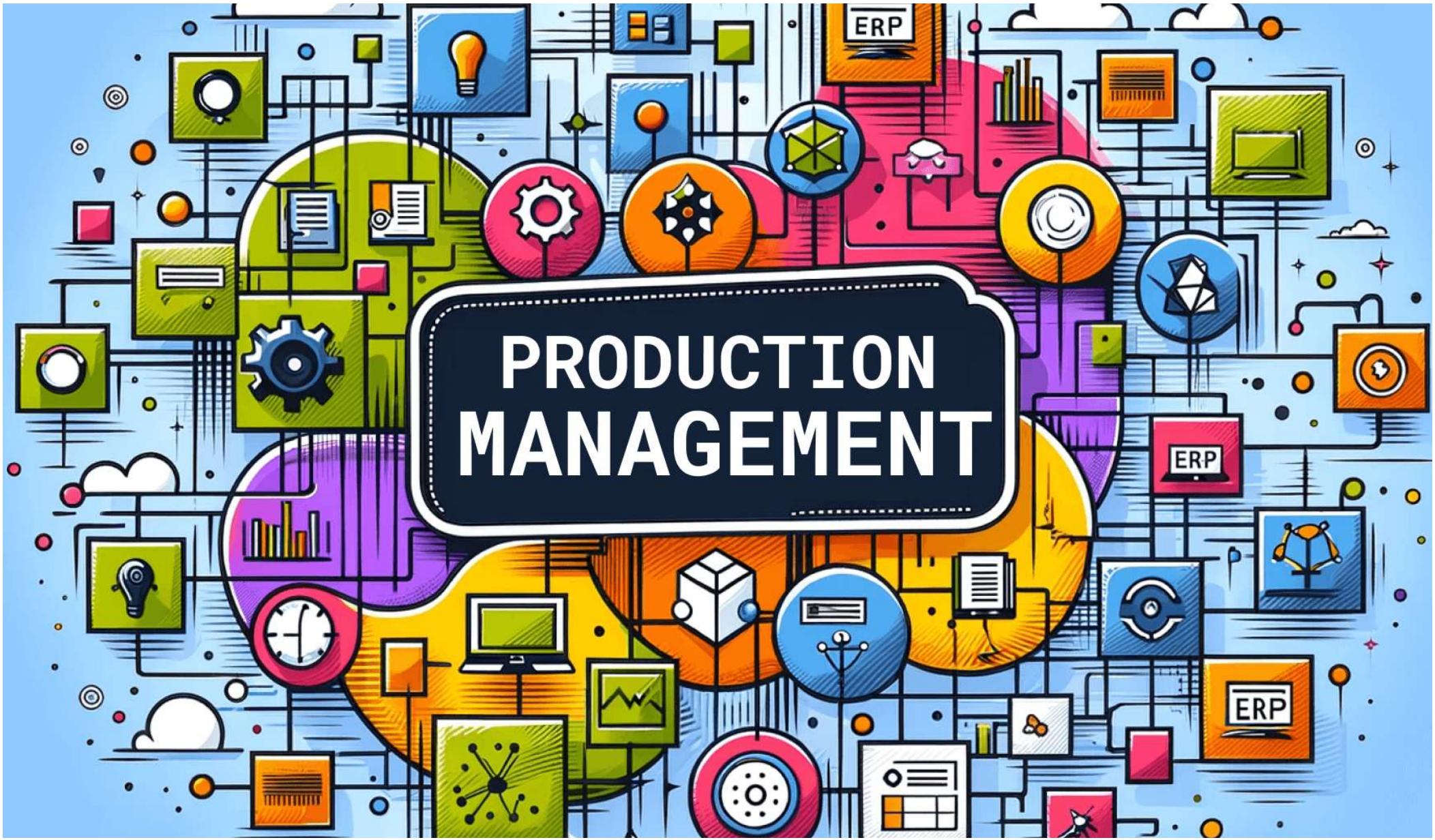


Dimitris Zissis

Short Bio

- **Assistant Professor** of Management Science, AUEB
- **Director** of the *Operations and ERP Systems* unit at Management Science Lab, AUEB
- **Visiting Professor** at Hellenic Open University & Open University of Cyprus
- Working experience: Cranfield University, University of Liverpool, University of Bath, Warwick Business School Norwich Business School, Alba Graduate Business School
- Contact details: *Dzisis@aueb.gr, 210-8203554*

Agenda

- Module Outline & Learning Goals
- Background & Framework
- Management Science Approach

Module Outline

- Content:
  1. Introduction (8/6)
  2. Forecasting & Game Theory (11/6)
  3. Inventory Management & Modelling (15/6)
  4. **The Beer Game (18/6)**
  5. Scheduling & Planning (22/6)
  6. **Visit: ACS premises (25/6)**
  7. **Group Work Presentations (29/6)**

Exam (2/7)

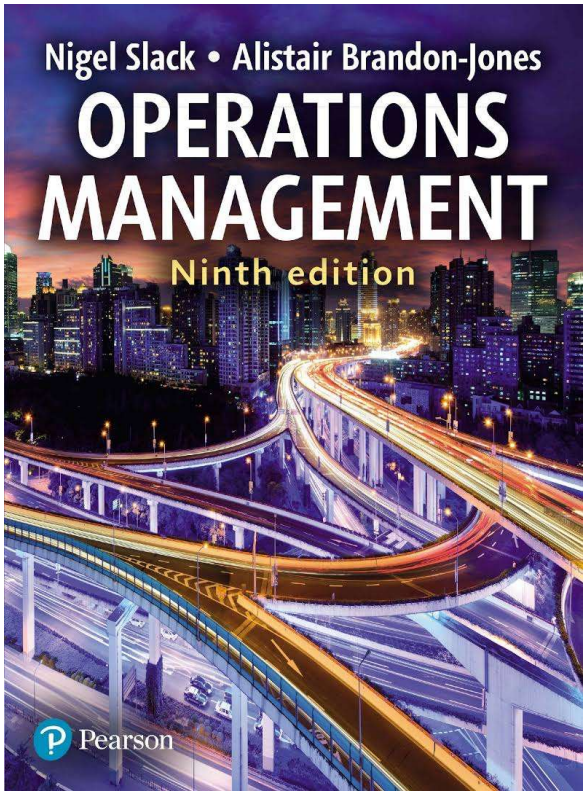
Assessment

- Assessment method:
  - Exam (70%), one double-sided A4 cheat sheet allowed
  - Group work (30%)

