



CHAPTER 19 OPERATIONS MANAGEMENT AND PLANNING

Learning Objectives

1. Define operations management.
2. Describe an operating system, and identify the two basic types of operating systems.
3. Differentiate among product/service design, process selection, and site selection decisions.
4. Explain what a materials-handling system is.
5. Describe and give an example of the three basic classifications of facilities layouts.
6. Explain the sociotechnical approach to job design.
7. Describe several computer-related technologies that are currently playing major roles in production/operations management.
8. Outline the three major steps in developing an aggregate operations plan.
9. Summarize the differences between resource allocation and activity scheduling.
10. Distinguish between Gantt charts, the critical path method (CPM), and the program evaluation and review technique (PERT).

Chapter Overview

Operations management evolved from the field of production or manufacturing management. It deals with the application of the basic concepts and principles of management to those segments of the organization that produce the goods and/or services of the organization. The operating systems that control the above processes are extremely important to the efficiency of the firm, especially given the emphasis on cost and quality control present in today's competitive environment.

Operations management examines design processes, site selection, materials-handling systems, facilities layouts, and job design. The advent and use of the computer is very important to all of these functions and processes. Production planning has benefited greatly from the technology that is at the disposal of management. The mathematical processes for examining and studying production vary but are valuable tools for controlling this critical phase of industrial production.

Methods such as Gantt charts, critical path method (CPM), and program evaluation and review technique (PERT) provide the building blocks upon which more sophisticated models and methods are built. Though far removed from the Scientific School of Management of the early 20th century, certain aspects of operations management are still similar in form and application. The production engineers of the future will rely heavily on technology to solve their problems but will still study the basics of the past.



Lecture Outline

- I. Introduction
 - A. **Operations management** is the application of the basic concepts and principles of management to those segments of the organization that produce the goods and/or services.
 - B. **Operations planning** is designing the systems of the organization that produce goods or services and planning the day-to-day operations within these systems.

Key Terms #1, 2; Learning Objective #1; Review Question #1

- II. The Importance of Operations Management
 - A. Operations management consumes a significant portion of resources.
 - B. Operations processes consume an appreciable amount of time.
 - C. Effective operations managers directly influence employee output.
 - D. Managers face an unstable environment.
- III. Operating Systems and Activities
 - A. An **operating system** consists of the processes and activities necessary to turn inputs into goods and/or services.
 - B. Operating systems exist in all organizations; they are made up of people, material, facilities, and information.
 - C. Basic types of operating systems are:
 - 1. **Continuous flow**—large amounts of similar products flow through the same system.
 - 2. **Intermittent flow system**—used when customized products and services are produced.

Key Terms #3, 4, 5; Learning Objective #2; Review Questions #2, 3; Figure 19.1; Management Illustration 19.1

- IV. Product/Service Design
 - A. An organization's product or service determines the design of its operating systems.
 - B. Being functionally and economically sound are important considerations.

Learning Objective # 3

- V. Process Selection



- A. **Process selection** specifies in detail the processes and sequences required to transform inputs into products or services.
- B. Processes considered in managerial planning include:
 - 1. Conversion processes.
 - 2. Fabrication processes.
 - 3. Assembly processes.
 - 4. Testing processes.
- C. Equipment decisions involve using general equipment or special-purpose equipment, making or buying components, and how much to automate.
- D. In process selection, the overriding objective is to specify in detail the most economical processes and sequences required to transform the inputs into the desired product or service.

Key Term #6; Learning Objective #3; Review Questions #4, 5

VI. Facilities Layout

- A. **Facilities layout** is the process of planning the optimum physical arrangement of facilities, including personnel, operating equipment, storage space, office space, materials-handling equipment, and room for customer service and movement.
- B. Facilities decisions are needed for a number of different reasons:
 - 1. Construction of a new or additional facility.
 - 2. Obsolescence of current facilities.
 - 3. Changes in demand.
 - 4. Development of a new or redesigned product or process.
 - 5. Personnel considerations.
- C. Materials handling concerns how materials are used and handled during manufacturing.
- D. Basic layout classifications include:
 - 1. A **product layout** where equipment or services are grouped according the progressive steps by which the product is made or the customer is served.
 - 2. A **process layout** where equipment or services of similar functional type are grouped together.
 - 3. A **fixed position layout** where the product is too large to move and remains in one place.

Key Term #7, 8, 9, 10; Learning Objective #4, 5; Review Question #7, 8; Figure 19.2

VII. Site Selection (production, offices, warehouses, service centers, branches, parent facility, etc.)

- A. Involves the total production/distribution system of the organization.



