Goods and Services Selection

► Organizations exist to provide goods or services to society
► Great products are the key to success
► Top organizations typically focus on core products
► Customers buy satisfaction, not just a physical good or particular service
► Fundamental to an organization's strategy with implications throughout the operations function
Goods and Services Selection

- Limited and predictable life cycles require constantly looking for, designing, and developing new products
- Utilize strong communication among customer, product, processes, and suppliers
- New products generate substantial revenue
Goods and Services Selection

The higher the percentage of sales from the last 5 years, the more likely the firm is to be a leader.

Figure 5.1

Position of firm in its industry
Product Decision

The objective of the product decision is to develop and implement a product strategy that meets the demands of the marketplace with a competitive advantage.
Product Strategy Options

- Differentiation
  - Shouldice Hospital
- Low cost
  - Taco Bell
- Rapid response
  - Toyota
Product Life Cycles

- May be any length from a few days to decades
- The operations function must be able to introduce new products successfully
Product Life Cycle

Cost of development and production

Sales revenue

Introduction  Growth  Maturity  Decline

Loss  Profit

Figure 5.2
Life Cycle and Strategy

Introductory Phase

► Fine tuning may warrant unusual expenses for
  1) Research
  2) Product development
  3) Process modification and enhancement
  4) Supplier development
Product Life Cycle

Growth Phase

► Product design begins to stabilize
► Effective forecasting of capacity becomes necessary
► Adding or enhancing capacity may be necessary
Product Life Cycle

Maturity Phase

- Competitors now established
- High volume, innovative production may be needed
- Improved cost control, reduction in options, paring down of product line
Product Life Cycle

Decline Phase

- Unless product makes a special contribution to the organization, must plan to terminate offering
Product Life Cycle Costs

Costs incurred

Costs committed

Ease of change

Percent of total cost

Concept design
Detailed design prototype
Manufacturing
Distribution, service, and disposal

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Product-by-Value Analysis

- Lists products in descending order of their individual dollar contribution to the firm
- Lists the total annual dollar contribution of the product
- Helps management evaluate alternative strategies
Generating New Products

1. Understanding the customer
2. Economic change
3. Sociological and demographic change
4. Technological change
5. Political and legal change
6. Market practice, professional standards, suppliers, distributors
Product Development Stages

Concept

Feasibility

Customer Requirements

Functional Specifications

Product Specifications

Design Review

Test Market

Introduction

Evaluation

Scope for design and engineering teams

Scope of product development team

Figure 5.3
Quality Function Deployment

- Quality function deployment (QFD)
  - Determine what will satisfy the customer
  - Translate those customer desires into the target design

- House of quality
  - Utilize a planning matrix to relate customer *wants* to *how* the firm is going to meet those *wants*
Quality Function Deployment

1. Identify customer *wants*
2. Identify *how* the good/service will satisfy customer wants
3. Relate customer wants to product *hows*
4. Identify relationships between the firm’s *hows*
5. Develop *our* importance ratings
6. Evaluate competing products
7. Compare performance to desirable technical attributes
QFD House of Quality

- Interrelationships
- How to satisfy customer wants
- Customer importance ratings
- Relationship matrix
- Competitive assessment
- Weighted rating
- What the customer wants
- Target values
- Technical evaluation
House of Quality Example

Your team has been charged with designing a new camera for Great Cameras, Inc.

The first action is to construct a House of Quality.
House of Quality Exam

What the customer wants

<table>
<thead>
<tr>
<th>Feature</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight</td>
<td>3</td>
</tr>
<tr>
<td>Easy to use</td>
<td>4</td>
</tr>
<tr>
<td>Reliable</td>
<td>5</td>
</tr>
<tr>
<td>Easy to hold steady</td>
<td>2</td>
</tr>
<tr>
<td>High resolution</td>
<td>1</td>
</tr>
</tbody>
</table>

Customer importance rating (5 = highest)
## House of Quality Example

<table>
<thead>
<tr>
<th>Low electricity requirements</th>
<th>Aluminum components</th>
<th>Auto focus</th>
<th>Auto exposure</th>
<th>High number of pixels</th>
<th>Ergonomic design</th>
</tr>
</thead>
</table>

