Operations Management - Processes and Supply Chains 14th edition Krajewski Solutions Manual

SKU: 9780138185060-SOLUTIONS

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Chapter

1 Using Operations to Create Value

DISCUSSION QUESTIONS

1. Answering this question demonstrates that processes underlie all of our jobs. What might be surprising is how many students would put their job in the category of "other," suggesting that many jobs do not fall neatly into any one functional area. Perhaps many in the "other" category might best be called "operations" on further reflection. Customers, both internal and external, are part of each process, and the goal is to manage the processes to add the most value for them.

2. The hospital's commitment *to provide attention to patients arriving to the emergency unit in less than 15 minutes and never to turn away patients who need to be hospitalized* implies that the facility must be designed to have extra capacity in both beds and emergency room facilities. It must plan on having extra personnel in the emergency room and also plan on having additional emergency personnel on call to take care of unprecedented heavy loads. In line with the mission statement, maximum utilization of the facilities (i.e., beds and emergency room personnel) would not be one of the performance objectives for the hospital.

3. Core processes should link to a firm's core competencies. Core processes are those processes that provide the firm the best competitive advantage. Essential to the definition a firm's core processes is the concept of "interaction costs." These costs include the time and money that are expended whenever people and companies exchange services, products, or ideas. If the transaction costs are higher to retain a process within the firm's organization than to outsource the process, the process should be outsourced.

PROBLEMS

Trends and Challenges in Operations Management

1. Boehring University

   a. Value of output:

$$75\frac{\text{students}}{\text{class}}\times 3\frac{\text{credit-hours}}{\text{student}}\times\left(\frac{\$200\text{ tuition}+\$100\text{ state support}}{\text{credit-hours}}\right)=\$67,500/\text{class}$$

   Value of input: labor + material + overhead

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$$\frac{\$6500 + \left(\frac{\$25}{\text{student}} \times 75 \text{ students}\right) + \$30,000}{\text{class}} = \$38,375/\text{class}$$

Multifactor Productivity ratio:

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}} = \frac{\$67,500}{\$38,375} = 1.76$$

Compared to Solved problem 1, multifactor productivity has increased from 1.25 to 1.76.

b. Value of output is the same as in part a: $\$67,500/\text{class}$

Labor-hours of input:

$$20\frac{\text{hours}}{\text{week}} \times 16\frac{\text{weeks}}{\text{class}} = 320\frac{\text{hours}}{\text{class}}$$

Productivity ratio:

$$\text{Labor Productivity} = \frac{\text{Output}}{\text{Input}} = \frac{\$67,500}{320 \text{ hours}} = \$210.94/\text{hour}$$

The $192 season ticket price is not used in this calculation. It is a "red herring."

2. Suds and Duds Laundry

a. Labor productivity

Week	Number of Workers	Input (Labor-hours)	Output (Shirts)	Output/Input Ratio
1	2	24	68	2.83 shirts/hour
2	2	46	130	2.83 shirts/hour
3	3	62	152	2.45 shirts/hour
4	3	51	125	2.45 shirts/hour
5	2	45	131	2.91 shirts/hour

b. Output per person does not vary much whether it is Sud, Dud, or Jud working. Productivity declines when all three are present. Perhaps there isn't enough work to keep three persons occupied, or perhaps there is not enough work space or equipment to accommodate three workers.

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3. White Tiger Electronics compact disc players
   Value of Output: $300
   Value of Input: Labor + Materials + Overhead

$$\text{Productivity} = \frac{\text{Ouput}}{\text{Input}} = \frac{\$300}{\$30+\$70+\$50} = 2.000$$

10% productivity improvement $\rightarrow 2.00 \times 1.10 = 2.200$

Given productivity $= 2.20$, and the value of output $= \$300$, we solve for the cost of inputs:

$$\text{Productivity} = \frac{\text{Ouput}}{\text{Input}} = \frac{\$300}{\text{Input}} = 2.20$$

$$\text{Input} = \frac{\$300}{2.2} = \$136.36 \quad \text{or } \$136$$

The cost of inputs must decrease by $(\$150 - \$136) = \$14$.

a. A $14 reduction in material costs is $\$14/\$70 = 20.00\%$
b. A $14 reduction in labor costs is $\$14/\$30 = 46.67\%$
c. A $14 reduction in overhead is $14/$50 = 28.00%

4. Symtecks
   The output of a process is valued at $100 per unit. The cost of labor is $50 per hour including benefits. The accounting department provided the following information about the process for the past four weeks:

	Week 1	**Week 2**	**Week 3**	**Week 4**
Units Produced	1124	1310	1092	981
Total Value	112,400	131,000	109,200	98,100
Labor ($)	12,735	14,842	10,603	9526
Labor (hrs)	254.7	296.8	212.1	190.5
Material ($)	21,041	24,523	20,442	18,364
Overhead ($)	8,992	10,480	8,736	7,848
Multifactor Productivity	2.63	2.63	2.75	2.75
Labor Productivity	4.41 units/hr	4.41units/hr	5.15 units/hr	5.15 units/hr

a. Use the multifactor productivity ratio to see whether recent process improvements had any effect and, if so, when the effect was noticeable.

