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# Chapter 1: Operations & Productivity

Chapter 1 Learning Objectives:

- Define operations management
- Explain the distinction between goods and services
- Explain the difference between production and productivity
- Compute single-factor productivity
- Compute multifactor productivity
- Identify the critical variables in enhancing productivity

# What is Operations Management?

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- Production: the creation of goods and services
  - Production activities that go on in an organization are referred to as “Operations”

- Operations Management (OM): the set of activities that create value in the form of goods and services by transforming inputs into outputs
  - Types of operations: goods producing, storage/transportation, exchange, entertainment, communication…

- The principles of OM help one to view a business enterprise as a total system, in which all activities are coordinated, not only vertically throughout the organization, but also horizontally across multiple functions

# Why Study Operations Management?

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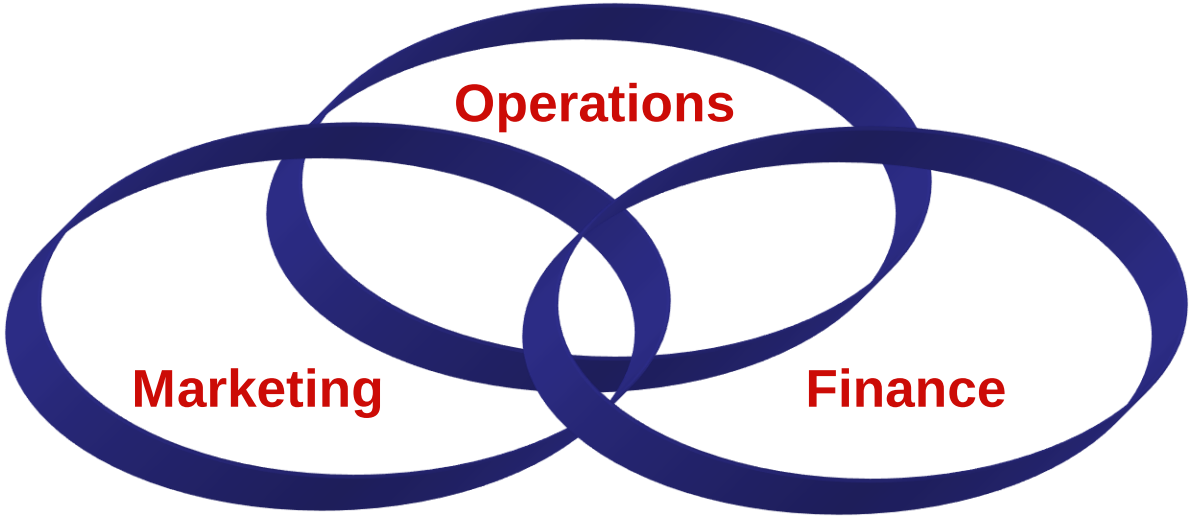
- The three major functions of an organization must work together for the organization to function successfully
  - Must understand their role and the roles of the other functions
- Significant interface between the functions
  - Exchange of information
  - Cooperative decision-making
  - Impact of decisions of one function on others



# The Supply Chain

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- Supply Chain: a global network of organizations and activities that supplies a firm with goods and services
  - Members of the supply chain collaborate to achieve high levels of customer satisfaction, efficiency and competitive advantage
  - In general, starts with the provider of basic raw materials and continues all the way to the final customer at the retail store
- Example: Supply chain for a bottle of Coke
  - Requires beet or sugar cane farmer, a syrup producer, a distributor and a retailer, each adding values to satisfy a customer

**Farmer** | **Syrup producer** | **Bottler** | **Distributor** | **Retailer** | **Customer**

# Four Basic Operations Management Functions

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- Planning: Provides the basis for future activities by developing strategies, goals and objectives and establishing guidelines, actions and schedules to meet them

- Organizing: The process of bringing together the resources (people, material, equipment, technology, information and capital) necessary to perform planned activities

- Directing (Staffing/Leading): The process of turning plans into realities by assigning specific tasks and responsibilities to employees, motivating them and coordinating their efforts

