

Operations and Productivity

1

**PowerPoint presentation to accompany
Heizer, Render, Munson
Operations Management, Twelfth Edition
Principles of Operations Management, Tenth Edition**

PowerPoint slides by Jeff Heyl

Operations Management at Hard Rock Cafe

- ▶ First opened in 1971
 - ▶ Now – 150 restaurants in over 53 countries
- ▶ Rock music memorabilia
- ▶ Creates value in the form of good food and entertainment
- ▶ 3,500+ custom meals per day in Orlando
- ▶ How does an item get on the menu?
- ▶ Role of the Operations Manager

Learning Objectives

When you complete this chapter you should be able to:

- 1.1 ***Define*** operations management
- 1.2 ***Explain*** the distinction between goods and services
- 1.3 ***Explain*** the difference between production and productivity

What Is Operations Management?

Production is the creation of goods and services

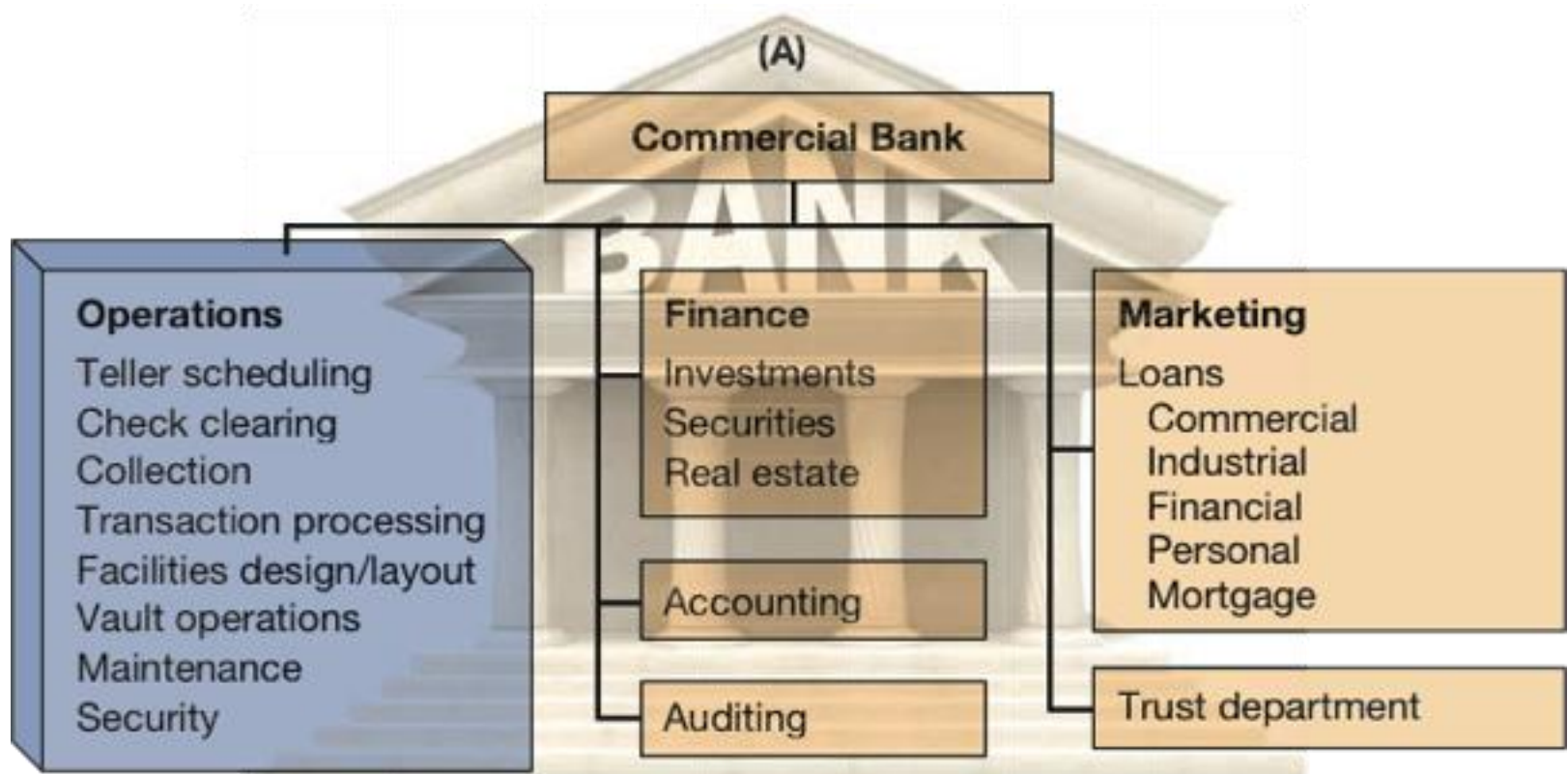
Operations management (OM) is the set of activities that create value in the form of goods and services by transforming inputs into outputs

Organizing to Produce Goods and Services

- ▶ Essential functions:
 1. ***Marketing*** – generates demand
 2. ***Production/operations*** – creates the product
 3. ***Finance/accounting*** – tracks how well the organization is doing, pays bills, collects the money

