

# Introduction to Operations Management

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## Lecture 1





# Operations Management

# Operations Management

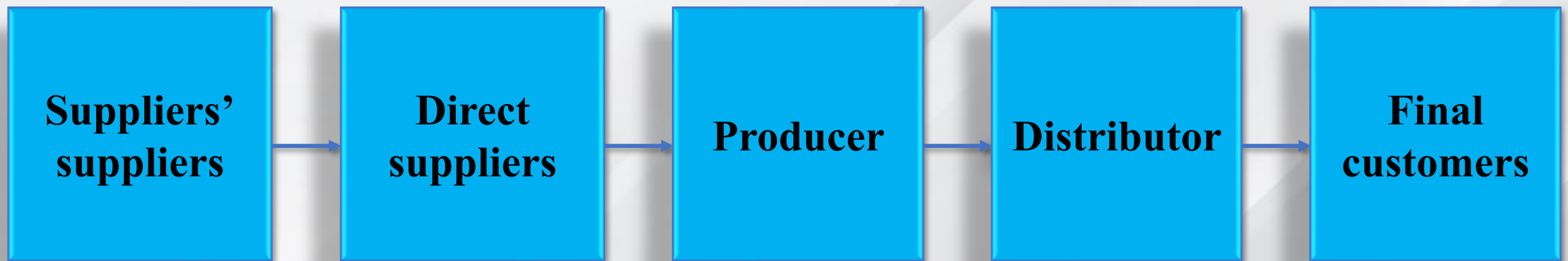
- What is operations?
  - The part of a business organization that is responsible for producing goods or services
- How can we define operations management?
  - The management of systems or processes that create goods and/or provide services

# Good or Service?

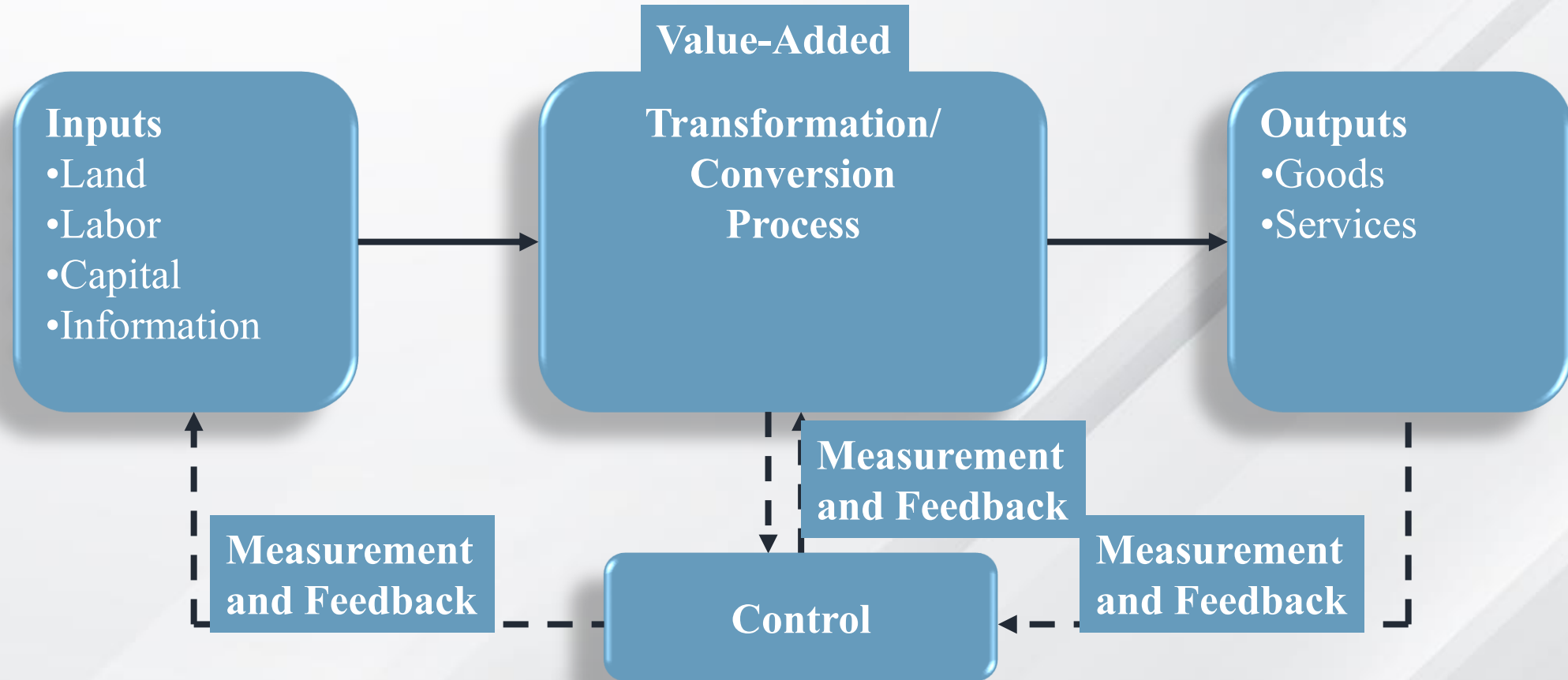
- ❖ Goods are physical items that include raw materials, parts, subassemblies, and final products
  - Automobile
  - Computer
  - Oven
  - Shampoo
  