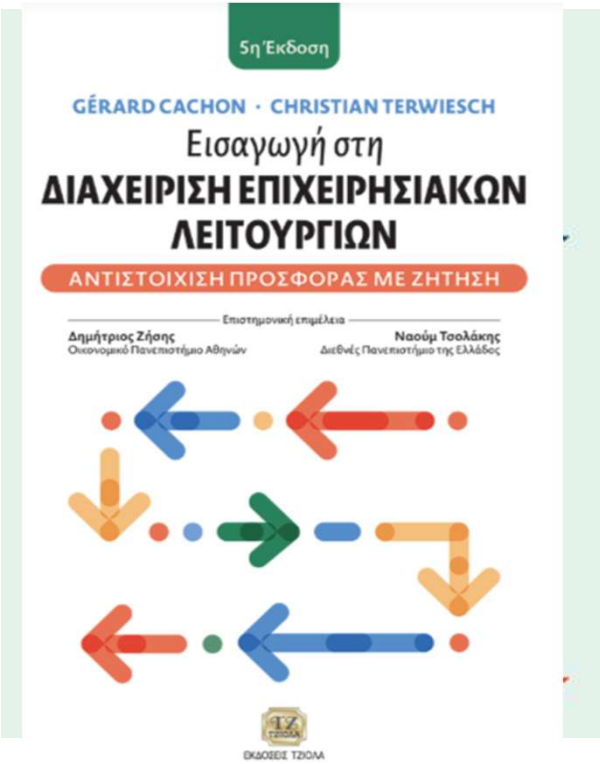
- **Topic: *Supply Chain Disruptions at [Company Name]: Challenges, Risks, and Opportunities***
- **Task: A 15-minute presentation**
- **Each team must have a minimum of 5 and a maximum of 6 members**

Textbooks

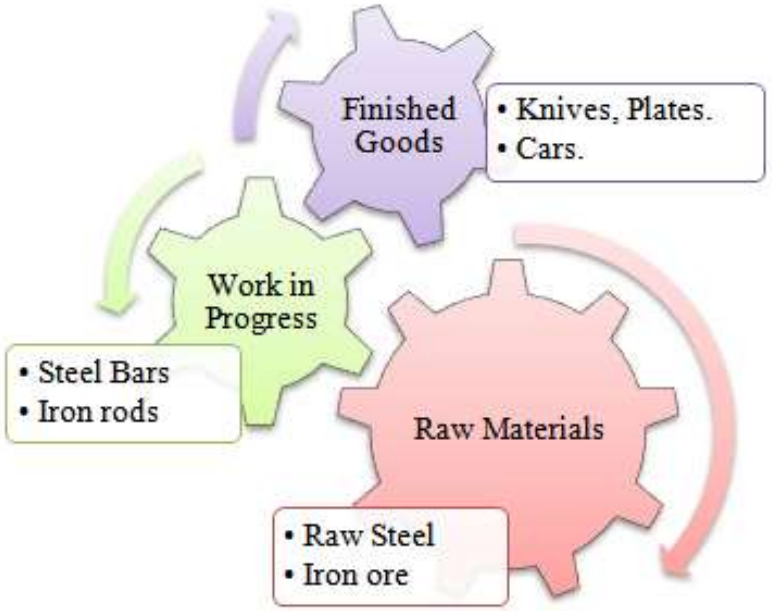
Slack, N. & Brandon-Jones, A. (2019), Operations Management, 9th Edition, Pearson



Cachon, G., & Terwiesch, C. (2024). Matching Supply with Demand: An Introduction to Operations Management, 5th Edition, New York, McGraw-Hill Education



Definition (1)



What is Production?

- The action of making or manufacturing from components or raw materials
- It is the process of transforming raw materials or purchased components into finished products for sale

Definition (2)

What is Operations Management?

- The systematic design, direction, and control of processes that transform inputs into services and products for internal, as well as external, customers
- Administration of business practices to create the highest level of efficiency

https://www.youtube.com/watch?v=nG5-52a5lRo

Definition (2)

What is Operations Management?

Operations management is a critical area of management that focuses on overseeing, designing, and controlling the production process and redesigning business operations in the production of goods or services. It involves ensuring that an organization's resources are used efficiently and effectively to meet customer demands and organizational goals. Key components of operations management include:

1. **Process Design and Improvement:** This involves designing efficient processes to produce goods and services, and continually improving these processes to enhance productivity and quality.

2. **Supply Chain Management:** This covers the management of the flow of goods and services, including all processes that transform raw materials into final products. It involves coordination with suppliers, manufacturers, and distributors to ensure smooth operations.

3. **Quality Management:** Ensuring that the products or services meet certain quality standards and are consistent. This involves quality control, quality assurance, and continuous improvement practices.

4. **Capacity Planning:** Determining the production capacity needed by an organization to meet changing demands for its products. This includes planning for labor, equipment, and facilities.

5. **Inventory Management:** Managing inventory levels to balance the costs of holding inventory with the need to meet customer demand promptly. Techniques include Just-in-Time (JIT) and Economic Order Quantity (EOQ).

Definition (2)

6. **Forecasting:** Predicting future demand for products or services to make informed production planning decisions. This can involve both qualitative and quantitative methods.

7. **Scheduling:** Planning the timing of production activities to ensure efficient use of resources and timely delivery of products. This includes job scheduling, workforce scheduling, and maintenance scheduling.

8. **Project Management:** Overseeing specific projects within the operations function, ensuring they are completed on time, within budget, and to the required quality standards.

