Lesson 06
Product & Service Design

Objective to achieve customer satisfaction while making a reasonable profit

Plays a strategic role in the degree to which an organization is able to achieve its goals.

Fundamental Business Equation

In a product or service business the most fundamental equation is

$$\frac{S \cdot C}{P}$$

Managers must understand the consequences of their decisions in terms of how they impact this formula.

Product/Service Design

Product/Service design can affect both sales and profits. Organizations that have well defined products/services are more likely to realize their goals than those with poorly designed products/services.

The Design Process must balance the benefits (appeal, features, etc) of the design with the costs (maintenance, service, etc.) of the design.
Lesson 06 – Product & Service Design

**Reasons for Product/Service Design**

- **Competition** - offering better more desirable products either to compete with your own or a competitors
- **Improve Profitability**
- **Lower costs** - more efficient production, lower labor, reduce number of parts, etc.
- **Increase sales** - new products, improve old products
- **Customer complaints** - accidents or injuries, excessive claims
- **Improve quality**
- **Regulations** (EPA, OSHA, ADA, etc)

**Trends In Product/Service Design**

- Increased emphasis on customer satisfaction - *user friendly products*
- Reduction in *time to bring* a new concept/product to market
- Reduction in *time to produce* a product
  - (8 min jean takes 28 days to produce)
- Greater attention to the *capabilities of the organization*
- Greater attention to the supply chain - *strategic supplier partnerships*
- Greater emphasis on *environmental concerns* - waste management, recycling, disposal of worn out part, etc.
- Increased effort to utilize less materials - *standardization*

**The Design Process**

- Idea generation
- Feasibility study
- Product feasible?
- Yes: Preliminary design
- No: Idea generation
- Final design
- Prototype
- Process planning
- Design & Manufacturing Specifications
- Manufacturing

Copyright – Harland E. Hodges, Ph.D
**Where Do Ideas Originate?**

- **Customers** - new products, complaints, liability issues, warranty claims
- **Competitors** - reverse engineering - dismantling and inspecting a competitor's product to discover product improvements
  - benchmarking – comparisons to “best” in class
- **Regulations, Standards, Legal Issues**
- **Research & Development (R&D) Departments**
- **Manufacturing** - manufacturability - the ease of which a product can be fabricated or assembled with respect to cost, quality productivity
- **Suppliers, Distributors, Salespersons**
- **Business Conditions** - needs for growth, increased profit, market share, etc.

**Regulations, Standards & Legal Issues**

**Regulatory Agencies**
- FDA (Food and Drug Administration)
- EPA (Environmental Protection Agency)
- NHTSA (National Highway Traffic Safety Administration)
- CPSC (Consumer Products Safety Commission)
- OSHA (Occupational Safety & Health Administration)

**Legal Considerations**
- Product Liability - any injuries/damages
- Errors and Omissions

**Industry Standards**
- Bar Codes (Uniform Code Council)
- Technology Standards (American National Standards Institute)
- Labeling Requirements

**Research & Development (R&D)**

R&D represents organized efforts that are directed toward increasing scientific knowledge and product or process innovation

- **Basic Research** - the objective of which is to advance the state of knowledge about a subject without any near term expectation of commercial application. Because it does not lead to near term commercialization, usually is underwritten by the government or large companies (Kodak, IBM, AT&T, GM, 3M)
- **Applied Research** - to achieve commercial application. Because of its near term impact on sales/profits, it is much more common.
- **Development** - converts the results of research into useful commercial applications
Lesson 06 – Product & Service Design

Research & Development (R&D)

For some companies the advantages of R&D can be tremendous. Research Protection (patents, trademarks, copyrights) (United States Patent & Trademark Office) First to market can yield a competitive advantage; however, it may not be easy to keep the advantage ... competition is sure to follow any good idea. However, R&D and technology in and of itself does not necessarily guarantee success! A good business strategy/plan/execution combined with a research and development strategy are necessary for prolonged success (e.g. dot.com business).