- ❖ Services are activities that provide some combination of time, location, form or psychological value
  - Air travel
  - Education
  - Haircut
  - Legal counsel

# Supply Chain

**A sequence of activities and organizations involved in producing and delivering a good or service**



# The Transformation Process



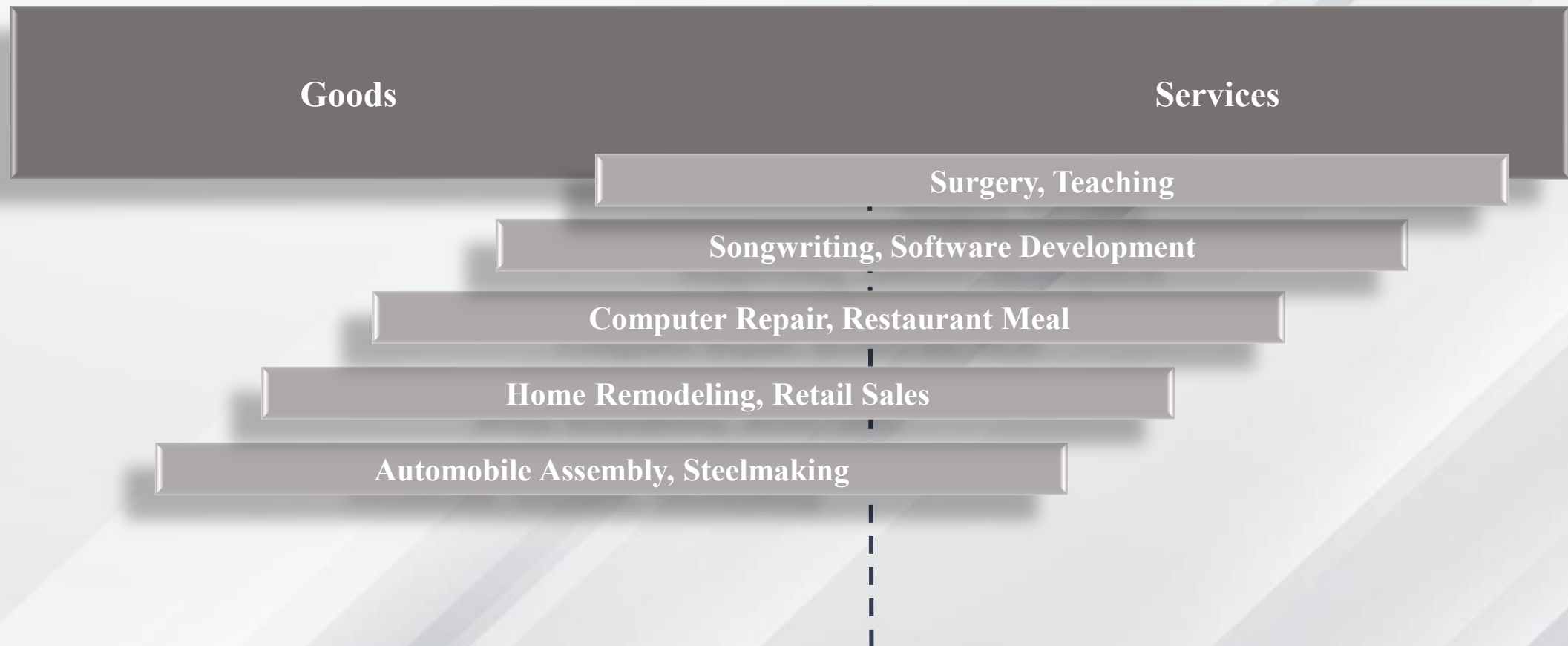
**Control** = The comparison of feedback against previously established standards to determine if corrective action is needed