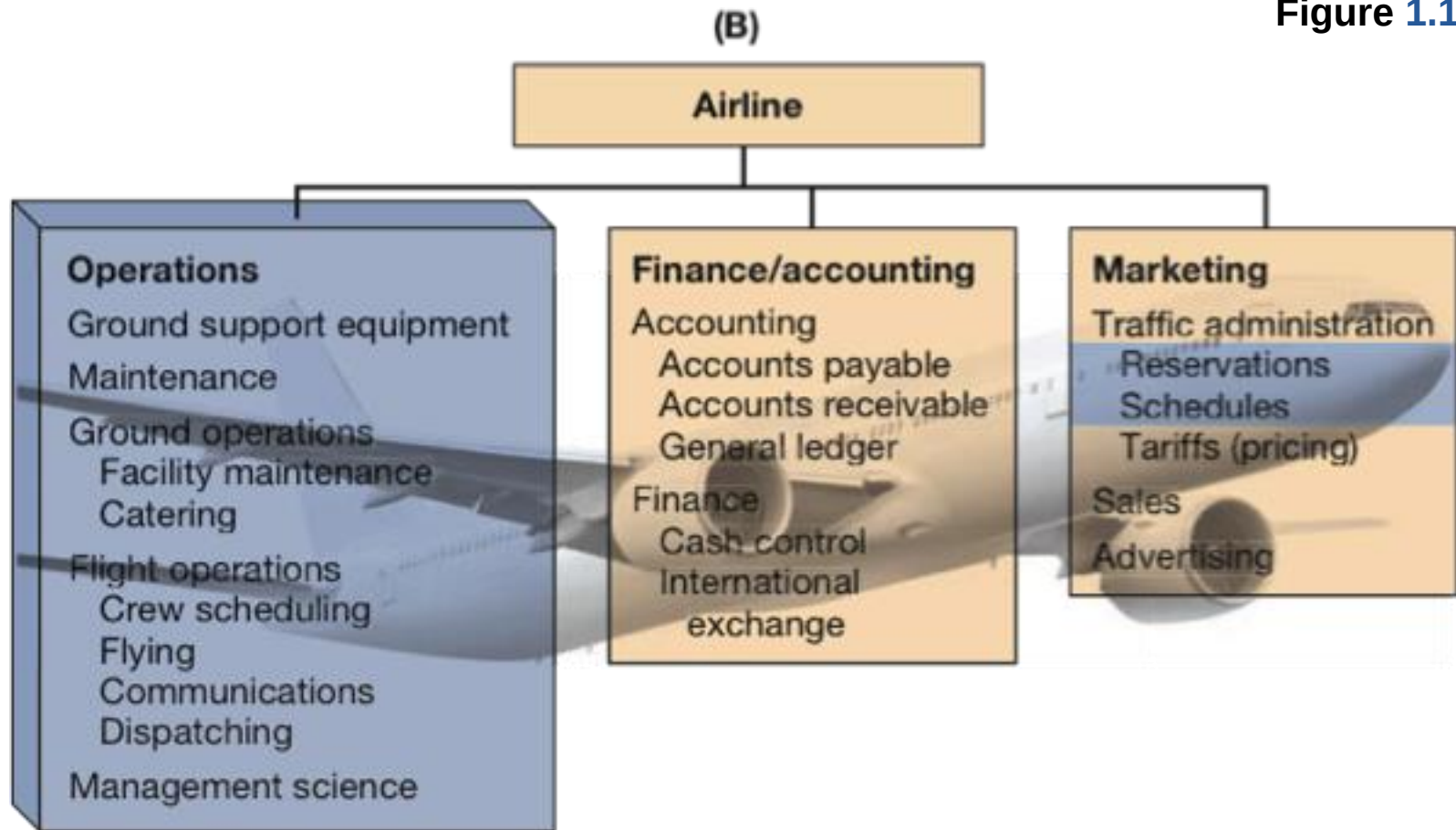
Organizational Charts

Figure 1.1



Organizational Charts

Figure 1.1



Organizational Charts

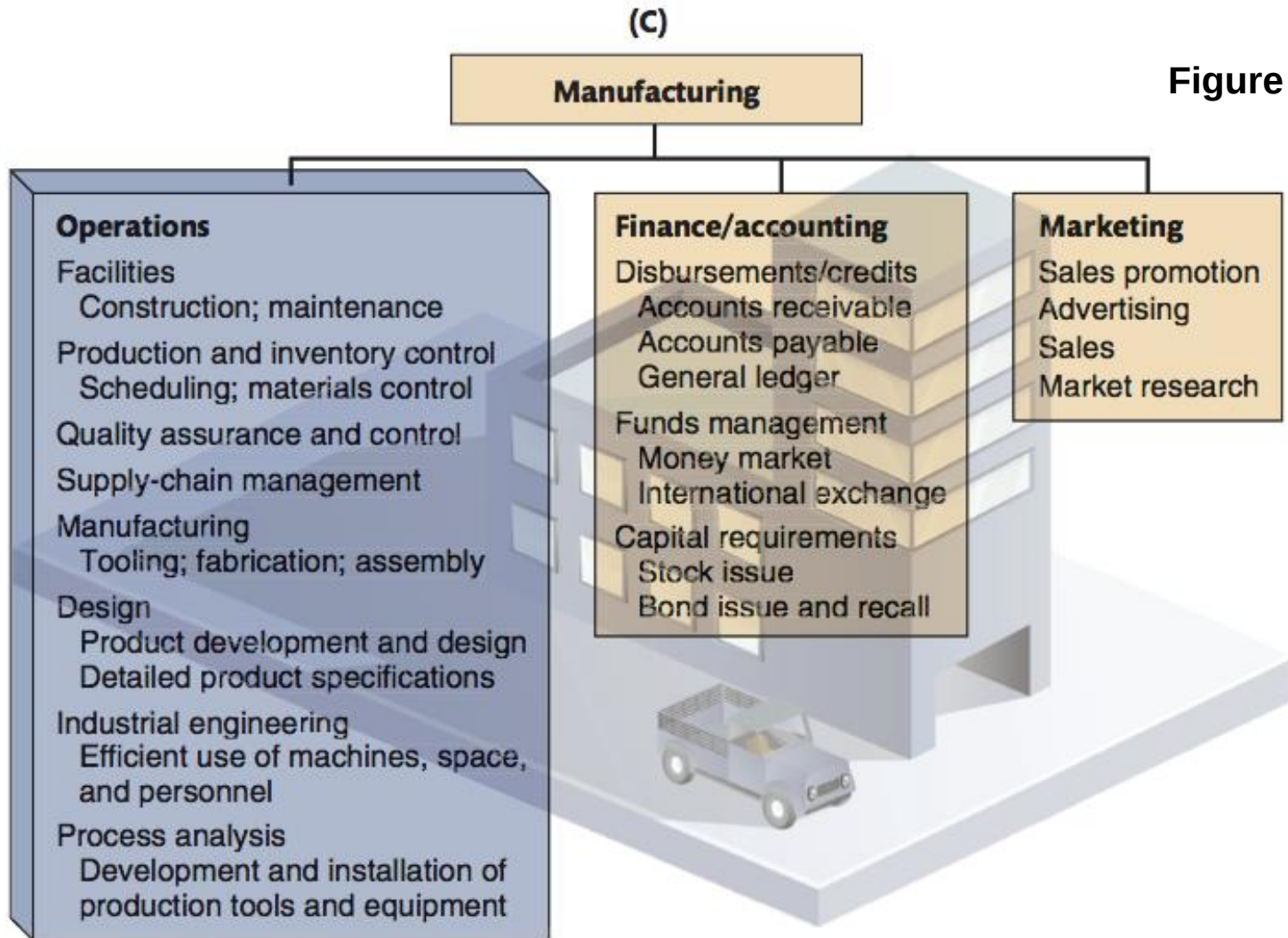
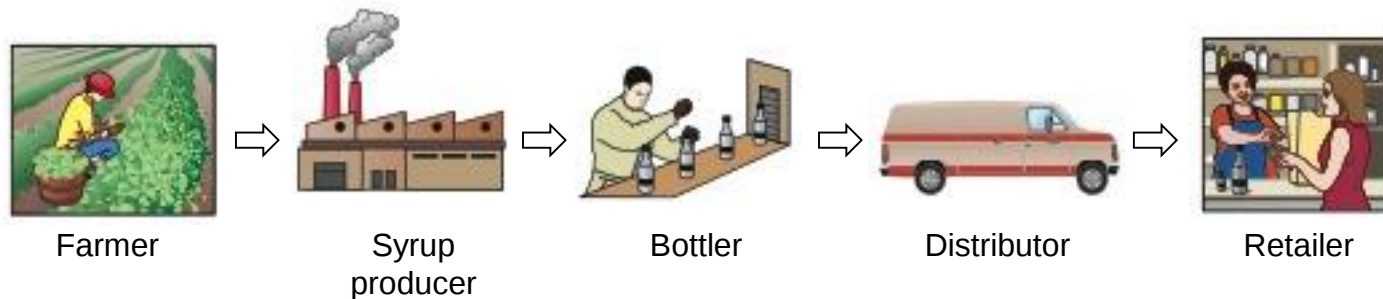


