CHAPTER 10
Production and Operations Management

Chapter Summary: Key Concepts

The Strategic Importance of the Production

Production
The use of resources, such as workers and machinery, to convert materials into finished goods and services.

Mass production
A system for manufacturing products in large quantities through effective combination of employees with specialized skills, mechanization, and standardization.

Flexible production
Involves using information technology to share the details of customer orders and programmable equipment to fulfill the orders, and skilled people to carry out whatever tasks are needed to fill a particular order.

Customer-driven production
A system that evaluates customer demands to make the connection between products manufactured and products bought.

Production processes
Systems based on the means and time used to create output. They include analytic system, synthetic system, continuous process, and intermittent process.

Technology and the Production Process

Green manufacturing processes
Manufacturing processes that result in a reduction of waste, energy use, and pollution.

Robot
A reprogrammable machine capable of performing a variety of jobs that require manipulations of materials and tools. Often used to replace boring or dangerous jobs.

Computer-aided design and manufacturing
Computer-aided design (CAD) allows engineers to design components as well as entire products on computer screens faster and with fewer mistakes than they could achieve working with traditional drafting systems. Computer-aided manufacturing (CAM) uses computer tools to analyze CAD output and enables a manufacturer to analyze the steps that a machine must take to produce a needed product or part.
Flexible manufacturing system  A production facility system that workers can quickly modify to manufacture different parts, typically consisting of computer-controlled machines and powerful software to run the machines.

Computer-integrated manufacturing  A production system in which computers help workers design products, control machines, handle materials, and control the production function in an integrated fashion.

The Location Decision

Location of facility  Considerations include proximity to raw materials and markets, availability of personnel, transportation, energy resources, taxes, and living conditions.

Environmental impact study  An analysis of how a proposed plant would affect the quality of life in the surrounding area. Local regulatory agencies may require a study to determine how a proposed facility will impact the quality of life in the surrounding area, taking into account such things as energy, water, sewage treatment, natural plant life and wildlife, and potential pollution.

The Job of Production Managers

Planning the production process  Production and operations managers must plan what to produce and how to produce it.

Determining the facility layout  The three basic types of layouts are process, product, and fixed position. A fourth, customer-oriented layout, is typical of service providers’ production systems.

Implementing the production plan  Implementing a production plan involves making the decision of whether to make, buy, or lease components, selecting the best suppliers, and controlling inventory.

Controlling the Production Processes

Production process  A well-defined set of procedures for coordinating people, materials, and machinery to provide maximum production efficiency.

Production planning  Determines the amount of resources, including raw materials and other components, an organization needs to produce a certain output.

Routing  Determines the sequence of work throughout the facility and specifies who will perform each aspect of the work at what location.
<table>
<thead>
<tr>
<th><strong>Scheduling</strong></th>
<th>Phase of production control in which managers develop timetables that specify how long each operation in the production process takes and when workers should perform it.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dispatching</strong></td>
<td>Phase of production control in which management instructs each department on what work to do and the time allowed for its completion.</td>
</tr>
<tr>
<td><strong>Follow-up</strong></td>
<td>Phase of production control in which managers and employees or team members spot problems in the production process and come up with solutions.</td>
</tr>
</tbody>
</table>

**Importance of Quality**

<table>
<thead>
<tr>
<th><strong>Quality</strong></th>
<th>Good or service that is free of deficiencies.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Benchmarking</strong></td>
<td>Determining how well other companies perform business functions or tasks.</td>
</tr>
<tr>
<td><strong>Quality control</strong></td>
<td>Measuring output against established quality standards. Some means of quality control must be devised. Common methods include benchmarking, inspections, customer surveys, and constant improvement in production processes.</td>
</tr>
</tbody>
</table>

