The Basics Of Operations Management

- Operations Management
  - The process of managing the resources that are needed to produce an organization's goods and services.
  - Operations managers focus on managing the "five Ps" of the firm's operations:
    - People, plants, parts, processes, and planning and control systems.

The Production System

- Input
  - A resource required for the manufacture of a product or service.
- Conversion System
  - A production system that converts inputs (material and human resources) into outputs (products or services); also the production process or technology.
- Output
  - A direct outcome (actual product or service) or indirect outcome (taxes, wages, salaries) of a production system.

The Basic Production System

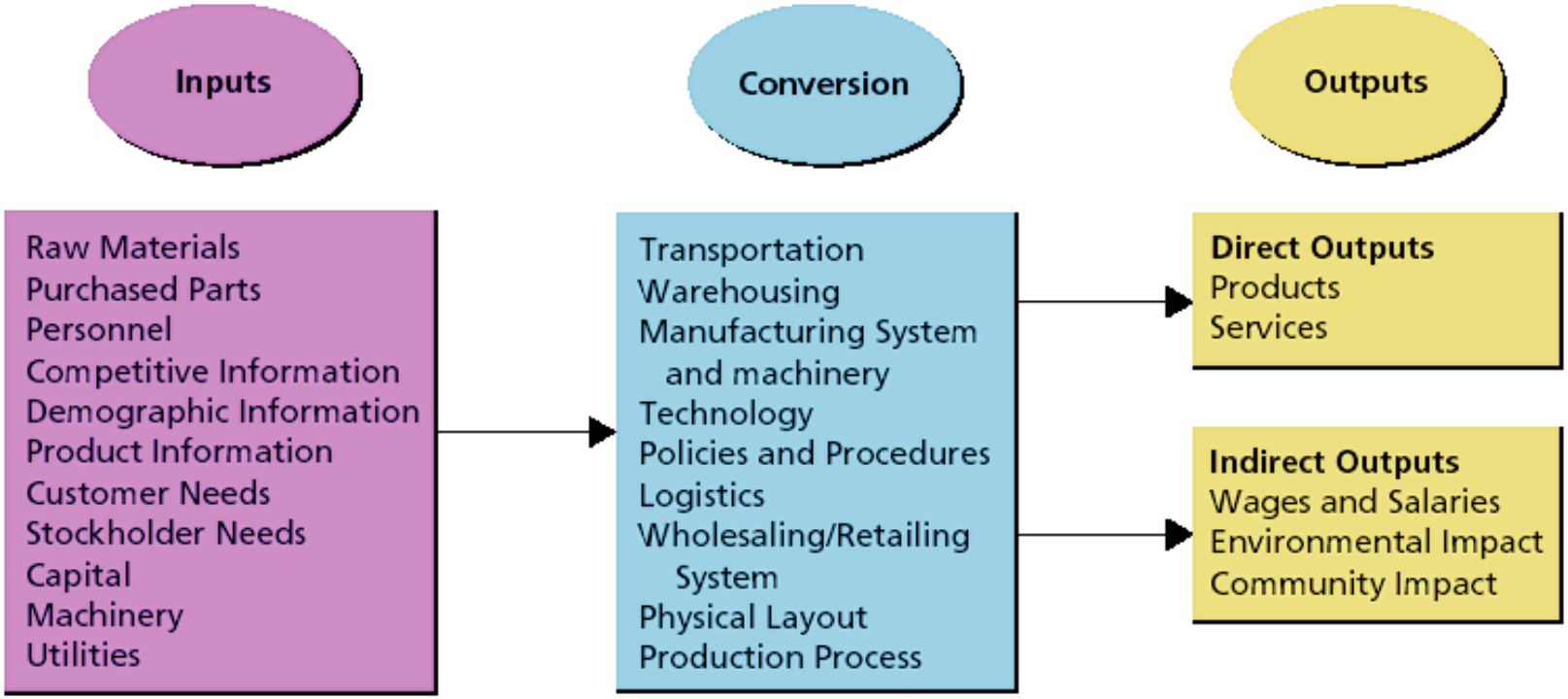


FIGURE ۱۵–۱

Production System Components

TABLE 15–1 Components of Some Typical Production Systems

Production System	Primary Inputs	Purpose of Conversion Subsystem	Outputs
1. Pet food factory	Grain, water, fish meal, personnel, tools, machines, paper bags, cans, buildings, utilities	Converts raw materials into finished goods	Pet food products
2. Public accounting firm	Supplies, personnel, information, computers, buildings, office furniture, machines, utilities	Attracts customers, compiles data, supplies management, information, computes taxes	Management information, tax services, and audited financial statements
3. College or university	Students, books, supplies, personnel, buildings, utilities	Transmits information and develops skills and knowledge via lectures, exams, computerized instruction	Educated persons

Source: Adapted from Norman Gaither, *Production and Operations Management*, 5th ed. (Fort Worth, TX: The Dryden Press, 1992), pp. 22–23.

Basic Types of Production Processes

- Intermittent Production System
  - Production is performed on a start-and-stop basis, such as for the manufacture of made-to-order products.
- Mass Production
  - A special type of intermittent production process using standardized methods and single-use machines to produce long runs of standardized items.

Basic Types of Production Processes (cont'd)

- Mass Customization
  - Designing, producing, and delivering customized products to customers for at or near the cost and convenience of mass-produced items.
  - Mass customization combines high production volume with high product variety.
  - Elements of mass customization:
    - Modular product design
    - Modular process design
    - Agile supply networks

Basic Types of Production Processes (cont'd)

- Continuous Production Processes
  - A production process, such as those used by chemical plants or refineries, that runs for very long periods without the start-and-stop behavior associated with intermittent production.
  - Enormous capital investments are required for highly automated facilities that use special-purpose equipment designed for high volumes of production and little or no variation in the type of outputs.

The Facility Location Decision

- Decision Factors:
  - Customer convenience
  - Transportation costs
  - Labor costs and availability
  - Sources of supplies and raw materials
  - Owner preferences for specific locations
  - Government policies, rules, regulations and incentives
  - Site cost and availability

Facility and Production Layout

- Facility Layout
  - The configuration of all the machines, employee workstations, storage areas, internal walls, and so forth that constitute the facility used to create a firm's product or service.
- Product Layout
  - A production system design in which every item to be produced follows the same sequence of operations from beginning to end, such as an assembly line.