   Value of output

$$1124\text{units} \times \$100 = \$112,400$$

   Value of input: labor + material + overhead

$$\$12,735 + \$21,041 + \$8,992 = \$42,768$$

   Productivity ratio:

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$$\text{Labor Productivity} = \frac{\text{Output}}{\text{Input}}$$

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Week 1 Productivity $= \frac{\text{Output}}{\text{Input}} = \frac{\$112,400}{\$42,768} = 2.628$

Week 2 Productivity $= \frac{\text{Output}}{\text{Input}} = \frac{\$131,000}{\$49,845} = 2.628$

Week 3 Productivity $= \frac{\text{Output}}{\text{Input}} = \frac{\$109,200}{\$39,781} = 2.745$

Week 4 Productivity $= \frac{\text{Output}}{\text{Input}} = \frac{\$98,100}{\$35,738} = 2.745$

$$\frac{2.745 - 2.628}{2.628} \times 100\% = 4.45\%$$

Improved 4.45% - noticeable in Week 3

b. Has labor productivity changed? Use the labor productivity ratio to support your answer.

Labor-hours of input: Labor $50/hour

<u>Labor costs</u>

Week 1 = $12,735/$50 = 254.7
Week 2 = $14,842/$50 = 296.84
Week 3 = $10,603/$50 = 212.06
Week 4 = $9,526/$50 = 190.52

Productivity ratio:

Labor Productivity $= \frac{\text{Output}}{\text{Input}}$

Week 1 = Labor Productivity $= \frac{\text{Output}}{\text{Input}} = \frac{1124}{254.7 \text{ hours}} = 4.4130/\text{hour}$

Week 2 = Labor Productivity $= \frac{\text{Output}}{\text{Input}} = \frac{1310}{296.84 \text{ hours}} = 4.413/\text{hour}$

Week 3 = Labor Productivity $= \frac{\text{Output}}{\text{Input}} = \frac{1092}{212.06 \text{ hours}} = 5.1495/\text{hour}$

Week 4 = Labor Productivity $= \frac{\text{Output}}{\text{Input}} = \frac{981}{190.52 \text{ hours}} = 5.1491/\text{hour}$

$$\frac{5.1491 - 4.4130}{4.4130} \times 100\% = 16.68\%$$

Improved 16.68%

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5. Alyssa's Custom Cakes

a.

5 Birthday cakes x $50 per cake = $250

2 Wedding cakes x $150 per cake = $300

3 Specialty cakes x $100 per cake = $300

Total monthly revenue = $850

Multifactor productivity ratio = output/input

1.25 = $850/x

Solve for x = $850/1.25 = $680

Total costs = $680

Average cost per cake = $680/10 = $68/cake

b. Labor productivity

Birthday cake = $50/ 1.5 hours = $33.30/hour

Wedding Cake = $150/ 4 hours = $37.50/hour

Specialty Cake = $100/1 hours = $100/hour

c. Based on labor productivity, Alyssa should try to sell specialty cakes the most.

d. Yes, Alyssa should stop selling birthday cakes. Based on answer a, she loses $68 - $50 = $18 every time she sells a birthday cake.

6. Big Black Bird Company

The Big Black Bird Company problem is based on a product made by Raven Industries. None of the numbers are representative of actual costs or volume.

a. Multifactor Productivity

Original Situation:

Value of output: $(2500 \text{ uniforms} \times \$200) = \$500{,}000$

Value of input: $(2500 \text{ uniforms} \times \$120) = \$300{,}000$

Productivity ratio:

$$\text{Productivity} = \frac{\text{Ouput}}{\text{Input}} = \frac{\$500{,}000}{\$300{,}000} = 1.67$$

Overtime Situation:

Value of output: $(4000 \text{ uniforms} \times \$200) = \$800{,}000$

Value of input: $(4000 \text{ uniforms} \times \$144) = \$576{,}000$

Productivity ratio:

$$\text{Productivity} = \frac{\text{Ouput}}{\text{Input}} = \frac{\$800{,}000}{\$576{,}000} = 1.39$$

Productivity decreases by:

$$\frac{1.67 - 1.39}{1.67} \times 100\% = 16.77\%$$

b. Labor Productivity

Original Situation:

Value of output (from part a) is: $500,000

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Labor-hours of input: $(70 \times 40 \text{ hours}) + (30 \times 40 \text{ hours}) = 4000 \text{ hours}$
Labor productivity $= \$500{,}000/4000 \text{ hours} = \$125/\text{hour}$

Overtime Situation:
Value of output (from part a) is: $800,000
Labor-hours of input: $(70 \times 72 \text{ hours}) + (30 \times 72 \text{ hours}) = 7200 \text{ hours}$
Labor productivity =$800,000 / 7200 hours = $111.11/hours
Labor productivity decreases by:
(125/111.11) / 125 x 100% = 11.1%

c. Gross profits
Original Situation: $500,000 – $300,000 = $200,000
Overtime Situation: $800,000 – $576,000 = $224,000
Weekly profits increased.