- Controlling: Evaluating performance and applying corrective measures to ensure that plans are achieved

# Operations Management Decisions

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- Strategic decisions are long-term decisions and concern the determination of broad policies and plans for using the resources of a company to best support its long-term competitive strategy

- Tactical decisions primarily address how to efficiently manage capacity, inventory and schedules within the constraints of previously made strategic decisions

- Operations decisions are narrow and short-term by comparison and act under the operation constraints set out by the strategic and tactical management decisions

# Understanding Goods and Services

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- A good is a physical product that you can see, touch, or possibly consume
  - A durable good is a product that typically lasts at least three years
  - A non-durable good is perishable and generally lasts for less than three years

- A service is any activity that does not directly produce a physical product
  - A service encounter is an interaction between the customer and the service provider
  - Service encounters consist of one or more “moments of truth” in which a customer comes into contact with any aspect of the delivery system, and thereby has an opportunity to form an impression

# Similarities Between Goods and Services

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- Goods and services provide value and satisfaction to customers who purchase and use them
- They both can be standardized or customized to individual wants and needs
- A process creates and delivers each good or service
  - Therefore, Operations Management is a critical skill!

# Differences Between Goods and Services

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1. Goods are tangible while services are intangible
2. Customers participate in many service processes, activities, and transactions
3. The demand for services is more difficult to predict than the demand for goods
4. Services cannot be stored as physical inventory
5. Service management skills are paramount to a successful service encounter
6. Service facilities typically need to be in close proximity to the customer
7. Patents protect goods, they do not protect services

# Examples of Goods and Service Content

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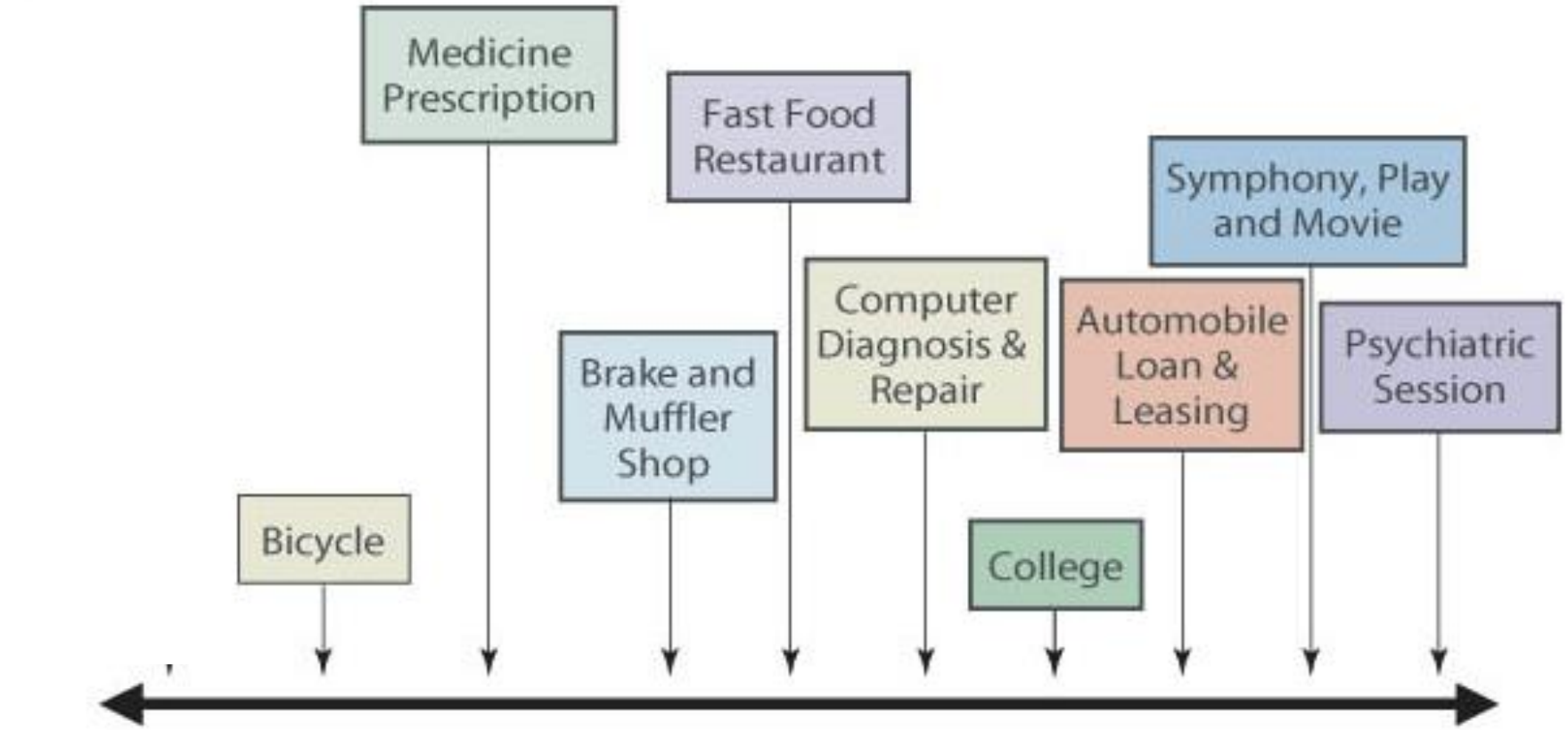