- B. Primary options include:
 - 1. Locating/adding new facilities
 - 2. Modifying present facilities.
 - 3. Relocating present facilities.
- C. Options for expanding capacity when the present facility is overcrowded include subcontracting work, adding another shift, working overtime, moving the operation to a larger facility, expanding the current facility, or keeping the current facility and adding another facility elsewhere.
- D. Primary decisional factors are financial concerns and human-relations concerns.

Learning Objectives #3; Review Questions #6; Figure 19.3; Management Illustration 19.2

VIII. Job Design

- A. **Job design** specifies the work activities of an individual or group of individuals.
- B. Job design specifies:
 - 1. The individual tasks.
 - 2. The method of performing each task.
 - 3. The combination of individual tasks into specific jobs to be assigned to individuals.
- C. **Job content** is the aggregate of all the work tasks the jobholder may be asked to perform.
 - 1. Different people react differently to similar jobs.
 - 2. Job specialization has both advantages and disadvantages.
- D. **Job method** is the manner in which the human body is used, the arrangement of the workplace, and the design of the tools and equipment used; the purpose is to find the one best way to do a job.
 - 1. Motion studies are used to design jobs.
 - 2. **Ergonomics** studies the interaction between people and machines.
- E. Job design may be described in terms of five key job characteristics:
 - 1. Skill variety
 - 2. Task identity
 - 3. Task significance
 - 4. Autonomy
 - 5. Feedback
- F. The physical work environment affects both employee performance and safety.
 - 1. Ergonomics



2. Safety—the **Occupational Safety and Health Act (OSHA) of 1970** is federal legislation designed to reduce job injuries; it established specific federal safety guidelines for almost all U.S. organizations.
- G. The **sociotechnical approach** to job design considers two premises:
 1. A joint operating system combines both the social and technological systems.
 2. The environment of such a system is influenced by culture, values, and other practices.

Key Terms #11, 12, 13, 14, 15, 16; Learning Objective #6; Review Questions #9, 10, 11; Figure 19.4

IX. Computer Technology and the Design Process

- A. Computers now play a major role in enhancing the manufacturing processes.
- B. Forms of computer design aids include:
 1. **Computer-aided design (CAD)**—generates various views of different components and assemblies.
 2. **Computer-aided engineering (CAE)**—uses a product’s characteristics to analyze its performance under different parameters.
 3. **Computer-aided manufacturing (CAM)**—uses stored data regarding various products to provide instructions for automated production equipment.
 4. **Computer-integrated manufacturing (CIM)**—uses computer technology to incorporate all of the organization’s production-related functions into an integrated computer system to assist, augment, or automate most functions.

Key Terms #17, 18, 19, 20; Learning Objective #7; Review Question #12; Management Illustrations 19.3; 19.4

X. Day-to-Day Operations Planning

- A. **Production planning** is concerned primarily with aggregate production planning, resource allocation, and activity scheduling; the overriding purpose of production planning is to maintain a smooth, constant flow of work from start to finish.
- B. **Aggregate operations planning** (also known as Aggregate production planning)—concerned with overall operations and balancing major sections of the operating system; matches the organization’s resources with demands for its goods and services.
 1. A demand forecast is necessary.
 2. **Gantt charts** are useful tools to plan the tasks with relation to time.
- C. **Resource allocation**—efficient allocation of people materials, and equipment to meet the demand requirements of the operating system; assisted by computer-assisted tools.
 1. **Critical path method (CPM)**



2. **Program evaluation and review technique (PERT)**
- D. **Routing** finds the best path and sequence of operations for attaining a desired level of output with a given mix of equipment and personnel; often uses two types of charts.
 1. **Assembly chart** depicts the sequence and manner in which the various components of a product or service are assembled.
 2. **Flow process chart** outlines what happens to a product or service as it progresses through the facility.
- E. **Activity scheduling** develops the precise timetable to be followed in producing a product or service.

Key Terms #21, 22, 23, 24, 25, 26, 27, 28, 29, 30; Learning Objectives #8, 9, 10; Review Questions #13, 14, 15; Figures 19.5, 19.6, 19.7, 19.8

Barriers to Student Understanding

1. The first barrier that the students will have to overcome in this chapter will be their inexperience with issues dealing with operations management in general. If the students have had their basic statistics course, some of the issues may be familiar. If not, the best beginning point to aid their understanding is to begin a discussion about manufacturing companies and discuss their general needs. Next, use the general outline of the chapter to carry the students through the various processes the manager must organize if successful operations are to occur.
2. It is beyond the scope of this text to teach the students how to mathematically analyze and perform calculation functions on the various methods that are briefly described in the chapter. However, by using the Appendix to this chapter the instructor can give a demonstration of CPM and PERT. The amount of time spent with this is up to the instructor.
3. The students may not understand how the computer can be of value in operations management and planning. Guest speakers or articles from contemporary business publications can prove useful in this area. If there is no time for these events, the instructor can ask the students to discuss how they think the computer can be of value in aiding the manufacturing processes.
4. The last area of concern is usually that the students do not understand ergonomics. Discussing how important a match between humans and machines is to the efficient manufacturing process is a significant addition to their understanding. International competitors understand the importance of the concept. Ask the students to find illustrations of good ergonomic environments.