7. Mack's Guitar Company
a. Labor productivity = output/input
Output = 100 guitars x 80% completion rate x price/guitar
= 80 guitars/ month x $250/guitar = $20,000
Input
Labor = 10/hours per guitar x 100 guitars = 1000 hours
Labor productivity is $20,000/1000 = $20/hour

Multifactor productivity ratio = output/input
Output = 100 guitars x 80% completion rate x price/guitar
= 80 guitars/ month x $250/guitar = $20,000
Input
Labor = $10/hour x 10/hours per guitar x 100 guitars = $10, 000
Material = $40/guitar x 100 guitars = $4, 000
Overhead = $4,000
Multifactor productivity ratio = $20, 000/$18, 000 = 1.11

b. <u>Option 1.</u> Increase sales price by 10%
Output = 100 guitars x 80% completion rate x ($250 x 1.1) = $22,000
Input
Labor is same as in part (a) = $10,000
Material is same as in part (a) = $4,000
Overhead is same as in part (a) = $4,000
Multifactor productivity ratio = $22,000/$18,000 = 1.22
<u>Option 2.</u> Improve Quality
Output = 100 guitars x 90% completion rate x $250/guitar = $22,500
Input
Labor is same as in part (a) = $10,000
Material is same as in part (a) = $4,000
Overhead is same as in part (a) = $4,000
Multifactor productivity ratio = $22,500/$18,000 = 1.25
<u>Option 3.</u> Reduce costs by 10%
Output = same as in part (a) = $20,000

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Input
Reduce costs by 10% yields 90% of the input costs from part (a).
= $18,000 x 0.90 = $16,200
Multifactor productivity ratio = $20,000/$16,200 = 1.23

Darren should choose Option 2 and improve quality because it yields the greatest improvement in multifactor productivity.

8. Mariah Enterprises Productivity of Process Alpha and Process Beta

Excel used to perform all calculations

	Process		
	Alpha	Beta	
Total Value of Output	$17,150	$16,450	
Total Cost of Labor	$2,600	$3,000	
Total Cost of Materials	$5,500	$4,900	
Total Cost of Overhead	$6,000	$5,000	
Labor Productivity	$6.596	$5.483	unit $/ labor $
Multifactor Productivity	$1.216	$1.275	unit $/ total $

Process Alpha has 20% [(6.596-5.483)/5.483] higher labor productivity.

Process Beta has 5% [(1.275-1.216)/1.216] higher multifactor productivity.

While process Beta generates more dollars of output per dollar invested in input, it doesn't use labor as efficiently as process Alpha.

9. Morning Brew Coffee Shop

Excel used to perform all calculations

a. Current labor and multifactor productivity

Currently	Regular Coffee	Cappuccino	Vienna coffee	total
Output in dollars	$700.00	$300.00	$600.00	$1,600.00
Labor cost				$320.00
Material cost	$175.00	$75.00	$187.50	$437.50
Equipment cost				$125.00

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Overhead cost		$225.00
	Profit	$492.50

Labor Productivity	5.0000
Multifactor Productivity	1.4447

After adding new product

After Adding New Product	Regular Coffee	Cappuccino	Vienna coffee	Eiskaffee	total
Output in dollars	$700.00	$300.00	$600.00	$375.00	$1,975.00
Labor cost					$320.00
Material cost	$175.00	$75.00	$187.50	$112.50	$550.00
Equipment cost					$200.00
Overhead cost					$350.00
			Profit		$555.00

Labor Productivity	6.1719
Multifactor Productivity	1.3908

Change in Labor Productivity	23.438%
Change in Multifactor Productivity	-3.727%

b. The units of Eiskaffee that would have to be sold to ensure that the multifactor productivity increases from its current level may be calculated as follows:

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$$\frac{output}{input}=\frac{Coffee\ sold\ in\ \$}{Labor\ cost+Material\ cost+Equipment\ cost+Overhead\ cost}=1.4447$$

$$\frac{350(\$2)+100(\$3)+150(\$4)+x(\$5)}{\$320+(350(\$.5)+100(\$.75)+150(\$1.25)+x(\$1.5))+200+350}=1.4447$$

$$\frac{\$1600+\$5.0x}{\$1307.5+\$1.5x}=1.4447$$

$$\$1600+\$5x=1.4447(\$1307.5+\$1.5x)$$

$$\$1600+5x=1888.945+2.1670x$$

$$2.833X=288.945$$

$$x\simeq 102$$

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Calculation confirmed in Excel:

After Adding New Product	Regular Coffee	Cappuccino	Vienna coffee	Eiskaffee	total
Output in dollars	$700.00	$300.00	$600.00	$510.00	$2,110.00
Labor cost					$320.00
Material cost	$175.00	$75.00	$187.50	$153.00	$590.50
Equipment cost					$200.00
Overhead cost					$350.00
			Profit		$649.50

Labor Productivity	6.5938
Multifactor Productivity	1.4447
Change in Labor Productivity	31.875%
Change in Multifactor Productivity	0.001%

CASE: CHAD'S CREATIVE CONCEPTS*

A. Synopsis

This case describes a small furniture manufacturing company that has gained a reputation for creative designs and quality by focusing on producing custom-designed furniture. As its reputation grew, it began to sell some standard furniture pieces to retail outlets. The overall growth in sales volume and the diversification into the production of standard furniture pieces have caused a number of issues to arise concerning both the internal manufacturing operations and its relationship to the other functional areas of the company.

B. Purpose

This case is designed to be used as either a "cold-call" case for class discussion or an assigned homework reading. Major points to be brought out in the discussion include:

1. The range of decisions that are made in designing and operating processes.
2. The impact that these operating decisions have on the organization as a whole, such as on marketing and finance.
3. The impact that decisions made in other functional areas of the organization have on the operating function.
4. The need to go beyond the "functional silo" mentality and manage in an integrative manner.

C. Analysis

*This case was prepared by Dr. Brooke Saladin, Wake Forest University, as a basis for classroom discussion.

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Question 1: *What types of decisions must Chad Thomas make daily for his company's operations to run effectively? Over the long run?*

The students should be able to discuss a number of short-term-oriented decisions that are facing Chad Thomas. These should include:

a. How to set priorities and schedule different orders? Chad is receiving orders for both custom-made, low-volume furniture pieces and higher-volume, standard pieces. Sales have increased, but the amount of equipment and the production capacity of the company have not. Neither has the type or mix of equipment changed. Different orders with different manufacturing requirements are now competing for the same productive capacity.

b. What orders to accept and how long of a lead time to plan for in promising a delivery date?

c. What type of work policies should be maintained for his employees? Decisions such as the number and type of employees to employ, the number of hours to work per day, and the amount of overtime to allow are all work policy decisions that impact the available capacity level.

d. The allocation of resources, equipment, labor, and money to each product line.

e. The level of inventory to maintain at various stages of the production process for both the custom and standard furniture lines (i.e., raw material, WIP, finished goods). These decisions are linked to the longer-term, total inventory-investment decision.

Examples of longer-term decisions that face Chad Thomas include:

a. Amount of money to tie up in the total inventory investment.

b. The type of equipment to invest in to support efficient production. At what point should more specialized equipment be purchased to manufacture high-volume, standard furniture pieces more efficiently?

c. What should be the overall workforce level to maintain, and what should be the proper mix of skills and capabilities?

d. How should the facilities be laid out to accommodate the two different product lines? This gets the students into a whole range of capacity and equipment allocation decisions including size, type, and configuration.

In these decisions it is important that the students see the significance of maintaining consistency of both strategic and operating decisions across functional areas.

Question 2*: How did sales and marketing affect operations when they began to sell standard pieces to retail outlets?*

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Standard furniture pieces compete on a different set of competitive priorities than custom-designed pieces. Timely delivery and low costs are much more important than product flexibility. Quality may also be defined differently. The existing facilities are set up to provide flexibility with its job-shop orientation and general-purpose equipment. By introducing a standard line that should be manufactured on a flow line with some dedicated, more specialized equipment, a conflict has developed, and scheduling problems have resulted.

Question 3: *How has the move to producing standard furniture pieces affected the company's financial structure?*

Inventory investment and operating costs are rising because of the frequent changeovers to accommodate the two different product lines and their scheduling conflicts.

Profit margins for the standard line are smaller, which puts pressure on manufacturing to increase productivity and reduce costs. There may also be an issue concerning the assignment of overhead costs to each product line.

Finally, the potential need to rent warehouse space to store either WIP or finished-goods inventory cuts into the profit margin for the standard furniture line.