# Goods Quality

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- Quality: the degree to which the output of a process meets customer requirements

- Goods quality: the physical performance and characteristics of a good
  - Performance: a good's primary operating characteristics
  - Features: the "bells and whistles" of a good
  - Reliability: the probability of a good's surviving over a specified period of time under stated conditions of its use
  - Conformance: the degree to which physical and performance characteristics of a good match pre-established standards
  - Durability: the amount of use one gets from a good before it physically deteriorates or until replacement is preferred
  - Serviceability: the speed, courtesy and competence of repair work
  - Aesthetics: how a good looks, feels, sounds, tastes or smells

# Service Quality

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- Service quality: consistently meeting or exceeding customer expectations (external focus) and service delivery system performance (internal focus) for all service encounters

  - Tangibles: physical facilities, uniforms, equipment, vehicles, and appearance of employees
  - Reliability: ability to perform the promised service dependably and accurately
  - Responsiveness: willingness to help customers and provide prompt recovery to service upsets
  - Assurance: knowledge and courtesy of the service-providers, and their ability to inspire trust and confidence in customers
  - Empathy: caring attitude and individualized attention provided to its customers

# Quality of Goods and Services

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- Three types of attributes to evaluate the quality of goods and services
  - Search attributes: are those attributes that a customer can determine *prior* to purchasing the goods and/or services
  - Experience attributes: are those attributes that can be discerned only *after* purchase or during consumption or use
  - Credence attributes: are any aspects of a good or service that the customer must *believe* in, but cannot personally evaluate even after purchase and consumption
- Goods are easier to evaluate than services

