Introduction to Operation Management

010 Directing the operation

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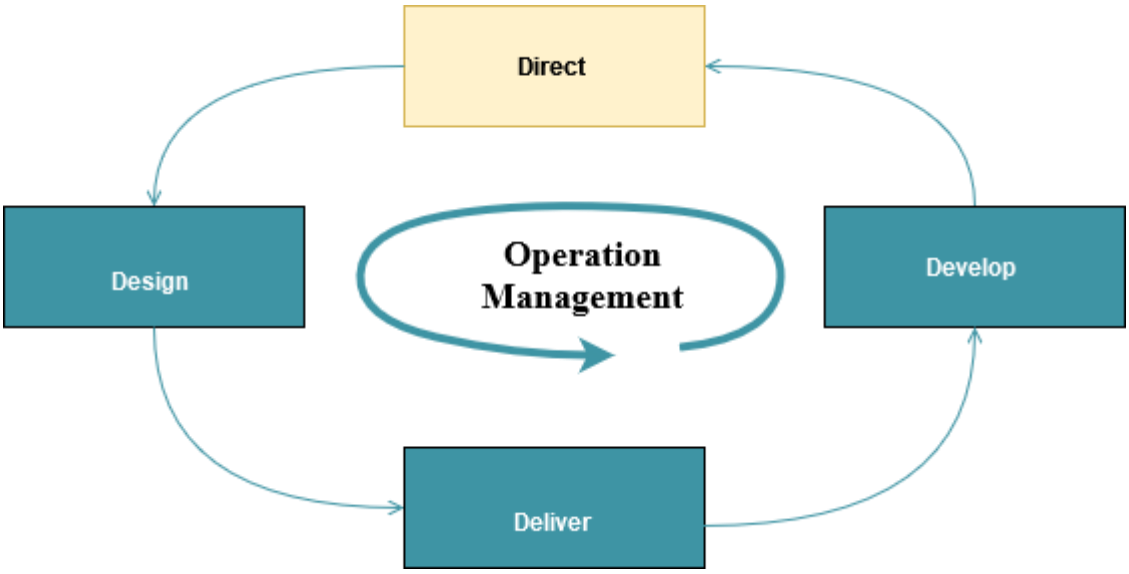
2 Operations strategy and competitiveness



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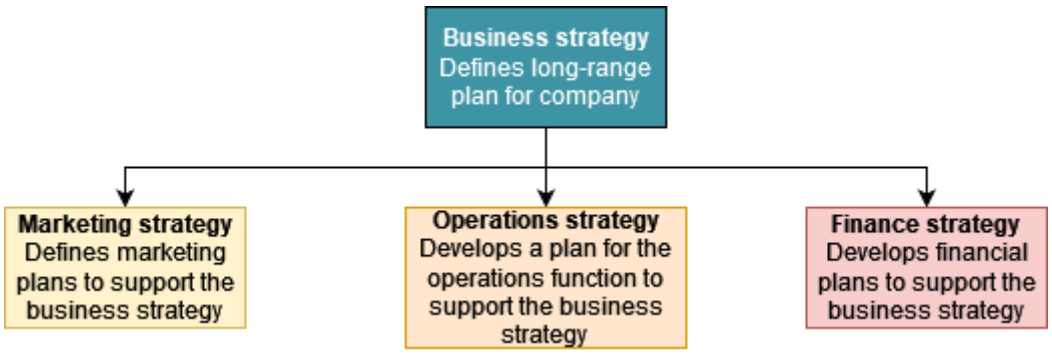
Operation strategy

Operations strategy is the total pattern of decisions that shape the long-term capabilities of any type of operation and their contribution to overall strategy, through the reconciliation of market requirements with operations resources.[1] The operations strategy outlines the guidelines and action plans for deploying the organization's resources in a way that aligns with and supports its overarching competitive strategy.

It's important to recognize that the operations function manages the resources required to produce the company's products and services. The operations strategy is a comprehensive plan that dictates how these resources should be designed and utilized to support the business strategy. This encompasses decisions about facility locations, sizes, and types; the skills and capabilities of the workforce; the adoption of technology; the need for specialized processes and equipment; and the methods for ensuring quality control. The operations strategy must be in harmony with the company's business strategy and facilitate the achievement of its long-term objectives.