Key Terms

1. Operations Management
2. Operations Planning
3. Operating Systems
4. Continuous Flow System
5. Intermittent Flow System
6. Process Selection
7. Facilities Layout
8. Product Layout
9. Process Layout
10. Fixed Position Layout
11. Job Design
12. Job Content
13. Job Method
14. Ergonomics
15. Occupational Safety and Health Act (OSHA) of 1970
16. Sociotechnical Approach
17. Computer-Aided Design (CAD)
18. Computer-Aided Engineering (CAE)
19. Computer-Aided Manufacturing (CAM)
20. Computer-Integrated Manufacturing (CIM)
21. Production Planning
22. Aggregate Operations Planning
23. Gantt Chart
24. Resource Allocation
25. Critical-Path Method (CPM)
26. Program Evaluation and Review Technique (PERT)
27. Routing



28. Assembly Chart
29. Flow Process Chart
30. Activity Scheduling

Suggested Answers to Analyzing Management Skills

- To what extent do you think the layout and physical facilities of the workplace are important?

The layout of an organization and its physical facilities are important because they affect the organization's efficiency and effectiveness. These factors also impact employee morale, performance, and safety.

Suggested Answers to Applying Management Skills

- Suppose you were designing a small store for selling office supplies to college students. What are some of the major factors you would want to consider in your design?

First, if the target market is college students, then the site selection would need to be located within close proximity to where students live and/or attend classes. Second, since the preferences of college students may be different from other consumers, the store's design should specifically appeal to college students. Third, it might also be important to merchandise items consistent with their appeal to college students (location in store, colors, etc.)

Answers to Review Questions

1. What is operations management?

Operations management is the application of the basic concepts and principles of management to those segments of the organization that produce the goods and/or services of the organization.

2. Describe an operating system.

An **operating system** consists of the processes and activities necessary to transform various inputs into goods and/or services. The two basic types of operating systems are those based on continuous flows and those based on intermittent flows.

3. Describe the two basic types of operating systems.

Continuous flow systems generally have a standardized product or service. **Intermittent flow systems** usually produce customized products or services.



4. What is the overriding objective of the process selection decision?

To specify in detail the most economical processes and sequences required to transform the inputs into the desired product or service.

5. At the most basic level of process selection, what are the four primary types of processes?

- a. Conversion processes.
- b. Fabrication processes.
- c. Assembly processes.
- d. Testing processes.

6. Discuss several factors that should be considered in site location.

Revenue (location of customers and competitors), operating costs (materials, transportation, wages, taxes, utilities, rent, communication), investment (land, construction), other (availability of labor and materials, union activity, community attitudes, climate, living conditions, politics, pollution restrictions).

7. What is a process-oriented layout? A product-oriented layout? A fixed-position layout?

The three basic types of layouts are process layouts, product layouts, and fixed-position layouts. With a **process layout**, the equipment or services of a similar functional type are arranged or grouped together. Custom fabrication shops and hospitals are examples of organizations that use process layouts. With a **product layout**, the equipment or services are arranged according to the progressive steps by which the product is made or the customer is serviced. Automobile assembly plants and cafeterias are examples of organizations that use product layouts. With a **fixed position layout**, the product is too large to move and remains in one place. A large ship-builder might use a fixed position layout.

8. What is a materials-handling system?

A **materials handling system** is the entire network that receives materials, stores materials, moves materials between processing points and between buildings, and finally positions the final product or service for delivery to the ultimate customer.

9. Identify the three phases of the job design process.

Specification of individual tasks, specification of the method of performing each task, and the combination of individual tasks into specific jobs to be assigned to individuals.



10. Define ergonomics.

Ergonomics is the study of the interface between humans and machines.

11. What is the sociotechnical approach to job design? Using the sociotechnical approach, give some guidelines for job design.

The sociotechnical approach considers not only the technical system and the task to be done but also the accompanying social system. The job should provide some challenge and variety; provide for growth and learning; provide some minimum area of decision making; entail some social support and recognition at the workplace; permit the jobholder to relate it to social life; and lead to a desirable future.

12. Define CAD, CAE, CAM, and CIM.

CAD (Computer-Aided Design) can be used in product design by generating various views of different components and assemblies.

CAE (Computer-Aided Engineering) uses a product's characteristics to analyze its performance under different parameters.

CAM (Computer-Aided Manufacturing) uses stored data about various products to provide instructions for automated production equipment.