### How to Satisfy Customer Wants

- Low electricity requirements
- Aluminum components
- Auto focus
- Auto exposure
- High number of pixels
- Ergonomic design
# House of Quality Example

1. **High relationship**
2. **Medium relationship**
3. **Low relationship**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight</td>
<td>3</td>
<td>●</td>
<td>○</td>
<td>●</td>
</tr>
<tr>
<td>Easy to use</td>
<td>4</td>
<td>●</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Reliable</td>
<td>5</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Easy to hold steady</td>
<td>2</td>
<td></td>
<td>○</td>
<td>●</td>
</tr>
<tr>
<td>High resolution</td>
<td>1</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

**Relationship matrix**
House of Quality Example

Relationships between the things we can do

- Low electricity requirements
- Aluminum components
- Auto focus
- Auto exposure
- High number of pixels
- Ergonomic design

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## House of Quality Example

<table>
<thead>
<tr>
<th>Feature</th>
<th>Weighted Rating</th>
<th>Customer Importance</th>
<th>Technical Attributes</th>
<th>How to Satisfy Customer Wants</th>
<th>Analysis of Competitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight</td>
<td>3</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy to use</td>
<td>4</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reliable</td>
<td>5</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy to hold steady</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>●●●</td>
</tr>
<tr>
<td>High resolution</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>●●●</td>
</tr>
</tbody>
</table>

### Our importance ratings

- Weighted rating: 22, 9, 27, 27, 32, 25

### Diagram Notes
- The diagram illustrates the process of mapping customer wants to technical attributes.
- The weighted rating is shown for each attribute, indicating its importance.
- The table and diagram together help in prioritizing development efforts based on customer needs and technical feasibility.
# House of Quality Example

How well do competing products meet customer wants

<table>
<thead>
<tr>
<th></th>
<th>Company A</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy to use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reliable</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Easy to hold steady</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>High resolution</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Our importance ratings</strong></td>
<td><strong>22</strong></td>
<td><strong>5</strong></td>
</tr>
</tbody>
</table>

## Analysis of Competitors

<table>
<thead>
<tr>
<th></th>
<th>G</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy to use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reliable</td>
<td></td>
<td>F</td>
</tr>
<tr>
<td>Easy to hold steady</td>
<td></td>
<td>G</td>
</tr>
<tr>
<td>High resolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### House of Quality Example

#### What the Customer Wants

<table>
<thead>
<tr>
<th>Technical Attributes and Evaluation</th>
<th>How to Satisfy Customer Wants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interrelationships</td>
<td></td>
</tr>
<tr>
<td>Analysis of Competitors</td>
<td></td>
</tr>
<tr>
<td>Relationship Matrix</td>
<td></td>
</tr>
<tr>
<td>What the Customer Wants</td>
<td></td>
</tr>
</tbody>
</table>

#### Target values (Technical attributes)

<table>
<thead>
<tr>
<th>Company</th>
<th>Technical Evaluation</th>
<th>Target Value</th>
<th>Failure 1 per 10,000</th>
<th>Panel Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Us</td>
<td>0.5</td>
<td>75%</td>
<td>2 circuits</td>
<td>ok G</td>
</tr>
<tr>
<td>Company B</td>
<td>0.6</td>
<td>50%</td>
<td>yes</td>
<td>2 ok F</td>
</tr>
<tr>
<td>Company A</td>
<td>0.7</td>
<td>60%</td>
<td>yes</td>
<td>1 ok G</td>
</tr>
</tbody>
</table>

- **Target values:**
  - Company A: 0.7, 60%
  - Company B: 0.6, 50%
  - Us: 0.5, 75%

- **Analysis of Competitors:**
  - Company A: 60%, yes, 1, ok, G
  - Company B: 50%, yes, 2, ok, F
  - Us: 75%, yes, 2, ok, G

- **Panel ranking:**
  - G: Good
  - F: Fair
  - ok: Good enough
House of Quality Example