**International organization for Standards (ISO)**

| **International organization for Standards (ISO)** | This international organization promotes the development of standardized products to facilitate trade and cooperation across national borders.                                                                 |
Business Vocabulary

assembly line
benchmarking
computer-aided design (CAD)
computer-aided manufacturing (CAM)
computer-integrated manufacturing (CIM)
critical path
customer-driven production
customer-oriented layout
dispatching
environmental impact study
fixed-position layout
flexible manufacturing system (FMS)
flexible production
follow-up
International Organization for Standards (ISO)
inventory control
just-in-time (JIT)
LEED (Leadership in Energy and Environmental Design)
make, buy, or lease decision
mass production
materials requirement planning (MRP)
perpetual inventory
process layout
product layout
production
production and operations management
production control
production planning
program evaluation and review technique (PERT)
quality
quality control
robot
routing
scheduling
vendor-managed inventory (VMI)

Application of Vocabulary

Select the term from the list above that best completes the statements below. Write that term in the space provided.

1. ___________________________ is the general term applied to operations that use people, machinery, and other resources to convert materials into finished goods and services.

2. The industrial development of the United States involved the manufacture of large quantities of standardized goods using specialized labor and mechanization in an approach known as ____________________________.

3. The ___________________________ is a manufacturing technique, first used by Henry Ford, wherein the product passes through several work stations, each with a specialized task.

4. A ____________________________ makes it possible to quickly modify production methods as different products are manufactured.

5. Designers can use computers to create and modify a part or product before producing an actual prototype using ____________________________.
6. When computers are used to analyze a CAD and electronically transmit instructions to production processing equipment, a ________________________________ is in use.

7. The use of computers to design products, control machines, handle materials, and control the production function in an integrated fashion is called ________________________________ ________________________________.

8. ________________________________ involves balancing the costs of holding raw materials, work in progress, and inventory against the costs involved in carrying the inventory.

9. ________________________________ is the process of identifying best practices in a field or industry and then using those standards to continually measure and improve performance.

10. ________________________________ is a computer-based planning system for ensuring that the needed amount of parts and materials is available at the right time and place and in the right amounts.

11. Producers must make a ________________________________ about whether it is advisable to manufacture, purchase, or lease a needed component, product, or material.

12. ________________________________ is the phase of production control that develops timetables specifying how long each operation in the production process takes and when it should be performed.

13. The management of people, machinery, and other resources used in converting inputs into finished goods and services is called ________________________________.

14. During the phase of production control known as ________________________________, managers develop a bill of materials and a determination of other resources needed to produce a certain quantity of good or service.

15. ________________________________ is the phase of production control that specifies where and by whom each aspect of production will be performed.

16. The measurement of products or services produced against established quality standards is referred to as ________________________________.

17. A study undertaken to determine what effect a proposed plant will have on the quality of life in a given area is known as a(n) ________________________________.

18. ________________________________ is a scheduling technique developed by the military, used to minimize production delays by coordinating all aspects of a complex task.

19. The ________________________________ phase of production control spots problems and informs management of needed adjustments.
20. A ________________ inventory system supplies the needed parts to the production line on a last-minute basis.

21. A ________________ system makes it possible to continuously update the list of items in inventory.

22. The sequence of operations in a PERT diagram requiring the longest time for completion is called the ________________.

23. Once routing and scheduling have been completed, each department is instructed on what work is to be done and the time allowed for its completion in a phase of production control known as ________________.

24. A ________________ is a smart machine capable of performing numerous or dangerous tasks without getting hungry, tired, or sick.

25. ________________ is a well-defined set of procedures for coordinating people, materials, and machinery to provide maximum production efficiency.

26. The organization established to ensure consistent standards for products and to facilitate trade and cooperation is called the ________________.

27. When inventory control decisions are turned over to a supplier, the ________________ system is in use.

28. A ________________ system evaluates customer demands to make the connection between products manufactured and products bought.

29. A service firm should arrange its facilities to enhance the interactions between customers and its services by utilizing a ________________.

30. A ________________ places the product in one spot, and workers, materials, and equipment come to it.

31. ________________ is usually more cost-effective for producing smaller runs.

32. A voluntary certification program administered by the U.S. Green Building Council, aimed at promoting the most sustainable construction processes available, is known as ________________.