**"Added value"** does not necessarily have to be a positive number, because "added" means increase or decrease.

**Feedback** = Measurements taken at various points in the transformation process

# Goods-service Continuum

Products are typically neither purely service- or purely goods-based

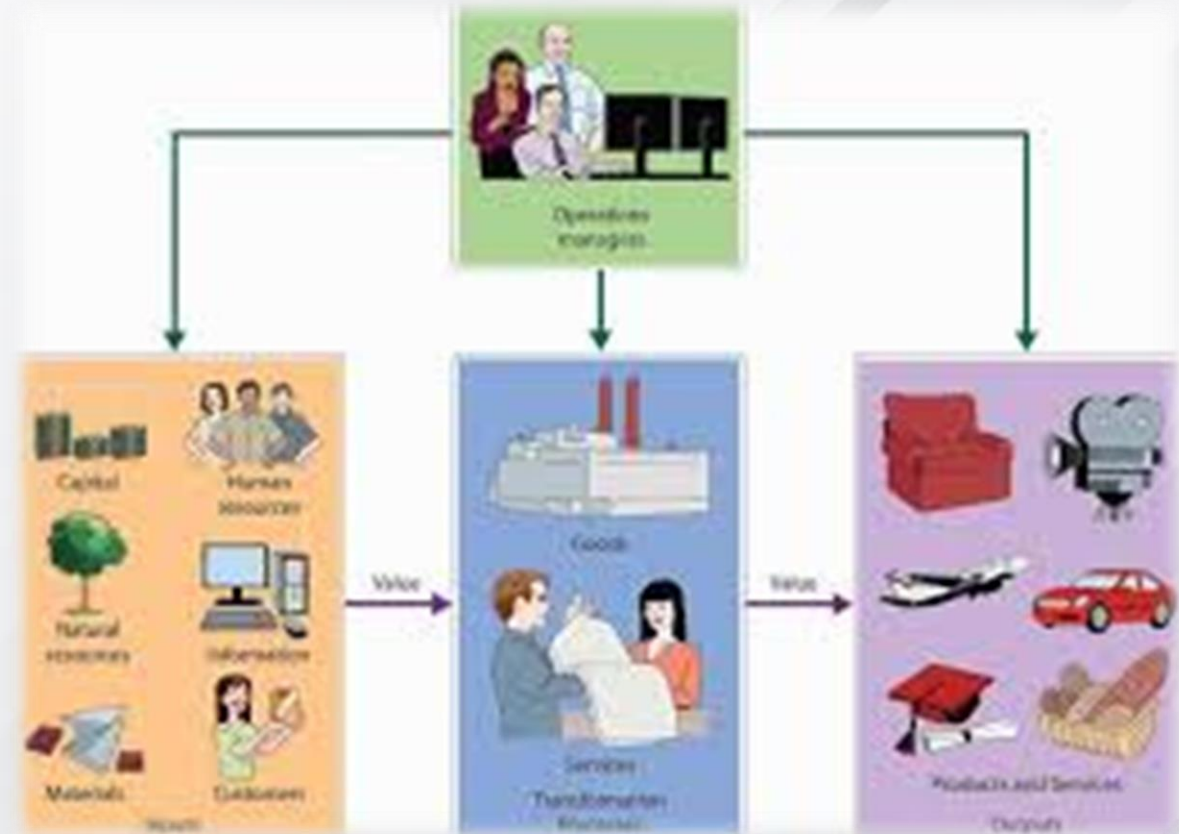


# Illustrations of the transformation process

|                | Inputs           | Processing  | Output            |
|----------------|------------------|-------------|-------------------|
| Food Processor | Raw vegetables   | Cleaning    | Canned vegetables |
|                | Metal sheets     | Making cans |                   |
|                | Water            | Cutting     |                   |
|                | Energy           | Cooking     |                   |
|                | Labor            | Packing     |                   |
|                | Building         | Labeling    |                   |
|                | Equipment        |             |                   |
| Hospital       | Doctors, nurses  | Examination | Treated patients  |
|                | Hospital         | Surgery     |                   |
|                | Medical supplies | Monitoring  |                   |
|                | Equipment        | Medication  |                   |
|                | Laboratories     | Therapy     |                   |