CIM (Computer-Integrated Manufacturing) is a way of using computer technology so that all of an organization's production-related functions are incorporated in an integrated computer system to assist, augment, and/or automate most functions.

13. What is production planning?

Aggregate production planning, resource allocation, and scheduling—all part of day-to-day operations planning and execution.

14. Define aggregate operations planning?

Aggregate production planning deals with overall operations and with balancing major parts of the operating system.

15. What is the difference between resource allocation and activity scheduling?

Resource allocation is concerned with the efficient allocation of people, materials, and equipment in order to meet the demand requirements of the operating system. This includes distributing the workload and determining how much time should be allotted for each stage in the production process.

Activity scheduling develops the precise timetable to be followed when producing the product or



service. Activity scheduling does not involve determining how long a job will take but rather it determines when the work is to be done.

Suggested Answers to Skill-Building Questions

1. Explain how you might take a production line approach (transferring the concepts and methodologies of operations management) to a service organization such as a branch bank.

Regardless of whether a product is being produced or a service is being provided, operations management concepts and methodologies apply. For example, even for a service organization, operating systems must be designed to turn the inputs into a service, facility sites must be selected and properly laid out, and jobs must be designed in such a way that the clientele is effectively served.

2. Does process selection in service industries such as restaurants and hotels differ from process selection in manufacturing? If so, how?

There is no reason that it should. Both service organizations and manufacturers must determine work processes to be used, establish the basic sequences of the work processes, and choose the equipment to be employed.

3. Why should all of the phases in designing an operating system be integrated?

So that the collection of people, materials, facilities, and information can be formed into a more valuable whole that will better convert inputs into goods or services.

4. Discuss the following statement: Most production planning is a waste of time because it all depends on demand forecasts, which are usually inaccurate.

Regardless of how much product demand is forecast, the purpose of production planning is to maintain a smooth, constant flow of work from start to finish so that the product or service will be completed in the desired time at the lowest possible cost.

5. What can the computer do to help with modern assembly-line planning? How might simulations be used?

Computers can be utilized to graphically depict work that is planned and work that is accomplished (Gantt chart). Other mathematical and computer-assisted tools and techniques, such as the critical path method and the program evaluation and review technique, can assist in resource allocation. Computers might also assist in flowcharting activities and scheduling activities.



Skill Building Exercise 19.1

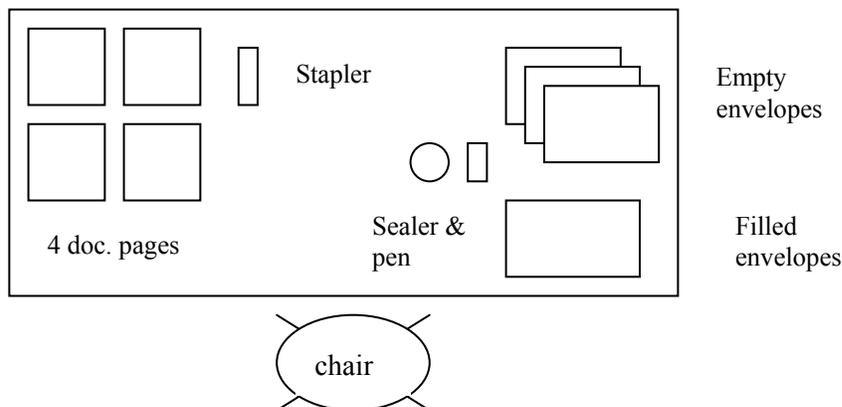
Analyzing the Layout

An opportunity to do a bit of field work. Observation is an important information-gathering technique in layout design and analysis, and it will be interesting to see what relatively untrained observers catch and miss.

Skill Building Exercise 19.2

Disseminating Confidential Information

1.



- Arrange pages to left of table
 - Gather pages in order, one document at a time
 - Staple
 - Fill envelope
 - Seal and write "Confidential"
 - Place into filled envelope pile
2. Divide each task to a separate area and accomplish each step separately for all documents all at one time. When pages are copied at a copier, let the machine gather them into documents and staple by hand. Also, stamping "Confidential" with a rubber stamp would be more efficient than hand writing.

Skill Building Exercise 19.3

1. Student answers will vary. Student answers could include points such as:

- A CPM network gives a representation of a project or a group of activities.
- The interdependencies of the activities are noted explicitly.
- It can be used for controlling once plans have been put into action.
- By tracking actual progress compared to planned progress, activities that fall behind schedule can quickly be spotted.
- Project network analysis can provide information beyond simple project planning and control.
- By knowing the critical activities, the project manager can best allocate limited resources and can make more accurate time-cost trade-offs.