# Evaluating the Quality of Services

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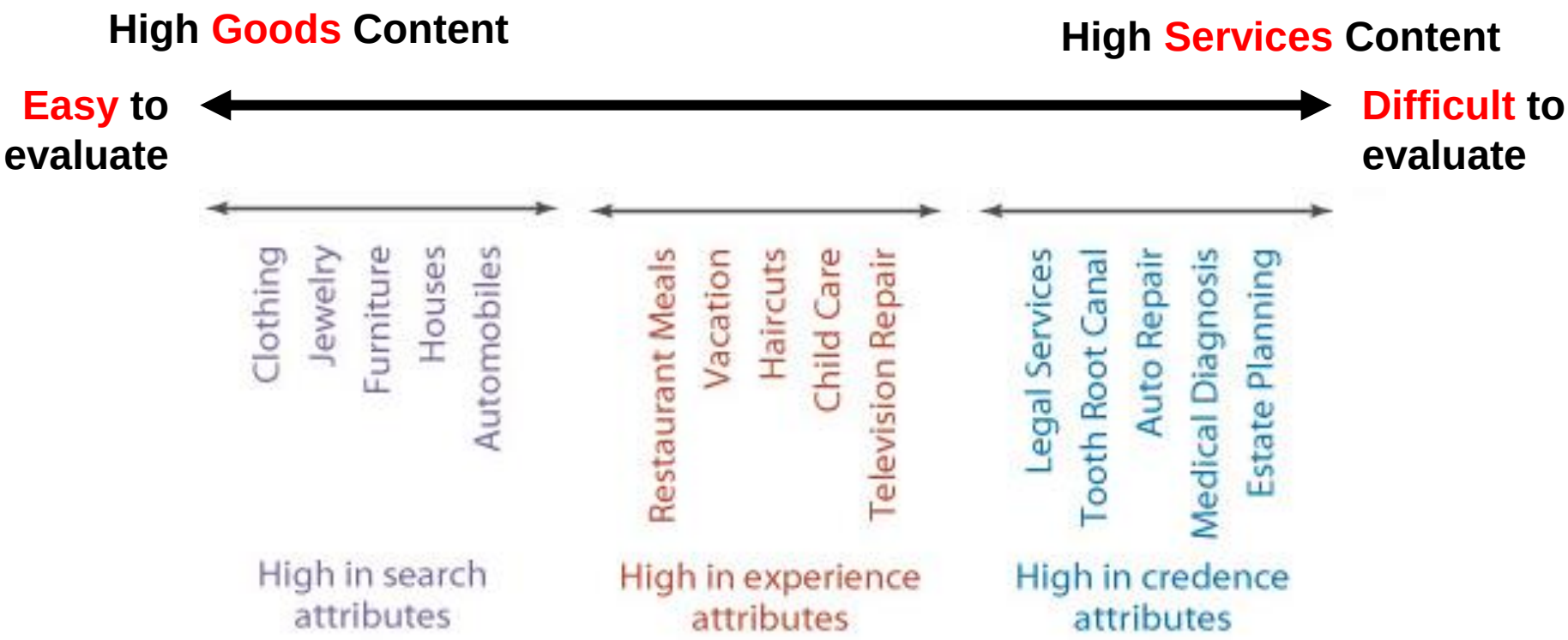
- Customers evaluate services in ways that are often different from goods, such as:
  - Customers seek and rely more on information from personal sources than from non-personal sources when evaluating services prior to purchase
  - Customers use a variety of perceptual features in evaluating services
  - Customers normally adopt innovations in services more slowly than they adopt innovation in goods
  - Customers perceive greater risks when buying services than when buying goods
- These insights help to explain why it is more difficult to design services and service processes than goods and manufacturing operations

# Goods-Services Continuum





# Characteristics of Goods and Services

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| Characteristic | Goods | Service |
|---|---|---|
| Customer contact | Low | High |
| Uniformity of input | High | Low |
| Labor content | Low | High |
| Uniformity of output | High | Low |
| Output | Tangible | Intangible |
| Measurement of productivity | Easy | Difficult |
| Opportunity to correct problems | High | Low |
| Inventory | Much | Little |
| Evaluation | Easier | Difficult |
| Patentable | Usually | Not usual |