# Manufacturing vs. Service

1. Degree of customer contact
2. Labor content of jobs
3. Uniformity of input
4. Uniformity of output
5. Measurement of productivity
6. Production and delivery
7. Quality assurance
8. Amount of inventory
9. Evaluation of work
10. Ability to patent design



# Typical differences between production of goods and provision of services

| Characteristic                                  | Goods        | Services    |
|-------------------------------------------------|--------------|-------------|
| Output                                          | Tangible     | Intangible  |
| Customer contact                                | Low          | High        |
| Labor content                                   | Low          | High        |
| Uniformity of input                             | High         | Low         |
| Measurement of productivity                     | Easy         | Difficult   |
| Opportunity to correct problems before delivery | High         | Low         |
| Inventory                                       | Much         | Little      |
| Wages                                           | Narrow range | Wide range  |
| Patentable                                      | Usually      | Not usually |

**Compared to production, where material costs must be considered, measuring productivity in services is simpler.**

# Why Study Operations Management?

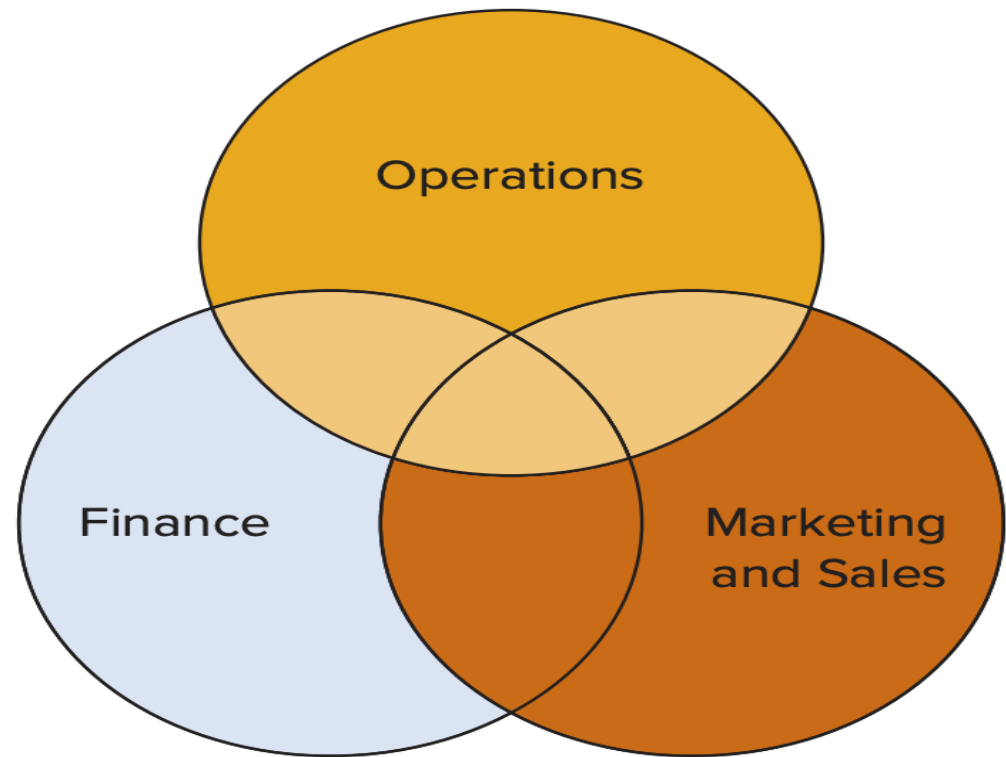
- Every aspect of business affects or is affected by operations
- Many service jobs are closely related to operations
  - Financial services
  - Marketing services
  - Accounting services
  - Information services
- Through learning about operations and supply chains you will have a better understanding of:
  - The world you live in
  - The global dependencies of companies and nations
  - Reasons that companies succeed or fail
  - The importance of working with others

