CHAPTER 6

GOODS AND SERVICE DESIGN

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LO1  Describe the steps involved in designing goods and services.
LO2  Explain the concept of robust design and the Taguchi loss function.
LO3  Explain how to calculate system reliability.
LO4  Explain the concept and application of quality function deployment.
LO5  Describe methods for designing goods.
LO6  Explain the five elements of service delivery system design.
LO7  Describe the four elements of service encounter design.
LO8  Explain how goods and service design concepts are integrated at LensCrafters.
Business Week reported that Lockheed Martin beat out Boeing for the largest defense contract in U.S. history—production of the Joint Strike Fighter jet—worth at least $400 billion. A Pentagon source noted “Compare the two designs for the Joint Strike Fighter, and you’ll see the obvious: Boeing’s looks like “a flying frog with its mouth wide open.” A senior Air Force general also observed “the Lockheed design wins hands down.” However, a Boeing spokesman retorted, “Boeing officials say looks aren’t part of the design. We design our planes to go to war, not to the senior prom.”

What do you think?

How important are design and style in your purchasing decisions? Provide examples for goods and services.
Exhibit 6.1
An Integrated Framework for Goods and Service Design (slide 1)

- **Step 1:** Strategic Mission and Vision
- **Step 2:** Strategic and Market Analysis, and Understanding Competitive Priorities
- **Step 3:** Customer Benefit Package Design and Configuration
- **Step 4:** Detailed Goods, Service, and Process Design
Customer Benefit Package (CBP) Design & Configuration

• “We’ve known for a long time that Starbucks is more than just a wonderful cup of coffee. It’s the experience … We saw that [Hear Music stores] were doing for music what we had done for coffee.”
CBP design and configuration choices revolve around a solid understanding of customer needs and target markets, and the value that customers place on attributes, such as:

- **Time**: reduce waiting time, be more responsive to customer needs.
- **Place**: select location for customer convenience.
- **Information**: provide product support, user manuals.
- **Entertainment**: enhance customer experience.
- **Exchange**: multiple channels used for purchases.
- **Form**: how well the physical characteristics of a good address customer needs.
Robust Design and the Taguchi Loss Function

• **Genichi Taguchi** states that instead of constantly directing effort toward controlling a process to assure consistent quality, design the manufactured good to achieve high quality despite the variations that will occur in the production line.
Robust Design and the Taguchi Loss Function

- **Taguchi’s loss function** explains the economic value of reducing variation in manufacturing.

\[ L(x) = k(x - T)^2 \]  

[6.1]

where:

- \( L(x) \) is the monetary value of the loss associated with deviating from the target, \( T \);
- \( x \) is the actual value of the dimension;
- \( k \) is a constant that translates the deviation into dollars.
Exhibit 6.3  
Nominal-Is-Best Taguchi Loss Function

\[ L(x) = k(x - T)^2 \]

Quality characteristic value

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Exhibit 6.2  
Traditional Goal Post View of Conforming to Specifications
Solved Problem

Suppose that the specification on a part is 0.500 ± 0.020 cm. A detailed analysis of product returns and repairs has discovered that many failures occur when the actual dimension is near the extreme of the tolerance range (that is, when the dimensions are approximately 0.48 or 0.52) and costs $50 for repair.

Thus, in Equation 6.1, the deviation from the target, \( x - T \), is 0.02 and \( L(x) = $50 \). Substituting these values, we have:

\[
50 = k(0.02)^2
\]

or

\[
k = 50/0.0004 = 125,000
\]

Therefore, the loss function for a single part is \( L(x) = 125000(x - T)^2 \).

This means when the deviation is 0.10, the firm can still expect an average loss per unit of:

\[
L(0.10) = 125,000(0.10)^2 = $12.50 \text{ per part}
\]
Solved problem (continued)

Knowing the Taguchi loss function helps designers to determine appropriate tolerances economically. For example, suppose that a simple adjustment can be made at the factory for only $2 to get this dimension very close to the target.

If we set \( L(x) = $2 \) and solve for \( x - T \), we get:

\[
2 = 125000(x - T)^2
\]

\[
x - T = 0.004
\]

Therefore, if the dimension is more than 0.004 away from the target, it is more economical to adjust it at the factory and the specifications should be set as 0.500 ± 0.004.
Nominal-Is-Best Taguchi Loss Function

Exhibit 6.3

Quality characteristic value

\[ L(x) = k(x - T)^2 \]
Reliability is the probability that a manufactured good, piece of equipment, or system performs its intended function for a stated period of time under specified operating conditions.
• **Reliability** is defined as a probability, that is, a value between 0 and 1.