# Production

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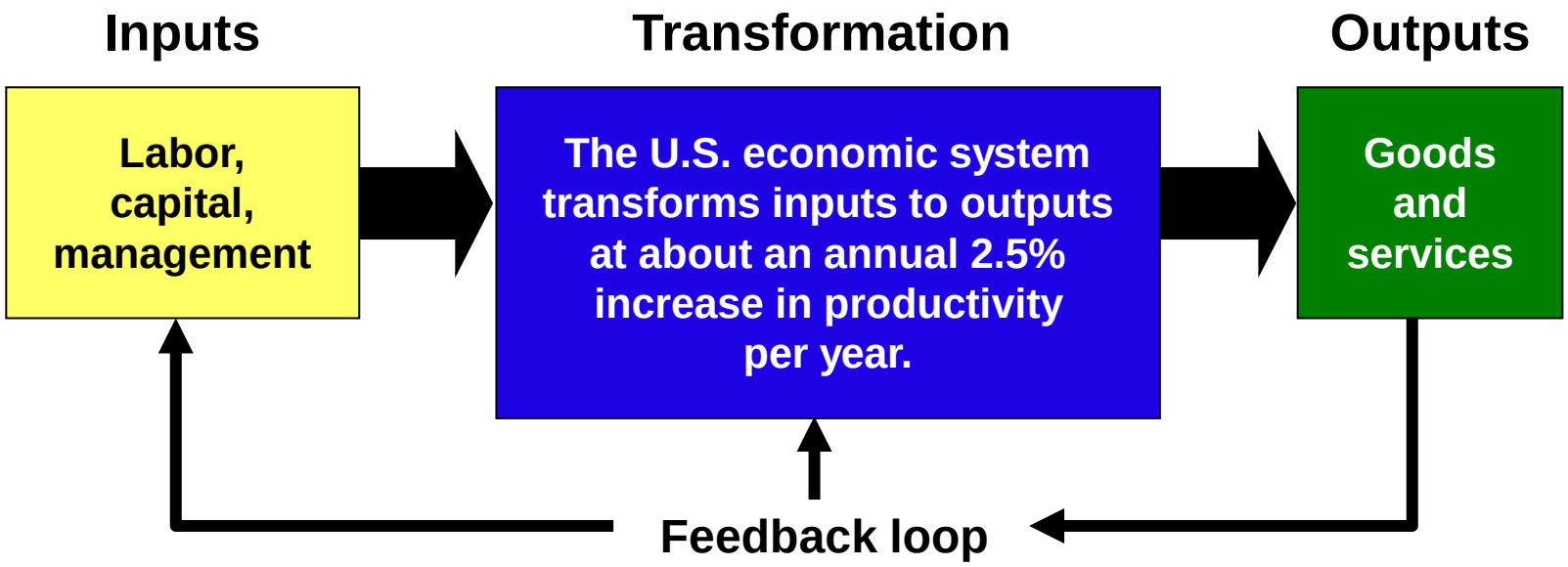
- Production: the creation of goods and services
- The production of goods and services requires transforming inputs into outputs
- Operations manager's job is to improve the transformation processes



# Productivity Variables

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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

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# Productivity

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- Productivity: A measure of the effective use of resources, expressed as the ratio of output of a process to the input
  - The objective is to *improve* productivity by improving the ratio

**Productivity = Units produced / Input used**

- Efficiency: doing the job well, with a minimum of resources and waste
  - Improving productivity improves efficiency
- Productivity ratios are used for
  - Planning workforce requirements
  - Scheduling equipment
  - Financial analysis

# Productivity

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- Productivity is a *relative* measure
  - Can be compared with similar operations within its industry
  - Can be compared over time
- Productivity may be expressed as:
  - Partial measures: output to one input

$$\text{Partial Measures: } \frac{\text{Output}}{\text{Labor}} \quad \frac{\text{Output}}{\text{Machine}} \quad \frac{\text{Output}}{\text{Capital}} \quad \frac{\text{Output}}{\text{Energy}}$$

  - Multifactor measures: output to a group of inputs

$$\text{Multifactor Measures: } \frac{\text{Output}}{\text{Labor} + \text{Machine}} \quad \frac{\text{Output}}{\text{Labor} + \text{Capital} + \text{Energy}}$$

  - Total measures: output to all inputs

$$\text{Total Measures: } \frac{\text{Goods or Services Produced}}{\text{All inputs used to produce them}}$$

# Productivity Growth

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- Productivity growth (decline) is the increase (decrease) in productivity from one period to the next relative to the productivity of the *previous* period

$$\text{Productivity Growth} = \frac{\text{Current Productivity} - \text{Previous Productivity}}{\text{Previous Productivity}} \times 100\%$$

Example: What is the growth rate if productivity increased from 80 to 84?