Completed House of Quality

<table>
<thead>
<tr>
<th>Feature</th>
<th>Importance Rating</th>
<th>Company A</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightweight</td>
<td>3</td>
<td>G P</td>
<td></td>
</tr>
<tr>
<td>Easy to use</td>
<td>4</td>
<td></td>
<td>G P</td>
</tr>
<tr>
<td>Reliable</td>
<td>5</td>
<td></td>
<td>F G</td>
</tr>
<tr>
<td>Easy to hold steady</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High resolution</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our importance ratings</td>
<td>22 9 27 27 32 25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target values (Technical attributes)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.5 A</td>
<td>75%</td>
<td>yes 2 to ∞</td>
<td>Failure 1 per 10,000</td>
</tr>
<tr>
<td>Company A</td>
<td>0.7</td>
<td>60% yes 1</td>
<td>ok</td>
</tr>
<tr>
<td>Company B</td>
<td>0.6</td>
<td>50% yes 2</td>
<td>ok</td>
</tr>
<tr>
<td>Us</td>
<td>0.5</td>
<td>75% yes 2</td>
<td>ok</td>
</tr>
</tbody>
</table>
House of Quality Sequence

Deploying resources through the organization in response to customer requirements

Figure 5.4
Organizing for Product Development

- Traditionally – distinct departments
  - Duties and responsibilities are defined
  - Difficult to foster forward thinking
- A Champion
  - Product manager drives the product through the product development system and related organizations
Organizing for Product Development

- Team approach
  - Cross functional – representatives from all disciplines or functions
  - Product development teams, design for manufacturability teams, value engineering teams
- Japanese “whole organization” approach
  - No organizational divisions
Organizing for Product Development

► Product development teams
  ► Market requirements to product success
  ► Cross functional teams often involving vendors
  ► Open, highly participative environment

► Concurrent engineering
  ► Simultaneous performance of product development stages
Manufacturability and Value Engineering

Benefits:

1. Reduced complexity of the product
2. Reduction of environmental impact
3. Additional standardization of components
4. Improvement of functional aspects of the product
5. Improved job design and job safety
6. Improved maintainability (serviceability) of the product
7. Robust design
Cost Reduction of a Bracket via Value Engineering

Figure 5.5
Issues for Product Design

► Robust design
► Modular design
► Computer-aided design (CAD)
► Computer-aided manufacturing (CAM)
► Virtual reality technology
► Value analysis
► Sustainability and Life Cycle Assessment (LCA)
Robust Design

► Product is designed so that small variations in production or assembly do not adversely affect the product.

► Typically results in lower cost and higher quality.
Modulear Design

- Products designed in easily segmented components
- Adds flexibility to both production and marketing
- Improved ability to satisfy customer requirements
Computer Aided Design (CAD)

- Using computers to design products and prepare engineering documentation
- Shorter development cycles, improved accuracy, lower cost
- Information and designs can be deployed worldwide
Extensions of CAD

- 3-D Object Modeling
  - Small prototype development
- Design for Manufacturing and Assembly (DFMA)
  - Solve manufacturing problems during the design stage
- CAD through the internet
- International data exchange through STEP
- 3-D printing
Computer-Aided Manufacturing (CAM)

► Utilizing specialized computers and program to control manufacturing equipment

► Often driven by the CAD system (CAD/CAM)
Benefits of CAD/CAM

1. Product quality
2. Shorter design time
3. Production cost reductions
4. Database availability
5. New range of capabilities
Virtual Reality Technology

- Computer technology used to develop an interactive, 3-D model of a product from the basic CAD data
- Allows people to ‘see’ the finished design before a physical model is built
- Very effective in large-scale designs such as plant layout
Value Analysis

- Focuses on design improvement during production
- Seeks improvements leading either to a better product or a product which can be produced more economically with less environmental impact
Sustainability and Life Cycle Assessment (LCA)

- Sustainability means meeting the needs of the present without compromising the ability of future generations to meet their needs.
- LCA is a formal evaluation of the environmental impact of a product.
Product Development Continuum

- Product life cycles are becoming shorter and the rate of technological change is increasing
- Developing new products faster can result in a competitive advantage
- **Time-based competition**
Product Development Continuum

**External Development Strategies**
- Alliances
  - Joint ventures
  - Purchase technology or expertise by acquiring the developer

**Internal Development Strategies**
- Migrations of existing products
- Enhancements to existing products
- New internally developed products

<table>
<thead>
<tr>
<th>Internal</th>
<th>Lengthy</th>
<th>Cost of product development</th>
<th>Shared</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td>Risk of product development</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Speed of product development</th>
<th>Rapid and/or Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared</td>
<td>Shared</td>
</tr>
</tbody>
</table>

