



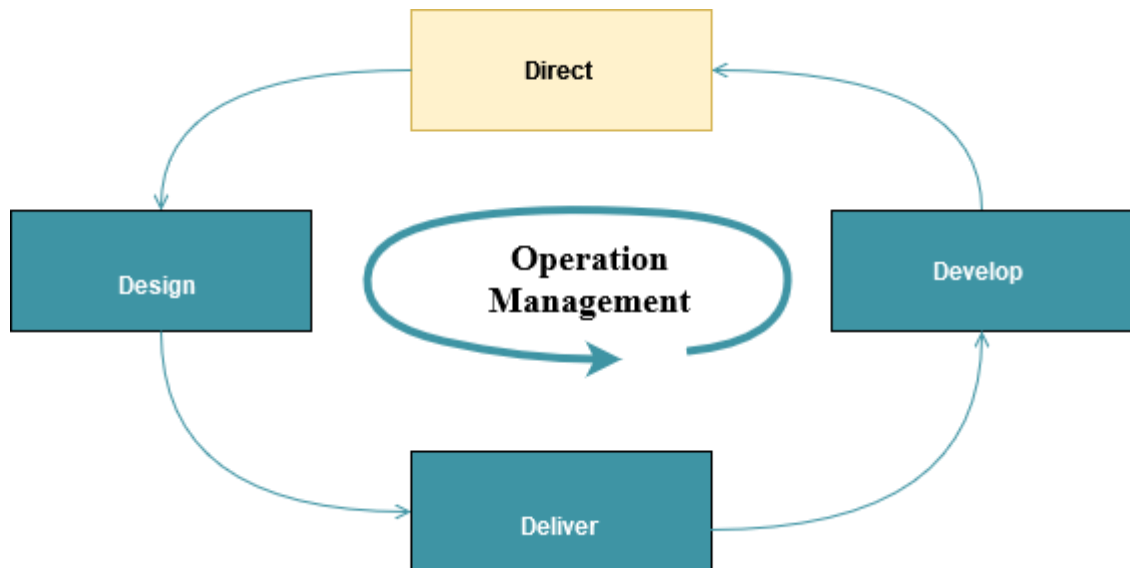
Introduction to Operation Management

010 Directing the operation

Operation strategy.....	3
Productivity	5
Computing productivity	6
Computing multifactor productivity	6
References	18
Business strategy.....	15
Mission.....	15
Market environment	15
Core competencies	16
References	Error! Bookmark not defined.
Operations strategy.....	19

2

Operations strategy and competitiveness

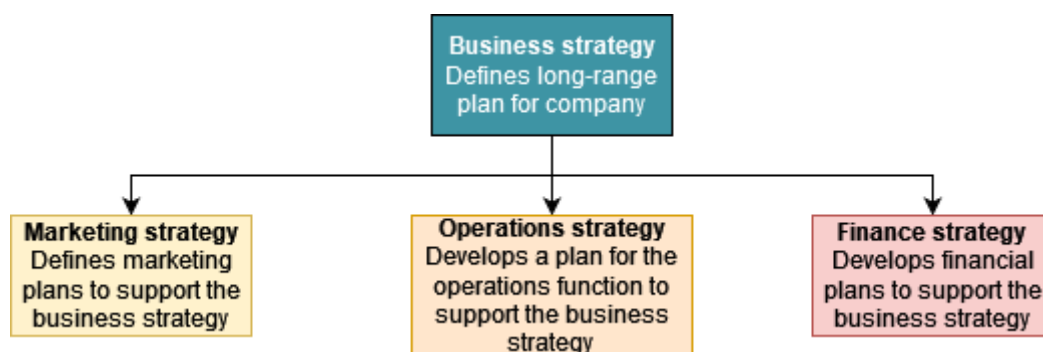


Operation strategy

The purpose of an operations strategy is to outline a framework for the operations function, ensuring that it effectively utilizes its resources. 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 is tasked with managing 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 reinforce 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



Competitiveness

Operations managers must collaborate with the marketing department to gain insights into the competitive landscape of the company's market. This understanding is crucial for determining which competitive priorities to focus on. There are four main categories of competitive priorities that companies can choose to emphasize:

Cost: Competing on cost involves offering products at a low price relative to competitors. The operations strategy in this case is to develop a resource plan that supports cost efficiency without compromising quality. A low-cost strategy can lead to higher profit margins even with competitive pricing. Operations functions in cost-competitive companies might focus on process efficiencies, economies of scale, and cost-saving measures.

Quality: Quality is a priority for many companies and customers, but it can be subjective. Some may define quality as durability, while others may see it as high performance. Operations strategies that prioritize quality will focus on the dimensions of quality valued by their customers, which include high-performance design and consistency in goods

and services. Operations must ensure that products and services consistently meet design specifications and customer expectations.