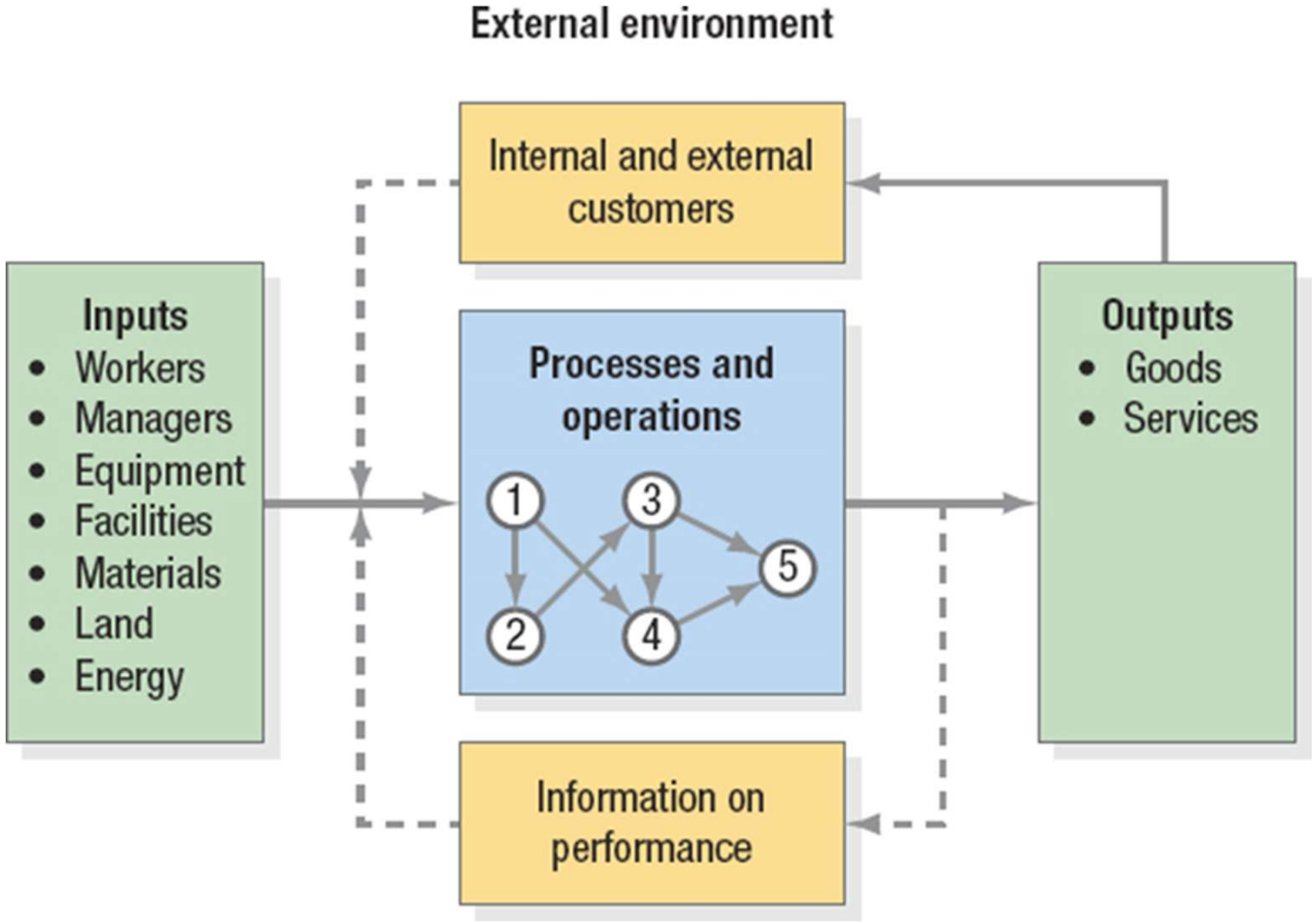
9. **Lean Operations:** Implementing methodologies to minimize waste and improve efficiency. This includes practices like Lean Manufacturing and Six Sigma.

10. **Facility Layout and Location:** Designing the physical layout of facilities to optimize workflow and locating facilities in the best geographical locations to minimize costs and improve service levels.

Operations management is vital for any organization as it directly impacts the organization's ability to meet customer demands, manage resources efficiently, and achieve overall business objectives. It integrates various functions and activities, ensuring that they align with the strategic goals of the organization.

POM Overview

Direction and control of the processes that transform inputs into finished goods-services