Question 4: *What might Chad Thomas have done differently to help avoid some of these problems he now faces?*

Chad needs to address issues relating to functional areas. Make sure the student is able to identify decisions that relate to more than one functional area. Examples include the following:

Operations Function

1. Monitoring capacity and utilization of facilities
2. Formulating inventory policies—dollars, items, and unit levels
3. Setting scheduling policies and priorities
4. Maintaining product line quality

Marketing and Sales

1. Accurately forecasting orders for standard pieces
2. Defining market segments and customer needs
3. Determining what delivery schedules can be promised to customers

Finance

1. Deciding level and type of investment
2. Investigating the effect of capacity investment decisions on ROI

Distribution/Logistics

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1. Managing distribution and pipeline inventory
2. Comparing cost and advantages of various transportation modes
3. Meeting delivery lead times

Three possible avenues that students may focus on are: Chad Thomas might have -

a. Established a plan for a more controlled growth. Part of this plan would be the development of the appropriate infrastructure to manage a controlled growth as to what markets to enter, what product lines to develop, and how to develop the proper manufacturing capabilities.

b. Maintained the company focus on custom-designed furniture only. This alternative presents a whole different set of issues and decisions pertaining to future growth, but it would have avoided the issues of mixed competitive priorities and scheduling conflicts.

c. Realized the different requirements for each product line and focused the manufacturing facilities into two separate sets of production facilities designed to cater to each product line's specific needs.

D. Recommendations

This case is not designed to be a decision-making case per se but rather a vehicle to get students thinking about the types and the integrated nature of decisions that operations managers face. The students may, indeed, have suggestions as to what should be done to help out Chad Thomas. These recommendations will more than likely follow the alternatives already discussed. As recommendations are provided by students, make sure you push them to understand the implications of their recommendations with respect to the company as a whole and the other functional areas.

E. Teaching Strategy

This case can be effectively discussed in 20 to 30 minutes by following the discussion questions provided at the end. The questions are interconnected and somewhat redundant on purpose to reinforce the inter-relatedness of decisions made in various functional areas of the company. The intent is to have the students understand the range of decisions that face managers in the operations function and to realize that different types of products competing in different markets place different demands on the operations function. Therefore, manufacturing systems will take on a variety of configurations.

Exhibit TN.1 lays out a sample table to be written on the board displaying important issues in the class discussion. Each column can be used to compare and contrast the differences in the requirements imposed by custom versus standard furniture for each area.

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EXHIBIT TN.1 Board Plan

Important Issues	Custom Furniture	Standard Furniture
Marketing		
Quality level and quality control		
Process equipment		
Process flow		
Production scheduling system		
Purchasing		
Type of inventory and inventory control system		
Type of engineering		
Type of labor and supervision needed		
Wage/reward system		
Layout		

Video Case: Using Operations to Create Value at the Seattle Airport

Length: 06:02

Subject: Using Operations to Create Value at the Seattle Airport

Textbook Reference: Chapter 1: Using Operations to Create Value, page 47

Summary

This video discusses the daily rhythms of the Seattle-Tacoma International Airport through the eyes of Laurel Dunphy, the Director of Airport Operations. She indicates that the airport operates 24 hours a day, 7 days a week and 365 days per year. All primary and ancillary services are aligned to help achieve the port's Century Agenda with six strategic goals: positioning the region as a premier international destination, advancing tourism, responsible economic growth, energy efficiency, becoming a model for DEI, and being a highly effective public agency.

The video also highlights Lance Lyttle, the managing director for the airport, who oversees all operations that span 2500 acres of land, a far smaller footprint than most other airports of similar capacity. The airport communications center (ACC) allows Lance's operations staff to monitor all aspects of the operation. The screens display weather, debris, light rail and connections between terminals, parking, roads, and runways.

Julie Collins, the Director of Customer Experience and Brand Strategy, manages the airport's amenities like retail and restaurants, nursing, and customer flow through ticketing and security checkpoints. Perhaps the most important aspect of her job is maintaining the smooth flow of their customers throughout the terminal.