Figure 5.6
Product Development Continuum

- Purchasing technology by acquiring a firm
  - Speeds development
  - Issues concern the fit between the acquired organization and product and the host

- Joint Ventures
  - Both organizations learn
  - Risks are shared
Product Development Continuum

- Alliances
  - Cooperative agreements between independent organizations
  - Useful when technology is developing
  - Reduces risks
Defining a Product

- First definition is in terms of *functions*
- Rigorous specifications are developed during the design phase
- Manufactured products will have an *engineering drawing*
- **Bill of material (BOM)** lists the components of a product
Monterey Jack Cheese

(a) *U.S. grade AA*. Monterey cheese shall conform to the following requirements:

(1) *Flavor*. Is fine and highly pleasing, free from undesirable flavors and odors. May possess a very slight acid or feed flavor.

(2) Body and texture. A plug drawn from the cheese shall be reasonably firm. It shall have numerous small mechanical openings evenly distributed throughout the plug. It shall not possess sweet holes, yeast holes, or other gas holes.

(3) *Color*. Shall have a natural, uniform, bright and attractive appearance.

(4) *Finish and appearance—bandaged and paraffin-dipped*. The rind shall be sound, firm, and smooth providing a good protection to the cheese.
Product Documents

- Engineering drawing
  - Shows dimensions, tolerances, and materials
  - Shows codes for Group Technology
- Bill of Material
  - Lists components, quantities and where used
  - Shows product structure
Engineering Drawings

Figure 5.8

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# Bills of Material

## BOM for a Panel Weldment

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 60-71</td>
<td>PANEL WELDM’T</td>
<td>1</td>
</tr>
<tr>
<td>A 60-7</td>
<td>LOWER ROLLER ASSM.</td>
<td>1</td>
</tr>
<tr>
<td>R 60-17</td>
<td>ROLLER</td>
<td>1</td>
</tr>
<tr>
<td>R 60-428</td>
<td>PIN</td>
<td>1</td>
</tr>
<tr>
<td>P 60-2</td>
<td>LOCKNUT</td>
<td>1</td>
</tr>
<tr>
<td>A 60-72</td>
<td>GUIDE ASSM. REAR</td>
<td>1</td>
</tr>
<tr>
<td>R 60-57-1</td>
<td>SUPPORT ANGLE</td>
<td>1</td>
</tr>
<tr>
<td>A 60-4</td>
<td>ROLLER ASSM.</td>
<td>1</td>
</tr>
<tr>
<td>02-50-1150</td>
<td>BOLT</td>
<td>1</td>
</tr>
<tr>
<td>A 60-73</td>
<td>GUIDE ASSM. FRONT</td>
<td>1</td>
</tr>
<tr>
<td>A 60-74</td>
<td>SUPPORT WELDM’T</td>
<td>1</td>
</tr>
<tr>
<td>R 60-99</td>
<td>WEAR PLATE</td>
<td>1</td>
</tr>
<tr>
<td>02-50-1150</td>
<td>BOLT</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 5.9 (a)
## Bills of Material

### Hard Rock Cafe’s Hickory BBQ Bacon Cheeseburger

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bun</td>
<td>1</td>
</tr>
<tr>
<td>Hamburger patty</td>
<td>8 oz.</td>
</tr>
<tr>
<td>Cheddar cheese</td>
<td>2 slices</td>
</tr>
<tr>
<td>Bacon</td>
<td>2 strips</td>
</tr>
<tr>
<td>BBQ onions</td>
<td>1/2 cup</td>
</tr>
<tr>
<td>Hickory BBQ sauce</td>
<td>1 oz.</td>
</tr>
<tr>
<td>Burger set</td>
<td></td>
</tr>
<tr>
<td>Lettuce</td>
<td>1 leaf</td>
</tr>
<tr>
<td>Tomato</td>
<td>1 slice</td>
</tr>
<tr>
<td>Red onion</td>
<td>4 rings</td>
</tr>
<tr>
<td>Pickle</td>
<td>1 slice</td>
</tr>
<tr>
<td>French fries</td>
<td>5 oz.</td>
</tr>
<tr>
<td>Seasoned salt</td>
<td>1 tsp.</td>
</tr>
<tr>
<td>11-inch plate</td>
<td>1</td>
</tr>
<tr>
<td>HRC flag</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 5.9 (b)
Make-or-Buy Decisions