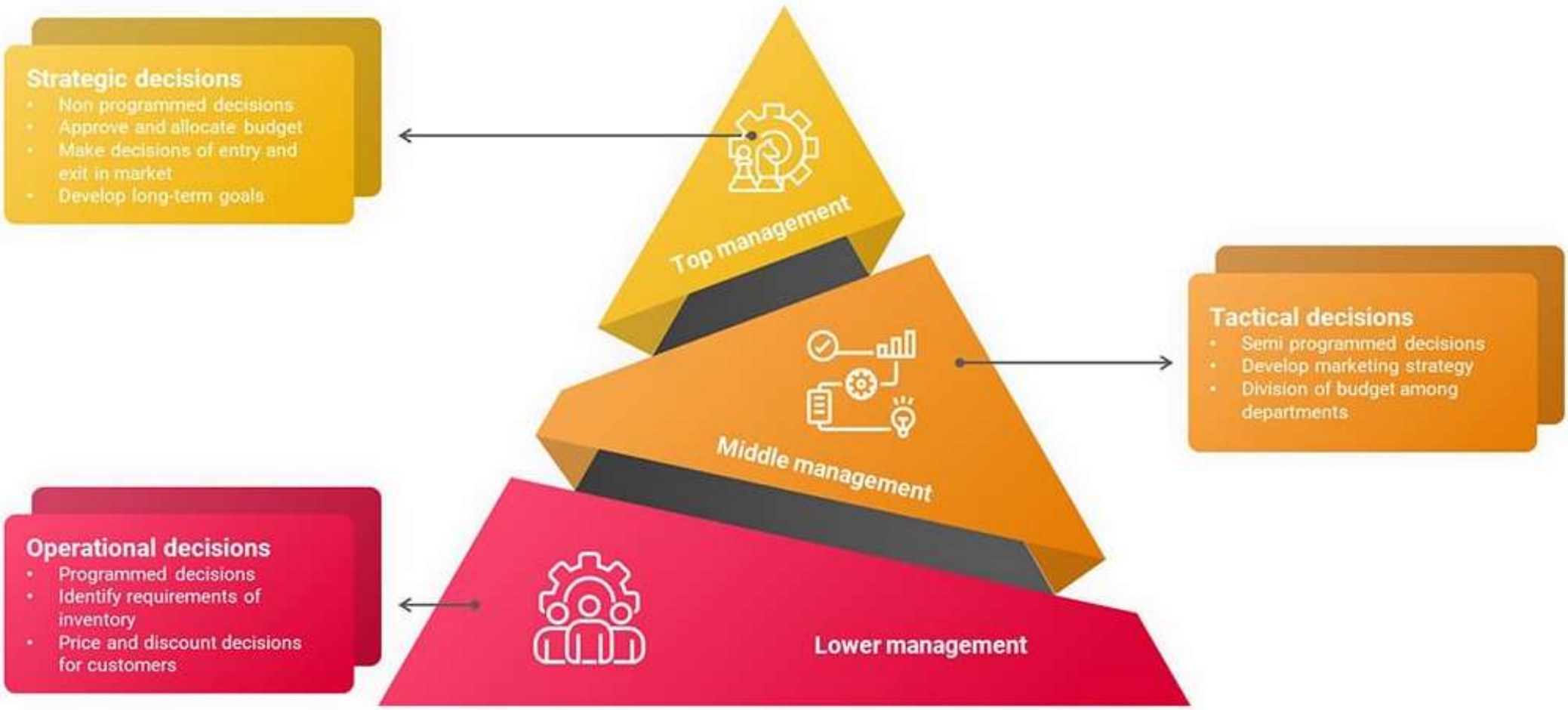
POM Overview

- Input examples:
  - Medical professionals, building, diagnostic equipment, pharmaceuticals, first aid material (*Hospital*)
  - Workers, managers, engineering blueprints, drills, lathes, metals, paints, energy (*Manufacturer*)
  - Financial professionals, checks, currency, building (*Bank*)

POM Overview

- Output examples:
  - Healed patients - hopefully! (*Hospital*)
  - Physical products (*Manufacturer*)
  - Financial products (*Bank*)
- Transformation examples:
  - Physiological, behavioral (*Hospital*)
  - Physical change of shape (*Manufacturer*)
  - Monetary (*Bank*)

Decisions & Time



POM & Decisions

Competitive priorities:

- **Cost**
  - Basic food items – salt, flour, paper
  - Consumer electronics
- **Quality**
  - High performance design (superior features, tight tolerances, greater durability, courteous service, convenient location, safety – Holmes Place Gyms)
  - Consistent quality (frequency of conformance to specs)

POM & Decisions

Competitive priorities:

- **Time (time-based competition)**
  - Fast delivery (FedEx)
  - On-time delivery (General Motors)
  - Product development speed (Zara)
- **Flexibility**
  - Customization – accommodate unique customer needs
  - Volume flexibility – quick changes in production rates

Flow Strategies

- **Make-to-stock** (Sony, Siemens, Delta)
  - Finished goods held in stock for immediate delivery
  - High volumes, standard products
  - Production based on forecasted demand
  - Supports low cost, consistent quality priority
- **Standardized services** (FedEx, Postal Services)
  - Services with little variety and high volumes
  - Supports low cost, on-time delivery & consistent quality

Flow Strategies

- **Assemble-to-order** (Dell, Vodafone, IKEA)
  - Assemblies & components held in stock
  - Final assembly completed after customer selects options
  - Large number of final configurations are possible
  - Forecasting of customer demand for final products is impractical (multitude of combinations)
  - Widely used in computer manufacturing
  - Services: mobile providers (packages for individuals)

Flow Strategies

- **Make-to-order** (Home construction, Boeing)
  - Most required materials are purchased when customer places the order
  - Production based on individual customer specifications
  - Requires flexibility at all levels (organization, processes, flows etc.)
  - Supports customization as a competitive priority
  - Automotive industry towards make-to-order

Flow Strategies

- **Engineer-to-order** (AVAX Group, GEK TERNA)
  - Product is designed and built after customer order
  - Highest customization, longest lead time
  - Common in: construction, industrial equipment, complex B2B systems

Dynamic Environment

Retail Industry (Kiva Robots):
https://www.youtube.com/watch?v=HYjc9h8oSsY

Grocery Industry (Ocado):
https://www.youtube.com/watch?v=4DKrcpa8Z_E

Passenger transport (Waymo & May Mobility):
https://www.youtube.com/watch?v=hA_-MkU0Nfw
https://www.youtube.com/watch?v=NIuIvgAJiZE