2. Student answers will vary. They should understand that Gantt charts graphically depict work planned and work accomplished in relation to time. A CPM network results in a network representation of a project or a group of activities. The CPM network would note the interdependencies of the activities more explicitly than a Gantt chart. Also the activities would be shown in greater detail by CPM network as compared to a Gantt chart.

Suggested Answers to Case Incident Questions

Case 19.1 The Lines at Sam's

1. What are Sam's options?

Sam could either take the industry's position and just accept these problems as an inherent part of the business or he could take an operations or production approach to solving the problems.

2. How might Sam improve his present situation?

Sam could improve his present situation by taking an operations or production approach to solving his problems.

3. Do you have any further suggestions for Sam? If so, what are they?

Sam should not accept the problems as inherent with the business. He should try improving his present situation. For example, Sam should study the checkout problem and possibly install a second register for use during rush hours. He might also consider installing a register with pictures of the items on the buttons (like McDonald's). Another suggestion might be to place all foods of a similar type into one price category. Sam could also use standardized pie cutters and spoons to eliminate the

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problems of varying sizes. Sam might also undertake a cost-benefit study to investigate the desirability of increasing his capacity to handle the Sunday crowds.

4. What other service-oriented industries can you think of that seem to take the same view toward their problems that Sam's industry does?

Many, if not most, service organizations take the attitude of just accepting certain problems as a natural part of the business. Some common examples include ticket counters at airports or ball games, retail clothing stores, and gasoline stations.

Case 19.2 A New Building for Tot-Two

1. What are the strong points of Shirley's layout? What are the weak points?

Strengths:

- The total area does not exceed the 7,000 square foot limit, and it is in a rectangular shape.

Weaknesses:

- Space designated for some areas is not appropriate for their operational needs.
- The break room area is close to the office areas, but it should be accessible for machine workers as well.
- Same for washrooms
- The flow of goods is not accommodated well with this plan

2. Redesign the layout, based on your answers to question 1.

Layouts will vary depending on the assumptions made by the students.

Suggested Student Projects

1. Go to a fast-food restaurant of your choice during a rush and non-rush hour (observe for at least 30 minutes) and chart what you perceive to be efficient and inefficient processes. Examine their processes, equipment, and personnel. What suggestions do you have?
2. Compare the processes of three fast-food restaurants. What are the differences and similarities? Do you see the potential for any competitive advantages because of their operations?
3. Examine the registration and/or registrar's function at your university and comment on the processes. What are the strengths and weaknesses? How could they be changed? Why do think they have not been changed?

4. Interview the manager of a small manufacturing plant, a fast-food restaurant, or a service firm about his/her attitude toward and training procedures for operations planning. Do they have training programs? Do they use any mathematical models to assist them? What is the role of the computer (if any)? What do they perceive to be the biggest problems faced by their industry?



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MANAGEMENT
skills & applications

Leslie W. Rue
Lloyd L. Byars

**Chapter
19**

**Operations
Management
and Planning**

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Learning Objectives

After studying this chapter, you will be able to:

1. Define operations management.
2. Describe an operating system, and identify the two basic types of operating systems.
3. Differentiate among product/service design, process selection, and site selection decisions.
4. Explain what a materials-handling system is.

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Learning Objectives (cont'd)

After studying this chapter, you will be able to:

5. Describe and give an example of the three basic classifications of facilities layouts.
6. Explain the sociotechnical approach to job design.
7. Describe several computer-related technologies that are currently playing major roles in production/operations management.

19-3

Learning Objectives (cont'd)

After studying this chapter, you will be able to:

8. Outline the three major steps in developing an aggregate operations plan.
9. Summarize the differences between resource allocation and activity scheduling.
10. Distinguish between Gantt charts, the critical path method (CPM), and the program evaluation and review technique (PERT).

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Operations Management and Planning

- Operations management
 - Application of the basic concepts and principles of management to those segments of the organization that produce its goods or services.
- Operations planning
 - Designing the systems of the organization that produce goods or services.
 - Planning the day-to-day operations within those systems.

19-5

Importance of Operations Management

- Most operations managers no longer manage in a stable environment with standard products.
 - Changing technology and a strong emphasis on low costs have altered technical and administrative problems confronted.
 - Other aspects operations managers deal with:
 - Product diversity
 - Demand for high quality
 - Short lead times

19-6

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Operating Systems and Activities

- Operating systems consist of processes and activities necessary to turn inputs into goods or services.
 - They are made up of people, materials, facilities, and information.
- Types
 - Many operating systems take a collection of parts and form them into a more valuable whole.
 - In some cases, these break something down from a larger quantity to smaller quantities with more value.
 - A third type produces services by turning inputs into more useful outputs.