Standardization of Product/Service Design

Standardization refers to the absence of variety in products/services

Advantages
- interchangeable parts resulting in fewer items
- reduced time for training workers
- may require less effort (purchasing, facilities, inventory management)

Disadvantages
- reduction in variety limiting the range of potential customers

Differences Product/Service Design

Products - tangible, Services - intangible (intangible factors such as peace of mind, ambiance, feelings are important)

Services usually occur at the time of need (e.g. haircut, bank transaction, car wash) making it more difficult to provide consistent service (training, customer relations and process design are particularly important)

Services can not be inventoried thus placing restrictions on flexibility and increasing the need for capacity design

Services are highly visible to consumers

Some services have low barriers to entry and exit making it difficult to be innovative and cost effective

Location/convenience is often a major factor in service design
Product Life Cycles
Manufacturing Design
Re-manufacturing
Robust Design
Concurrent Engineering
Computer Aided Design
Modular Design

Approaches To Product Design

Product Life Cycle

Demand changes over time

Product Life Cycle Phases

Introduction - low familiarity and demand, prices may not be very competitive (DVD)
Growth - production and design improvements can reduce costs to stimulate demand (PC)
Maturity - few design changes, demand levels off (TV)
Saturation - those who want one have one and new “bells and whistles” aren’t wanted/needed (Basic Calculator)
Decline - decisions should be made regarding product future (8 Track Tapes)
**Manufacturing Design**

*Design for Manufacturing* (DFM) - designing products that are compatible with an organization’s capabilities.

*Design for Operations* encompasses administrative functions as well as manufacturing functions.

*Design for Assembly* (DFA)/*Design for Disassembly* (DFD) - related to DFM, it deals with not only how a product will be fabricated but with the assembly/disassembly procedures (e.g. training, methods, reduced materials, sequence of assembly, etc.)

*Design for Recycling* (DFR) - focuses on designing products to allow for disassembly/recovery of used products for reuse.

---

**Design Simplification**

Original design | Revised design | Final design

---

**Re-manufacturing**

*Deals with the removal/recovery of old products and reusing them (DFR) to create new products.* This can be done by the Original Equipment Manufacturer (OEM) or another company. Typical products that utilize a DFR and Re-manufacturing concepts include:

- Automobiles
- Computers, printers and copiers
- Cameras
- Telephones
- Plastic and paper products

Re-manufacturing creates “environmentally friendly” products.
Robust Design
Robust design deals with designing products that can function over a broad range of conditions thus creating broader acceptance and satisfaction.

Can you think of some other examples?
- rubber boots
- microwave safe plastics
- ceramics

Premise: It is often easier to design a product that is insensitive to environmental factors (either in manufacturing or use) than to control the environment.

Utilizes parameter design and statistical experimentation (DSCI 232 concepts) to determine the specification settings for both the product/process in terms of manufacturing variations, product deterioration, and conditions during use.

Concurrent Engineering
Concurrent engineering deals with bringing all interested parties together early in the design process to deal with issues associated with design, marketing, manufacturing, quality, supply, etc. to eliminate over the wall product design.

What are they thinking ... We can't make this thing!
Concurrent Engineering Key Advantages

Manufacturing can identify production capabilities, capacities, materials, and design alternatives to assist in manufacturability.
Identifies early opportunities for special tooling, equipment, training, etc., some of which have long lead times.
Early consideration of technical feasibility of a design
Can shorten overall “time to market”
Focuses attention on cooperation and problem resolution instead of conflict resolution (finger pointing)
However, long standing boundaries must be overcome!

CAD, CAM

Almost all manufacturing companies utilize some level of computer aided technology (Computer Aided Design or Computer Aided Manufacturing) for the design and manufacturing of its products.
Can you think of a service business which utilizes CAD?

Modular Design

A form of standardization in which component parts are subdivided into modules that are easily replaced.

- **Computer/Electronics Industry** - component parts
- **Construction Industry** - pre-constructed floor joists, pre-constructed hotel rooms
- **Automotive Industry** - same body style can have different engines and suspensions

**Advantages:** fewer inventoried parts, purchasing and inventory control can be simpler and more routine, fabrication and assembly procedures can become more standardized thus lowering training and labor costs, take advantage of a suppliers strengths rather than invent the sub-component in your own facilities.
Service design begins with the **strategy** which determines the target market and the nature/focus of the service. Some guidelines for service design are listed below:

- **Begin with a single unifying theme** (e.g. convenience or speed) to provide direction to those who perform the service.
- **Make sure that the system has the capability to handle unexpected variability**.
- **Include checks to ensure that the service will be reliable** and will provide consistent high quality (e.g. this call will be recorded).
- **Design the system to be user friendly**... especially important for self-service systems (e.g. ATM transactions).
### Customer Contact & Service Design

<table>
<thead>
<tr>
<th>Service Req'mts</th>
<th>High</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

Degree of Customer Contact

- None
- Low
- Moderate
- High

Identify the matrix position for each of the following services.

- A - Internet Purchase
- C - Department Store Purchase
- B - Telephone Purchase
- D - Customized Clothing Purchase

### Service Blueprinting

Service blueprinting is a method for describing and analyzing a service or proposed service.