Figure 1.1

The Supply Chain

- ▶ A global network of organizations and activities that supply a firm with goods and services
- ▶ Members of the supply chain collaborate to achieve high levels of customer satisfaction, efficiency and competitive advantage

Figure 1.2



Why Study OM?

1. OM is one of three major functions of any organization; we want to study *how people organize themselves for productive enterprise*
2. We want (*and need*) to *know how goods and services are produced*
3. We want to understand *what operations managers do*
4. OM *is such a costly part of an organization*

Options for Increasing Contribution

TABLE 1.1

		MARKETING OPTION	FINANCE/ ACCOUNTING OPTION	OM OPTION
	CURRENT	INCREASE SALES REVENUE 50%	REDUCE FINANCE COSTS 50%	REDUCE PRODUCTION COSTS 20%
Sales	\$100,000	\$150,000	\$100,000	\$100,000
Cost of goods	<u>-80,000</u>	<u>-120,000</u>	<u>-80,000</u>	<u>-64,000</u>
Gross margin	20,000	30,000	20,000	36,000
Finance costs	<u>-6,000</u>	<u>-6,000</u>	<u>-3,000</u>	<u>-6,000</u>
Subtotal	14,000	24,000	17,000	30,000
Taxes at 25%	<u>-3,500</u>	<u>-6,000</u>	<u>-4,200</u>	<u>-7,500</u>
Contribution	\$ 10,500	\$ 18,000	\$ 12,750	\$ 22,500

What Operations Managers Do

Basic Management Functions

- ▶ Planning
- ▶ Organizing
- ▶ Staffing
- ▶ Leading
- ▶ Controlling



Ten Strategic Decisions

TABLE 1.2

DECISION	CHAPTER(S)
1. <i>Design of goods and services</i>	5, Supplement 5
2. <i>Managing quality</i>	6, Supplement 6
3. <i>Process and capacity strategy</i>	7, Supplement 7
4. <i>Location strategy</i>	8
5. <i>Layout strategy</i>	9
6. <i>Human resources and job design</i>	10
7. <i>Supply-chain management</i>	11, Supplement 11
8. <i>Inventory management</i>	12, 14, 16
9. <i>Scheduling</i>	13, 15
10. <i>Maintenance</i>	17

The Strategic Decisions

1. Design of goods and services

- ▶ Defines what is required of operations
- ▶ Product design determines quality, sustainability and human resources

2. Managing quality

- ▶ Determine the customer's quality expectations
- ▶ Establish policies and procedures to identify and achieve that quality

Table 1.2 (cont.)

The Strategic Decisions

3. Process and capacity design

- ▶ How is a good or service produced?
- ▶ Commits management to specific technology, quality, resources, and investment

4. Location strategy

- ▶ Nearness to customers, suppliers, and talent
- ▶ Considering costs, infrastructure, logistics, and government

Table 1.2 (cont.)

The Strategic Decisions

5. Layout strategy

- ▶ Integrate capacity needs, personnel levels, technology, and inventory
- ▶ Determine the efficient flow of materials, people, and information

6. Human resources and job design

- ▶ Recruit, motivate, and retain personnel with the required talent and skills
- ▶ Integral and expensive part of the total system design

Table 1.2 (cont.)

The Strategic Decisions

7. Supply chain management

- ▶ Integrate supply chain into the firm's strategy
- ▶ Determine what is to be purchased, from whom, and under what conditions

8. Inventory management

- ▶ Inventory ordering and holding decisions
- ▶ Optimize considering customer satisfaction, supplier capability, and production schedules

Table 1.2 (cont.)

The Strategic Decisions

9. Scheduling

- ▶ Determine and implement intermediate- and short-term schedules
- ▶ Utilize personnel and facilities while meeting customer demands