Product Layout for Carwash

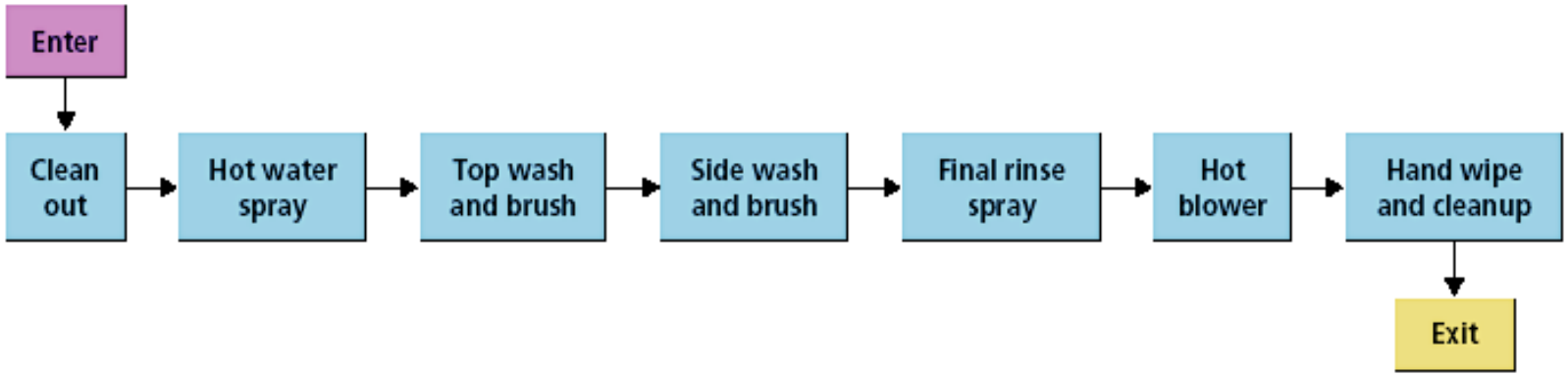
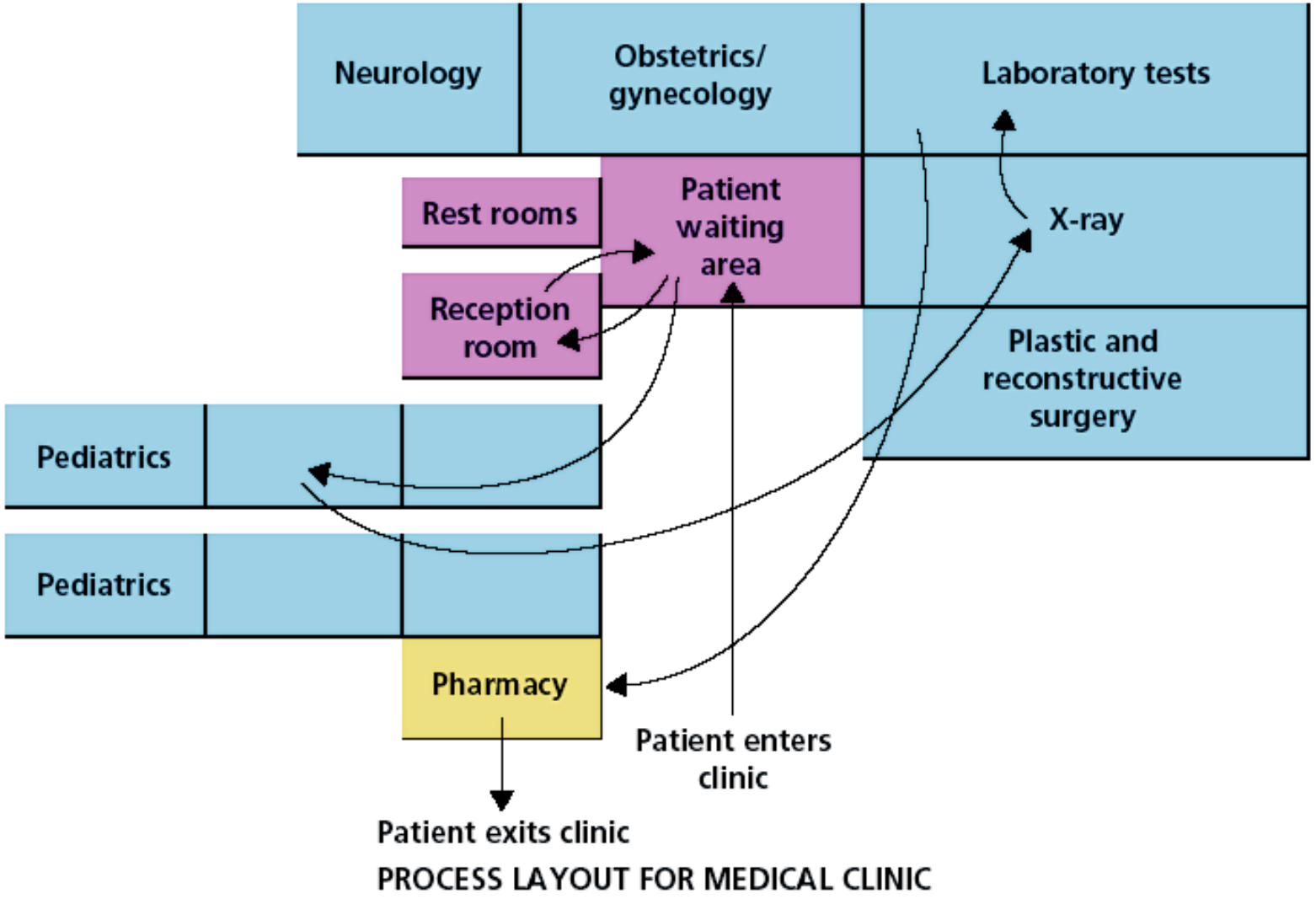


FIGURE ۱۵–۲

Facility and Production Layout (cont'd)

- Process Layout
  - A production system design in which similar machines or functions are grouped together.
- Fixed-Position Layout
  - A production system arrangement in which the product being built or produced stays at one location and the machines, workers, and tools required to build the product are brought to that location as needed, as for the building of ships or other bulky products.

Process Layout



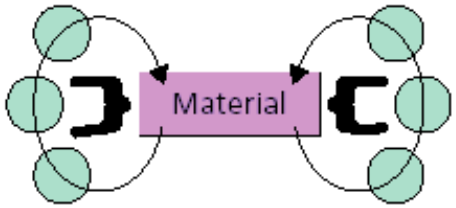
PROCESS LAYOUT FOR MEDICAL CLINIC

FIGURE ۱۵–۳

Facility and Production Layout (cont'd)

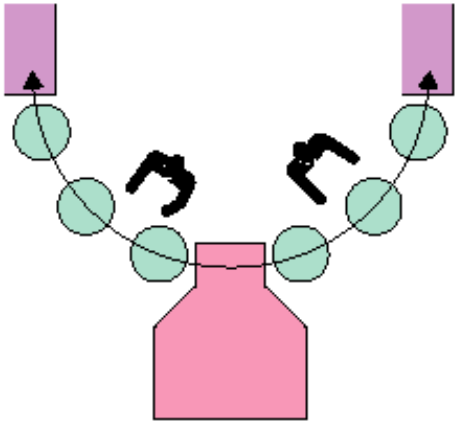
- Cellular Manufacturing Layout
  - A combination of process and product layouts, in which machines and personnel are grouped into cells containing all the tools and operations required to produce a particular product or family of products.

Improving Layouts by Moving to the Cellular Manufacturing Concept

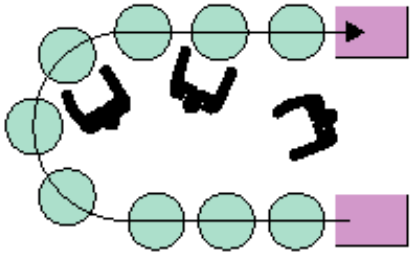


(a) Current layout—workers in small closed areas. Cannot increase output without a third worker.

(b) Current layout—straight lines are hard to balance.



Improved layout—workers can assist each other. May be able to add a third worker.