FIGURE 1. Relationship between the business strategy and the functional strategy



[1] Slack, N. and Lewis, M. (2020) *Operations Strategy*, 6th edn, Pearson, Harlow

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Competitiveness

Operations managers must work closely with marketing to understand the competitive situation in the company's market before they can determine which competitive priorities are important. There are four broad categories of competitive priorities:

Cost: Competing based on **cost** means offering a product at a low price relative to the prices of competing products. The role of the operations strategy is to develop a plan for using resources to support this type of competition. Note that a low-cost strategy can result in a higher profit margin, even at a competitive price. Also, low cost does not imply low quality.

Quality: Many companies claim that **quality** is their top priority, and many customers say they look for quality in the products they buy. Yet quality is subjective; it depends on who is defining it. Quality as a competitive priority has two dimensions. The first is *high-performance design*. This means that the operations function will be designed to focus on aspects of quality such as superior features, close tolerances, high durability, and excellent customer service. The second dimension is *goods and services consistency*, which measures how often the goods or services meet the exact design specifications.

Time: **Time** or speed is one of the most important competitive priorities today. Companies in all industries are competing to deliver high-quality products in as short a time as possible. Making time a competitive priority means competing based on all time-related issues, such as *rapid delivery* and *on-time delivery*. Rapid delivery refers to how quickly an order is received; on-time delivery refers to how often deliveries are made on time. Another time competitive priority is development speed, which is the time needed to take an idea to the marketplace.

Flexibility: As a company's environment changes rapidly, including customer needs and expectations, the ability to readily accommodate these changes can be a winning strategy. This is *flexibility*. There are two dimensions of flexibility. One is the ability to offer a wide variety of goods or services and customize them to the unique needs of clients. This is called *product flexibility*. A flexible system can quickly add new products that may be important to customers or easily drop a product that is not doing well. Another aspect of flexibility is the ability to rapidly increase or decrease the amount produced in order to accommodate changes in the demand. This is called *volume flexibility*.

Reference

Reid, R. D., Sanders, R. N., (2023). *Operations Management An Integrated Approach 8th edition*. Wiley. Competitive Priorities (p. 33-35)

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Productivity

The creation of goods and services requires changing resources into goods and services. The more efficiently we make this change, the more productive we are and the more value is added to the good or service provided. **Productivity** is the ratio of outputs (goods and services) divided by the inputs (resources, such as labor and capital).

The operations manager's job is to improve the ratio of outputs to inputs. Enhancing productivity means increasing efficiency.

Productivity is indeed a critical concept in operations management and is used as a measure of the efficiency with which an organization utilizes its resources to produce goods and services.

The formula for productivity is typically expressed as a ratio:

$$\text{Productivity} = \frac{\text{Output}}{\text{Inputs}}$$

Where:

- Output refers to the goods and services produced by the organization.
- Input refers to the resources used to produce the output, which can include labor, materials, energy, capital, and other resources.

Productivity can be measured in various ways depending on the type of inputs and outputs being considered:

- Labor Productivity This measures the output produced per unit of labor input, often per labor hour or per employee.

$$\text{Labor Productivity} = \frac{\text{Total Output}}{\text{Total Labor Hours}}$$

- Materials Productivity This measures how efficiently materials are used to produce output.

$$\text{Materials Productivity} = \frac{\text{Total Output}}{\text{Total Materials Used}}$$

- Energy Productivity This measures the output produced per unit of energy consumed.

$$\text{Energy Productivity} = \frac{\text{Total Output}}{\text{Total Energy Used}}$$

- Capital Productivity This measures the output produced per unit of capital investment.

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$$\text{Capital Productivity} = \frac{\text{Total Output}}{\text{Total Capital Employed}}$$

Total Factor Productivity (TFP) This measures the output relative to the combined input of multiple factors, such as labor and capital.

$$\text{TFP} = \frac{\text{Total Output}}{\text{Combined Inputs}}$$

Improving productivity means increasing the output for the same or a lesser amount of input or maintaining the same level of output using fewer inputs. Managers strive to enhance productivity as it can lead to lower costs, higher competitiveness, better customer service, and increased profitability. They may employ various strategies to improve productivity, such as adopting new technologies, streamlining processes, training employees, and optimizing resource allocation.