Why POM is Important

- Disruptions:
  - Problems/issues
  - Challenges
  - Opportunities

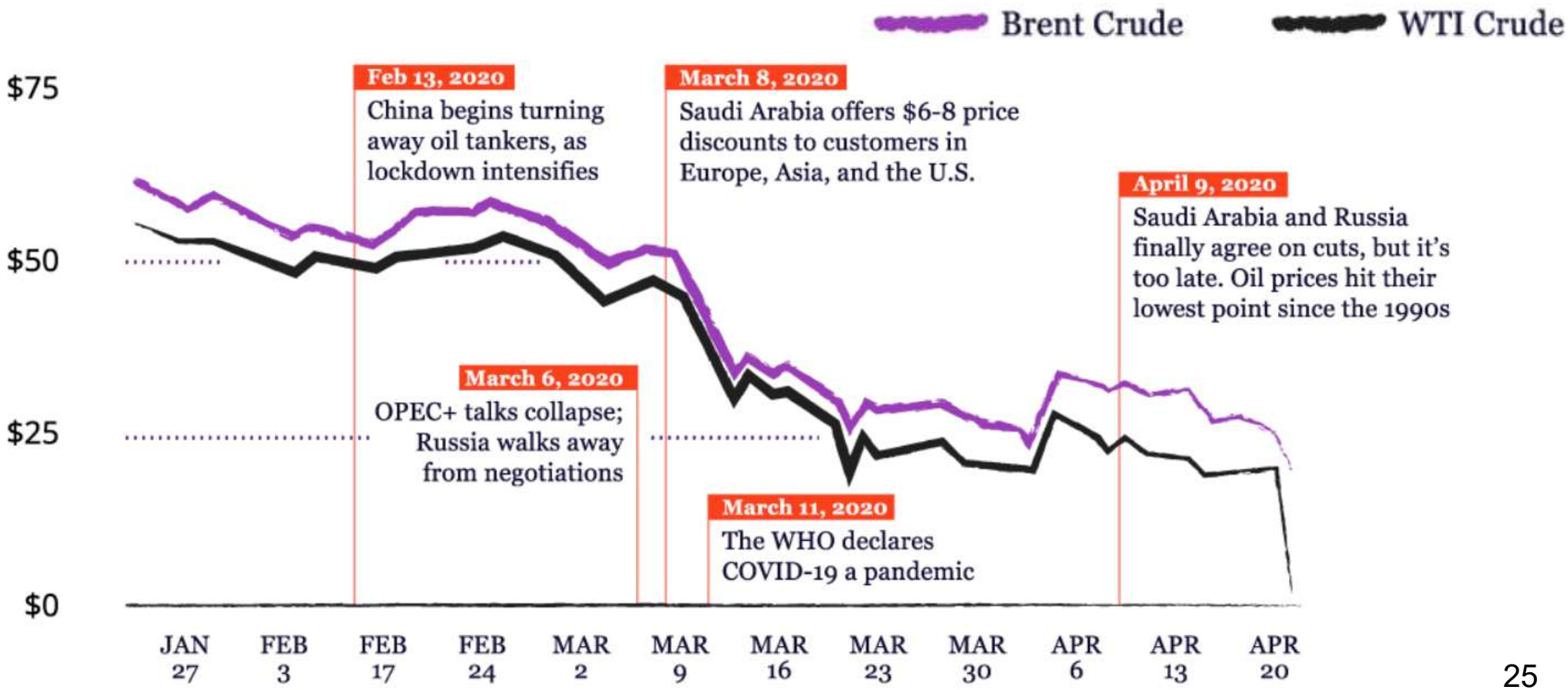
Why POM is Important

Why POM is Important

The number of passengers travelling through Heathrow Airport last month fell by around 97% compared with April 2019 as coronavirus took its toll

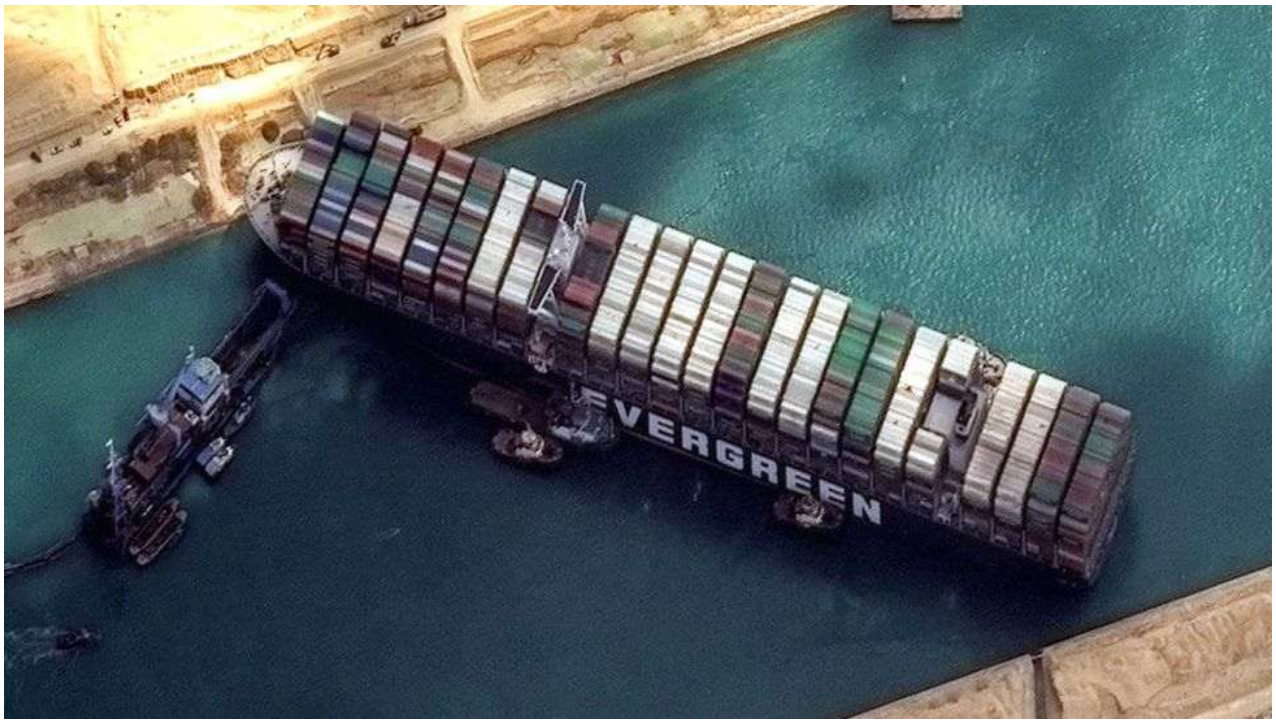
Why POM is Important

COVID-19 and oil prices



Why POM is Important

- Suez Canal blockage (23-29/03/2021)
  - Problems/issues
  - Challenges
  - Opportunities