10. Maintenance

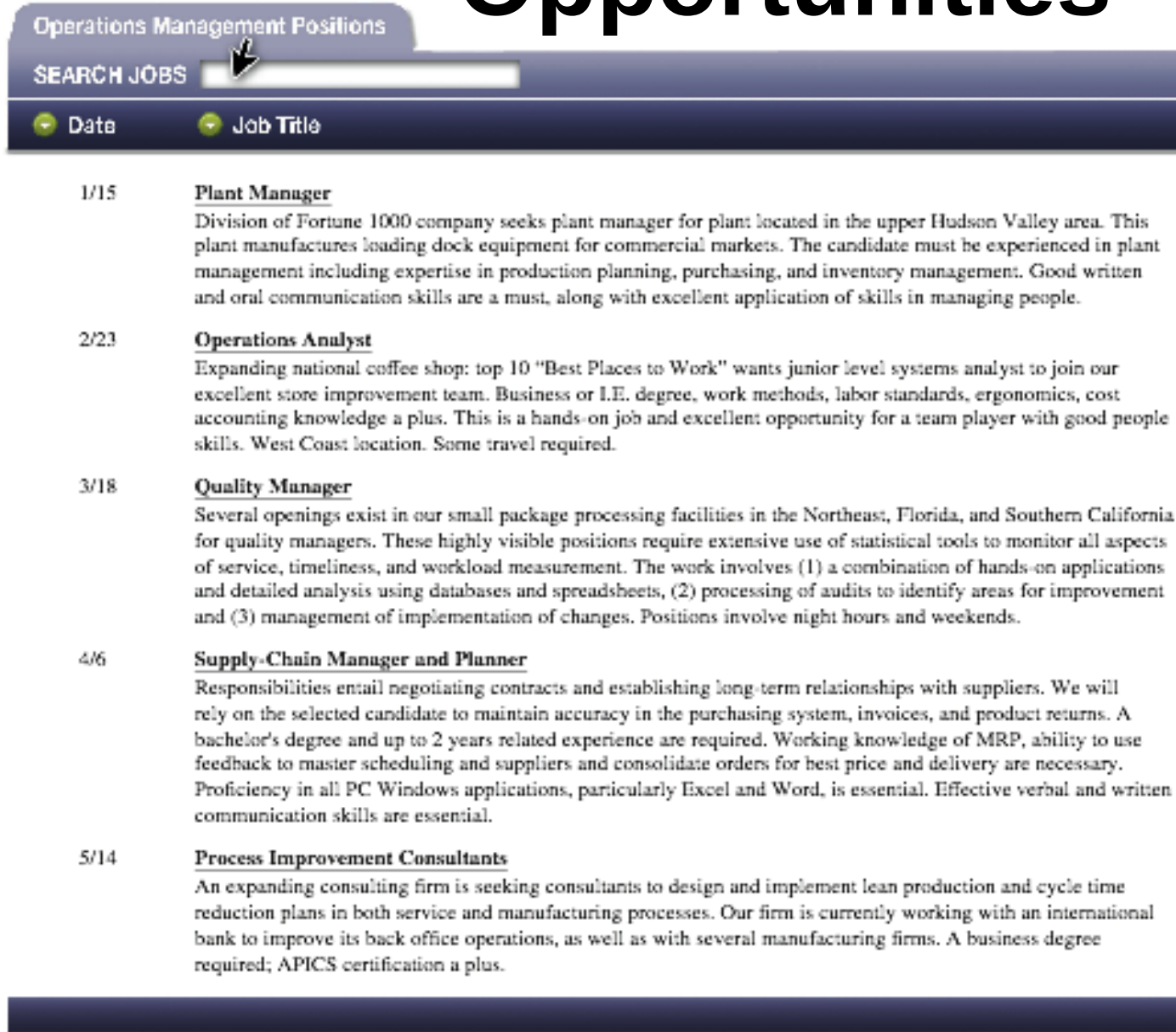
- ▶ Consider facility capacity, production demands, and personnel
- ▶ Maintain a reliable and stable process

Table 1.2 (cont.)

Where are the OM Jobs?

- ▶ Technology/methods
- ▶ Facilities/space utilization
- ▶ Strategic issues
- ▶ Response time
- ▶ People/team development
- ▶ Customer service
- ▶ Quality
- ▶ Cost reduction
- ▶ Inventory reduction
- ▶ Productivity improvement

Opportunities



The screenshot shows a web interface for finding job opportunities. At the top, there is a header bar with the text "Operations Management Positions" and a "SEARCH JOBS" button. Below this, there are two columns of filters: "Date" and "Job Title". The main content area displays a list of job openings, each with a date, a job title, and a description. The jobs listed are: 1/15 Plant Manager, 2/23 Operations Analyst, 3/18 Quality Manager, 4/6 Supply-Chain Manager and Planner, and 5/14 Process Improvement Consultants.

Date	Job Title	Description
1/15	<u>Plant Manager</u>	Division of Fortune 1000 company seeks plant manager for plant located in the upper Hudson Valley area. This plant manufactures loading dock equipment for commercial markets. The candidate must be experienced in plant management including expertise in production planning, purchasing, and inventory management. Good written and oral communication skills are a must, along with excellent application of skills in managing people.
2/23	<u>Operations Analyst</u>	Expanding national coffee shop: top 10 "Best Places to Work" wants junior level systems analyst to join our excellent store improvement team. Business or I.E. degree, work methods, labor standards, ergonomics, cost accounting knowledge a plus. This is a hands-on job and excellent opportunity for a team player with good people skills. West Coast location. Some travel required.
3/18	<u>Quality Manager</u>	Several openings exist in our small package processing facilities in the Northeast, Florida, and Southern California for quality managers. These highly visible positions require extensive use of statistical tools to monitor all aspects of service, timeliness, and workload measurement. The work involves (1) a combination of hands-on applications and detailed analysis using databases and spreadsheets, (2) processing of audits to identify areas for improvement and (3) management of implementation of changes. Positions involve night hours and weekends.
4/6	<u>Supply-Chain Manager and Planner</u>	Responsibilities entail negotiating contracts and establishing long-term relationships with suppliers. We will rely on the selected candidate to maintain accuracy in the purchasing system, invoices, and product returns. A bachelor's degree and up to 2 years related experience are required. Working knowledge of MRP, ability to use feedback to master scheduling and suppliers and consolidate orders for best price and delivery are necessary. Proficiency in all PC Windows applications, particularly Excel and Word, is essential. Effective verbal and written communication skills are essential.
5/14	<u>Process Improvement Consultants</u>	An expanding consulting firm is seeking consultants to design and implement lean production and cycle time reduction plans in both service and manufacturing processes. Our firm is currently working with an international bank to improve its back office operations, as well as with several manufacturing firms. A business degree required; APICS certification a plus.

Figure 1.3

Certifications

- ▶ APICS, the Association for Operations Management
- ▶ American Society for Quality (ASQ)
- ▶ Institute for Supply Management (ISM)
- ▶ Project Management Institute (PMI)
- ▶ Council of Supply Chain Management Professionals
- ▶ Charter Institute of Procurement and Supply (CIPS)

Significant Events in OM



Everett Collection/Newscom

Cost Focus		Quality Focus	Customization Focus	Globalization Focus
Early Concepts 1776–1880 Labor Specialization (Smith, Babbage) Standardized Parts (Whitney)		Mass Production Era 1910–1980 Moving Assembly Line (Ford/Sorensen) Statistical Sampling (Shewhart)	Lean Production Era 1980–1995 Just-in-Time (JIT) Computer-Aided Design (CAD) Electronic Data Interchange (EDI) Total Quality Management (TQM) Baldrige Award Empowerment Kanbans	Mass Customization Era 1995–2005 Internet/E-Commerce Enterprise Resource Planning International Quality Standards (ISO) Finite Scheduling Supply Chain Management Mass Customization Build-to-Order Radio Frequency Identification (RFID)
Scientific Management Era 1880–1910 Gantt Charts (Gantt) Motion & Time Studies (Gilbreth) Process Analysis (Taylor) Queuing Theory (Erlang)		Globalization Era 2005–2020 Global Supply Chains Growth of Transnational Organizations Instant Communications Sustainability Ethics in a Global Workforce Logistics		

Figure 1.4

The Heritage of OM

- ▶ Division of labor (Adam Smith 1776; Charles Babbage 1852)
- ▶ Standardized parts (Whitney 1800)
- ▶ Scientific Management (Taylor 1881)
- ▶ Coordinated assembly line (Ford/ Sorenson 1913)
- ▶ Gantt charts (Gantt 1916)
- ▶ Motion study (Frank and Lillian Gilbreth 1922)
- ▶ Quality control (Shewhart 1924; Deming 1950)