Space provided for calculations!

$$\frac{84 - 80}{80} \times 100 = 5\%$$

# Productivity Example

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- Consider a division of Miller Chemicals that produces water purification crystals for swimming pools. The major inputs used in the production process are labor, raw materials and energy.
  - For 2019 labor costs are $180,000; raw materials cost $30,000 and energy costs amount to $5,000
  - For 2020 labor costs are $350,000; raw materials cost $40,000 and energy costs amount to $6,000
  - Miller Chemicals produced 100,000 pounds of crystals in 2019 and 150,000 in 2020
- **Question**: Has productivity increased or declined between 2019 and 2020?

# Productivity Solution

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| Miller Chemicals | | | |
|---|---|---|---|
| Inputs | | 2019 | 2020 |
| | Labor, $ | 180,000 | 350,000 |
| | Raw Materials, $ | 30,000 | 40,000 |
| | Energy, $ | 5,000 | 6,000 |
| | | | |
| Output | | 2019 | 2020 |
| | Crystals, pounds | 100,000 | 150,000 |

Productivity = Quantity of output/quantity of input

2019: Productivity = 100,000 / (180,000 + 30,000 + 5,000)
= 0.465 lb/dollar

2020: Productivity = 150,000 / (350,000 + 40,000 + 6,000)
= 0.379 lb/dollar

So, productivity **dropped** from 2019 to 2020:
(P-cur) – (P-prev)/(P-prev) x 100=
[(0.379-0.465)/0.465]x100= **-18.49%**

# Real life Productivity Example at Starbucks

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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 |

Operations improvements have helped Starbucks increase yearly revenue per facility by $250,000 to $1,000,000 in seven years. Productivity has improved by 27%, or about 4.5% per year.

# Service Productivity

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- Productivity in the service sector is difficult to improve because:
  - Typically labor intensive
  - Frequently focused on unique individual attributes or desires
  - Often an intellectual task performed by professionals
  - Often difficult to mechanize
  - Often difficult to evaluate for quality

# Historical Evolution of Operations Management

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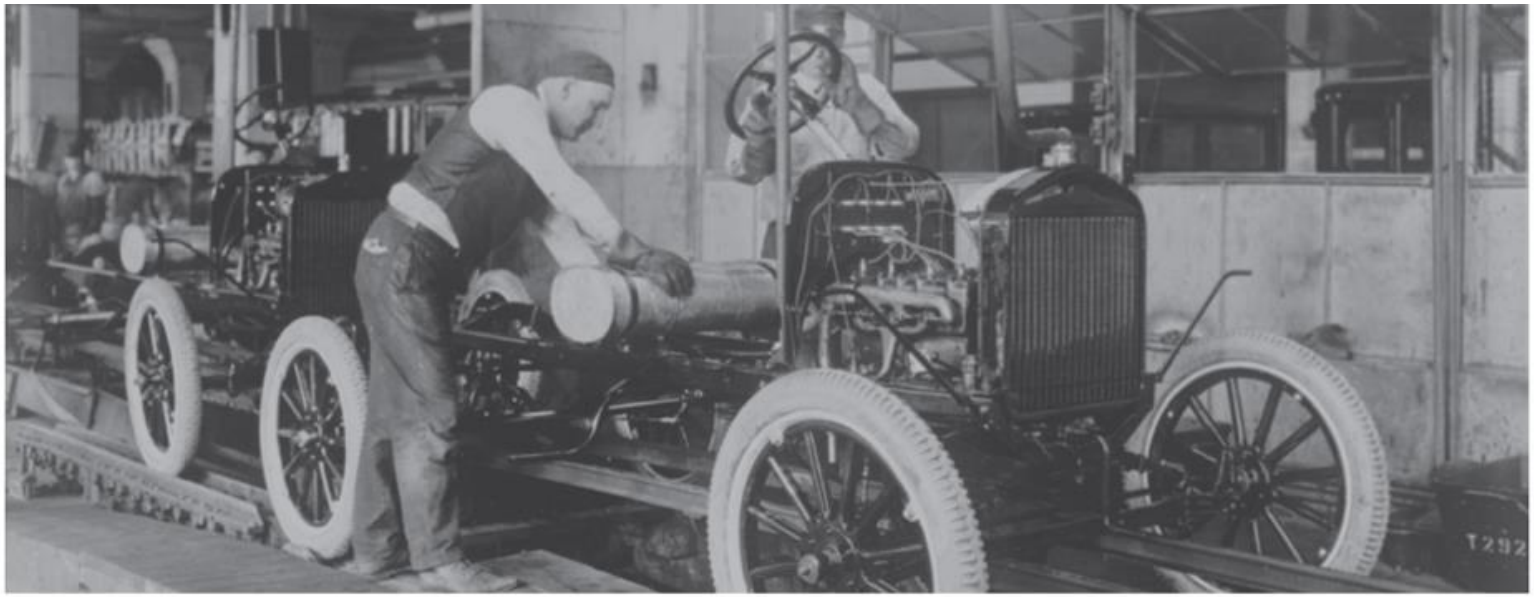