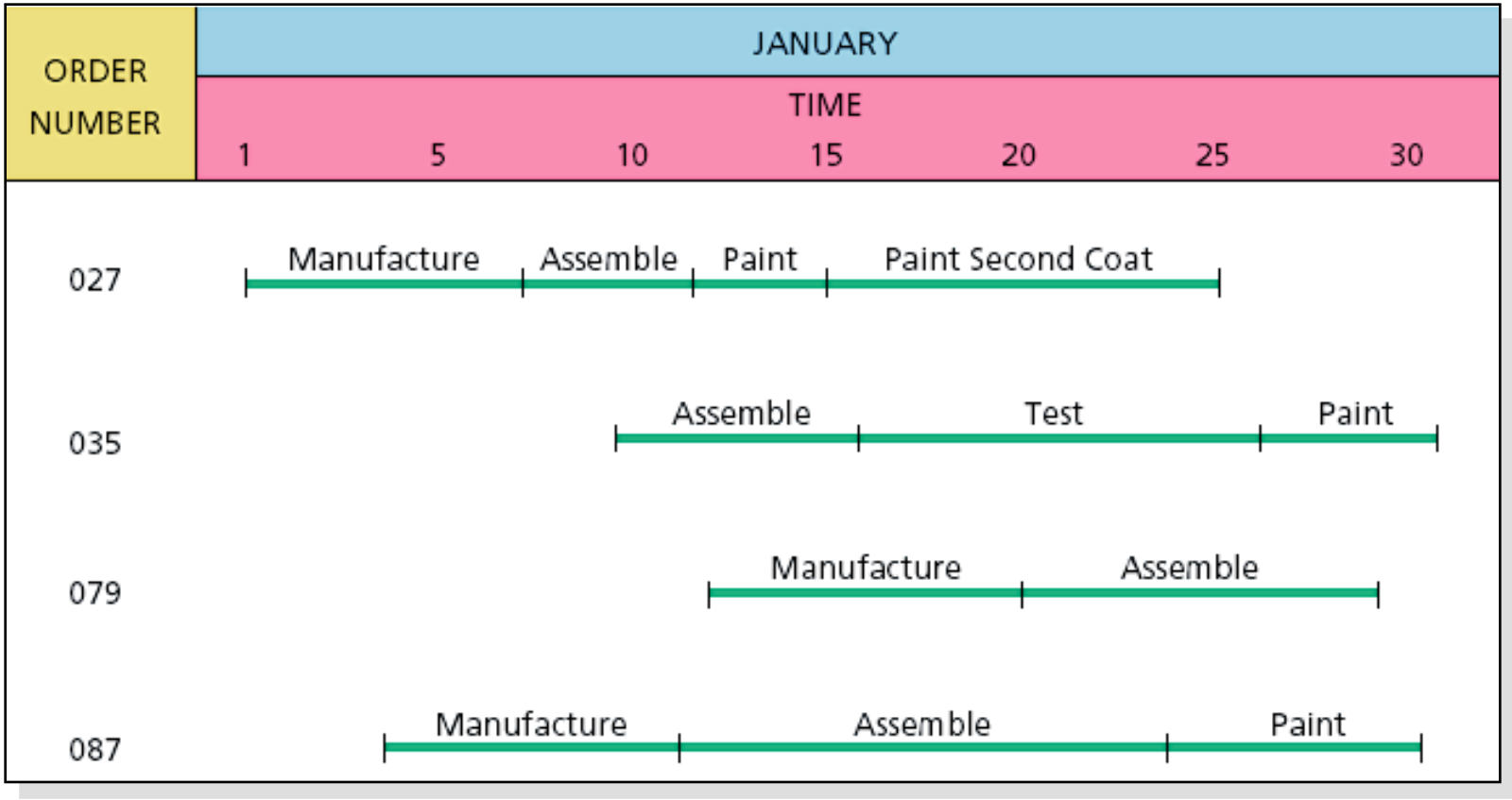
Improved layout—in U shape, workers have better access. Four workers were reduced to three.

FIGURE ۱۵–۴

Operations Planning And Control Techniques

- Operations or Production Planning
  - The process of deciding what products to produce and where, when, and how to produce them.
- Operations or Production Control
  - The process of ensuring that the specified production plans and schedules are being adhered to.

A Gantt Chart



Gantt chart: a production scheduling chart (named after management pioneer Henry Gantt) that plots time on a horizontal scale and generally shows, for each product or project, the start-and-stop times of each operation.

FIGURE ۱۵–۵

Network Planning and Control Methods

- Network Planning and Control methods
  - Ways of planning and controlling projects by graphically representing the projects' steps and the timing and links between these steps.
  - PERT (program evaluation review technique)
  - CPM (critical path method)

Components of PERT Networks

- Events
  - The specific accomplishments in a project, represented by circles in a PERT chart.
- Activities
  - The time-consuming aspects of a project, represented by arrows in a PERT chart.
- Critical Path
  - The sequence of events in a project that, in total, requires the most time to complete.