The Heritage of OM

- ▶ Computer (Atanasoff 1938)
- ▶ CPM/PERT (DuPont 1957, Navy 1958)
- ▶ Material requirements planning (Orlicky 1960)
- ▶ Computer aided design (CAD 1970)
- ▶ Flexible manufacturing system (FMS 1975)
- ▶ Baldrige Quality Awards (1980)
- ▶ Computer integrated manufacturing (1990)
- ▶ Globalization (1992)
- ▶ Internet (1995)

Eli Whitney

- ▶ Born 1765; died 1825
- ▶ In 1798, received government contract to make 10,000 muskets
- ▶ Showed that machine tools could make standardized parts to exact specifications
 - ▶ Musket parts could be used in any musket

Frederick W. Taylor

- ▶ Born 1856; died 1915
- ▶ Known as 'father of scientific management'
- ▶ In 1881, as chief engineer for Midvale Steel, studied how tasks were done
 - ▶ Began first motion and time studies
- ▶ Created efficiency principles

Taylor's Principles

Management Should Take More Responsibility for:

1. Matching employees to right job
2. Providing the proper training
3. Providing proper work methods and tools
4. Establishing legitimate incentives for work to be accomplished

Frank and Lillian Gilbreth

- ▶ Frank (1868-1924); Lillian (1878-1972)
- ▶ Husband and wife engineering team
- ▶ Further developed work measurement methods
- ▶ Applied efficiency methods to their home and 12 children!
- ▶ Book and Movie: “Cheaper by the Dozen,” “Bells on Their Toes”

Henry Ford

- ▶ Born 1863; died 1947
- ▶ In 1903, created Ford Motor Company
- ▶ In 1913, first used moving assembly line to make Model T
 - ▶ Unfinished product moved by conveyor past work station
- ▶ Paid workers very well for 1911 (\$5/day!)

W. Edwards Deming

- ▶ Born 1900; died 1993
- ▶ Engineer and physicist
- ▶ Credited with teaching Japan quality control methods in post-WW2
- ▶ Used statistics to analyze process
- ▶ His methods involve workers in decisions

Contributions From

- ▶ Industrial engineering
- ▶ Statistics
- ▶ Management
- ▶ Economics
- ▶ Physical sciences
- ▶ Information technology

Operations for Goods and Services

Services – Economic activities that typically produce an intangible product (such as education, entertainment, lodging, government, financial, and health services)

Operations for Goods and Services

- ▶ Manufacturers produce tangible product, services often intangible
- ▶ Operations activities often very similar
- ▶ Distinction not always clear
- ▶ Few pure services

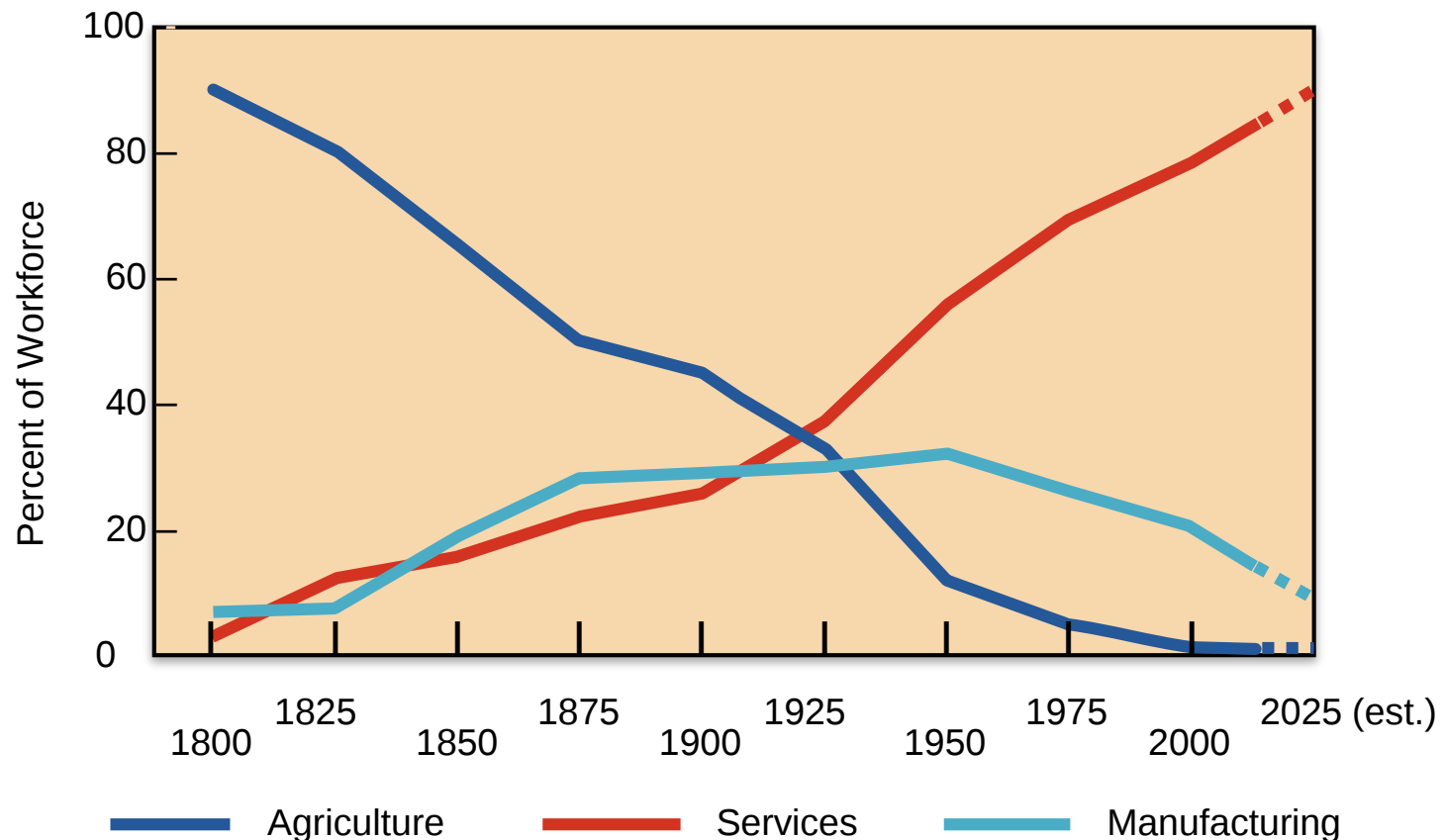
Differences Between Goods and Services

TABLE 1.3

CHARACTERISTICS OF SERVICES	CHARACTERISTICS OF GOODS
Intangible: Ride in an airline seat	Tangible: The seat itself
Produced and consumed simultaneously: Beauty salon produces a haircut that is consumed as it is produced	Product can usually be kept in inventory (beauty care products)
Unique: Your investments and medical care are unique	Similar products produced (iPods)
High customer interaction: Often what the customer is paying for (consulting, education)	Limited customer involvement in production
Inconsistent product definition: Auto Insurance changes with age and type of car	Product standardized (iPhone)
Often knowledge based: Legal, education, and medical services are hard to automate	Standard tangible product tends to make automation feasible
Services dispersed: Service may occur at retail store, local office, house call, or via internet.	Product typically produced at a fixed facility
Quality may be hard to evaluate: Consulting, education, and medical services	Many aspects of quality for tangible products are easy to evaluate (strength of a bolt)
Reselling is unusual: Musical concert or medical care	Product often has some residual value