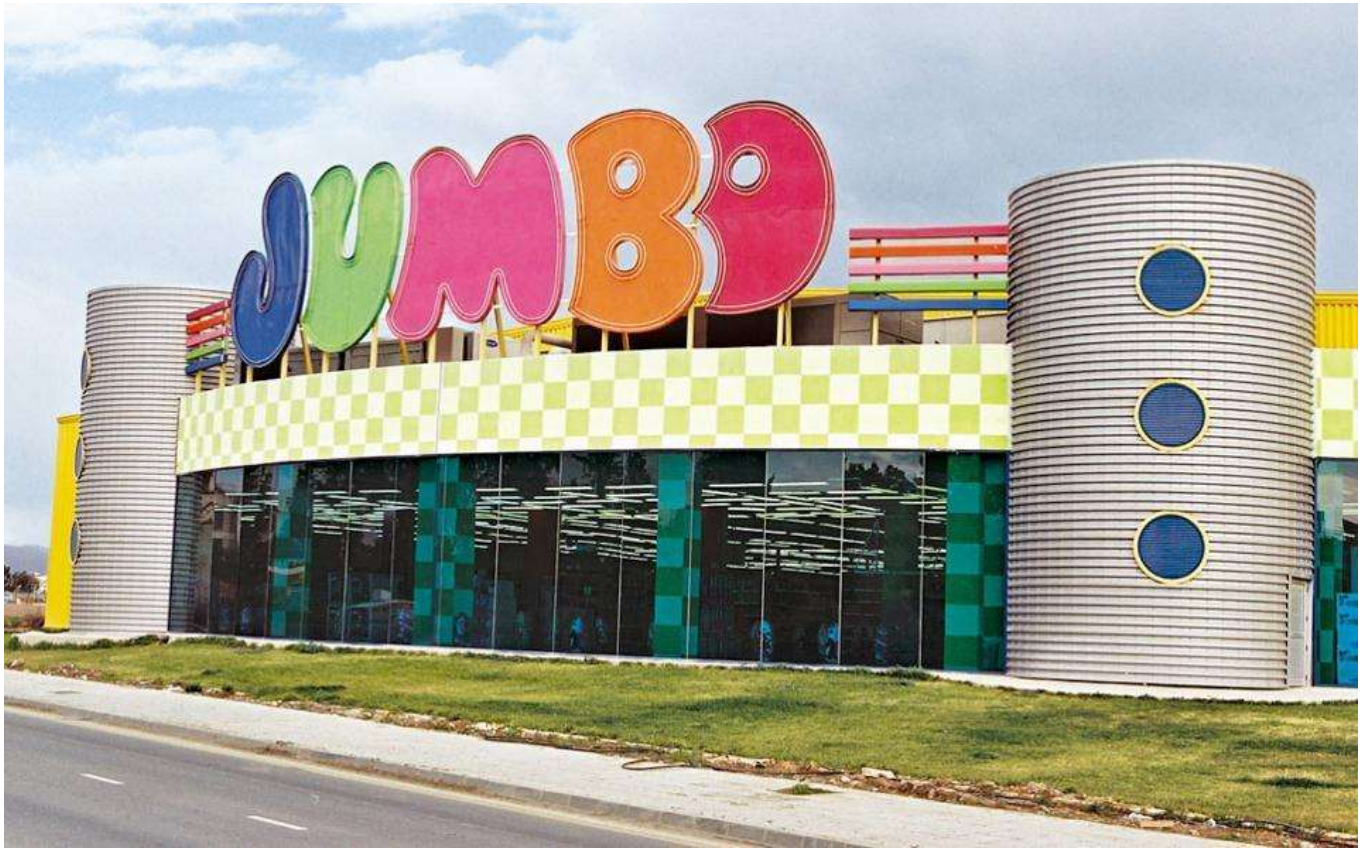
Estimated cost: $9.6 billion per day

Case Study

COVID-19

Pipeline Inventory

Warehouse Capacity



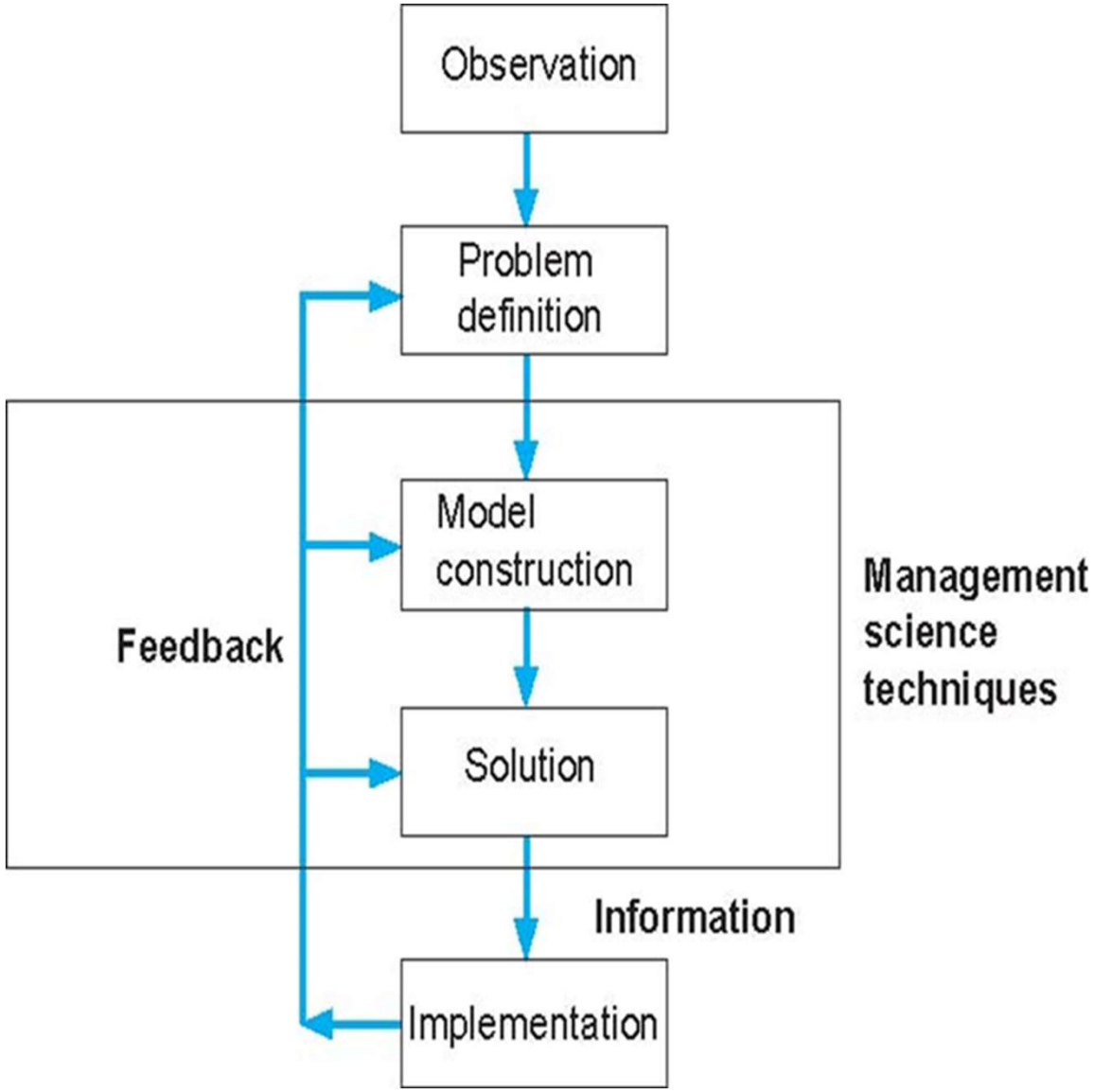
Management Science

- Management science is a **scientific approach** to **solving** practical and management problems
- It is used in a variety of organizations to solve many different types of problems
- It encompasses a **logical mathematical approach** to problem solving

Management Science Process

1. Observation - Identification of a problem that exists (or may occur soon) in a system or organization
2. Problem Definition - The problem must be clearly and consistently defined
3. Model Construction - Development of the mathematical relationships that describe the key elements of the problem
4. Model Solution - The model is solved using management science techniques
5. Model Implementation – Apply the model or its solution

Management Science Process



Key Elements of a Problem

- **Parameters** are known, constant values that are often coefficients of variables
- **Variables** are symbols used to represent items that can take on any value
- **Objective function** is a mathematical relationship describing our objectives
- **Constraints** are requirements or restrictions placed on a problem

Key Elements of a Problem

- A company makes and sells cookers