PERT Chart for Building a House

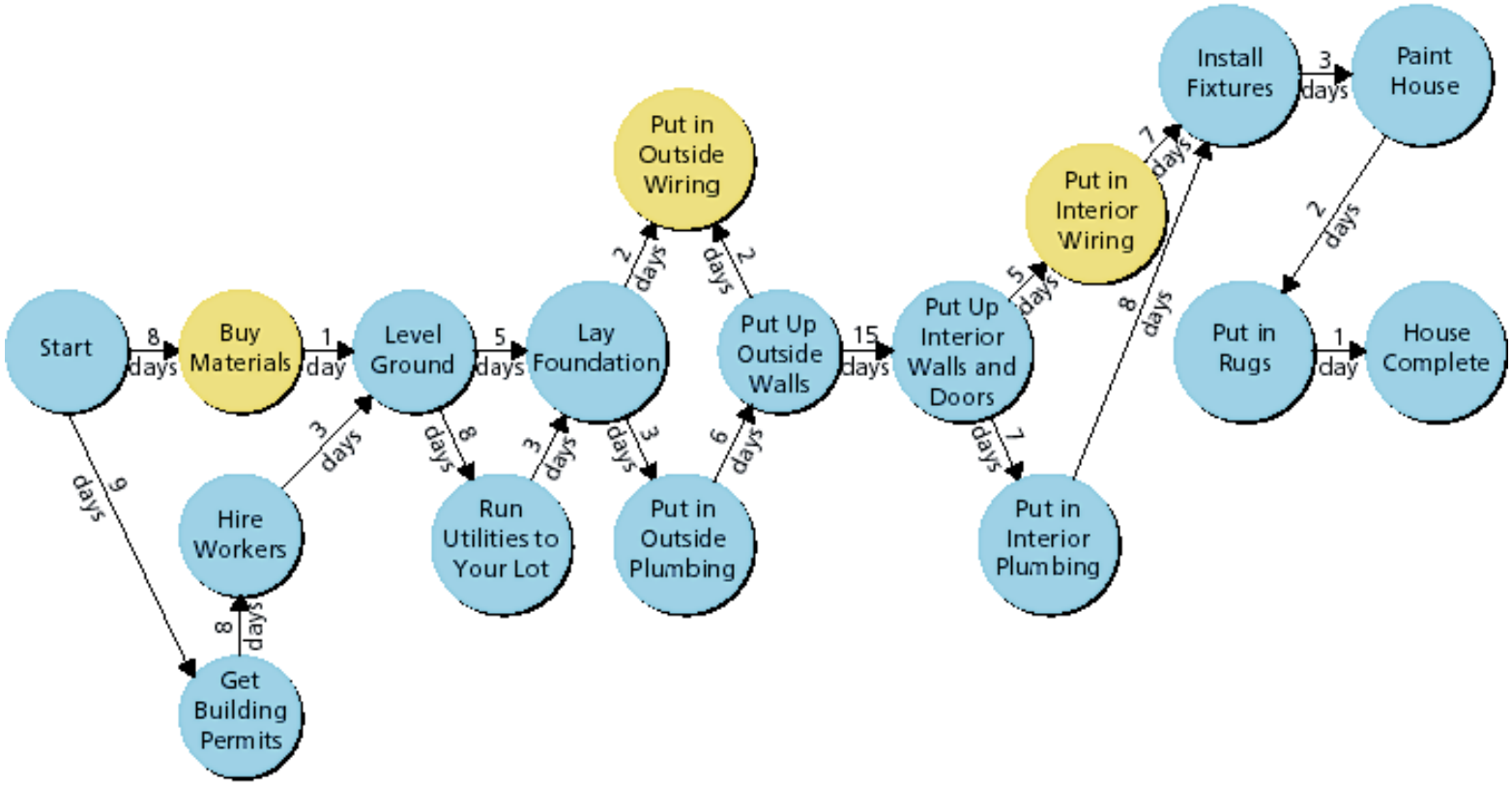


FIGURE ۱۵–۶

Example of a Computerized Network Planning Report

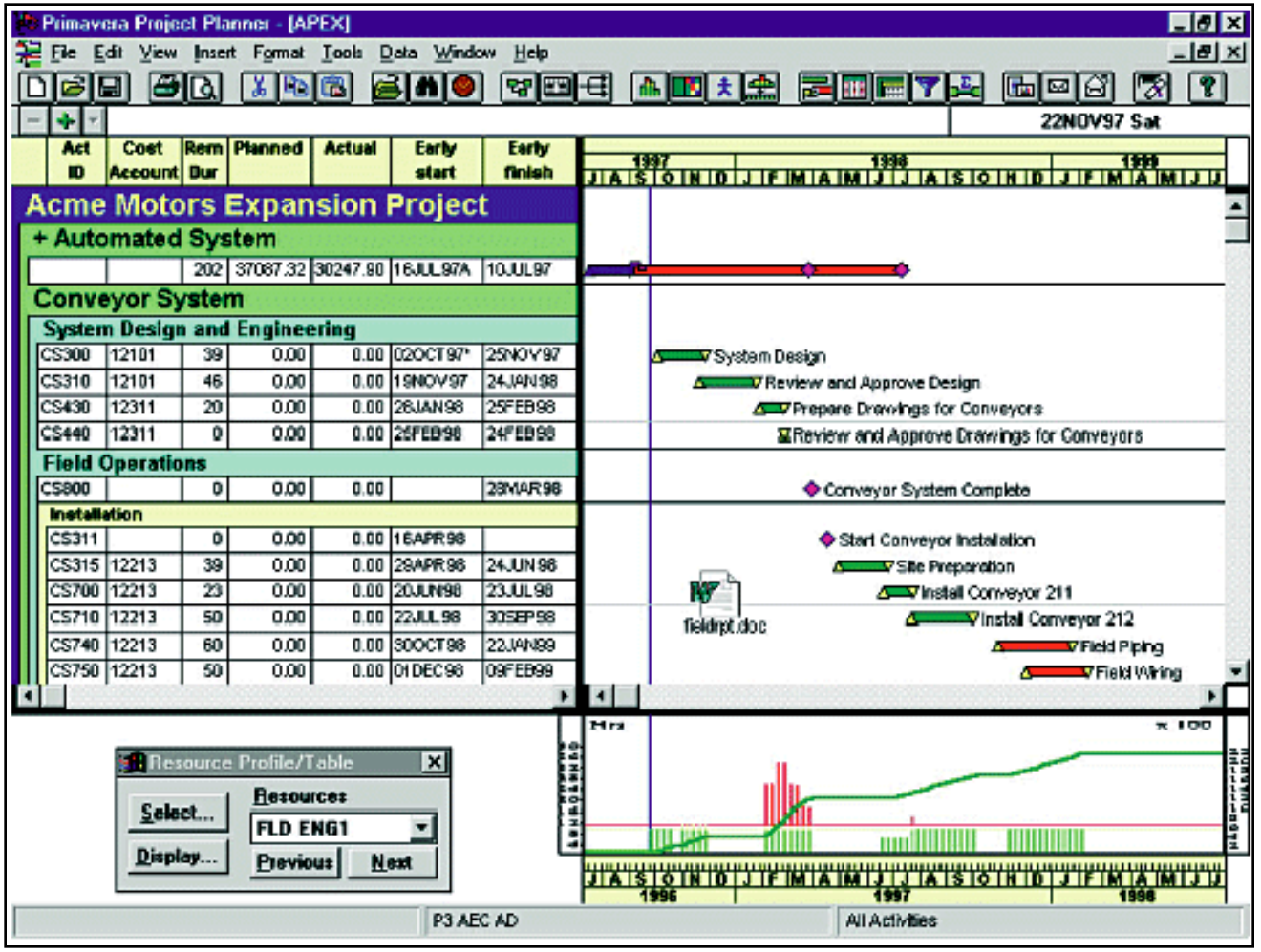


FIGURE ۱۵–۷

Inventory

- Types of Inventory Items
  - **Raw materials and purchased parts** from outside suppliers.
  - **Components:** subassemblies that are awaiting final assembly.
  - **Work in process:** all materials or components on the production floor in various stages of production.
  - **Finished goods:** final products waiting for purchase or to be sent to customers.
  - **Supplies:** all items needed but that are not part of the finished product, such as paper clips, duplicating machine toner, and tools.

The Role of Inventory Management

- Inventory Management
  - The process of ensuring that the firm has adequate inventories of all parts and supplies needed, within the constraint of minimizing total inventory costs.
- Inventory Costs
  - Ordering (setup) costs
  - Acquisition costs
  - Holding (carrying) costs
  - Stockout costs

Inventory Costs

- Ordering (Setup) Costs
  - The costs, usually fixed, of placing an order or setting up machines for a production run.
- Acquisition Costs
  - The total costs of all units bought to fill an order, usually varying with the size of the order.
- Inventory-Holding (Carrying) Costs
  - All the costs associated with carrying parts or materials in inventory.
- Stockout Costs
  - The costs associated with running out of raw materials, parts, or finished-goods inventory.

Basic Inventory Management Systems

- ABC Inventory Management
- Inventory is divided into three dollar-volume categories—A, B, and C—with the A parts being the most active (largest dollar volume).
  - Inventory surveillance concentrates most on checking the A parts to guard against costly stockouts.
  - The idea is to focus most on the high-annual-dollar-volume A inventory items, to a lesser extent on the B items, and even less on the C items.

Economic Order Quantity (EOQ)

- Economic Order Quantity (EOQ)
  - An inventory management system based on a simple formula that is used to determine the most economical quantity to order so that the total of inventory and setup costs is minimized.
  - Assumptions:
    - Constant per unit holding and ordering costs
    - Constant withdrawals from inventory
    - No discounts for large quantity orders
    - Constant lead time for receipt of orders