• A **97% reliable part** has a probability of 0.97 that it will perform its function for a given period of time under specified operating conditions.

• A **system** is a related group of components that work together to accomplish a task.
The total reliability of a *serial system* is the product of the individual probabilities of each process in a system.

\[ R_s = (p_1)(p_2)(p_3) \ldots (p_n) \]  

[6.2]
In parallel systems, functions are independent and the entire system will fail only if all components fail.

\[ R_n = 1 - (1 - p_1)(1 - p_2)(1 - p_3) \ldots (1 - p_n) \]  [6.3]
The reliability of this series system is 0.883, or 83.3%.

\[ R = (0.98)(0.91)(0.99) = 0.883 \text{ or } 88.3\% \]
The reliability of the parallel system for subassembly B is:

\[ R = 1 - (1 - 0.91)(1 - 0.91) = 1 - 0.0081 = 0.9919. \]

Thus, the reliability of the equipment is:

\[ R = (0.98)(0.9919)(0.99) = 0.962 \text{ or } 96.2\%. \]
Quality Function Deployment (House of Quality)

• *Quality function deployment (QFD)* is both a philosophy and a set of planning and communication tools that focus on customer requirements in coordinating the design, manufacturing, and marketing of goods or services.

• QFD fosters improved communication and teamwork among all constituencies in the design process.
The House of Quality

- QFD translates customer wants and needs into technical requirements of a product or service.

- Building the House of Quality:
  - Determine customer requirements through the voice of the customer (VOC).
  - Define technical requirements of the product.
  - Determine interrelationships between the technical requirements.
  - The relationship matrix defines what technical requirements satisfy VOC needs.
  - Customer priorities and competitive evaluation help select which VOC requirements the product should focus on.
Exhibit 6.8

The House of Quality

- Interrelationships
- Technical requirements
- Customer requirement priorities
- Voice of the customer
- Relationship matrix
- Technical requirement priorities
- Competitive evaluation
The House of Quality for Building a Better Pizza

Legend: 1=low, 5=high
- Very strong relationship
- Strong relationship
- Weak relationship
Product and Process Design in Manufacturing

• **Prototype testing** is the process by which a model (real or simulated) is constructed to test the good’s physical properties or use under actual operating conditions, as well as consumer reactions to the prototype.

• **Goods that are insensitive to external sources of variation are called** _robust_.


Product and Process Design in Manufacturing

- **Quality engineering** refers to a process of designing quality into a manufactured good based on a prediction of potential quality problems prior to production.

- **Value engineering** refers to cost avoidance or cost prevention before the good or service is created.
Quality Engineering

- **Failure-Mode-and-Effects-Analysis (FMEA)** is a technique in which each component of a product is listed along with the way it may fail, the cause of failure, the effect or consequence of failure, and how it can be corrected by improving the design.

- A FMEA can uncover serious design problems prior to manufacturing and improve the quality and reliability of a product considerably.
Product and Process Design in Manufacturing

• **Product and process simplification** is the process of trying to simplify designs to reduce complexity and costs, and thus improve productivity, quality, flexibility, and customer satisfaction.

• Process simplification of the Cadillac Seville rear-bumper assembly reduced the number of parts by half and cut assembly time by 57 percent to less than 8 minutes ($450,000 annual savings).
Design for Environmental Quality

• A focus on improving the environment by better good or service design is often called green manufacturing or green practices.

• Green manufacturing example: packaging for fast food restaurants.
Service delivery system design includes the following:

✓ Facility location and layout
✓ The servicescape
✓ Process and job design
✓ Technology and information support systems
✓ Organizational structure
Service Delivery System Design According to G. Lynn Shostack (see text box)

• The design of a “service” cannot be done independently from the “process” by which the service is delivered.

• A service is a dynamic, living process; it is performed and rendered.

• The process by which the service is created and delivered is, in essence, the service itself.

• A service cannot be stored or shipped; only the means for creating it can.
Service Delivery System Design

• A poor choice on any one of these service delivery system design components, such as technology or job design, can degrade service system efficiency and effectiveness.