- Product costs $5 to produce
- Product sells for $20
- Product requires 4 kilos of steel to make
- Company has available 100 kilos of steel
- Problem: Determine the number of units to produce to make the most profit, given the limited amount of steel available

Mathematical Formulation

- Parameters: \$20, \$5, 4 kilos, 100 kilos (known values)
- Variables:
  - x = how many units to produce (decision variable)
  - Z = total profit (in \$)
- Objective Function: $Z = 20x - 5x$
- Constraints: $4x$ = 100 kilos of steel (resource constraint)

Model: maximize $Z = 20x - 5x$

subject to: $4x = 100$

Solution

- Solve the constraint equation: $4x = 100$

$$4x/4 = 100/4$$

$$x = 25$$

- Substitute this value into the objective function:

$$Z = 20x - 5x$$

$$Z = 375$$

- Solution: Produce 25 units (profits $375)

Break-Even Analysis

- Used to determine the number of units of a product to sell or produce that will equate total revenue with total cost
- The volume at which total revenue equals total cost is called the break-even point; profit at break-even point is zero

Break-Even Analysis

Model Components:

- Fixed Cost (*A*) - costs that are independent of the number of units produced,
- Variable Cost (*B*) - unit cost,
- Volume (*n*) - the number of units produced or sold

Break-Even Analysis

Total cost (TC): Fixed cost plus variable cost, i.e.