# Basic Functions of the Business Organization



# Function Overlap

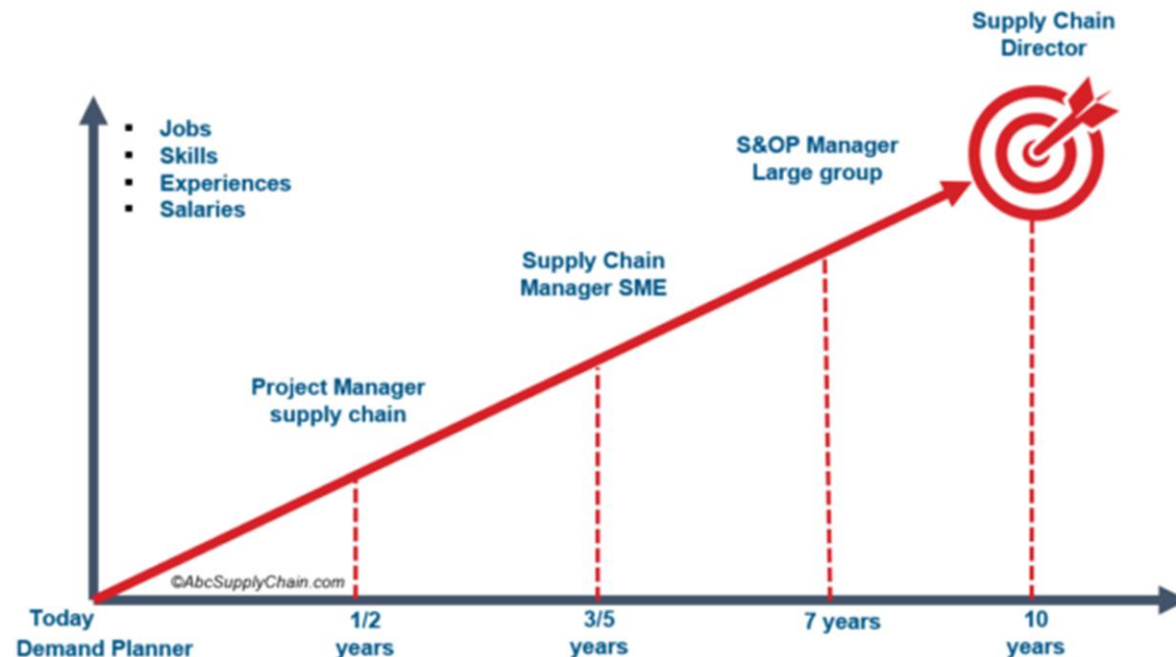
- Finance & operations
  - Budgeting
  - Economic analysis of investment proposals
  - Provision of funds
- Marketing & operations
  - Demand data
  - Product and service design
  - Competitor analysis
  - Lead time data



# OM and Supply Chain Career Opportunities

- Operations manager
- Supply chain manager
- Production analyst
- Schedule coordinator
- Production manager
- Industrial engineer
- Purchasing manager
- Inventory manager
- Quality manager

## Typical Supply Chain career path



# OM-Related Professional Societies

- APICS - The Association for Operations Management
- American Society for Quality (ASQ)
- Institute for Supply Management (ISM)
- Institute for Operations Research and Management Science (INFORMS)
- The Production and Operations Management Society (POMS)
- The Project Management Institute (PMI)
- Council of Supply Chain Management Professionals (CSCMP)

# Process Management

**Process** - one or more actions that transform inputs into outputs

## Three Categories of Business Processes:

Upper-management processes

These govern the operation of the entire organization.

Operational processes

These are core processes that make up the value stream.

Supporting processes

These support the core processes.

# Supply & Demand

**Operations &  
Supply Chains**

Supply > Demand

Supply < Demand

Supply = Demand

**Sales & Marketing**

Wasteful  
Costly

Opportunity Loss  
Customer  
Dissatisfaction

Ideal

# Process Variation

| <b>Four Sources of Variation:</b>          |                                                                                                                                   |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Variety of goods or services being offered | The greater the variety of goods and services offered, the greater the variation in production or service requirements.           |
| Structural variation in demand             | These are generally predictable. They are important for capacity planning.                                                        |
| Random variation                           | Natural variation that is present in all processes. Generally, it cannot be influenced by managers.                               |
| Assignable variation                       | Variation that has identifiable sources. This type of variation can be reduced, or eliminated, by analysis and corrective action. |

**Variations can be disruptive to operations and supply chain processes. They may result in additional costs, delays and shortages, poor quality, and inefficient work systems.**

# Scope of Operations Management

The scope of operations management ranges across the organization.