Time: Speed is increasingly important in today's market. Companies are striving to deliver high-quality products quickly. Operations strategies that prioritize time focus on rapid delivery, on-time delivery, and development speed. The operations function must streamline processes, leverage technology, and maintain a flexible workforce to meet these time-based competitive priorities.

Flexibility: In rapidly changing markets, the ability to adapt to shifts in customer needs and expectations can be a key competitive advantage. Flexibility has two dimensions: product flexibility, which is the ability to offer a wide variety of goods or services and customize them to individual customer needs, and volume flexibility, which is the ability to quickly scale production up or down in response to demand changes. Operations strategies that prioritize flexibility will design systems that can easily introduce new products, discontinue underperforming ones, and adjust production volumes as needed.

Each of these competitive priorities requires a tailored operations strategy that aligns with the company's business strategy and market position. Operations managers must carefully consider these priorities when planning and managing the operations function to ensure that the company can effectively compete in its chosen areas.

(Reid, R. D., Sanders, R. N., Operations Management An Integrated Approach)

Productivity

Creating goods and services involves converting resources into final products and services. The more efficiently we perform this transformation, the more productive we become, and the greater the value we add to the goods and services we offer. Productivity is the ratio between the outputs (goods and services) and one or more inputs (resources such as labor and capital).

(Heizer, J., Render, B., 2013).

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.

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



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

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

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

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	$\frac{\text{Output}}{\text{Labor} + \text{Machine}}$		$\frac{\text{Output}}{\text{Labor} + \text{Capital} + \text{Energy}}$	
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.

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

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:

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

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

Input

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

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

(Stevenson, J. W., Operations Management)

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:

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.

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:

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

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.

Interpreting Productivity Measures

To interpret the meaning of a productivity measure, it must be compared with a similar productivity measure. For example, if one worker at a pizza shop produces 17 pizzas in two hours, the productivity of that worker is 8.5 pizzas per hour. This number by itself does not tell us very much. However, if we compare it to the productivity of two other workers, one who produces 7.2 pizzas per hour and another 6.8 pizzas per hour, it is much more meaningful. We can see that the first worker is much more productive than the other two workers. But how do we know whether the productivity of all three workers is reasonable? What we need is a standard. In Chapter 11 we will discuss ways to set standards and how those standards can help in evaluating the performance of our workers. It is also helpful to measure and compare productivity over time. Let's say that we want to measure the total productivity of our three pizza makers (our "labor") and we compute a labor productivity measure of 7.5 pizzas per hour. This number does not tell us much about the workers' performance. However, if we compare weekly productivity measures over time, perhaps over the last four weeks, we get much more information:

Week	1	2	3	4
Productivity (pizzas/labor-hour)	5.4	6.8	7.1	7.5

Now we see that the workers' productivity is improving over time. In fact, productivity changed from 5.4 to 7.5 pizzas per labor-hour, resulting in an increase of $7.5/5.4 = 1.39$, or an increase of 39 percent. But what if we find out that our main competitor, a pizzeria down the street, has a productivity of 9.5 pizzas per labor-hour? This productivity rate is 26.7 percent ($9.5/7.5 = 1.267$) higher than our productivity in week 4. Suddenly we know that even though our productivity is going up, it should be higher. We may have to analyze our processes and increase our productivity in order to be competitive. By comparing our productivity over time and against similar operations, we have a much better sense of how high our productivity really is.

When evaluating productivity and setting standards for performance, we also need to consider our strategy for competing in the marketplace—namely, our competitive priorities. A company that competes based on speed would probably measure productivity in units produced over time. However, a company that competes based on cost might measure productivity in terms of costs of inputs such as labor, materials, and overhead. The important thing is that our productivity measure provides information on how we are doing relative to the competitive priority that is most important to us.

(Reid, R. D., Sanders, N. R., 2013)

Productivity and Competitiveness

Productivity is essentially a scorecard of how efficiently resources are used and a measure of competitiveness. Productivity is measured on many levels and is of interest to a wide range of people. As we showed in earlier examples, productivity can be measured for individuals, departments, or organizations. It can track performance over time and help managers identify problems. Similarly, productivity can be measured for an entire industry and even a country.

The economic success of a nation and the quality of life of its citizens are related to its competitiveness in the global marketplace. Increases in productivity are directly related to increases in a nation's standard of living. That is why business and government leaders continuously monitor the productivity at the national level and by industry sectors. Productivity in the United States had been increasing for over 100 years. Then in the 1970s and 1980s productivity dropped, even lagging behind that of other industrial nations. Fortunately, productivity rebounded in the mid- and late 1990s. Today, companies understand the importance of competitiveness, and productivity in the United States continues to improve.

Productivity and the Service Sector

Service sector companies have a unique challenge when trying to measure productivity.