U.S. Agriculture, Manufacturing, and Service Employment

Figure 1.5



Organizations in Each Sector

TABLE 1.4

SECTOR	EXAMPLE	PERCENT OF ALL JOBS	
Service Sector			
Education, Medical, Other	San Diego State University, Arnold Palmer Hospital	15.3	85.2
Trade (retail, wholesale), Transportation	Walgreen's, Walmart, Nordstrom, Alaska Airlines	15.8	
Information, Publishers, Broadcast	IBM, Bloomberg, Pearson, ESPN	1.9	
Professional, Legal, Business Services, Associations	Snelling and Snelling, Waste Management, Inc., American Medical Association, Ernst & Young	13.6	
Finance, Insurance, Real Estate	Citicorp, American Express, Prudential, Aetna	9.6	
Food, Lodging, Entertainment	Olive Garden, Motel 6, Walt Disney	10.4	
Public Administration	U.S., State of Alabama, Cook County	15.6	
Manufacturing Sector	General Electric, Ford, U.S. Steel, Intel		8.6
Construction Sector	Bechtel, McDermott		4.3
Agriculture	King Ranch		1.4
Mining Sector	Homestake Mining		.5
Grand Total			100.0

Service Pay

- ▶ Perception that services are low-paying
- ▶ 42% of service workers receive above average wages
- ▶ 14 of 33 service industries pay below average
- ▶ Retail trade pays only 61% of national average
- ▶ Overall average wage is 96% of the average

Productivity Challenge

Productivity is the ratio of outputs (goods and services) divided by the inputs (resources such as labor and capital)

The objective is to improve productivity!

Important Note!
*Production is a measure of output only
and not a measure of efficiency*

The Economic System

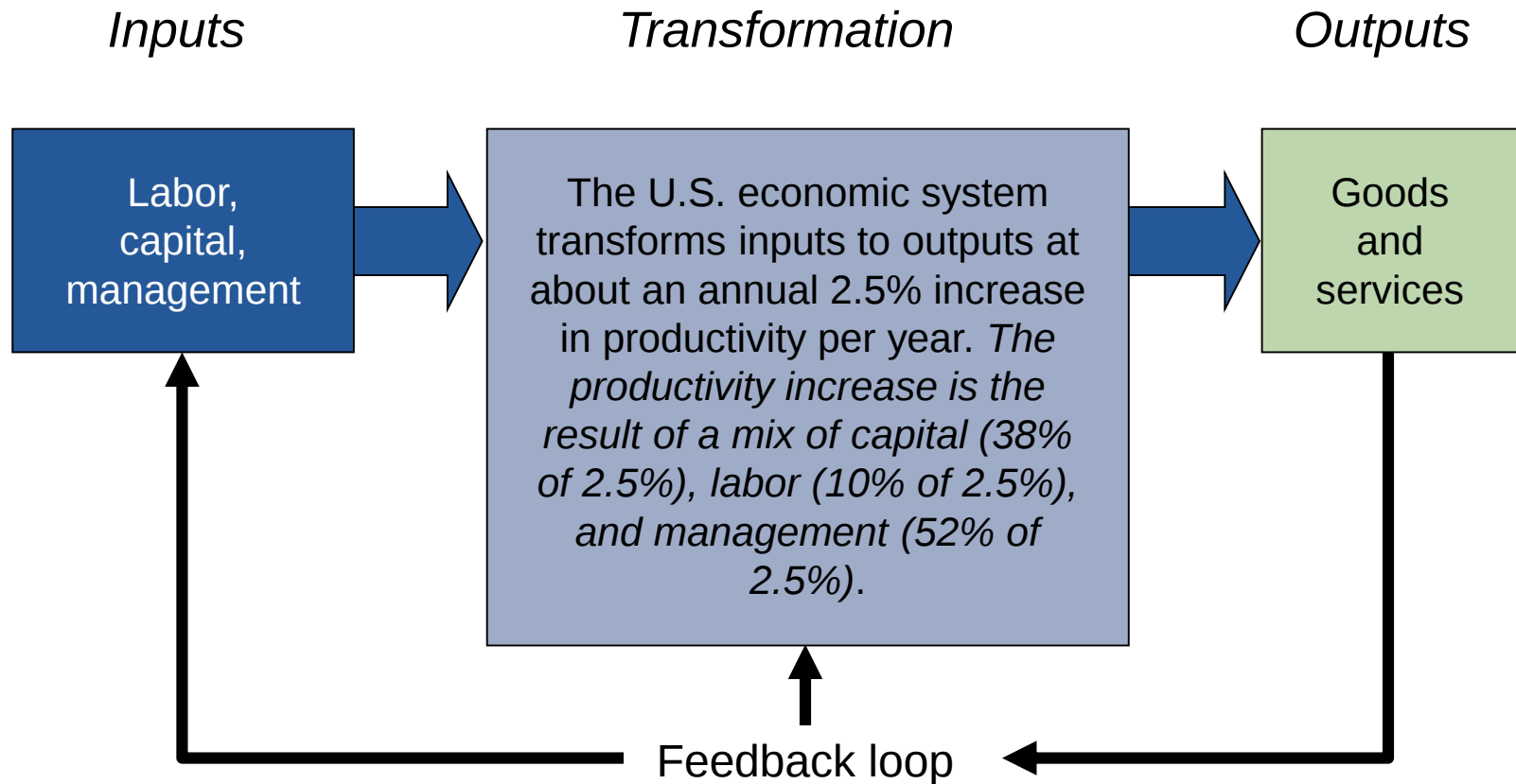


Figure 1.6

Improving Productivity at Starbucks

A team of 10 analysts continually look for ways to shave time. Some improvements:



Stop requiring signatures on credit card purchases under \$25



Saved 8 seconds per transaction

Change the size of the ice scoop



Saved 14 seconds per drink

New espresso machines



Saved 12 seconds per shot

Improving Productivity at Starbucks

A team of 10 analysts continually look for ways to shave time. Some improvements



Stop requiring
on credit card
under \$25

Change the s
scoop

New espresso

Operations improvements have helped Starbucks increase yearly revenue per outlet by \$250,000 to \$1,000,000.