- establish boundaries for the service process and decide on the level of service detail that will be needed
- identify the steps involved and describe them ... if there is and existing process consult those who currently do it
- prepare a flow chart for major process steps ... it will help train new personnel who will perform the service
- identify potential failure points and incorporate features that minimize the chances for failures (e.g. hold on a minute while I consult with my supervisor)

### Service Blueprinting (cont'd)

- establish a time frame for service execution and estimate the variability in processing time requirements ... remember that time is a cost ... however, there are some circumstances where shorter = better (e.g. ATM transaction) and circumstances where shorter = worse (e.g. dinner at a fine upscale restaurant)
- analyze perceived value or profitability to determine key factors that influence the service ... then concentrate designing the service process accordingly.
- establish design features that concentrate on maximizing the positive and minimizing the negative
**Service Blueprinting – Shoe Shine**

- **Standard execution time**: 2 minutes
- **Total acceptable execution time**: 5 minutes
- **Brushe shoes**: 30 secs
- **Apply polish**: 30 secs
- **Buff**: 45 secs
- **Collect payment**: 15 secs
- **Wrong color wax**: 45 secs
- **Clean shoes**: 45 secs
- **Materials** (e.g., polish, cloth)

- **Line of visibility**
  - Not seen by customer but necessary to performance
  - Seen by customer

**Goods-Service Spectrum**

- **Steel production**
- **Automobile fabrication**
- **House building**
- **Road construction**
- **Dressmaking**
- **Farming**
- **Auto Repair**
- **Appliance repair**
- **Maid Service**
- **Manual car wash**
- **Teaching**
- **Lawn mowing**

**When Is It Product/Service Design?**

Product design and service design may go hand in hand (e.g., carpet installation, oil change, fast food hamburger) and the consumer evaluates them simultaneously.

For example: If you are getting a fast food hamburger and it takes an inordinately long time, you might not go back.

In some cases a service may not involve a product at all (e.g., hair styling, bank transaction, getting your lawn mowed, education).

Since services have a high degree of customer contact, it is extremely important to place high emphasis on the process design for delivering the service.
Quality Function Deployment (QFD)

QFD refers to a structured approach for integrating the voice of the customer into the product/service development process. The methodology is based on a set of matrices which correlate customer requirements with technical requirements.

**Quality Function Deployment (QFD)**

**Correlation matrix**

<table>
<thead>
<tr>
<th>Customer requirements</th>
<th>Design requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifications or target values</td>
<td>Competitive assessment</td>
</tr>
</tbody>
</table>

**Relationship matrix**

<table>
<thead>
<tr>
<th>Customer requirements</th>
<th>Technical Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper Width</td>
<td>Paper Thickness</td>
</tr>
<tr>
<td>Paper won't tear</td>
<td>3</td>
</tr>
<tr>
<td>Consistent finish</td>
<td>1</td>
</tr>
<tr>
<td>No ink bleed</td>
<td>2</td>
</tr>
<tr>
<td>Prints Clearly</td>
<td>3</td>
</tr>
</tbody>
</table>

**Importance Weighting**

<table>
<thead>
<tr>
<th>Paper Width</th>
<th>Paper Thickness</th>
<th>Roll Roundness</th>
<th>Coating Thickness</th>
<th>Tensile Strength</th>
<th>Paper Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>27</td>
<td>36</td>
<td>36</td>
<td>27</td>
<td>9</td>
</tr>
</tbody>
</table>

**Benefits of QFD**

- Promotes better understanding of customer demands
- Promotes better understanding of design interactions
- Involves manufacturing in the design process
- Breaks down barriers between functions and departments
- Improves documentation of the design and development process
- Focuses the design effort
- Fosters teamwork
- Provides a database for future designs
- Increases customer satisfaction
- Reduces the number of engineering changes
- Brings new designs to the market faster
- Reduces the cost of design and manufacture
Reliability

Reliability is the ability of a product, part or system to perform its intended function under a prescribed set of conditions (normal operating conditions).

Failure - does not perform as intended

Reliability assurance relies heavily on the disciplines of probability and statistics.

Have you ever heard the term mean-time-before failure?

Can you give an example of a product that has a high reliability standard? automobile airbags

Improving Reliability

Component design
Production/assembly techniques
Testing
Redundancy
Preventive maintenance procedures
User education
System design

Homework

Read and understand all material in the chapter.

Discussion and Review Questions
Recreate and understand all classroom examples
Exercises on chapter web page