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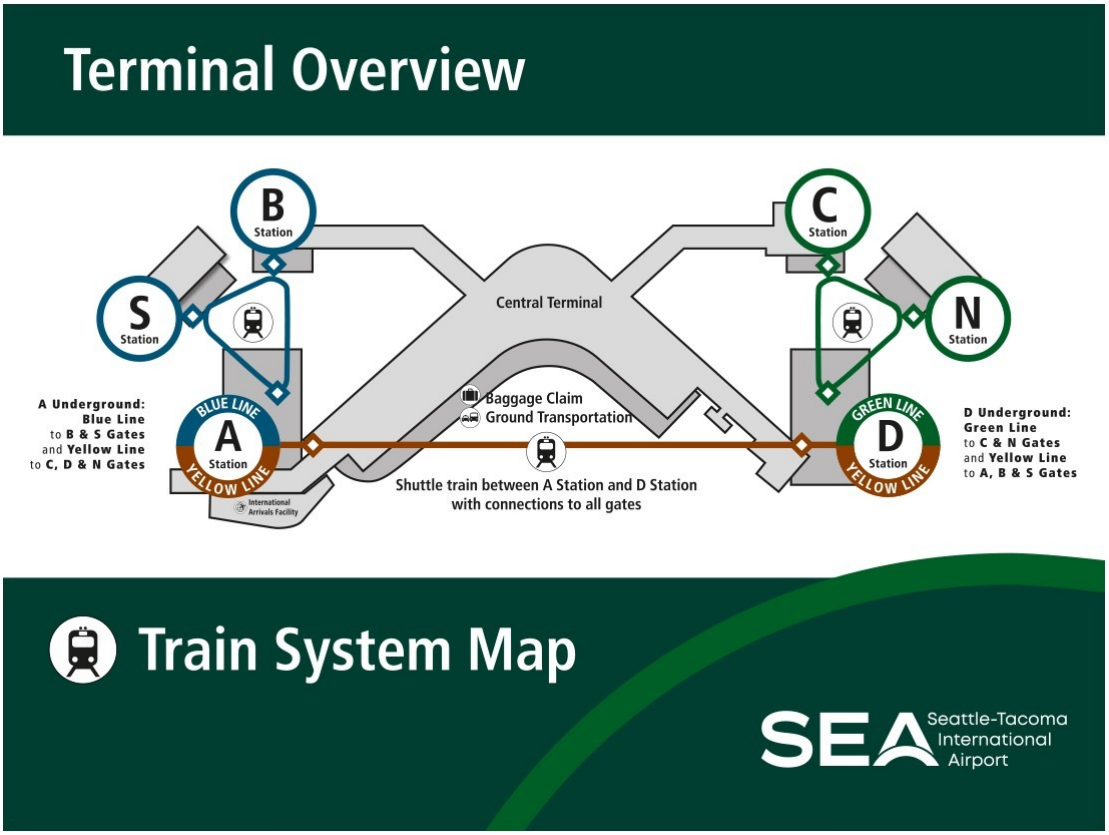
Discussion Questions Based on Video

1. Using the Seattle Airport layout, draw a map of the Port of Seattle's processes and operations.



The primary operations at SeaTac Airport are commercial passenger travel, air freight shipment, baggage handling, air traffic and runway control, ground crew operations, TSA, ground transportation for rental car, parking, restaurant and customer amenities, and ticketing. Most of these occur at the main terminal with parking and ground transportation for rental cars entirely outside of the main terminal.

2. How might the Port of Seattle benefit from analyzing its data? What would you expect to see on each operation manager's dashboard of key metrics each morning?

The Port of Seattle can benefit from analyzing its data to develop metrics that accurately and completely describe its operational and financial performance. Once measurement systems are in place, the Port of Seattle can track their performance over time to identify issues before they become problems and determine the effects of operational changes.

An operations manager's dashboard would likely have a section devoted to weather, both current conditions and forecasts, the planned arrivals and departures of passenger and freight, an area for maintenance and customer issues, and meeting/schedule reminders. The dashboard would also include information on key performance metrics for each function and project.

3. Visit the Port of Seattle's website at portseattle.org. Assume the role of an operations manager at the airport and pick an area where you might use your skill to add value to operations. Areas to consider include construction, retail and restaurant, passenger journey assistance, ticketing, baggage handling, project management, or capital planning. Describe the operations area and your contribution.

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Operations Area	Description
Construction & Project Management	The construction area requires management of materials, subcontractors, and personnel. An operations manager employs project management principles to develop a project plan and monitor the project during the construction phase to ensure it stays on budget, is completed on time, and at the expected level of quality.
Retail & Restaurant	The operations manager will staff retail and restaurants appropriately during peak and slow travel periods and assist with layout decisions to minimize congestion and improve flow at all outlets.
Passenger Journey Assistance	The operations manager will examine passenger flow and accessibility issues to ensure that passengers and their luggage can navigate the terminal in a timely manner to make their flights. The operations manager would also ensure the availability of parking and adequacy of shuttle services between the terminal, lots, and rental car locations.
Ticketing	An operations manager will ensure an appropriate mix of kiosk and counter service help depending on the customer loads.
Baggage Handling	For passenger travel, the operations manager will develop processes that route outgoing baggage to the correct nonstop flights and ensure that all baggage on connecting flights makes it from one plane to the next.
Capital Planning	An operations manager will assist in capital planning to allow the Port of Seattle to reach long term goals and enhancements of service.

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Chapter 1 Using Operations to Create Value

Course Introduction

1. Today's objectives:
   a. What are the course requirements?
   b. What is OM? OM deals with processes that produce services and goods that people use every day.

TEACHING TIP
Ask the students to share their ideas on a business they would like to start. Discuss the major OM, Accounting, Finance, Human Resources, Management Information Systems, and Marketing decisions.

   c. Why study OM?
2. Course objectives:
   a. Primary goal of this textbook is to gain an understanding of how to make operations a competitive weapon
   b. Strategy and analysis
3. Syllabus
   a. Go over course outline
   b. Performance measures
   c. Office hours and other administration
   d. Questions
   e. Nature of assignments

TEACHING TIP
Introduce Apple and its supply chain and discuss reasons of its operational and supply chain sucess.

