



# Chapter 14 Operations—Producing Goods and Services

## Introduction

- Operations focus on the “make/build” portion of the supply chain.
- Production facilities must interact with supply chain functions.
- Operations create the outputs that are distributed through supply chain networks.



# The Role of Production Operations in Supply Chain Management

- An effective production operation is supported by the supply chain and in turn supports the supply chain.
- Supply chain tradeoffs must be understood and made.
  - Inventory
  - Order cycle
  - Customer service
  - Total cost



# Production Challenges

- Intensified competition, more demanding customers, and relentless pressure for efficiency as well as adaptability
- New competition for many established manufacturers and service providers
- Customers' demand for choice and rapidly changing tastes



# Production Strategies

## Mass Production

- Operations strategy focused on cost reduction, efficiency, and scale.
- The push-based strategy works well for supply chains that focus on the immediate delivery of off-the-shelf, low-cost, standardized goods.

## Lean Manufacturing

- Materials arrive at the needed location just in time for rapid processing and flow through.
- Relies on pull-based systems to coordinate production and distribution with actual customer demand.

**Figure 14-3****Evolution of Production Strategies**

	<i>1970s</i>	<i>1980s</i>	<i>1990s</i>	<i>2000+</i>
<i>Strategy</i>	Mass Production	Lean Manufacturing	Flexible Manufacturing	Adaptive Manufacturing
<i>Market Differentiator</i>	Cost Inventory Protection	Quality Waste Reduction	Availability Leverage Resources	Velocity Real-time Execution
<i>Process Option</i>	Make-to-stock	+ Assemble-to-order	+ Build-to-order + Engineer-to-order	+ Hybrids
<i>Materials Release</i>	Push	Pull	Pull	Pull
<i>Performance Focus</i>	Production Throughput	Cost Management	Segment Market Share	Customer Satisfaction

# Production Process Functionality

- Make-to-stock (MTS) production is driven by demand forecast. Customer order fulfilled from inventory.
- Assemble-to-order (ATO) production method build final product from common components, starting from a common base product and add variable parameters (e.g. color). <PC, bicycles>
- Build to order (BTO) utilizes a combination of standard and customs parts. <servers, air planes>
- Engineer-to-order (ETO) focuses on highly customized products that requires unique engineering and design. <bridges, power plants>