33. A grouping of machinery and equipment according to their functions is called a ________________.

34. A ________________ is also referred to as an assembly line.

35. Good or service that is free of deficiencies is said to have ________________.

Analysis of Learning Objectives

Learning Objective 10.1: Explain the strategic importance of the production function.
True or False

1. ______ Production and operations managers oversee the conversion of inputs (labor, materials, and machines) into outputs (goods and services).

2. ______ Production and operations managers are needed by business, but are rarely used in the not-for-profit sector.

3. ______ Effective production and operations management can reduce production costs and increase profits.

4. ______ Production management applies to manufacturing but not to service businesses.

5. ______ Unfortunately, flexible production systems offer no means to integrate the information technology and programmable equipment used in mass production.

6. ______ Customer-driven production techniques allow a firm to alter its production plans continuously in response to customer demands.

7. ______ Mass production is effective combinations of employees, with specialized skills, mechanization, and standardization.

Learning Objective 10.2: Identify and describe the four main categories of production processes.

Multiple Choice

1. Which category of production reduces a raw material to its component parts to extract one or more marketable products?
   a. analytic production system  
   b. synthetic production system  
   c. continuous production process  
   d. intermittent production process

2. Which category of production combines a number of raw materials or parts to produce finished products?
   a. analytic production system  
   b. synthetic production system  
   c. continuous production process  
   d. intermittent production process

3. Which category of production generates finished products over a lengthy period of time?
   a. analytic production system  
   b. synthetic production system  
   c. continuous production process  
   d. intermittent production process

4. Which category of production generates products in short production run:
   a. analytic production system  
   b. synthetic production system  
   c. continuous production process  
   d. intermittent production process
Learning Objective 10.3: Explain the role of technology in the production process.

**True or False**

1. ______ With the use of computer-integrated manufacturing (CIM), production can be integrated by a centralized computer system that designs products, controls machines, handles materials, and controls production processes.

2. ______ Computer controlled machining centers, powerful software, and other technologies make it possible to quickly modify systems to manufacture different products.

3. ______ In computer-aided design (CAD), users can sketch, analyze, and modify three dimensional designs on a computer screen.

4. ______ In computer-aided manufacturing (CAM), the user can analyze the steps that will be needed in manufacturing the product designed using the CAD program.

5. ______ Robots are reprogrammable machines that have replaced many production workers in the performance of repetitive or dangerous tasks.

6. ______ Integration of modern technology in production allows firms to produce items so fast customers can keep a lower stock on hand and place more frequent orders.

Learning Objective 10.4: Identify the factors involved in a plant location decision.

**Short Answer**

What are the nine factors that should be considered when selecting a location?

1. 

2. 

3. 

4. 

5. 

6. 

7.
Learning Objective 10.5: Explain the major tasks of production and operations managers and outline the three activities involved in implementing the production plan.

Short Answer

Describe the four major tasks of production managers.

1. 

2. 

3. 

4. 

Describe the three activities involved in implementing the production plan.

5. 

6. 

7. 

Learning Objective 10.6: Identify the steps in the production control process.

Fill in the Blank
Identify the following steps in the production control process. Write the name of the step in the space provided.

1. __________________________ is the phase of production control that determines the amount of inventory needed to produce a certain amount of product.

2. The phase that spots problems in the production process and informs management of needed adjustments is called ________________________.

3. __________________________ instructs each department on what work is to be done and the time allowed for completion.

4. The phase of production control that determines the sequence of work throughout the facility is known as ________________________.

5. PERT networks are used in the phase of production control known as ________________________.

Learning Objective 10.7: Explain the benefits of quality control.

True or False

1.______ Investing more money up front in quality design and development, ultimately lowers the costs of maintaining high quality.

2.______ The most efficient way to control quality is to spot-check output and fix any mistakes.

3.______ X-rays, electronic sensors, and robots can help automate quality control inspections.

4.______ Benchmarking involves recognizing best practices and doing what it takes to achieve, and even exceed, these standards.

Self Review

True or False

1.______ Production can be defined as the use of people, machinery, and other resources to convert materials into finished products and services.

2.______ Plant location can contribute to the difference between profit and loss for a firm.