The Economic Order Quantity Model

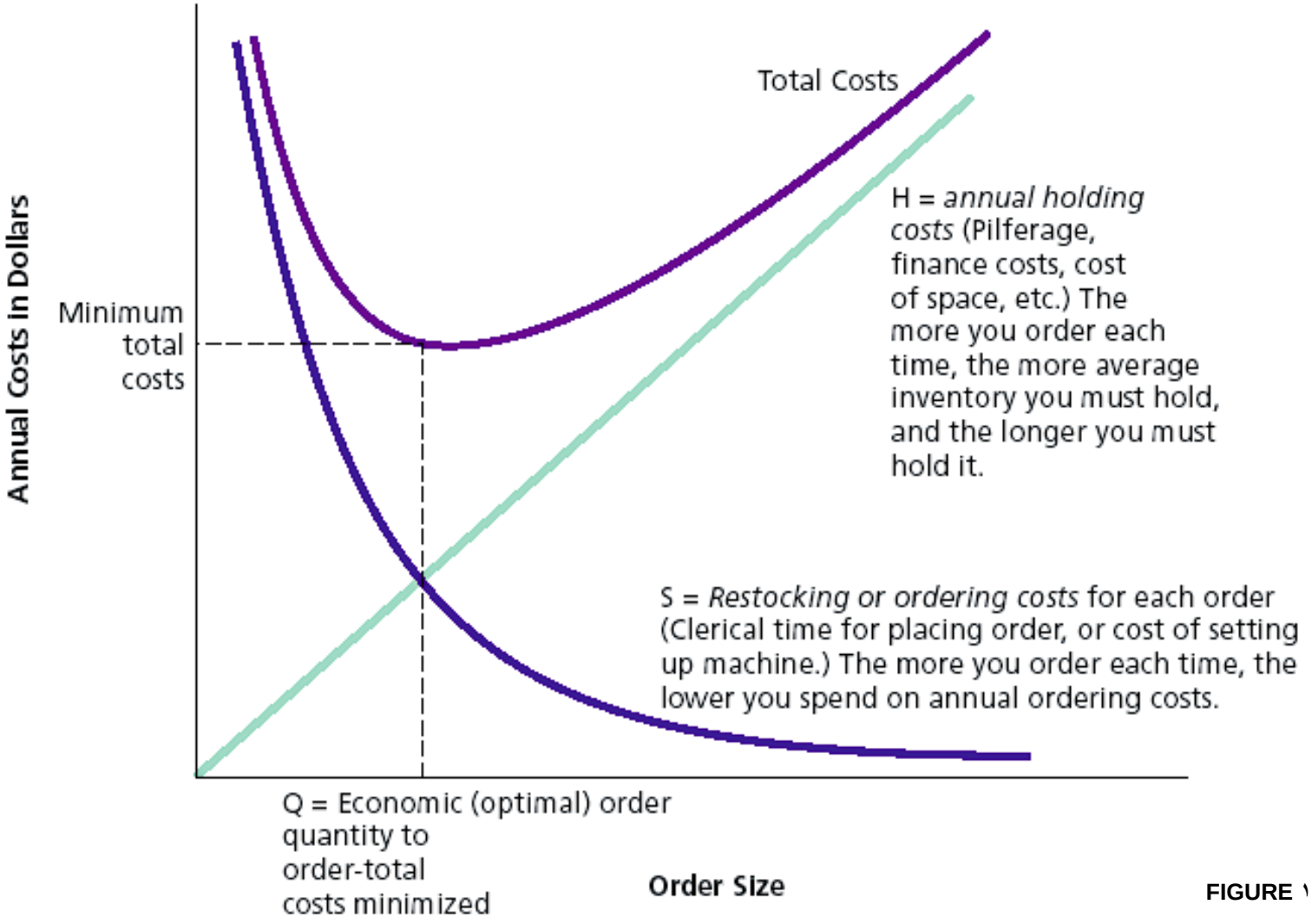


FIGURE ۱۵–۸

Controlling For Quality And Productivity

- Quality
  - The extent to which a product or service is able to meet customer needs and expectations.
    - Customer's needs are the basic standard for measuring quality
    - High quality does not have to mean high price.
- ISO ۹۰۰۰
  - The quality standards of the International Standards Organization.

Controlling For Quality And Productivity

- Total Quality Management (TQM)
  - A specific organization-wide program that integrates all the functions and related processes of a business such that they are all aimed at maximizing customer satisfaction through ongoing improvements.
  - Also called: Continuous improvement, Zero defects, Six-Sigma, and Kaizen (Japan)

Quality Control Methods

- Acceptance Sampling
  - a method of monitoring product quality that requires the inspection of only a small portion of the produced items.

Example of a Quality Control Chart

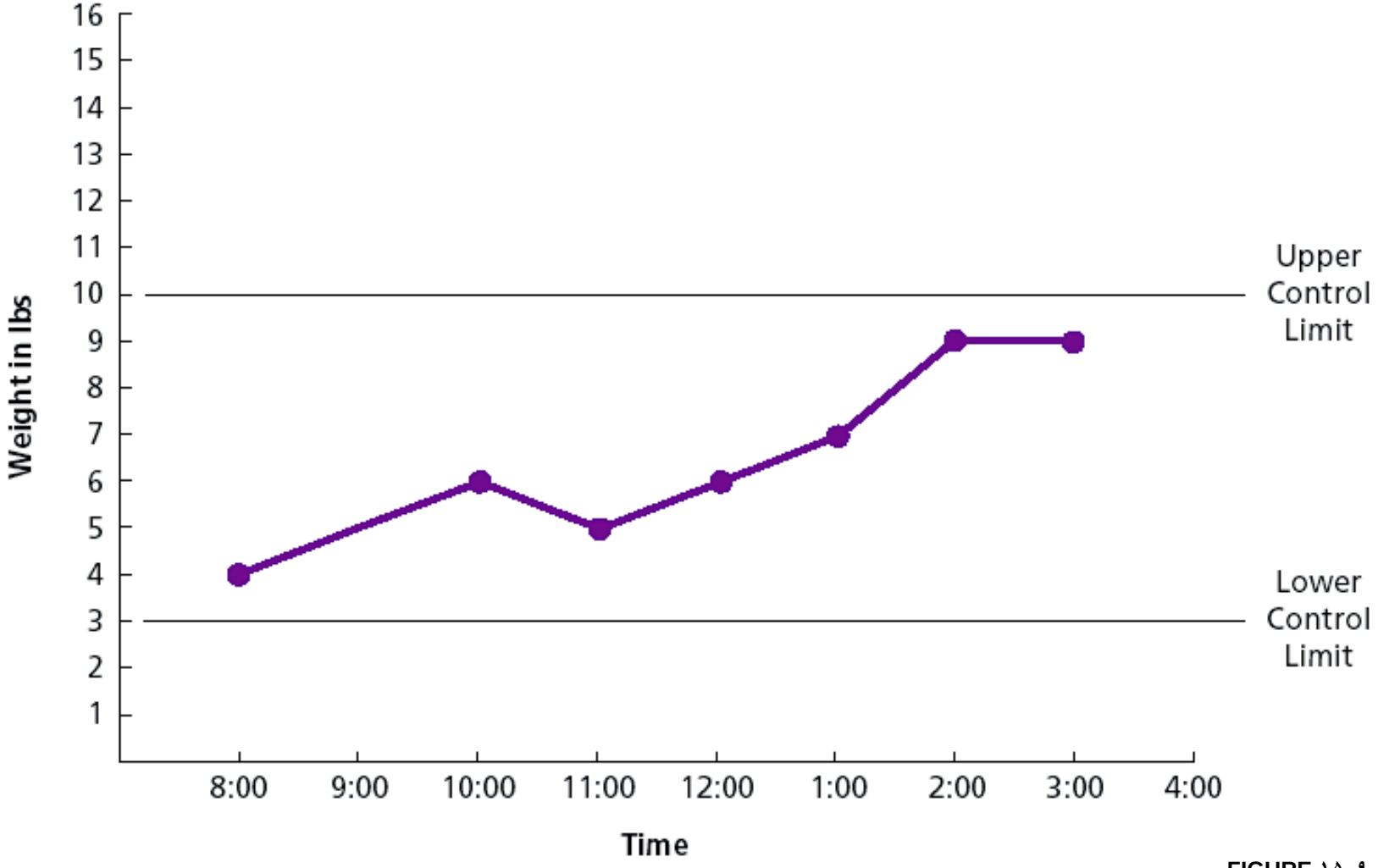
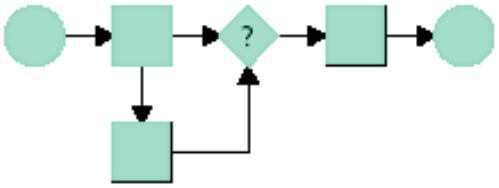


FIGURE ۱۵–۹

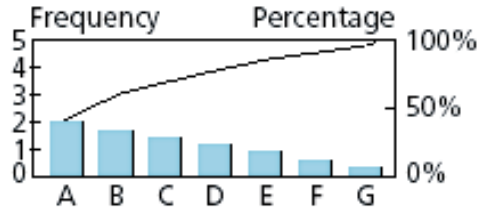
Commonly Used Tools for Problem Solving and Continuous Improvement

Process Flowchart



A chart that describes the main steps, branches, and eventual outputs of a process.

Pareto Analysis



A plot of the frequencies of important error sources. 80/20 rule: 80 percent of problems are due to 20 percent of causes (A, B, etc., are error sources).

Run Chart

A chart showing plotted values of a characteristic over time.

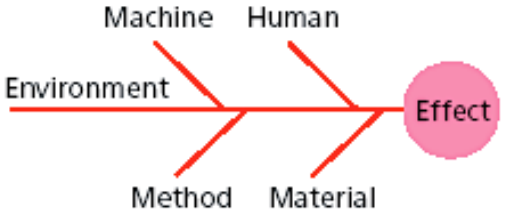
Histogram

A distribution showing the frequency of occurrences between the high and low range of data.

Scatter Diagram

Also known as a correlation chart. A graph of the value of one characteristic versus another characteristic.