• Integrating all of these elements is necessary to design a service that provides value to customers and can create a competitive advantage.
Service Delivery System Design

Facility location and layout:

• Location creates customer’s convenience.

• Great store layout, process design, and service encounter design are meaningless if the store is in the wrong location.
Service Delivery System Design

Facility location and layout:

- Example facilities: health clinics and clubs, retail stores, rental car firms, libraries, hotels, emergency service facilities, branch banks, post offices, gasoline stations, airports, and so on.

- The Internet is making physical locations less important for some information-intensive services such as Charles Schwab, Vanguard, and Scottrade.
**Servicescape:**

- *All of the physical evidence a customer might use to form an impression.*

- *The servicescape provides the behavioral setting where service encounters take place.*

- Standardization of servicescape and service processes enhances efficiency, especially for multiple site organizations.
Servicescape: 3 dimensions

- **Ambient conditions** – manifest by sight, sound, smell, touch, and temperature; five human senses; e.g., leather chairs in the lobby, cartoon characters in children’s hospital, music at a coffee shop.

- **Spatial layout and functionality** – how furniture, equipment, and office spaces are arranged; also streets, parking lots, stadiums, etc.

- **Signs, symbols, and artifacts** – explicit signals that communicate an image of the firm; e.g., diplomas hanging on the wall in a medical clinic, company logos and uniforms, artwork, mission statements.
Service process design is the activity of developing an efficient sequence of activities to satisfy internal and external customer requirements.

- Specifications on how work is done at job and process levels.
- Flowcharts of process flows integrate layout, technology, servicescape, and organizational structure (see Chapter 7).
Service Delivery System Design

Technology and information support systems:

- What technology does each job require?
- What information technology best integrates all parts of the value chain?
- Technology ensures speed, accuracy, customization, and flexibility.
Service Delivery System Design

Organizational structure:

• Organize by process or by function.

• Who owns the process?

• Functional approach requires many different handoffs between work activities and no one owns the total process.
**Service encounter design** focuses on the interaction, directly or indirectly, between the service provider and the customer.

The Principal dimensions include:

- Customer contact behavior and skills
- Service provider selection, development, and empowerment
- Recognition and reward
- Service recovery and guarantees
Service Encounter Design

• **Customer contact** refers to the physical or virtual presence of the customer in the service delivery system during a service experience.

• Customer contact is measured by the percentage of time the customer must be in the system relative to the total time it takes to provide the service.

• **Systems in which the percentage is high are called high-contact systems; those in which it is low are called low-contact systems.**
Service Encounter Design

• Examples of high-contact systems are estate planning and hotel check-in.

• Examples of low-contact systems are construction services and package sorting and distribution.

• High customer contact areas of the organization are sometimes described as the "front room or front office" and low customer contact areas as "back room or back office."
Service Encounter Design

• Hire the right people, train them well, empower them, give recognition and reward.
Service Encounter Design

• **Empowerment** simply means giving people authority to make decisions based on what they feel is right, to have control over their work, to take risks and learn from mistakes, and to promote change.

• Ritz-Carlton Hotel employees can spend up to $2,000 to resolve customer complaints with no questions asked.
Recognition & Reward

• Attract, retain, and motivate

• Keep good employees

• Rewards such as free trips, parking spots, team recognition, and discounts
Service Recovery & Guarantees

• _A service upset_ is any problem a customer has—real or perceived—with the service delivery system and includes terms such as service failure, error, defect, mistake, or crisis.

• _Service recovery_ is the process of correcting a service upset and satisfying the customer.
An Integrative Case Study of LensCrafters

- LensCrafters’ (www.lenscrafters.com) mission statement suggests that time and service quality are the most important competitive priorities and potential order winners.

- CBP is the integrated set of goods (eyewear) and services (accurate eye exam and one-hour service).
An Integrative Case Study of LensCrafters

• Eyewear is produced in “store backroom factory” in rapid response without sacrificing quality, efficient production procedures.

• Service delivery system design:
  ✓ Located in high-traffic areas for convenience.
  ✓ Servicescape of quality and professionalism.
  ✓ 11 different in-store job roles.
  ✓ Customers can see glasses being made in the optical lab.
Exhibit 6.9
One Example View of LensCrafters’ Customer Benefit Package

- Contact lens accessories
- Convenient location
- Eyewear accessories and cases
- Exams and Service
- Professional, friendly employees
- Modern equipment in showroom
- One-Hour Service
- Eyewear