The operations function includes many interrelated activities such as:

- Forecasting
- Capacity planning
- Locating facilities
- Facilities and layout
- Scheduling
- Managing inventories
- Assuring quality
- Motivating employees
- And more . . .



# Role of the Operations Manager

The **Operations function** consists of all activities *directly* related to producing goods or providing services.

A primary function of the operations manager is to guide the system by decision making.

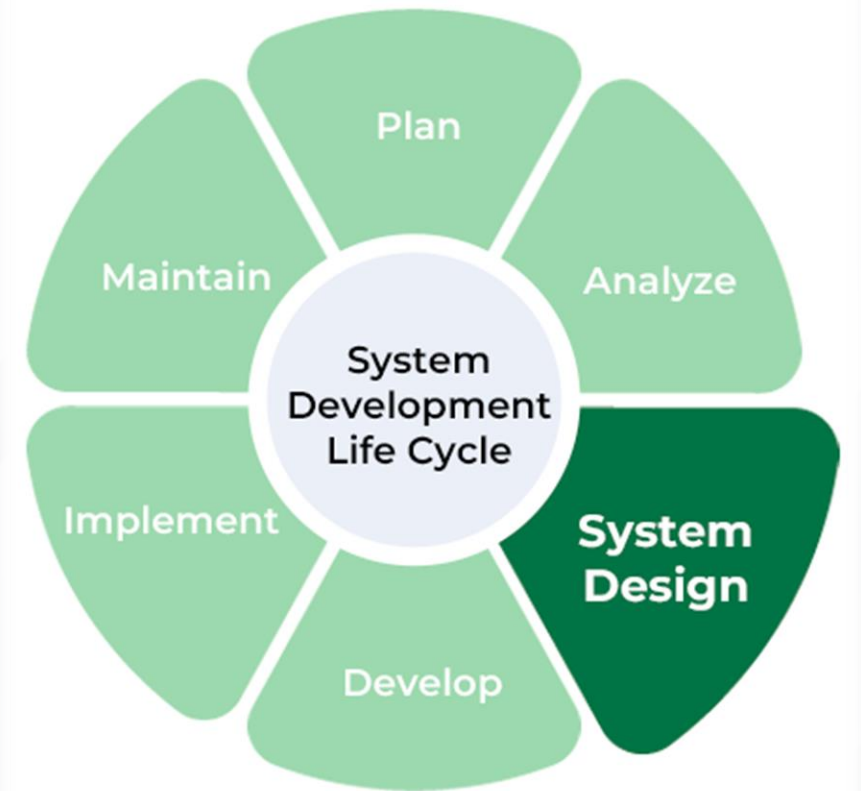
- System design decisions
- System operation decisions

**The level of similarity is one consideration in the design of production systems.**



# System Design Decisions

- **System design**
  - Capacity
  - Facility location
  - Facility layout
  - Product and service planning
  - Acquisition and placement of equipment
- These are typically strategic decisions that
  - usually require long-term commitment of resources
  - determine parameters of system operation



# System Operation Decisions

- **System operation**
  - These are generally tactical and operational decisions
    - Management of personnel
    - Inventory management and control
    - Scheduling
    - Project management
    - Quality assurance
- Operations managers spend more time on system operation decision than any other decision area
  - They still have a vital stake in system design
  - They usually use both quantitative and qualitative approaches, as they intend to make ethical decisions.



# OM Decision Making

- Most operations decisions involve many alternatives that can have quite different impacts on costs or profits
- Typical operations decisions include:
  - ***What:*** What resources are needed, and in what amounts?
  - ***When:*** When will each resource be needed? When should the work be scheduled? When should materials and other supplies be ordered?
  - ***Where:*** Where will the work be done?
  - ***How:*** How will the product or service be designed? How will the work be done? How will resources be allocated?
  - ***Who:*** Who will do the work?

**Therefore, Service often requires greater labor content, whereas manufacturing is more capital intensive.**

# General Approach to Decision Making

- Modeling is a key tool used by all decision makers
  - *Model* - an abstraction of reality; a simplification of something
  - Common features of models:
    - They are simplifications of real-life phenomena
    - They omit unimportant details of the real-life systems they mimic so that attention can be focused on the most important aspects of the real-life system
  - Physical Model – miniature airplane
  - Schematic Model – drawing of a city
  - Mathematical Model – Inventory optimization

# Understanding Models

- Keys to successfully using a model in decision making
  - What is its purpose?
  - How is it used to generate results?
  - How are the results interpreted and used?
  - What are the model's assumptions and limitations?