19-7

Simplified Model of an Operating System

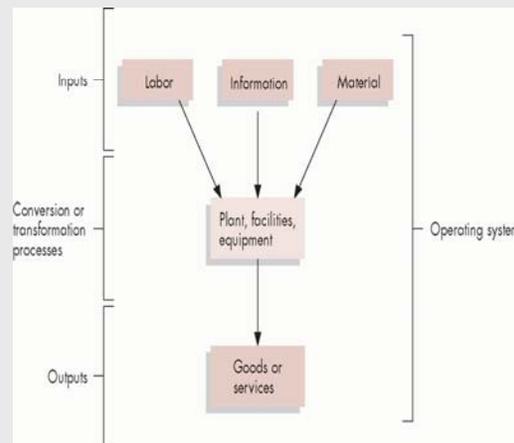


Figure 19.1

19-8

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Types of Operating Systems

- **Continuous Flow System**
 - Operating systems used by companies that produce large amounts of similar products/ services flowing through similar stages of the operating system.
 - Product or service is often advertised and available to the customer immediately.
 - Require special purpose equipment that is less flexible and usually more expensive than general purpose equipment.
- **Intermittent Flow System (Job shop)**
 - Operating system used when customized products and services are produced.
 - Results in higher unit costs as compared to the continuous flow system.

19-9

Product or Service Design

- **Organization's product or service determines the design of its operating systems.**
 - Design of a new product/service or the redesign may lead to extensive systems redesign, equipment changes, new personnel, and other modifications.
 - Common goals and close communication between design and operations is a necessity.
- **Design engineers have encountered conflict with operations managers.**
 - Design engineers are technically oriented and sometimes lack concern for production methods and costs.
 - Operations managers may care more about production costs and requirements than about functional requirements of the product.

19-10

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Process Selection

- Specifies in detail the processes and sequences required to transform inputs into products or services.
- In equipment selection, factors other than costs should also be considered,
 - Availability of operators and training required for operators.
 - Maintenance record and potential and availability of parts and services.
 - Supplier assistance in installation and debugging and compatibility with existing equipment.
 - Flexibility of equipment in handling product variation and safety of equipment.
 - Expected delivery date and warranty coverage.

19-11

Facilities Layout

- Facilities layout
 - Process of planning the optimal physical arrangement of facilities, including personnel, operating equipment, storage space, office space, materials-handling equipment, and room for customer or product movement.
 - Needed for a variety of reasons
 - Construction of new or additional facility facilities.
 - Obsolescence of current facilities.
 - Changes in demand.
 - Development of a new or redesigned product or process.
 - Personnel considerations: frequent accidents, poor working environment, or prohibitive supervisory costs.

19-12

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Materials Handling

1. Materials should move through the facility in direct flow patterns, minimizing zigzagging or backtracking.
2. Related production processes should be arranged to provide for direct material flows.
3. Mechanical materials-handling devices should be designed and located, and material storage locations should be selected so that human effort expended through bending, reaching, lifting, and walking is minimized.
4. Heavy or bulky materials should be moved the shortest distance through locating the processes that use them near receiving and shipping areas.
5. The number of times each material is moved should be minimized.
6. Systems flexibility should allow for unexpected situations such as materials-handling equipment breakdowns, changes in production system technology, and future expansion of production capacities.
7. Mobile equipment should carry full loads at all times; empty and partial loads should be avoided.

Figure 19.2

19-13

Layout Classifications

- Product layout
 - Arranges equipment or services according to the progressive steps by which the product is made or the customer is served.
 - Advantage: It is efficient because it simplifies production planning.
 - Disadvantage:
 - Workers who perform a limited number of repetitive tasks often grow bored.
 - Second, an assembly line can move only as fast as the slowest link in the chain.

19-14

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Layout Classifications (cont'd)

- Process layout
 - Groups equipment or services of a similar functional type.
 - Advantage: Employees perform a wider variety of tasks than do people working on assembly lines.
 - Disadvantage: Requires high-skilled workers.
- Fixed-position layout
 - Used when the product is too large to move and remains in one place.
 - Disadvantage: Not always as efficient as a product layout or process layout.

19-15

Site Selection

Options for expanding capacity:

- Subcontract work.
- Add another shift.
- Work overtime.
- Move operation to a larger facility.
- Expand the current facility.
- Keep the current facility and add another facility elsewhere.

19-16

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Site Selection Factors

- | | |
|--|---|
| 1. Revenue | 3. Investment |
| a. Location of customers and accessibility | a. Cost of land |
| b. Location of competitors | b. Cost of construction |
| 2. Operating costs | 4. Other limiting factors |
| a. Price of materials | a. Availability of labor with appropriate skills |
| b. Transportation costs: materials, products, people | b. Availability of materials, utilities, supplies |
| c. Wage rates | c. Union activity |
| d. Taxes: income, property, sales | d. Community attitudes and culture |
| e. Utility rates | e. Political situation |
| f. Rental rates | f. Pollution restrictions |
| g. Communication costs | g. Climate |
| | h. General living conditions |

Figure 19.3

19-17

Job Design

- Designates the specific work activities of an individual or a group of individuals.
- Consists of three phases:
 - Specification of individual tasks.
 - Specification of the method of performing each task.
 - Combination of individual tasks into specific jobs to be assigned to individuals.