- Produce components themselves or buy from an outside source
- Variations in
  - Quality
  - Cost
  - Delivery schedules
- Critical to product definition
Group Technology

- Parts grouped into families with similar characteristics
- Coding system describes processing and physical characteristics
- Part families can be produced in dedicated manufacturing cells
Group Technology Scheme

(a) Ungrouped Parts

(b) Grouped Cylindrical Parts (families of parts)

<table>
<thead>
<tr>
<th>Grooved</th>
<th>Slotted</th>
<th>Threaded</th>
<th>Drilled</th>
<th>Machined</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Grooved Parts" /></td>
<td><img src="image2" alt="Slotted Parts" /></td>
<td><img src="image3" alt="Threaded Parts" /></td>
<td><img src="image4" alt="Drilled Parts" /></td>
<td><img src="image5" alt="Machined Parts" /></td>
</tr>
</tbody>
</table>
Group Technology Benefits

1. Improved design
2. Reduced raw material and purchases
3. Simplified production planning and control
4. Improved layout, routing, and machine loading
5. Reduced tooling setup time, work-in-process, and production time
Documents for Production

- Assembly drawing
- Assembly chart
- Route sheet
- Work order
- Engineering change notices (ECNs)
Assembly Drawing

- Shows exploded view of product
- Details relative locations to show how to assemble the product

Figure 5.11 (a)
Assembly Chart

Identifies the point of production where components flow into subassemblies and ultimately into the final product.

Figure 5.11 (b)
## Route Sheet

Lists the operations and times required to produce a component

<table>
<thead>
<tr>
<th>Process</th>
<th>Machine</th>
<th>Operations</th>
<th>Setup Time</th>
<th>Operation Time/Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Auto Insert 2</td>
<td>Insert Component Set 56</td>
<td>1.5</td>
<td>.4</td>
</tr>
<tr>
<td>2</td>
<td>Manual Insert 1</td>
<td>Insert Component Set 12C</td>
<td>.5</td>
<td>2.3</td>
</tr>
<tr>
<td>3</td>
<td>Wave Solder</td>
<td>Solder all components to board</td>
<td>1.5</td>
<td>4.1</td>
</tr>
<tr>
<td>4</td>
<td>Test 4</td>
<td>Circuit integrity test 4GY</td>
<td>.25</td>
<td>.5</td>
</tr>
</tbody>
</table>
Work Order

Instructions to produce a given quantity of a particular item, usually to a schedule

<table>
<thead>
<tr>
<th>Work Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>157C</td>
</tr>
<tr>
<td>Production Dept</td>
</tr>
</tbody>
</table>
Engineering Change Notice (ECN)

► A correction or modification to a product’s definition or documentation
  ► Engineering drawings
  ► Bill of material

Quite common with long product life cycles, long manufacturing lead times, or rapidly changing technologies
Configuration Management

- The need to manage ECNs has led to the development of configuration management systems
- A product’s planned and changing components are accurately identified
- Control and accountability for change are identified and maintained
Product Life-Cycle Management (PLM)

- Integrated software that brings together most, if not all, elements of product design and manufacture
  - Product design
  - CAD/CAM
  - DFMA
  - Product routing
  - Materials
  - Layout
  - Assembly
  - Maintenance
  - Environmental
Service Design

- Service typically includes direct interaction with the customer
- **Process – chain – network (PCN)** analysis focuses on the ways in which processes can be designed to optimize interaction between firms and their customers
Process-Chain-Network (PCN) Analysis

**Sandwich supplier**
Supplier's process domain

**Sandwich consumer**
Consumer's process domain

**Independent processing**
Prepare sandwiches at factory for resale at convenience stores

**Surrogate interaction**
Make sandwich in restaurant kitchen from menu offerings with modest modifications

**Direct interaction**
Customer assembles sandwich from buffet offerings

**Independent processing**
Assemble sandwich at home using ingredients from refrigerator

**Direct interaction**
Assemble custom sandwich at Subway as customer orders

Figure 5.12
Process-Chain-Network (PCN) Analysis

1. *Direct interaction* region includes process steps that involve interaction between participants