Productivity has improved by 27%, or about 4.5% per year.

per shot

Productivity

$$\text{Productivity} = \frac{\text{Units produced}}{\text{Input used}}$$

- ▶ Measure of process improvement
- ▶ Represents output relative to input
- ▶ Only through productivity increases can our standard of living improve

Productivity Calculations

Labor Productivity

$$\begin{aligned}\text{Productivity} &= \frac{\text{Units produced}}{\text{Labor-hours used}} \\ &= \frac{1,000}{250} = 4 \text{ units/labor-hour}\end{aligned}$$

One resource input $\Rightarrow$ single-factor productivity

Multi-Factor Productivity

$$\text{Multifactor} = \frac{\text{Output}}{\text{Labor} + \text{Material} + \text{Energy} + \text{Capital} + \text{Miscellaneous}}$$

- ▶ Also known as total factor productivity
- ▶ Output and inputs are often expressed in dollars

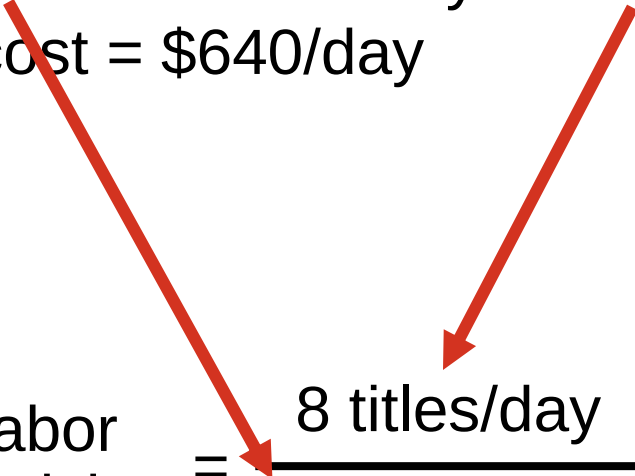
Multiple resource inputs $\Rightarrow$ multi-factor productivity

Collins Title Productivity

Old System:

Staff of 4 works 8 hrs/day
Payroll cost = \$640/day

8 titles/day
Overhead = \$400/day


$$\text{Old labor productivity} = \frac{8 \text{ titles/day}}{32 \text{ labor-hrs}} = .25 \text{ titles/labor-hr}$$

Collins Title Productivity

Old System:

Staff of 4 works 8 hrs/day
Payroll cost = \$640/day

8 titles/day
Overhead = \$400/day

New System:

14 titles/day

Overhead = \$800/day

Old labor productivity = $\frac{8 \text{ titles/day}}{32 \text{ labor-hrs}} = .25 \text{ titles/labor-hr}$

New labor productivity = $\frac{14 \text{ titles/day}}{32 \text{ labor-hrs}} = .4375 \text{ titles/labor-hr}$

Collins Title Productivity

Old System:

Staff of 4 works 8 hrs/day
Payroll cost = \$640/day

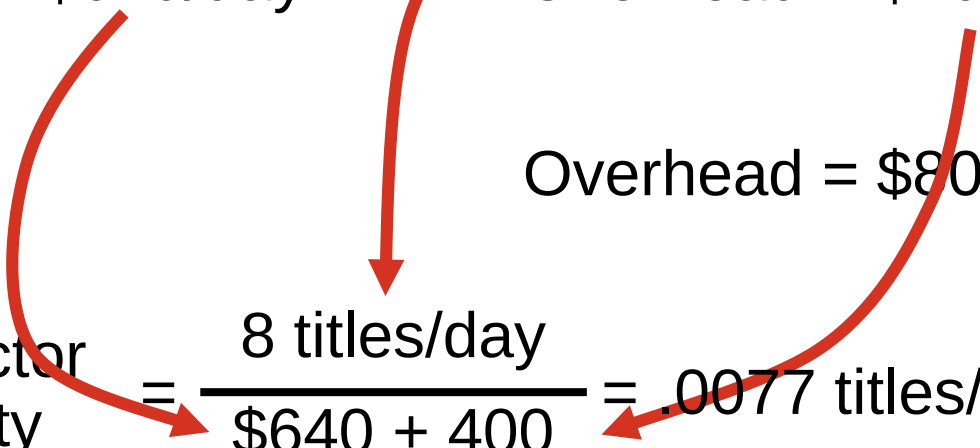
8 titles/day
Overhead = \$400/day

New System:

14 titles/day

Overhead = \$800/day

Old multifactor productivity = $\frac{8 \text{ titles/day}}{\$640 + 400} = .0077 \text{ titles/dollar}$



Collins Title Productivity

Old System:

Staff of 4 works 8 hrs/day
Payroll cost = \$640/day

8 titles/day
Overhead = \$400/day

New System:

14 titles/day

Overhead = \$800/day

Old multifactor productivity = $\frac{8 \text{ titles/day}}{\$640 + 400} = .0077 \text{ titles/dollar}$

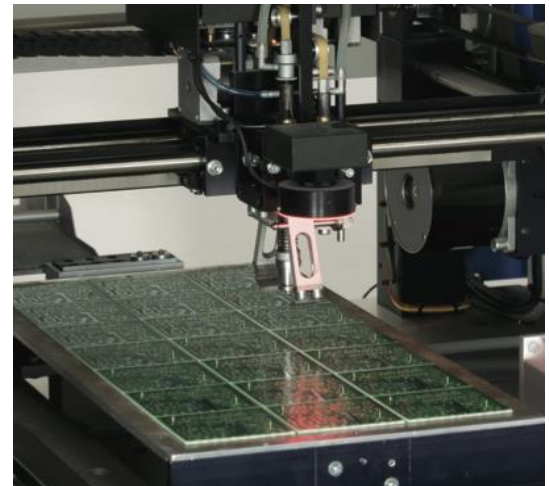
New multifactor productivity = $\frac{14 \text{ titles/day}}{\$640 + 800} = .0097 \text{ titles/dollar}$

Measurement Problems

1. ***Quality*** may change while the quantity of inputs and outputs remains constant
2. ***External elements*** may cause an increase or decrease in productivity
3. ***Precise units*** of measure may be lacking

Productivity Variables

1. ***Labor*** - contributes about 10% of the annual increase
2. ***Capital*** - contributes about 38% of the annual increase
3. ***Management*** - contributes about 52% of the annual increase