The reason is that traditional productivity measures tend to focus on tangible outcomes, as seen with goods-producing activities. Services primarily produce intangible products, such as ideas and information, making it difficult to evaluate quality.

Consequently, accurately measuring productivity improvements can be difficult. A good example of the difficulty in using traditional productivity measures in the service sector is the emergency room. Here inputs are the medical staff, yet outputs may not exist if no one needed treatment on that shift. In that case, by traditional measures, productivity would be zero! The real issue in this type of environment is the level of readiness, and the challenge is to adequately measure it.

As we discussed previously, employment in the service sector of the U.S. economy has grown rapidly over the past 30 years. Unfortunately, productivity gains in this sector have been much lower than those of manufacturing. It is hoped that advancements in information technology will help standardize services and accelerate productivity in this sector.

(Reid, R. D., Sanders, N. R., 2013)

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 define 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.

- **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

References

Reid, R. D., Sanders, N. R. (2013). *Operations Management An Integrated Approach*. Wiley

Paksoy, T. (2023) *Smart and Sustainable Operations and Supply Chain Management in Industry 4.0*. CRC Press

Operations strategy

The operations strategy is a critical component of the overall business strategy, as it translates the company's strategic objectives into actionable plans within the operations function. The competitive priorities you've outlined—cost, quality, time, and flexibility—are the key areas where operations can contribute to creating a competitive advantage. Let's delve into each of these competitive priorities and how they can be leveraged in operations strategy:

1. Cost:

Operations strategies focused on cost leadership aim to be the lowest-cost producer in the industry without sacrificing acceptable quality levels. Cost reduction can be achieved through process improvements, economies of scale, supply chain optimization, waste reduction, and efficient labor management. The challenge is to maintain cost leadership while still meeting other competitive priorities such as quality and delivery performance.

2. Quality:

Quality can be a differentiator in the market, with operations strategies focusing on delivering products or services that exceed customer expectations. High-performance design involves creating products with superior features, durability, and serviceability. Consistency in quality ensures that every product or service delivered meets the same high standards, leading to customer trust and loyalty. Operations must implement rigorous quality control systems, continuous improvement programs, and employee training to maintain high quality.

3. Time:

Speed and timeliness are increasingly important in today's fast-paced market. Rapid delivery and on-time delivery are critical for customer satisfaction and can be a significant competitive advantage. Development speed is essential for innovation-driven industries where being first to market can capture significant market share. Operations strategies must focus on reducing lead times, optimizing workflows, and ensuring reliability in delivery schedules.

4. Flexibility:

Flexibility allows a company to respond quickly to changes in customer demand, market conditions, and technological advancements. Product flexibility enables the operation to offer a wide range of products, customize products to customer specifications, and rapidly introduce new products. Volume flexibility allows the operation to scale production up or down efficiently in response to demand fluctuations. Operations strategies must incorporate flexible manufacturing systems, cross-trained employees, and adaptable supply chains to achieve this priority.

To develop an effective operations strategy, companies must carefully consider which competitive priorities align best with their overall business strategy and market position. It's often challenging to excel in all areas simultaneously, so companies typically choose to focus on one or two priorities that will provide the most significant competitive edge.

For example, a discount retailer might prioritize cost and quality, ensuring that they can offer products at the lowest possible price while maintaining a level of quality that meets customer expectations. On the other hand, a luxury car manufacturer might focus on quality and flexibility, delivering high-performance vehicles with customizable options to cater to individual customer preferences.

In implementing an operations strategy, companies must consider the following:

Trade-offs: There are inherent trade-offs between the different competitive priorities. For instance, increasing product variety (flexibility) might lead to higher costs. Companies need to understand these trade-offs and make strategic choices that align with their business goals.

Capability Development: To excel in chosen competitive priorities, companies must develop specific capabilities within their operations. This could involve investing in new technologies, training employees, redesigning processes, or reconfiguring the supply chain.

Alignment Across Functions: Operations strategy must be aligned with other functional strategies, such as marketing, finance, and human resources, to ensure a cohesive approach to achieving the business strategy.

Performance Measurement: Companies need to establish metrics to measure performance against their competitive priorities. This allows for continuous monitoring and improvement of operations.

Strategic Fit: The chosen competitive priorities must fit with the needs and desires of the target market. For example, if customers value speed and customization, the operations strategy should focus on reducing lead times and increasing product flexibility.

Dynamic Adaptation: Operations strategy is not static; it must evolve in response to changes in the business environment, technology, and customer preferences. Companies must be prepared to reassess and adjust their operations strategy as needed.

Ultimately, the operations strategy is about making deliberate choices on how to configure the operations function to support the business strategy effectively. By excelling in the competitive priorities that matter most to their customers and to their market position, companies can build a strong competitive advantage that is difficult for competitors to replicate.