Causes-and-Effect Diagram



A tool that uses a graphical description to list and analyze potential sources of process variation, classified by machine, human, method, and material.

FIGURE ۱۵–۱۰

Fishbone Chart (or Cause-and-Effect Diagram) for Problems with Airline Customer Service

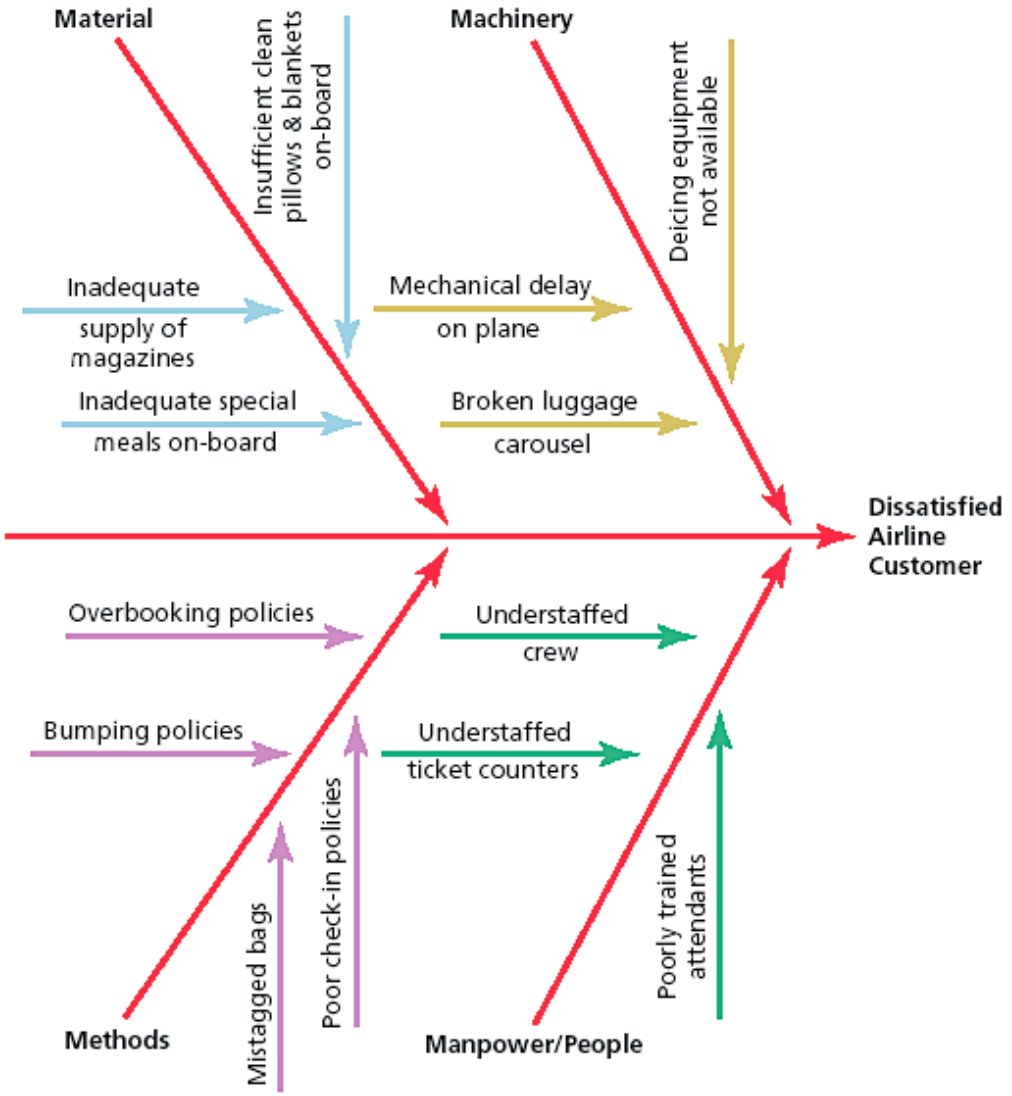


FIGURE ١٥–١١

Pareto Analysis Chart

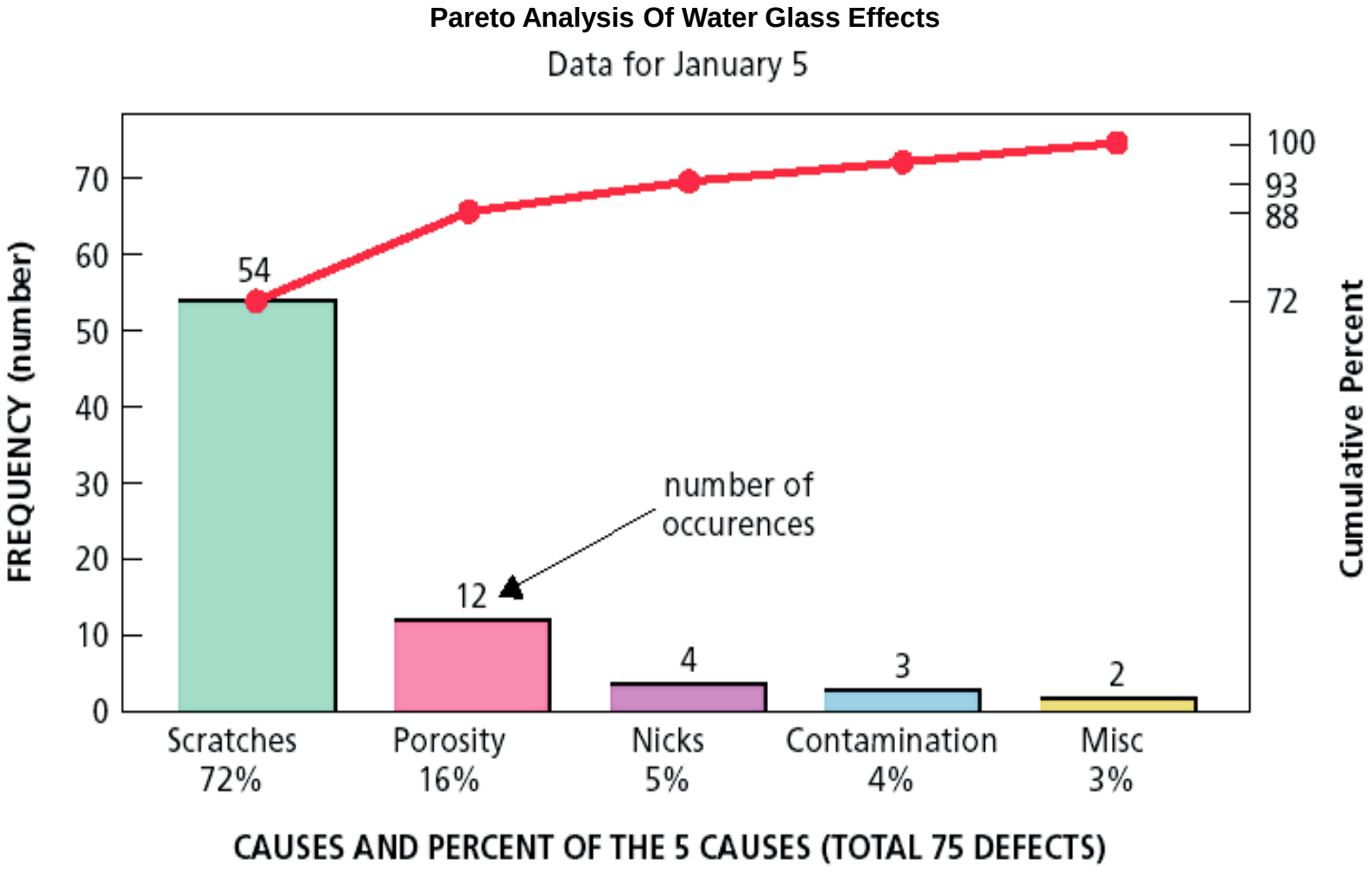


FIGURE ۱۵–۱۲

Design for Manufacturability

- Designing for Manufacturability (DFM)
  - Designing products with ease of manufacturing and quality in mind. DFM Goals:
    - Exhibit the desired level of quality and reliability.
    - Be designed in the least time with the least development cost. Make the quickest and smoothest transition into production.
    - Be produced and tested with the minimum cost in the minimum amount of time.
    - Satisfy customers' needs and compete in the marketplace.