3.______ Refining crude oil is an example of an analytic production process.

4.______ Mass production was based in part on the specialization of labor and tasks.

5.______ Mechanization refers to using machines to perform work previously done by people.
6. ______ In a process layout, the facility is designed so that the product stays in one place while workers, materials, and machines come to it.

7. ______ Customers and suppliers are increasingly involved in forecasting and implementing production schedules.

8. ______ Automobiles are manufactured by means of an analytic process.

9. ______ Proximity to customers should be a determining factor in the location of service facilities.

10. ______ Transportation is an important factor to be considered when selecting a location.

11. ______ Production control is a three-step process: planning, scheduling, and dispatching.

12. ______ Synthetic production involves putting various parts together to make a finished product.

13. ______ Continuous-process production is used in petroleum refineries.

14. ______ One of the advantages of flexible manufacturing systems is that they enable the users to produce small batches at mass production speed.

15. ______ A PERT network may consist of a few events and cover a short amount time.

**Multiple Choice**

1. Producing uniform, interchangeable goods and parts is called:
   a. dispatching.  
   b. standardization.  
   c. routing.  
   d. quality control.  
   e. none of the above.

2. Under a ____________, machines and equipment are grouped by function.
   a. process layout  
   b. static product layout  
   c. product layout  
   d. PERT layout  
   e. quality control layout

3. An important consideration in plant location is:
   a. transportation.  
   b. taxes and regulations in the area.  
   c. adequate labor supply.  
   d. quality of life in the community.  
   e. all of the above.

4. The step in production control that involves developing the timetables for each operation is:
   a. planning.  
   b. dispatching.
b. routing.  e. mechanization.
c. scheduling.

5. The PERT network method is most useful for:
   a. prototype building.  d. service centers.
   b. routine jobs.  e. none of the above.
   c. complex projects.

6. A synthetic system is the opposite of:
   a. a basic system.  c. an intermittent system.
   b. a fixed position system.  d. an analytic system.

7. If the price and quality of an item are similar, what other factors should determine the selection of the supplier?
   a. speed of delivery.
   b. previous experience.
   c. warranties on purchases.
   d. the supplier’s commitment to quality control.
   e. all of the above.

8. JIT has to do with:
   a. inventory control.  d. product design.
   b. quality control.  e. plant layout.
   c. production control.

9. Managers of the production function are responsible for:
   a. planning overall production processes.
   b. determining the best layout for the production facilities.
   c. implementation of the production plan.
   d. maintaining quality control standards in production.
   e. all of the above.

10. Today, production planning:
    a. is confined to the production department.
    b. involves only the production and marketing departments.
    c. increasingly utilizes the team concept.
    d. never includes customer or supplier input.
    e. excludes evaluation of production processes.

11. Standards set to ensure standardization of components and goods sold in 140 countries are set by the:
    a. ISO.  c. CIM.
    b. MRP.  d. JIT.
12. A firm that relies on its supplier to manage inventory is using:
   a. a perpetual inventory system.
   b. a vendor-managed inventory system.
   c. a JIT inventory system.
   d. poor judgment.

13. Historically, mass production relied on:
   a. specialization of labor.
   b. standardization.
   c. mechanization.
   d. all of the above.

**Application Exercises**

Pat and Todd Doty own a small but growing manufacturing firm. The firm produces custom-made products and is becoming more mechanized. Currently, the company’s employees are trained on a variety of tasks. Most of them can literally perform every step in the manufacturing process. The employees enjoy the variety of work. However, the training time for new employees is very long and thus expensive.

The firm is considering going to the specialization of labor. They have asked you to outline the advantages and disadvantages of specialization and suggest a method that would not completely devastate the morale of the present employees and, at the same time, reduce the cost of training new employees.

1. What are the advantages of specialization?

2. What are the disadvantages of specialization?

3. What suggestions can you make?

**Short Essay Questions**

1. What are the tasks of production and operations management? How important are these techniques in the creation of services?
2. Technology has vastly changed the way production and operations management works. Write a brief essay detailing the various techniques used by modern production managers.