| Cost Focus | | Quality Focus | Customization Focus | Globalization Focus |
|---|---|---|---|---|
| **Early Concepts 1776–1880**<br>Labor Specialization (Smith, Babbage)<br>Standardized Parts (Whitney)<br><br>**Scientific Management Era 1880–1910**<br>Gantt Charts (Gantt)<br>Motion & Time Studies (Gilbreth)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

# U.S. Agriculture, Manufacturing, and Service Employment

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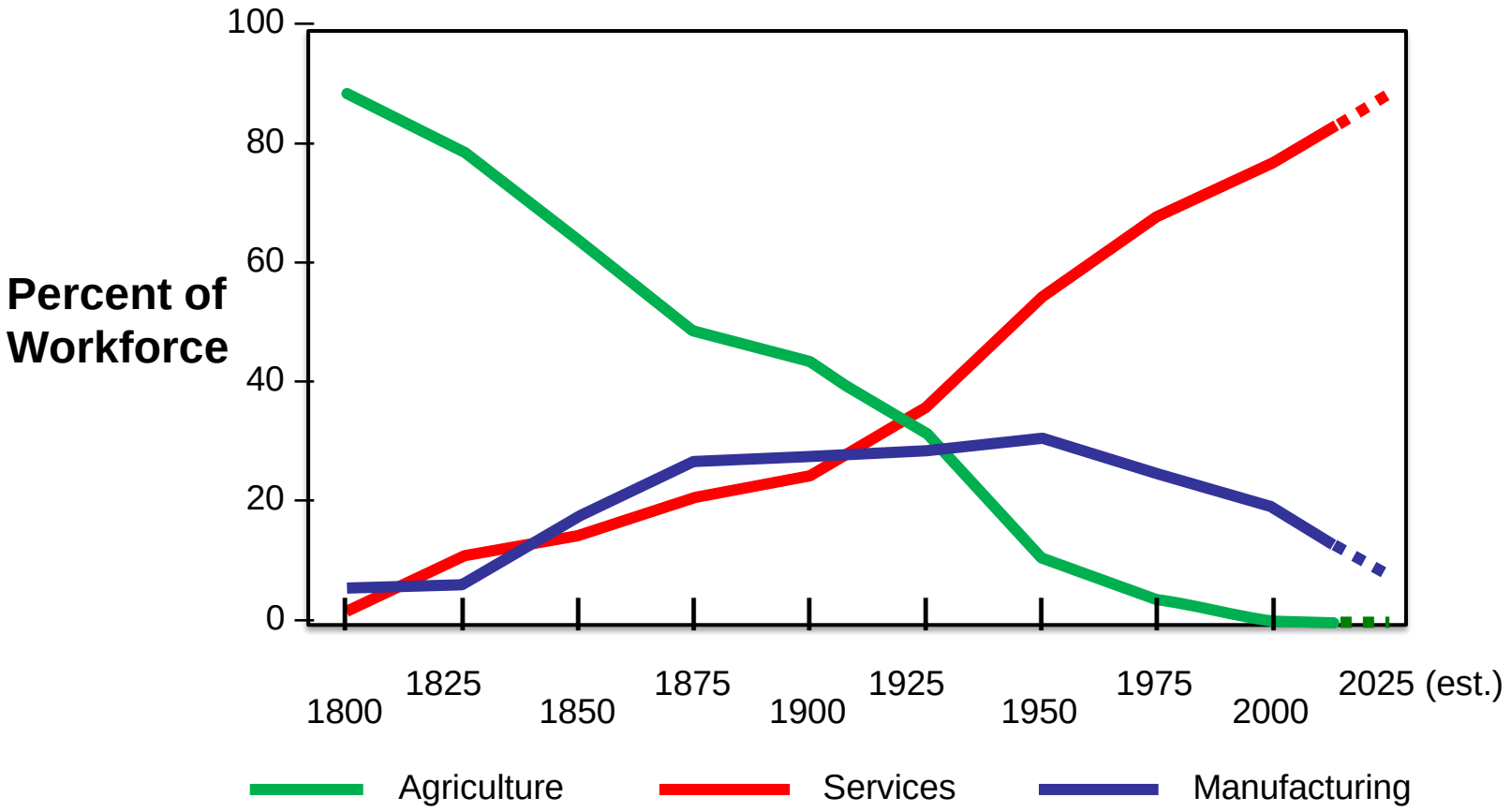