Design for Manufacturability (cont'd)

- Concurrent Engineering
  - Designing products in multidisciplinary teams so that all departments involved in the product's success contribute to its design.

Rapid Plant Assessment Rating Sheet

Categories	Related questions in RPA questionnaire	Ratings: poor (1)	below average (3)	average (5)	above average (7)	excellent (9)	best in class (11)	category score
1 Customer satisfaction	1, 2, 20							
2 Safety, environment, cleanliness, and order	3–5, 20							
3 Visual management system	12, 4, 6–10, 20							
4 Scheduling system	11, 20							
5 Use of space, movement of materials, and product line flow	7, 12, 13,20							
6 Levels of inventory and work in progress	7, 11, 20							
7 Teamwork and motivation	6, 9, 14, 15, 20							
8 Condition and maintenance of equipment and tools	16, 20							
9 Management of complexity and variability	8, 17, 20							
10 Supply chain integration	18, 20							
11 Commitment to quality	15, 17, 19, 20							

Total score for 11 categories _____
(*max = 121*)

FIGURE ۱۵–۱۳

World-Class Operations Management Methods

- Total Quality Management (TQM)
- Just-In-Time (JIT) manufacturing
- Computer-Aided Design and Manufacturing (CADCAM)
- Flexible Manufacturing Systems (FMS) Computer-Integrated Manufacturing (CIM), Supply-Chain Management
- Enterprise Resource Planning (ERP)

Just-In-Time (JIT)

- Just-In-Time (JIT)
  - A production control method used to attain minimum inventory levels by ensuring delivery of materials and assemblies just when they are to be used.
  - A philosophy of lean or value-added manufacturing manufacturing that aims to optimize production processes by continuously reducing waste.
  - A management philosophy that assumes that any manufacturing process that does not add value to the product for the customer is wasteful.

Just-In-Time (JIT) (cont'd)

- Seven Wastes and Their Solutions
  - Overproduction: reduce by producing only what is needed as it is needed.
  - Waiting: synchronize the workflow.
  - Transportation: minimize transport with better layouts.
  - Processing: "Why do we need this process at all?"
  - Stock: reduce inventories.
  - Motion: reduce wasted employee motions.
  - Defective products: improve quality to reduce rework.

Computer-Aided Design and Manufacturing

- Computer-Aided Design (CAD)
  - A computerized process for designing new products, modifying existing ones, or simulating conditions that may affect the designs.
- Computer-Aided Manufacturing (CAM)
  - A computerized process for planning and programming production processes and equipment.

Flexible Manufacturing Systems

- Flexible Manufacturing System (FMS)
  - The organization of groups of production machines that are connected by automated materials-handling and transfer machines, and integrated into a computer system for the purpose of combining the benefits of made-to-order flexibility and mass-production efficiency.
- Automation
  - The automatic operation of a system, process, or machine.

Computer-Integrated Manufacturing

- Computer-Integrated Manufacturing (CIM)
  - The total integration of all production-related business activities through the use of computer systems.
  - Automation, JIT, flexible manufacturing, and CAD/CAM are integrated into one self-regulating production system.

The Elements of CIM

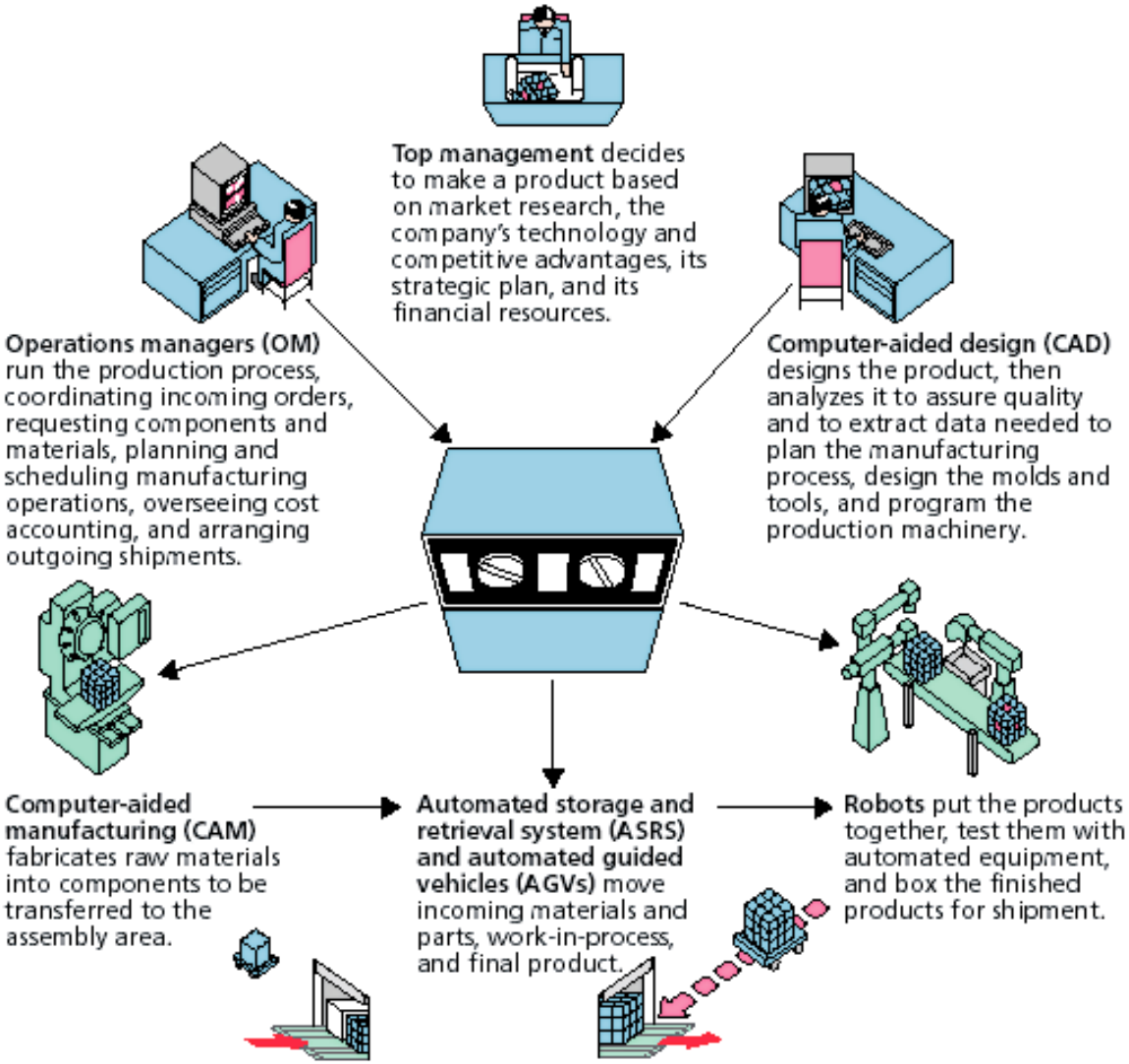


FIGURE ۱۵–۱۴

Supply Chain Management

- Supply Chain Management
  - The integration of the activities that procure materials, transform them into intermediate goods and final product, and deliver them to customers.

Trends in Supply Chain Management

- Supplier Partnering
  - Choosing to do business with a limited number of suppliers, with the aim of building relationships that improve quality and reliability rather than just improve costs.
- Channel assembly
  - Organizing the product assembly process so that the company doesn't send finished products to its distribution channel partners, but instead sends the partners components and modules. Partners become an extension of the firm's product assembly process.