Partial measures	$\frac{\text{Output}}{\text{Labor}}$	$\frac{\text{Output}}{\text{Machine}}$	$\frac{\text{Output}}{\text{Capital}}$	$\frac{\text{Output}}{\text{Energy}}$
Multifactor measures	$\frac{\text{Output}}{\text{Labor + Machine}}$		$\frac{\text{Output}}{\text{Labor + Capital + Energy}}$	
Total measures	$\frac{\text{Goods or services produced}}{\text{All inputs used to produce them}}$			

FIGURE 2. Some examples of different types of productivity measures

Computing productivity

Determine the productivity for these cases:

1. Four workers installed 720 square yards of carpeting in eight hours.

   $$\text{Productivity} = \frac{\text{Yards of carpet installed}}{\text{Labor hours worked}} = \frac{720 \text{ square yard}}{4 \text{ workers x } 8\frac{\text{hours}}{\text{worker}}}$$

2. A machine produced 70 pieces in two hours. However, two pieces were unusable.

   $$\text{Productivity} = \frac{\text{Usable pieces}}{\text{Production time}} = \frac{70-2=68 \text{ usable pieces}}{2 \text{ hours}} = 34 \text{ pieces/hours}$$

Calculations of multifactor productivity measure inputs and outputs using a common unit of measurement, such as cost. For instance, the measure might use cost of inputs and units of the output:

$$\frac{\text{Quantity of production}}{\text{Labor cost + Materials cost + Overhead}}$$

Note: The unit of measure must be the same for all factors in the denominator.

Computing multifactor productivity

Determine the multifactor productivity for the combined input of labor and machine time using the following data:

Output: 7,040 units

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Input

- Labor: 1,000 €
- Materials: 520 €
- Overhead: 2,000 €

$$\text{Multifactor productivity} = \frac{\text{Output}}{\text{Labor+Materials+Overhead}} = \frac{\text{7040 units}}{\text{1000 € x 520 € x 2000 €}} = 2 \text{ units per euro input}$$

Reference:

Heizer, J., Render, B., (2013). *Operations Management 10th edition.* Pearson College Div. The productivity challenge (p. 13-18)

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Exercise 1

Let's consider a hypothetical use case of a dairy company situated in the north of Spain. We'll calculate the productivity of the company based on its milk production and processing operations.

Use Case: Dairy Company in Northern Spain

Company Overview:

- Name: Cantabria Dairy Co.
- Location: Cantabria, Northern Spain
- Operations: Milk production and processing
- Employees: 50
- Daily Milk Production: 10,000 liters
- Daily Operating Hours: 8 hours

Objective:
Calculate the productivity of Cantabria Dairy Co. in terms of milk production per employee per hour.

Step-by-Step Solution:

1. **Determine Total Output:**
    - Total daily milk production: 10,000 liters
2. **Determine Total Input:**
    - Number of employees: 50
    - Daily operating hours: 8 hours
3. **Calculate Total Employee Hours:**
    - Total employee hours per day = Number of employees × Daily operating hours
    - Total employee hours per day = 50 employees × 8 hours = 400 employee hours
4. **Calculate Productivity:**
    - Productivity (liters per employee per hour) = Total daily milk production / Total employee hours per day
    - Productivity = 10,000 liters / 400 employee hours
    - Productivity = 25 liters per employee per hour

Conclusion:

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The productivity of Cantabria Dairy Co. is 25 liters of milk per employee per hour. This means that, on average, each employee contributes to the production of 25 liters of milk every hour.

Discussion Points:

1. **Factors Affecting Productivity:**
    - Discuss how factors such as technology, employee training, and process optimization can impact productivity.
    - Explore ways to improve productivity, such as investing in automated milking systems or enhancing employee skills.
2. **Comparative Analysis:**
    - Compare the productivity of Cantabria Dairy Co. with industry benchmarks or other dairy companies in the region.
    - Identify areas where the company can improve to match or exceed industry standards.
3. **Sustainability Considerations:**
    - Discuss the importance of sustainable practices in dairy production and how they can affect productivity.
    - Explore initiatives such as reducing water usage, improving feed efficiency, and managing waste effectively.

By solving this exercise, students can gain a practical understanding of productivity calculations and the factors that influence operational efficiency in a real-world context.

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Exercise 2

Let's consider a hypothetical use case of an automotive factory situated in Pamplona, Northern Spain. We'll calculate the productivity of the factory based on its car production operations.

Use Case: Automotive Factory in Pamplona

Company Overview:

- Name: Pamplona AutoWorks
- Location: Pamplona, Northern Spain
- Operations: Car manufacturing
- Employees: 200
- Daily Car Production: 50 cars
- Daily Operating Hours: 8 hours

Objective:
Calculate the productivity of Pamplona AutoWorks in terms of car production per employee per hour.