1. Operations management deals with the systematic design, direction, and control of processes.
   a. "A **process** is an activity or group of activities that takes one or more inputs, transforms them, and provides one or more outputs for its customers."
   b. An "**Operation** is a group of resources performing all or part of one or more processes."
   c. "**Supply chain management** is the synchronization of a firm's processes with those of its suppliers and customers to match flow of materials, services, and information with customer demand."

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1. Role of Operations in an Organization

1. Operations serve as an excellent career path to upper management positions in many organizations because operations managers are responsible for key decisions that affect the success of the organization.
2. Operations is one of several functions within an organization
   a. Cross-functional coordination is essential to effective management
   b. Operations plays an important role in meeting global competition
3. Historical Evolution and Perspectives
   a. James Watt invented the steam engine in 1785.
   b. With the invention of the cotton gin in 1794, Eli Whitney introduced the concept of interchangeable parts.
   c. The foundations of modern manufacturing and technological breakthroughs were also inspired by the creation of a mechanical computer by Charles Babbage in the early part of the nineteenth century.
   d. Scientific management of operations and supply chain management was further improved upon by Frederick Taylor in 1911
   e. First is the invention of the assembly line for the Model T car by Henry Ford in 1909
   f. Alfred Sloan in the 1930s introduced the idea of strategic planning for achieving product proliferation and variety.
   g. Toyota Production System in 1978, Taiichi Ohno laid the groundwork for removing wasteful activities from an organization.
   h. The 1980s were characterized by wide availability of computer aided design (CAD), computer aided manufacturing (CAM), and automation.
4. Operations Manager's Role and Responsibilities
   a. Involved in all facets of running an organization
   b. Responsible for translating materials and other inputs into goods and services
   c. Wide range of responsibilities
   d. This text provides requisite frameworks to organize thinking about the field and provide proper tools, techniques, and skills to pursue and excel in OM careers.

2. A Process View

Departments within an organization typically have their own set of objectives and a set of resources with capabilities to meet those objectives. The concept of a process is much broader: a process can have its own set of objectives where the work flow may cross different department boundaries, and require resources from several departments.

1. How Processes Work
   a. Inputs can include a combination of human resources (workers and managers), capital (equipment and facilities), purchased materials and services, land, and energy.
   b. Processes provide outputs to customers. Outputs could be services (that can take the form of information) or a tangible product.

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c. Customer-supplier relationships

- Every process and every person within an organization has customers
  - ⇒ External customers
  - ⇒ Internal customers
- Every process and every person in an organization also relies on suppliers
  - ⇒ External suppliers
  - ⇒ Internal suppliers

d. Inputs and outputs vary, depending on the service or product (examples)

- Jewelry store
  - ⇒ Inputs: merchandise, the store building, registers, the jeweler, and customers
  - ⇒ Outputs: to the external customers are services and sold merchandise
- Factory manufacturing blue jeans
  - ⇒ Inputs: denim, machines, the plant, workers, managers, and services by outside consultants
  - ⇒ Outputs: clothing and supporting services

2. Nested Processes

a. Process within a process

b. Interconnectivity within a business

c. Nature of each process's inputs and outputs

d. Greater detail in Chapter 3 "Process Strategy and Analysis"

3. Service and Manufacturing Processes

a. Ratio of services to manufacturing jobs

b. Differences

- Nature of output
- Degree of customer contact

c. Similarities

- Customers expect good service and good products

3. A Supply Chain View

The strategic view is that processes must add value for customers throughout the supply chain; reinforcing the link between processes and performance. This includes a firm's internal processes with those of external customers and suppliers.

1. Core Processes

a. Supplier relationship process

b. New service/product development process

c. Order fulfillment process

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d. Customer relationship process

2. Support Processes
   a. provide vital resources and inputs to the core processes
   b. capabilities
   c. other inputs that allow core processes to function
3. Supply Chain Processes
   a. Adding value with process innovation in supply chains
      - Outsourcing
      - Warehousing
      - Sourcing
      - Customer Service
      - Logistics
      - Cross-docking

4. Trends and Challenges in Operations Management

1. Productivity Improvement
   a. The value of outputs produced is divided by the value of input resources.

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

   b. In the United States, while there are signs of improvement, service sector productivity gains have been much lower than those in the manufacturing sector.

TEACHING TIP
Managerial Practice 1.1. Dot Foods. This example demonstrates how employee-focused management practices and the funding of new technologies can foster impressive productivity gains year over year.

   c. Use **Example 1.1: Productivity Calculations** to give students the chance to make their own productivity calculations.
   d. Productivity measures – two approaches
      - Single factor
        ⇒ In example 1.1, the single (input) factor is employee hours
      - Multifactor
        ⇒ In example 1.1, the multiple (input) factors are labor cost, materials cost, and overhead costs.
   e. The Role of Management: Managers must examine productivity from the level of the value chain, i.e., the collective performance of individual processes.
   f. Additional examples are provided as Solved Problems

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g. **Application 1.1**

	This Yr.	Last Yr.	Year Before Last
Factory unit sales ($)	2,762,103	2,475,738	2,175,447
Employment (hrs)	112,000	113,000	115,000
Sales of manufactured products ($)	$49,363	$40,831	—
Total manufacturing cost of sales ($)	$39,000	$33,000	—

- Calculate the year-to-year labor productivity.