Trends in Supply Chain Management (cont'd)

- Channel Assembly
  - Organizing the product assembly process so that a company sends its distribution channel partners components and modules rather than finished products. The partners then become an extension of the firm's product assembly process.
- Internet Purchasing (e-Procurement)
  - Vendors interact with other firms via the Internet to accept, place and acknowledge orders via the Web.

The Supply Chain

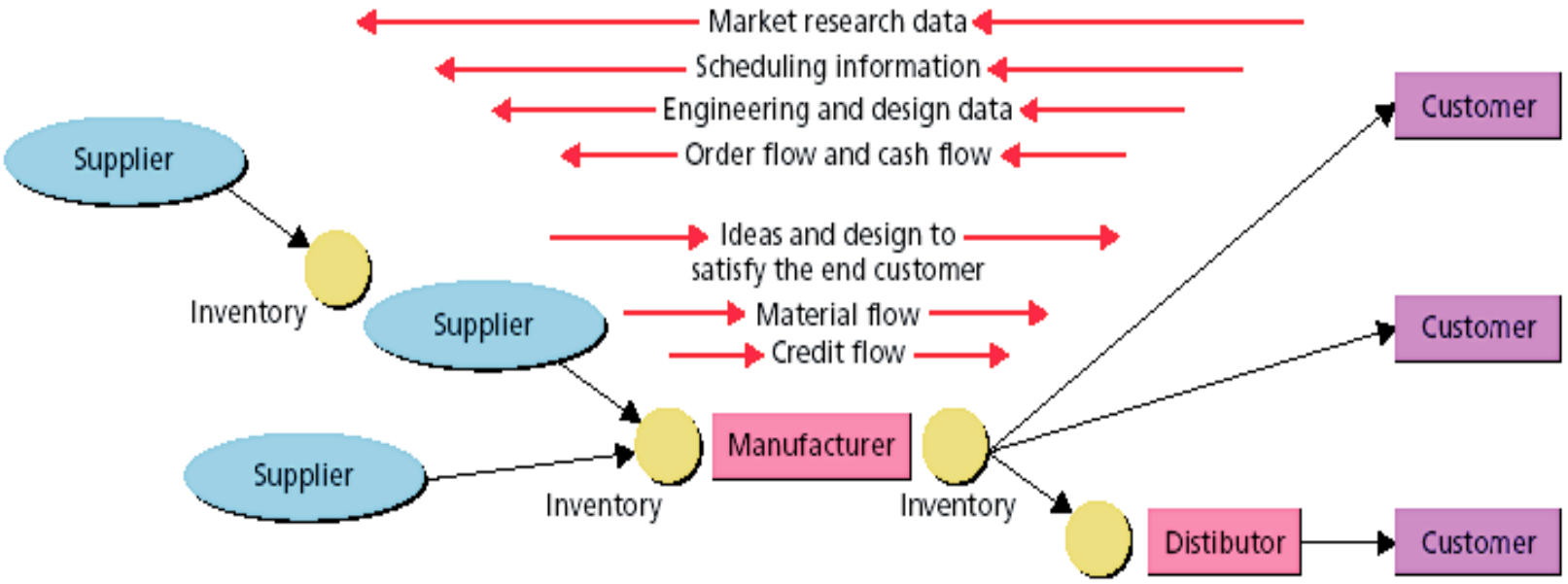


FIGURE ۱۵–۱۵

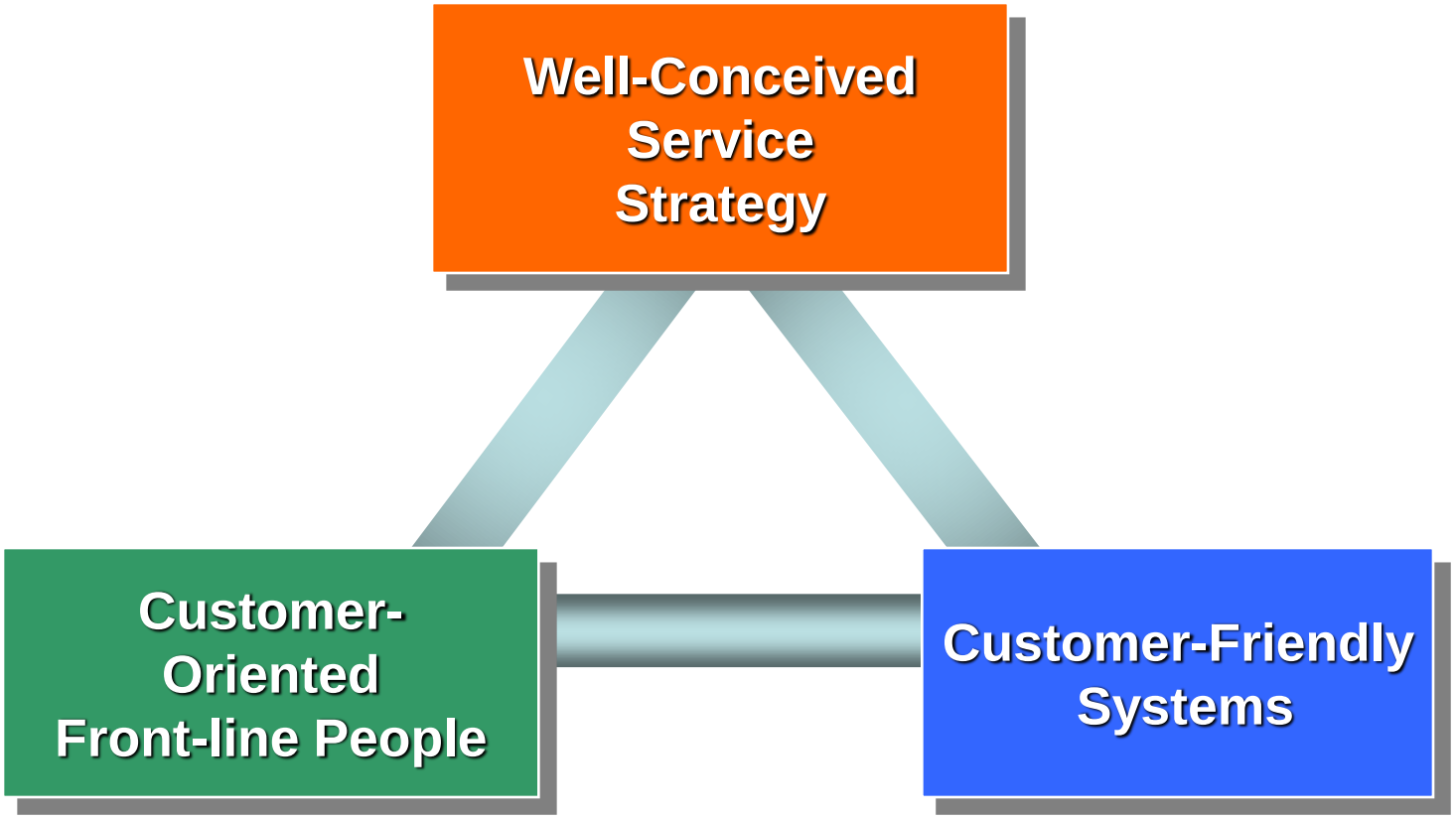
Managing Services

- Service Management
  - A total organization-wide approach that makes quality of service the business's number one driving force.
- Why Service Management Is Important
  - Service is a competitive advantage.
  - Bad service leads to lost customers.
  - Customer defections drain profits.

Managing Services (cont'd)

- Moment of Truth
  - The instant when the customer comes into contact with any aspect of a business and, based on that contact, forms an opinion about the quality of the service or product.
- Cycle of Service
  - Includes all of the moments of truth experienced by a typical customer, from first to last.

The Service Triangle (Karl Albrecht)



How to Implement a Service Management Program

THE END