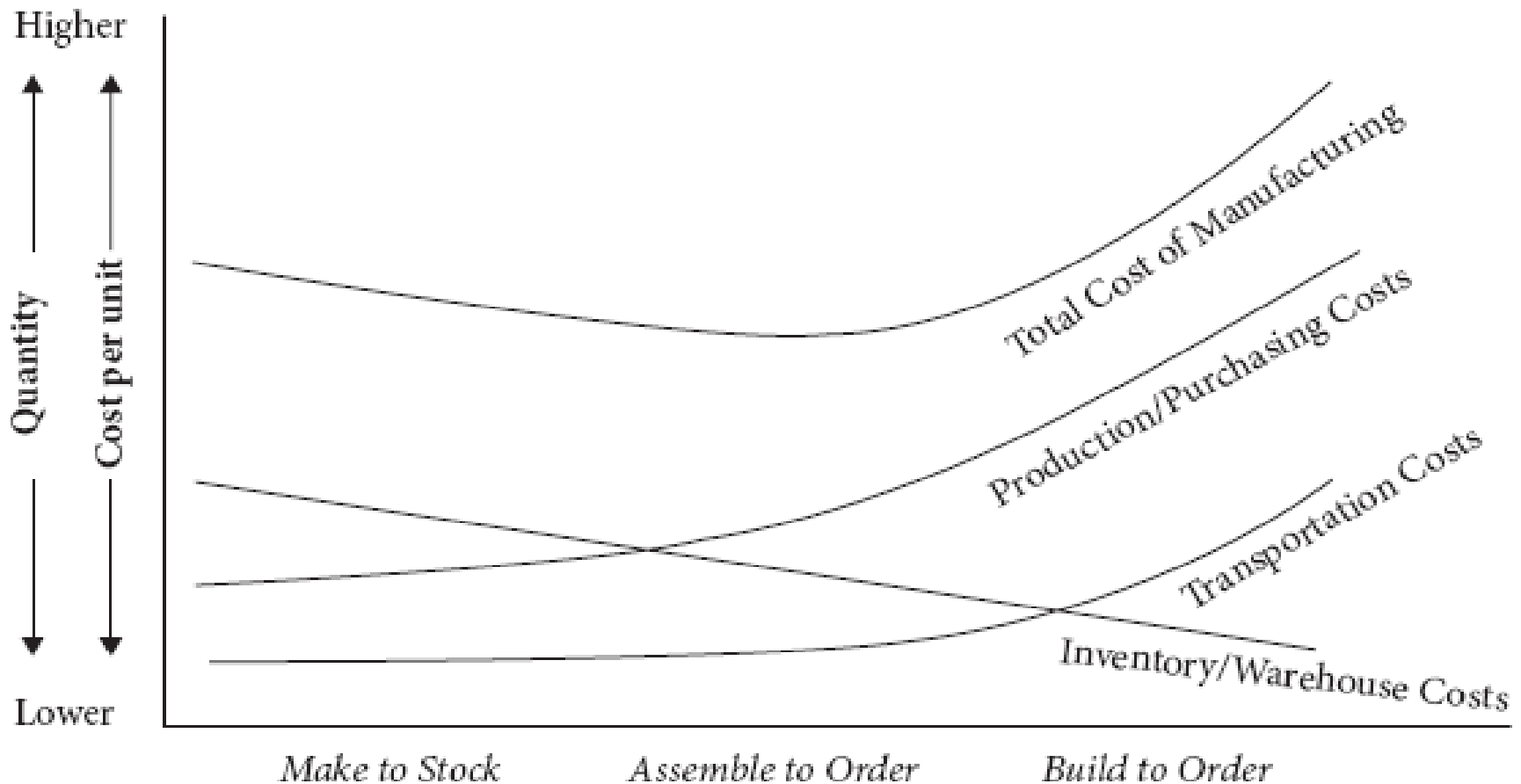


# Production Tradeoffs

- Processes that can produce a range of products are said to have “economies of scope”.
- Low-volume production runs of a wide variety of products are required to meet fast changing customer demand.
- Tradeoffs between flexible production processes and manufacturing costs must be considered.
- Production and supply chain costs vary for make-to-stock, assemble-to-order, build-to-order products and engineered-to-order items.

Figure 14-2

Total Cost of Manufacturing



Source: Adapted from Bowersox, Closs, and Cooper, *Supply Chain Logistics Management* (Boston, MA: McGraw Hill/Irwin, 2002).



**Table 14-1****TPS Seven Deadly Wastes**

<b>WASTE</b>	<b>DESCRIPTION</b>
Overproduction	Making more parts than you can sell.
Delays	Waiting for processing, parts sitting in storage, etc.
Transporting	Excessive movement of parts to various storage locations, from process to process, etc.
Overprocessing	Doing more “work” to a part than is required.
Inventory	Committing money and storage space to parts not sold.
Motion	Moving parts more than the minimum needed to complete and ship them.
Making defective parts	Creating parts that cannot be sold “as is” or that must be reworked, etc.

**TPS = Toyota Production System**

# Production Strategies

- Machine flexibility
  - general purpose machines staffed by cross-trained workers to produce different types of products
- Routing flexibility
  - provides managers with a choice between machines for a part's next operation
- Offshoring
  - activity relocated to contract manufacturer in another country
- Adaptive manufacturing
  - ability to replace planning with execution based on real-time demand

**Table 14-2****Dimensions of Adaptive Manufacturing**

<b>CHARACTERISTIC</b>	<b>DESCRIPTION</b>
Plan	Optimize and schedule production floor operations based on resource availability.
Execute	Manage, build, move, modify, track, and document activities on the production floor.
Sense	Monitor continually and alert in real time relevant expectations that impact production floor operations.
Respond	Act rapidly and efficiently on production floor to correct internal and external deviations.
Learn	Evolve continually and incorporate knowledge into manufacturing processes.

Source: *Manufacturing Strategy: An Adaptive Perspective* (Newtown Square, PA: SAP AG, 2003). Available from [http://www.sap.com/solutions/business-suite/scm/pdf/BWP\\_Mnf\\_Strategy.pdf](http://www.sap.com/solutions/business-suite/scm/pdf/BWP_Mnf_Strategy.pdf). Reprinted by permission.