	This Yr.	Last Yr.	Year Before Last
$\frac{factory\ \ unit\ \ s}{employment}$	$\frac{2,762,103}{112,000} = \$24.66/hr$	$\frac{2,475,738}{113,000} = \$21.91/hr$	$\frac{2,175,447}{115,000} = \$18.91/hr$

- Calculate the multifactor productivity.

	This Yr.	Last Yr.
$\frac{sales\ \ of\ \ mfg\ \ products}{total\ \ mfg\ \ cost}$	$\frac{\$49,363}{\$39,000} = 1.27$	$\frac{\$40,831}{\$33,000} = 1.24$

h. **Tutor 1.1** in **OM Explorer** provides a calculating productivity example**.**

2. Aftermath of the Covid-19 Pandemic
   a. Work-at-Home phenomenon increased flexibility for employers and employees alike to de-anchor and be able to work from varied locations by leveraging digital technologies such as Zoom.
   b. Supply Shortages as a result of key components.
   c. Inflation due to Russin-Ukraine war leading to food and energy cost increases.
3. Sustainability
   - Growing realization of need for sustainable operations leading to an emphasis on
     - ⇒ Environmental Protection
     - ⇒ Productivity Improvement
     - ⇒ Risk Minimization
     - ⇒ Innovation
   - The Three Elements of Supply Chain Sustainability

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⇒ Social Responsibility

⇒ Financial Responsibility

⇒ Environmental Responsibility

4. Workforce Diversity, Equity, Inclusion, and Ethics

- They refer to the values and practices that ensure all employees are treated fairly, respected, and valued, regardless of their identity, background, or beliefs. They can also help organizations achieve better performance, innovation, and social impact.

5. Fourth Industrial Revolution (Industry 4.0)

Fourth Industrial Revolution: Ongoing automation of traditional manufacturing and industrial practices using modern smart technology

a. *Smart Manufacturing Technologies* help a company's internal operations to become more efficient and can serve to increase virtual integration, augment virtualization, enhance automation, improve product traceability, and facilitate efficient energy management.

b. **Manufacturing execution systems (MES)**: Computerized systems used in manufacturing to track and document the transformation of raw materials to finished goods and optimize their production output

c. **Artificial intelligence (AI)**: A constellation of technologies, from machine learning to natural language processing, that allows machines to sense, comprehend, act, and learn

d. *Smart Products Technologies* are front-end technologies that embed digital capabilities in products themselves.

e. *Smart Supply Technologies* relate to supporting the digital integration of a company with its suppliers, customers, and internal operations in real time.

f. *Base Technologies* are needed to support the application of the other smart technologies.

1. The Internet of Things

a. The impact of the Internet of Things (IoT) on operations as objects embedded with software, sensors and actuators collect and exchange data

b. Examples of how IoT affects the field of operations management today

- Product design and development
- Health care
- Preventative maintenance
- Inventory management
- Logistics
- City management

c. Concerns and Barriers

- Technology
- Privacy

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- Security
- Organizational roles

2. Additive Manufacturing
   a. Additive Manufacturing (AM): The technologies that build 3D objects by adding layers of material such as plastic, metal, or concrete
   b. Operations and Supply Chain Implications of AM
      - Reduced material inputs
      - Simplified production
      - Production and supply chain flexibility
      - Decentralized, distributed production networks
   c. Enablers of Adopting AM
      - Talent/Workforce
      - Intellectual property rights
      - Quality assurance
      - Process

6. Developing Skills for Your Career

1. Developing skills to understand how organizations meet challenges by better design of its operating processes and supply chains.
   a. The management of processes and supply chains goes beyond designing them; it requires the ability to ensure they achieve their goals.
   b. All effective operations decisions follow from a sound operations strategy.
   c. The text has three major parts:
      - Part 1: "Managing Processes"
        ⇒ Focus on analyzing processes and how they can be improved to meet the goals of the operations strategy.
      - Part 2: "Managing Customer Demand"
        ⇒ Focus of this part of the book is on effectively forecasting and managing customer demand.
      - Part 3: "Managing Supply Chains"
        ⇒ Focus of Part 3 is on supply chains involving processes both internal and external to the firm and the tools that enhance their execution.
2. Adding Value with Process Innovation
   a. Each part of an organization, not just the operations function, must design and operate processes that are part of a supply chain and deal with quality, technology, and staffing issues.
   b. Each function of an organization has its own identity and yet is connected with operations through shared processes.

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