2. The *surrogate (substitute) interaction* region includes process steps in which one participant is acting on another participant’s resources

3. The *independent processing* region includes steps in which the supplier and/or the customer is acting on resources where each has maximum control
Process-Chain-Network (PCN) Analysis

- All three regions have similar operating issues but the appropriate way of handling the issues differs across regions – service operations exist only within the area of direct and surrogate interaction

- PCN analysis provides insight to aid in positioning and designing processes that can achieve strategic objectives
Adding Service Efficiency

- Service productivity is notoriously low partially because of customer involvement in the *design* or *delivery* of the service, or both
- Complicates product design
Adding Service Efficiency

- Limit the options
  - Improves efficiency and ability to meet customer expectations
- Delay customization
- Modularization
  - Eases customization of a service
Adding Service Efficiency

▶ Automation
  ▶ Reduces cost, increases customer service

▶ Moment of truth
  ▶ Critical moments between the customer and the organization that determine customer satisfaction
Documents for Services

- High levels of customer interaction necessitates different documentation
- Often explicit job instructions
- Scripts and storyboards are other techniques
First Bank Corp. Drive-up Teller Service Guidelines

• Be especially discreet when talking to the customer through the microphone.
• Provide written instructions for customers who must fill out forms you provide.
• Mark lines to be completed or attach a note with instructions.
• Always say “please” and “thank you” when speaking through the microphone.
• Establish eye contact with the customer if the distance allows it.
• If a transaction requires that the customer park the car and come into the lobby, apologize for the inconvenience.
Application of Decision Trees to Product Design

- Particularly useful when there are a series of decisions and outcomes that lead to other decisions and outcomes.
Application of Decision Trees to Product Design

Procedure

1. Include all possible alternatives and states of nature – including “doing nothing”
2. Enter payoffs at end of branch
3. Determine the expected value of each branch and “prune” the tree to find the alternative with the best expected value
Decision Tree Example

Purchase CAD

High sales

(.4)

(.6) Low sales

Hire and train engineers

(.4)

High sales

(.6)

Low sales

Do nothing
### Decision Tree Example

**EMV (purchase CAD system)**

\[
\text{EMV} = (0.4)(1,000,000) + (0.6)(-20,000)
\]

**Low sales**

- **Do nothing**

- **Hire and train engineers**
  - (.6) Low sales
    - Revenue: $800,000
    - Mfg cost ($40 x 8,000): $320,000
    - CAD cost: $500,000
    - Net loss: $20,000

- **Purchase CAD**
  - (.4) High sales
    - Revenue: $2,500,000
    - Mfg cost ($40 x 25,000): $1,000,000
    - CAD cost: $500,000
    - Net: $800,000

**Figure 5.13**
Decision Tree Example

EMV (purchase CAD system) = (.4)($1,000,000) + (.6)(- $20,000)
= $388,000

Figure 5.13
Decision Tree Example

Purchase CAD $388,000

- High sales (.4)
  - $2,500,000 Revenue
  - $1,000,000 Mfg cost ($40 x 25,000)
  - $500,000 CAD cost
  - $1,000,000 Net

- Low sales (.6)
  - $800,000 Revenue
  - $320,000 Mfg cost ($40 x 8,000)
  - $500,000 CAD cost
  - $20,000 Net loss

Hire and train engineers $365,000

- High sales (.4)
  - $2,500,000 Revenue
  - $1,250,000 Mfg cost ($50 x 25,000)
  - $375,000 Hire and train cost
  - $875,000 Net

- Low sales (.6)
  - $800,000 Revenue
  - $400,000 Mfg cost ($50 x 8,000)
  - $375,000 Hire and train cost
  - $25,000 Net

Do nothing $0

- $0 Net
Transition to Production

► Know when to move to production
  ► Product development can be viewed as evolutionary and never complete
  ► Product must move from design to production in a timely manner

► Most products have a trial production period to insure producibility
  ► Develop tooling, quality control, training
  ► Ensures successful production
Transition to Production

- Responsibility must also transition as the product moves through its life cycle
  - Line management takes over from design
- Three common approaches to managing transition
  - Project managers
  - Product development teams
  - Integrate product development and manufacturing organizations
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