# Benefits of Models

1. Generally easier to use and less expensive than dealing with the real system
2. Require users to organize and sometimes quantify information
3. Increase understanding of the problem
4. Enable managers to analyze “What if?” questions
5. Serve as a consistent tool for evaluation and provide a standardized format for analyzing a problem
6. Enable users to bring the power of mathematics to bear on a problem

# Model Limitations

- Quantitative information may be emphasized at the expense of qualitative information
- Models may be incorrectly applied, and the results misinterpreted
  - This is a real risk with the widespread availability of sophisticated, computerized models placed in the hands of uninformed users
- The use of models does not guarantee good decisions

# Quantitative Approaches

- A decision-making approach that frequently seeks to obtain a mathematically optimal solution
  - Supported by computer calculations
  - Often work together with qualitative approaches

# Metrics and Trade-Offs

- **Performance metrics**

- All managers use metrics to manage and control operations
  - Profits
  - Costs
  - Quality
  - Productivity
  - Flexibility
  - Inventories
  - Schedules
  - Forecast accuracy

- **Analysis of trade-offs**

- A trade-off is giving up one thing in return for something else
- Carrying more inventory (an expense) to achieve a greater level of customer service

# Systems Perspective

- **System** - a set of interrelated parts that must work together
  - The business organization is a system composed of subsystems
    - Marketing subsystem
    - Operations subsystem
    - Finance subsystem
- The systems perspective
  - Emphasizes *interrelationships among subsystems*
  - Main theme is that *the whole is greater than the sum of its parts*
  - The output and objectives of the organization take precedence over those of any one subsystem
  - That means we concentrate on efficiency within the whole system and so secure total efficiency.

# Establishing Priorities

- In nearly all cases, certain issues or items are more important than others
- Recognizing this allows managers to focus their attention to those efforts that will do the best
  - Pareto Phenomenon - a few factors account for a high percentage of occurrence of some event(s)
    - The critical few factors should receive the highest priority
    - This is a concept that is appropriately applied to all areas and levels of management

Pareto phenomenon that states that roughly 80% of outcomes come from 20% of causes

# Historical Evolution of OM

- Industrial Revolution
- Scientific management
- Human relations movement
- Decision models and management science
- Influence of Japanese manufacturers
- Production lines raised living standards while simultaneously increasing output.



# Industrial Revolution

- Pre-Industrial Revolution
  - **Craft production** - System in which highly skilled workers use simple, flexible tools to produce small quantities of customized goods
- Some key elements of the industrial revolution
  - Began in England in the 1770s
  - Division of labor - Adam Smith, 1776
  - Application of the “rotative” steam engine, 1780s
  - Cotton gin and interchangeable parts - Eli Whitney, 1792
- Management theory and practice did not advance appreciably during this period

# Scientific Management

- Movement was led by efficiency engineer, Frederick Winslow Taylor
  - Believed in a “science of management” based on observation, measurement, analysis and improvement of work methods, and economic incentives
  - Management is responsible for planning, carefully selecting and training workers, finding the best way to perform each job, achieving cooperation between management and workers, and separating management activities from work activities
  - Emphasis was on maximizing output

# Human Relations Movement

- The human relations movement emphasized the importance of the human element in job design
  - Lillian Gilbreth – applications of psychology
  - Abraham Maslow – motivation theory, 1940s;
  - hierarchy of needs, 1954
  - Frederick Hertzberg – Two Factor Theory, 1959



Therefore, People who work in the field of operations should have skills that include both knowledge and people skills.

# Decision Models & Management Science

- F.W. Harris – mathematical model for inventory management, 1915
- Dodge, Romig, and Shewart – statistical procedures for sampling and quality control, 1930s
- Tippett – statistical sampling theory, 1935
- Operations Research (OR) Groups – OR applications in warfare
- George Dantzig – linear programming, 1947

# Influence of Japanese Manufacturers

- Refined and developed management practices that increased productivity
  - Credited with fueling the “quality revolution”
  - Just-in-Time production



# Operations Today

- Technology Management
- Global competition
- Communications
- Working with fewer resources
- Revenue management
- Agility
- A combination of goods and services.



# Key Issues for Operations Managers Today

- Economic conditions
- Innovating
- Quality problems
- Risk management
- Cyber-security
- Competing in a global economy





Thank You