# U.S. Agriculture, Manufacturing, and Service Employment

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**TABLE 1.4**

| SECTOR | EXAMPLE | PERCENT OF ALL JOBS | |
|---|---|---|---|
| Service Sector | | | |
| Education, Legal, Medical, Other | SDSU, San Diego Zoo, Sharp Hospital | 13.2 | 85.9 |
| Trade (retail, wholesale) | Walgreen's, Walmart, Nordstrom | 13.8 | |
| Utilities, Transportation | San Diego Gas & Electric, American Airlines | 3.3 | |
| Professional and Business Services | Snelling and Snelling, Waste Management, Inc. | 10.1 | |
| Finance, Information, Real Estate | American Express, Wells Fargo, BofA, Prudential | 21.0 | |
| Food, Lodging, Entertainment | Starbucks, Olive Garden, Motel 6, Walt Disney | 9.0 | |
| Public Administration | U.S., State of California, San Diego County water | 15.5 | |
| Manufacturing Sector | General Electric, Ford, U.S. Steel, Intel | | 8.2 |
| Construction Sector | Bechtel, McDermott | | 4.1 |
| Agriculture | King Ranch | | 1.4 |
| Mining Sector | Homestake Mining | | .4 |
| Grand Total | | | 100.0 |

# New Challenges in Operations Management

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| Challenges | OM Response |
|---|---|
| Global focus: decline in communication and transportation costs has made markets global | Operations managers are seeking creative designs, efficient production and high-quality goods via international collaboration |
| Supply-chain partnering: shorter product life cycles, demanding customers and rapid changes in material, processes and technology | Operations managers are outsourcing and building long-term partnerships with critical players in the supply chain |
| Sustainability: concern for products and processes that are ecologically sustainable | Designing green products and packaging that minimize resource use and can be recycled or reused |
| Rapid product development: product life space is dramatically reduced | New management structures, enhanced collaboration and alliances that are more responsive and effective |

# New Challenges in Operations Management

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| Challenges | OM Response |
|---|---|
| Mass customization: consumers are increasingly aware of innovation and options and want customized products | Must respond with product designs and flexible processes that cater to the individual whims of consumers |
| Just-in-time performance: inventory requires financial resources and constrains response to shorter product life cycles | Operations managers must work with supply chains to cut inventory at every level |
| Empowered employees: knowledge explosion and more technical workplace require more employee competence | OM is responding by enriching jobs and moving more decision-making to the individual contributor |

# Ethics, Social Responsibility, and Sustainability

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- Challenges facing operations managers:
  - Develop and produce safe, high-quality green products
  - Train, retrain, and motivate employees in a safe workplace
  - Honor stakeholder commitments