Step-by-Step Solution:

1. **Determine Total Output:**
    - Total daily car production: 50 cars
2. **Determine Total Input:**
    - Number of employees: 200
    - Daily operating hours: 8 hours
3. **Calculate Total Employee Hours:**
    - Total employee hours per day = Number of employees × Daily operating hours
    - Total employee hours per day = 200 employees × 8 hours = 1,600 employee hours
4. **Calculate Productivity:**
    - Productivity (cars per employee per hour) = Total daily car production / Total employee hours per day
    - Productivity = 50 cars / 1,600 employee hours
    - Productivity = 0.03125 cars per employee per hour

Conclusion:

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The productivity of Pamplona AutoWorks is 0.03125 cars per employee per hour. This means that, on average, each employee contributes to the production of approximately 0.03125 cars every hour.

Discussion Points:

1. **Factors Affecting Productivity:**
    - Discuss how factors such as automation, employee training, and process optimization can impact productivity.
    - Explore ways to improve productivity, such as investing in robotic assembly lines or enhancing employee skills through training programs.
2. **Comparative Analysis:**
    - Compare the productivity of Pamplona AutoWorks with industry benchmarks or other automotive factories in the region.
    - Identify areas where the company can improve to match or exceed industry standards.
3. **Lean Manufacturing:**
    - Discuss the principles of lean manufacturing and how they can be applied to improve productivity in the automotive factory.
    - Explore initiatives such as reducing waste, improving workflow efficiency, and implementing just-in-time (JIT) production.
4. **Technology Integration:**
    - Discuss the role of advanced technologies such as IoT, AI, and data analytics in enhancing productivity.
    - Explore how these technologies can be used for predictive maintenance, quality control, and optimizing production schedules.
5. **Sustainability Considerations:**
    - Discuss the importance of sustainable practices in automotive manufacturing and how they can affect productivity.
    - Explore initiatives such as reducing energy consumption, recycling materials, and minimizing waste.

Example Calculation for Improved Productivity:

Suppose Pamplona AutoWorks decides to implement a new robotic assembly line that increases daily car production to 60 cars without increasing the number of employees or operating hours.

1. **New Total Output:**
    - Total daily car production: 60 cars

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2. **New Productivity Calculation:**
    - Productivity (cars per employee per hour) = Total daily car production / Total employee hours per day
    - Productivity = 60 cars / 1,600 employee hours
    - Productivity = 0.0375 cars per employee per hour

Conclusion:

With the implementation of the new robotic assembly line, the productivity of Pamplona AutoWorks increases to 0.0375 cars per employee per hour. This demonstrates how technological advancements can lead to significant improvements in operational efficiency.

By solving this exercise, students can gain a practical understanding of productivity calculations and the impact of various factors on operational efficiency in the context of an automotive factory. This exercise also encourages discussions on how to leverage technology and sustainable practices to enhance productivity.

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Interpreting Productivity Measures

To understand the significance of a productivity measure, it must be compared with similar metrics. For instance, consider a worker at a car manufacturing plant who assembles 34 cars in an eight-hour shift, resulting in a productivity rate of 4.25 cars per hour. This figure alone doesn't provide much insight. However, when compared to two other workers, one assembling 3.6 cars per hour and another 3.2 cars per hour, the comparison becomes more meaningful. We can see that the first worker is more productive than the other two. But how do we determine if the productivity of all three workers is reasonable? We need a benchmark.

It's also beneficial to track and compare productivity over time. Suppose we calculate the total productivity of our three car assemblers (our "labor") and find a labor productivity measure of 3.9 cars per hour. This figure alone doesn't reveal much about the workers' performance. However, by comparing weekly productivity measures over a period, say the last four weeks, we gain more insight:

Week	1	2	3	4
Productivity (cars/labor-hour)	2.8	3.4	3.7	3.9

We observe that the workers' productivity is improving over time. In fact, productivity increased from 2.8 to 3.9 cars per labor-hour, representing a growth of 3.9/2.8 = 1.39, or a 39 percent increase. However, if we discover that our main competitor, a nearby car plant, has a productivity rate of 4.9 cars per labor-hour, this rate is 25.6 percent (4.9/3.9 = 1.256) higher than our productivity in week 4. This indicates that although our productivity is rising, it should be higher. We may need to analyze our processes and enhance productivity to remain competitive. By comparing our productivity over time and against similar operations, we gain a clearer understanding of our productivity levels.