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Components of Job Design

- Job content
 - Aggregate of all the work tasks the jobholder may be asked to perform.
- Job methods
 - Manner in which the human body is used, the arrangement of the workplace, and the design of the tools and equipment used.
 - The goal of job method design is to find the one best way to do a job.
 - Motion study is used in designing jobs.
- Ergonomics
 - Study of the interface between people and, machines.
 - The goal behind ergonomics is to design equipment and the workplace so as to make jobs as physically easy as possible.

19-19

Advantages of Specialization

Advantages of Specialization	
To Management	To Labor
<ol style="list-style-type: none"> 1. Rapid training of the workforce. 2. Ease in recruiting new workers. 3. High output due to simple and repetitive work. 4. Low wages due to ease of substitutability of labor. 5. Close control over work flow and workloads. 	<ol style="list-style-type: none"> 1. Little or no education required to obtain work. 2. Ease in learning job.
Disadvantages of Specialization	
To Management	To Labor
<ol style="list-style-type: none"> 1. Difficulty in controlling quality since no one person has responsibility for entire product. 2. Worker dissatisfaction leading to hidden costs arising from turnover, absenteeism, tardiness, grievances, and intentional disruption of production process. 3. Reduced likelihood of improving the process because of workers' limited perspective. 4. Limited flexibility to change the production process to produce new or improved products. 	<ol style="list-style-type: none"> 1. Boredom stemming from repetitive nature of work. 2. Little gratification from work itself because of small contribution to each item. 3. Little or no control over the workplace, leading to frustration and fatigue (in assembly-line situations). 4. Little opportunity to progress to a better job since significant learning is rarely possible on fractionated work.

Source: Richard B. Chase, F. Robert Jacobs and Nicholas J. Aquilano, *Operations Management for Competitive Advantage*, 10th ed., 2003, p. 127; copyright © by The McGraw-Hill Companies. Reproduced with permission of The McGraw-Hill Companies.

Figure 19.4

19-20

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Job Characteristics

- Skill variety
 - Refers to the number of different skills an employee needs to perform a job.
- Task identity
 - Refers to the degree to which a job allows an employee to complete an entire task rather than just part of the task.
- Task significance
 - Refers to the level of impact a job has on the whole organization.
 - Employees who feel that their work affects the organization generally have high job satisfaction.

19-21

Job Characteristics (cont'd)

- Autonomy
 - Refers to the independence employees have to make decisions about how to perform their jobs.
 - Most people prefer to have some autonomy in their jobs.
- Feedback
 - Involves the extent to which managers let employees know how they are performing.

19-22

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Physical Work Environment

- Adverse physical conditions have a negative impact on performance, but the degree of influence varies from person to person.
- Occupational Safety and Health Act (OSHA) of 1970
 - Designed to reduce job injuries and in general.
- Guidelines for the work area should allow:
 - Normal lighting, temperature, ventilation, and humidity.
 - Baffles, acoustical wall materials, and sound absorbers should be used to reduce unpleasant noises.
 - Exposure to less than ideal conditions should be limited to short periods.

19-23

Sociotechnical Approach

- Approach to job design that considers both the technical system and the accompanying social system.
- Louis Davis' guidelines for job design:
 - The need for the content of a job to be reasonably demanding for the employee in terms other than sheer endurance and yet provide some variety.
 - The need to be able to learn on the job and go on learning.
 - The need for some minimum area of decision making that the individual can call his or her own.
 - The need for some minimum degree of social support and recognition at the workplace.
 - The need to be able to relate what the individual does and what he or she produces to the person's social life.
 - The need to feel that the job leads to some sort of desirable future.

19-24

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Computer Technology and the Design Process

- Computer-aided design (CAD)
 - Generates various views of different components and assemblies.
- Computer-aided engineering (CAE)
 - Uses a product's characteristics to analyze its performance under different parameters.
- Computer-aided manufacturing (CAM)
 - Uses stored data regarding various products to provide instructions for automated production equipment.
- Computer-integrated manufacturing (CIM)
 - Uses computer technology to incorporate all of the organization's production-related functions into an integrated computer to assist, augment, or automate most functions.