$$TC = A + B\,n$$

Profit (Z): Difference between total revenue and total cost

$$Z = np - TC$$

where: p is the unit price

Solution: Profit equals to zero

$$Z = 0$$

$$n = A/(p - B)$$

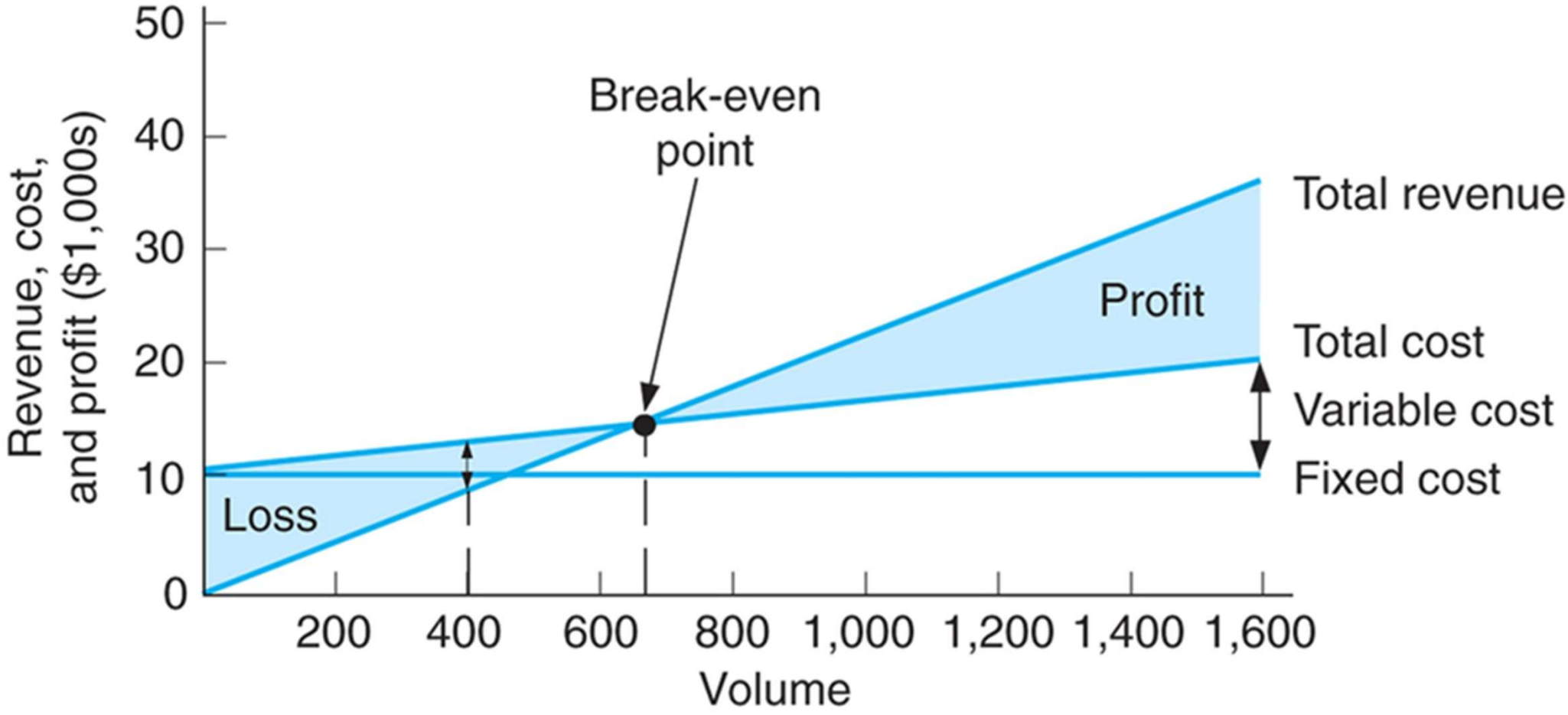
Example

- Western Clothing Company (WCC) produces jeans
- WCC has estimated that the fixed cost to produce jeans is $10,000, while the production cost per pair is $8
- The retail price of a pair of WCC jeans is $23
- How much is the break-even point?

Solution

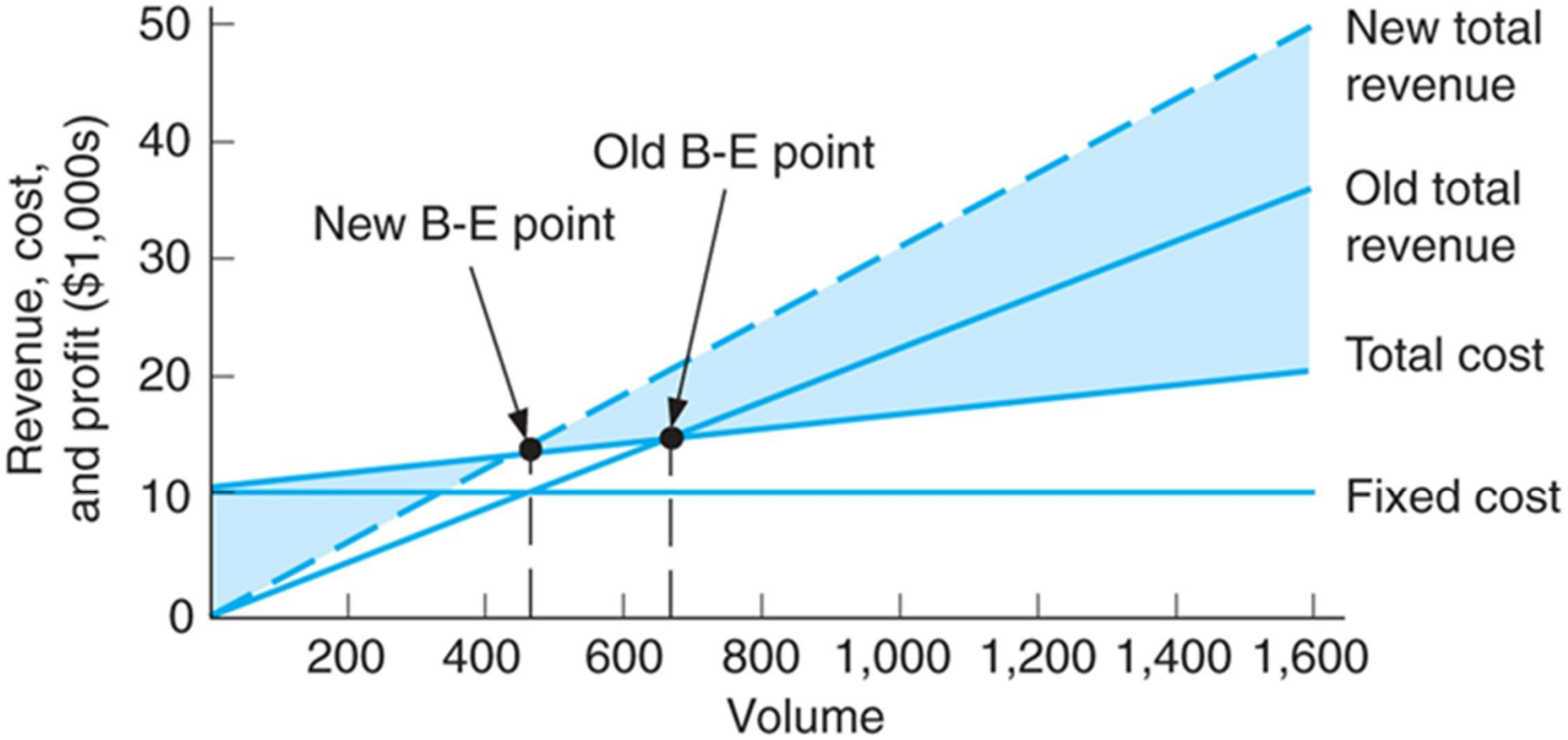
- A? 10,000
- B? 8
- p? 23
- *n?* *A/(p−B)* = 667 units

Graphical Solution



Sensitive Analysis

If retail price of jeans increases (p'=30), what should you anticipate?



Questions