When assessing productivity and setting performance standards, we must also consider our market competition strategy—specifically, our competitive priorities. A company competing on speed might measure productivity in units produced

Reference:

Heizer, J., Render, B., (2013). *Operations Management 10th edition.* Pearson College Div. Interpreting Productivity Measures (p. 41)

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Efficiency and Global Competitiveness

Efficiency, often reflected in productivity metrics, serves as a key indicator of how well resources are utilized and is a crucial measure of competitiveness. Productivity can be assessed at various levels, from individuals and departments to entire organizations, and is of interest to a diverse audience. As demonstrated in previous examples, productivity metrics can track performance over time, helping managers pinpoint issues. Additionally, productivity can be evaluated for entire industries and even at the national level.

A nation's economic prosperity and the quality of life of its citizens are closely linked to its competitiveness in the global market. Enhancements in productivity are directly tied to improvements in a nation's standard of living. This is why business and government leaders consistently monitor productivity at both the national and industry levels. In the United States, productivity had been on the rise for over a century. Today, companies recognize the significance of competitiveness, and productivity continues to advance.

Challenges in the Service Sector

Measuring efficiency in the service sector presents unique challenges. Traditional productivity metrics often focus on tangible outputs, typical of manufacturing activities. In contrast, services primarily generate intangible products, such as ideas and information, complicating quality assessment. Consequently, accurately gauging productivity improvements can be challenging. For instance, in an emergency room, where the medical staff are the inputs, there may be no outputs if no patients require treatment during a shift.

Unfortunately, productivity gains in this sector have lagged behind those in manufacturing. It is hoped that advancements in information technology will help standardize services and boost productivity in this sector.

Reference:

Heizer, J., Render, B., (2013). *Operations Management 10th edition.* Pearson College Div.

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Business strategy

Indeed, the development of a company's business strategy is a multifaceted process that involves a deep understanding of its mission, the market environment, and its core competencies.

Mission

The mission statement articulates the company's purpose and the value it aims to provide to its customers, employees, and stakeholders. It serves as a guiding principle for decision-making and sets the direction for the company's long-term goals. The mission helps to align the organization's activities and can be a source of inspiration and motivation for the workforce.

- What business will the company be in ("selling personal computers," "operating an Italian restaurant")?
- Who will the customers be, and what are the expected customer attributes "homeowners," "college graduates")?
- How will the company's basic beliefs defi ne the business ("gives the highest customer service," "stresses family values")?

Market environment

This involves systematically examining the external environment to identify opportunities and threats that could impact the business. Environmental scanning helps managers anticipate changes and adapt their strategies to maintain competitiveness.

Opportunities:

- Market Gaps: Identifying unmet customer needs or underserved market segments that the company can target.
- Technological Advances: Recognizing new technologies that can improve products, services, or processes.
- Regulatory Changes: Anticipating changes in laws or regulations that may open up new markets or allow for new ways of doing business.
- Partnerships: Finding potential partners for collaboration, which could lead to new markets, shared resources, or enhanced capabilities.
- Global Trends: Understanding global economic and social trends that could lead to new business models or market opportunities.

Threats:

- Competition: Monitoring existing competitors and new entrants that could erode the company's market share.
- Technological Disruption: Being aware of technological innovations that could make the company's products or services obsolete.
- Economic Fluctuations: Preparing for economic downturns or instability that could affect demand for the company's offerings.
- Supply Chain Risks: Identifying vulnerabilities in the supply chain, such as reliance on a single supplier or geopolitical risks in certain regions.

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- Regulatory Risks: Staying informed about potential regulatory changes that could impose restrictions or additional costs on the company.

Core competencies

Core competencies are the unique strengths and capabilities that give a company a competitive advantage in the market. These may include specialized knowledge, proprietary technologies, efficient processes, strong brand recognition, customer relationships, or a skilled workforce. Understanding and leveraging core competencies enable a company to differentiate itself from competitors and create value for customers.

1. Workforce	Highly trained
	Responsive in meeting customer needs
	Flexible in performing a variety of tasks
	Strong technical capability
	Creative in product design
2. Facilities	Flexible in producing a variety of products
	Technologically advanced
	An efficient distribution system
3. Market Understanding	Skilled in understanding customer wants and predicting market trends
4. Financial Know-how	Skilled in attracting and raising capital
5. Technology	Use of latest production technology
	Use of information technology
	Quality control techniques

Reference:

Heizer, J., Render, B., (2013). *Operations Management 10th edition.* Pearson College Div.

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