19-25

Operations Planning

- Production planning is concerned primarily with aggregate operations planning, resource allocation, and activity scheduling.
 - Aggregate operations planning (Aggregate production planning)
 - Concerned with overall operations and balancing major sections of the operating system.
 - Matches the organization's resources with demand for its goods and services.
 - Steps
 - First step: To obtain a demand forecast for the organization's goods or services.
 - Second step: Involves evaluating the impact of the demand forecasts on the organization's resources
 - Final step: Involves evaluating the impact of the demand forecasts on the organization's resources.

19-26

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Operations Planning (cont'd)

- Gantt chart
 - Graphically depicts work planned and work accomplished in relation to each other and to time.
 - From a planning perspective: It requires operations managers to clearly think through the sequence of events necessary to complete the tasks being charted.
 - From a control perspective: It emphasizes the element of time by readily pointing out any actual or potential slippages.
- Criticism of the Gantt chart
 - It can require considerable time to incorporate scheduling changes such as rush orders.

19-27

Resource Allocation

- Resource Allocation
 - Efficient allocation of people, materials, and equipment to meet the demand requirements of the operating system.
 - Has become critical in recent times due to resource scarcities.
- Mathematical and computer-assisted tools and techniques assisting in resource allocation
 - Linear programming
 - Critical path method (CPM)
 - Program evaluation and review technique (PERT)

19-28

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Tools and Techniques Assisting Resource Allocation

- Critical path method (CPM)
 - Depicts the relationships among the various activities of a project.
 - Used when time durations of project activities are accurately known and have little variance.
- Program evaluation and review technique (PERT)
 - Graphically depicts the relationships among the various activities of a project.
 - Used when time durations of project activities are not accurately known.

19-29

Project Represented by Gantt Chart and a Project Network

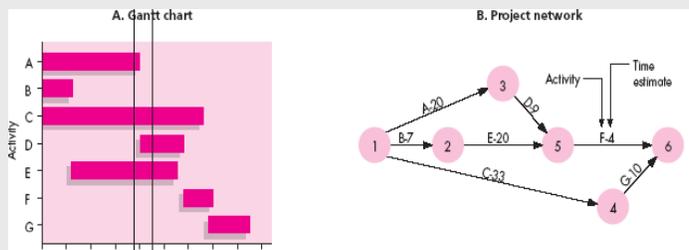


Figure 19.6

19-30

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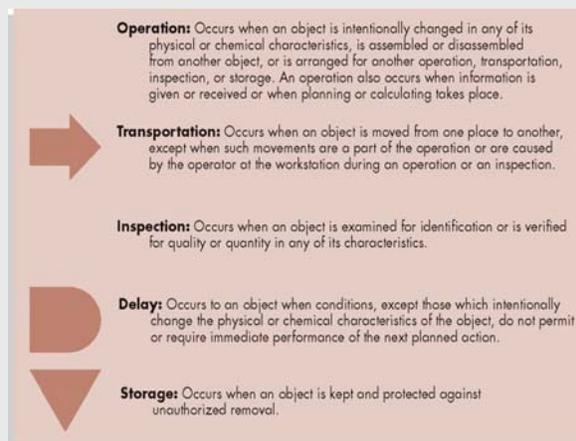


Other Operations Planning

- **Routing**
 - Finds the best path and sequence of operations for attaining a desired level of output with a given mix of equipment and personnel.
- **Assembly chart**
 - Depicts the sequence and manner in which the various components of a product or service are assembled.
- **Flow process chart**
 - Outlines what happens to a product or service as it progresses through the facility.

19-31

Flowcharting Activities



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Figure 19.7

19-32

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Other Operations Planning (cont'd)

- Activity scheduling
 - Develops the precise timetable to be followed in producing a product or service.
 - Also includes dispatching work orders and expediting critical and late orders.
 - Computer simulation is used to assist in the scheduling of continuous flow systems by estimating the impact of different scheduling decisions on the system.

19-33

Flow Process Chart: Present Method for Completing Authorization-to- Investigate Form

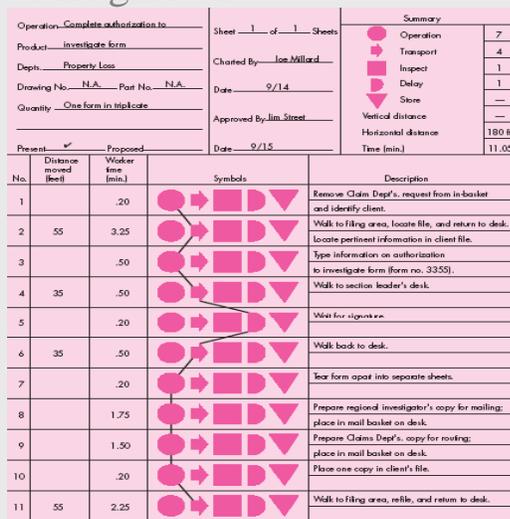


Figure 19.8

19-34

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