Key Variables for Improved Labor Productivity

1. Basic education appropriate for the labor force
2. Diet of the labor force
3. Social overhead that makes labor available
 - ▶ Challenge is in maintaining and enhancing skills in the midst of rapidly changing technology and knowledge

Labor Skills

About half of the 17-year-olds in the U.S. cannot correctly answer questions of this type

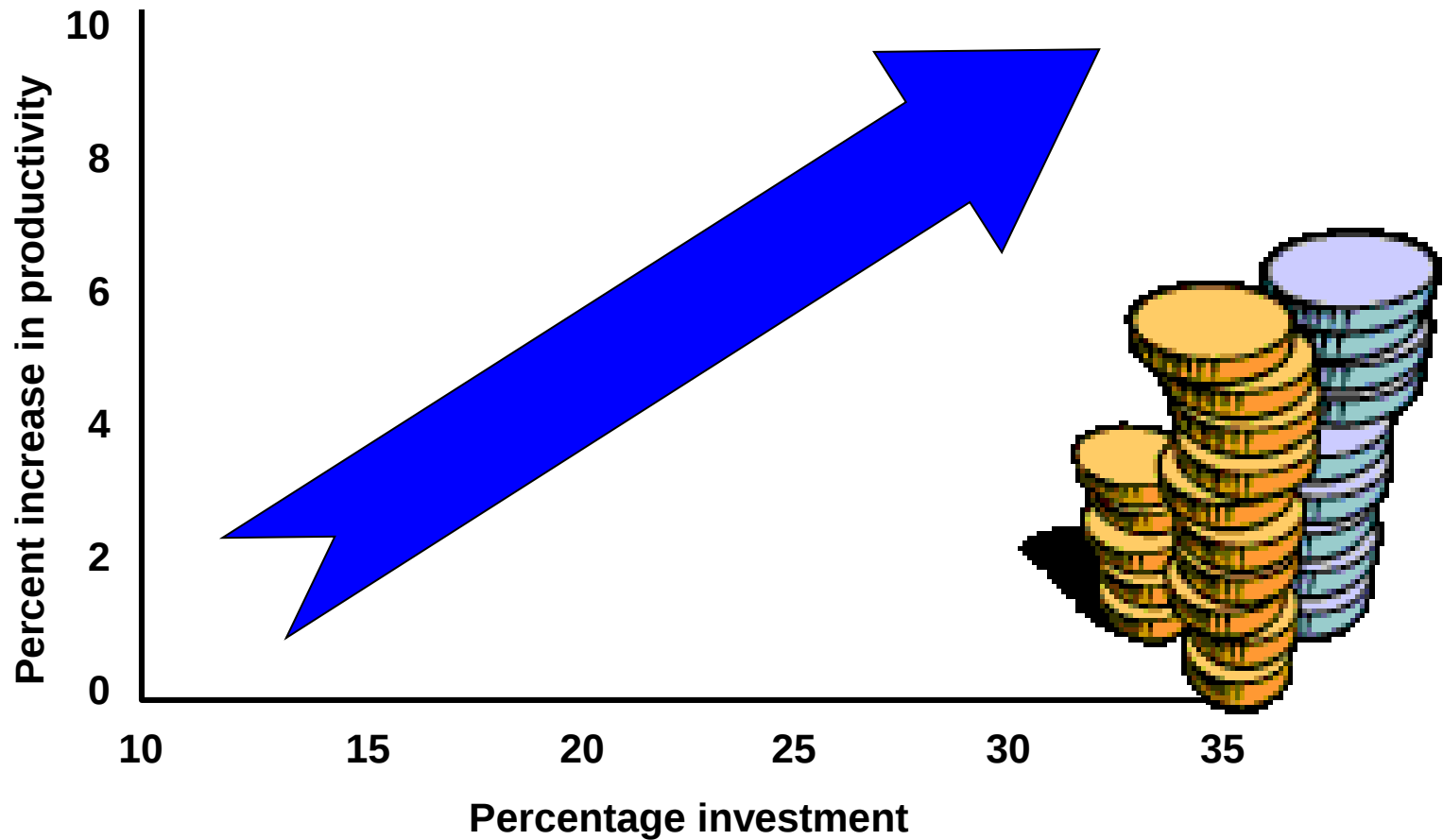
6 yds	
	4 yds
What is the area of this rectangle?	
_____	4 square yds
_____	6 square yds
_____	10 square yds
_____	20 square yds
_____	24 square yds

If $9y + 3 = 6y + 15$ then $y =$	
_____ 1	_____ 4
_____ 2	_____ 6

Which of the following is true about 84% of 100?	
_____	It is greater than 100
_____	It is less than 100
_____	It is equal to 100

Figure 1.7

Capital



Management

- ▶ Ensures labor and capital are effectively used to increase productivity
 - ▶ Use of knowledge
 - ▶ Application of technologies
- ▶ Knowledge societies
 - ▶ Labor has migrated from manual work to technical and information-processing tasks
- ▶ More effective use of technology, knowledge, and capital

Productivity in the Service Sector

- ▶ Productivity improvement in services is difficult because:
 1. Typically labor intensive
 2. Frequently focused on unique individual attributes or desires
 3. Often an intellectual task performed by professionals
 4. Often difficult to mechanize and automate
 5. Often difficult to evaluate for quality

Productivity at Taco Bell

Improvements:

- ▶ Revised the menu
- ▶ Designed meals for easy preparation
- ▶ Shifted some preparation to suppliers
- ▶ Efficient layout and automation
- ▶ Training and employee empowerment
- ▶ New water and energy saving grills



Results:

- ▶ Preparation time cut to 8 seconds
- ▶ Management span of control increased from 5 to 30
- ▶ In-store labor cut by 15 hours/day
- ▶ Floor space reduced by more than 50%
- ▶ Stores average 164 seconds/customer from drive-up to pull-out
- ▶ Water- and energy-savings grills conserve 300 million gallons of water and 200 million Kwh of electricity each year
- ▶ Green-inspired cooking method saves 5,800 restaurants \$17 million per year

Current Challenges in OM

- ▶ Globalization
- ▶ Supply-chain partnering
- ▶ Sustainability
- ▶ Rapid product development
- ▶ Mass customization
- ▶ Lean operations

Ethics, Social Responsibility, and Sustainability

Challenges facing operations managers:

- ▶ Develop and produce safe, high-quality green products
- ▶ Train, retrain, and motivate employees in a safe workplace
- ▶ Honor stakeholder commitments

Ethical

Stakeholders

Those with a vested interest in an organization, including customers, distributors, suppliers, owners, lenders, employees, and community members.

**Challenges
operating**

- ▶ Develop and produce safe, high-quality green products
- ▶ Train, retrain, and motivate employees in a safe workplace
- ▶ Honor stakeholder commitments



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