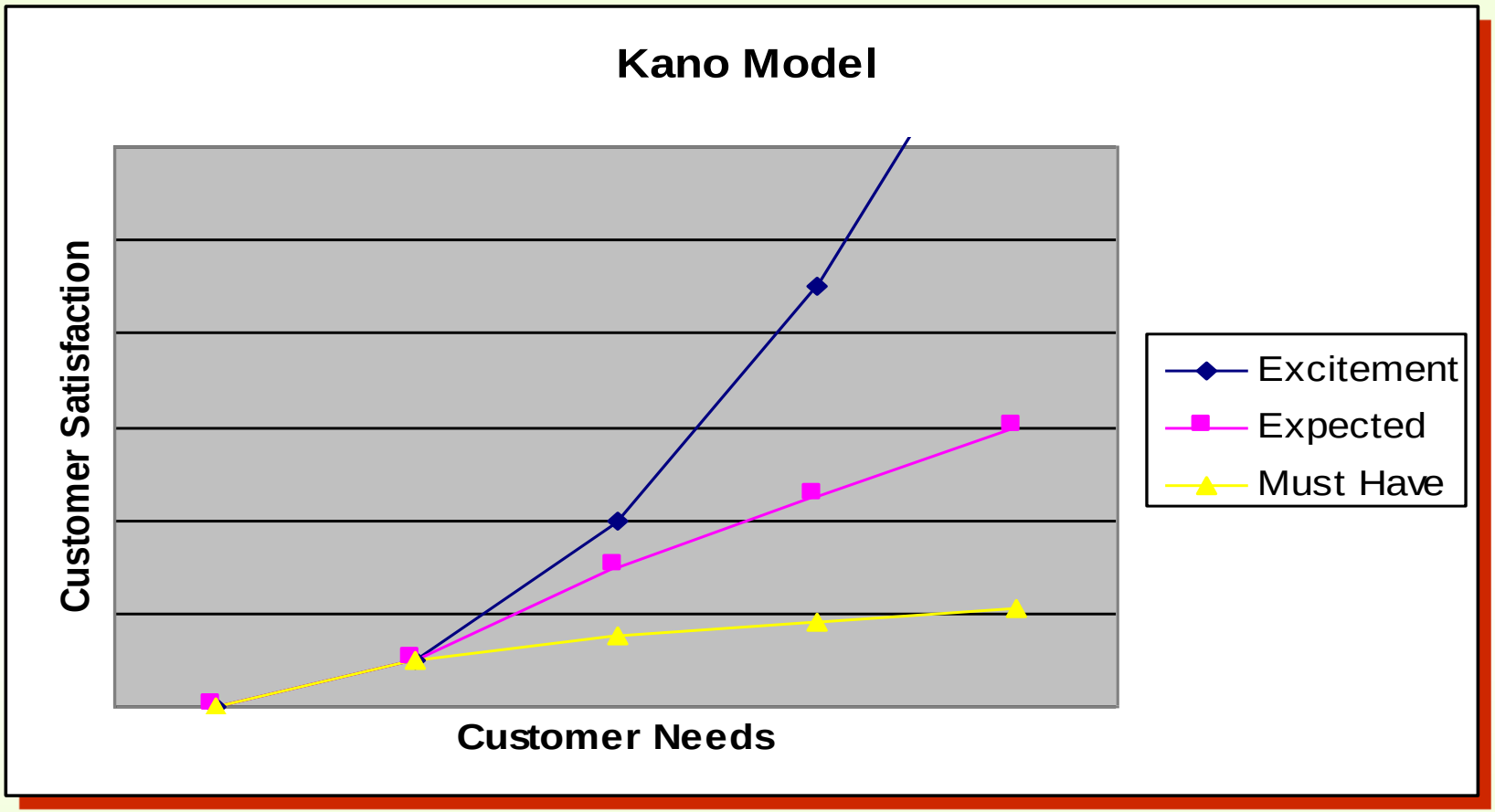
Correlation:
- Strong positive
- Positive
- X Negative
- * Strong negative

Customer Requirements	Importance to Customer	Paper width	Paper thickness	Roll roundness	Coating thickness	Tensile strength	Paper color	Competitive evaluation (X = Us, A = Comp. A, B = Comp. B, (5 is best))
Paper will not tear	3	△	○	◎		◎		X A B
Consistent finish	1				○			A X B
No ink bleed	2		◎		○			B A X
Prints clearly	3			○	◎		○	X AB
Importance weighting		3	27	36	36	27	9	
Target values		w mm	t mm	1 mm Total runout	C microns	5 lbs.	Within Approval panel	
Technical evaluation (5 is best)	5 4 3 2 1	B X A	A X B	B A X	A X B	A B X	X A B	

Relationships:
- Strong = 9
- Medium = 3
- Small = 1

The Kano Model

Figure 4-7



Design Characteristics

Operations Strategy

- Shortening time-to-market
- Packaging products and ancillary services
- Increasing emphasis on component commonality
- Using multiple-use platforms
- Considering tactics for mass customization
- Looking for continual improvement