# Production Process Layout

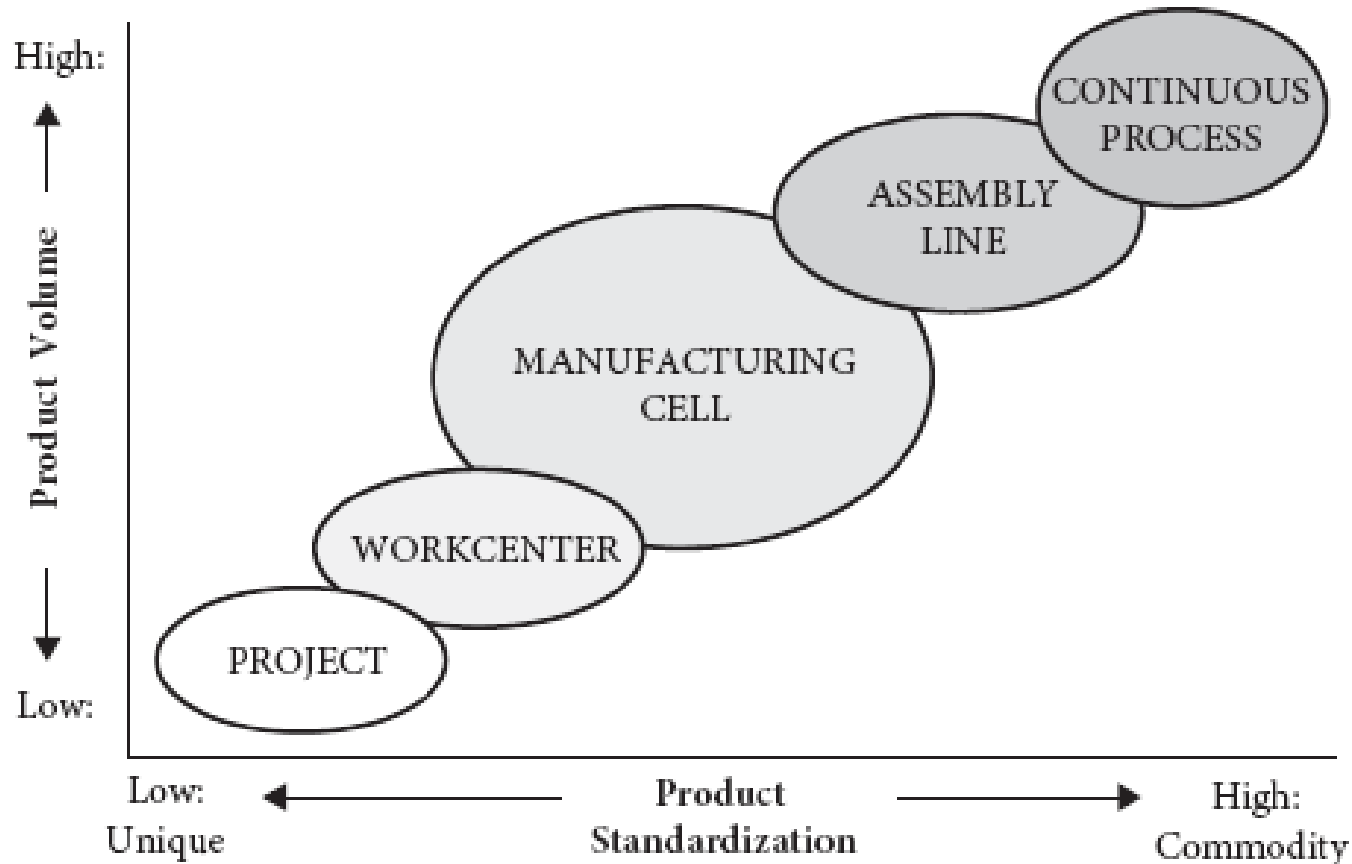
- Facility layout
  - The arrangement of machines, storage areas, and other resources within manufacturing or assembly facility.
  
- Successful layout is one that does the following:
  - Reduces bottlenecks in moving people or materials
  - Minimizes materials-handling costs
  - Reduces hazards to personnel
  - Utilizes labor efficiently
  - Increases morale and ease of supervision
  - Utilizes available space effectively and efficiently
  - Provides flexibility
  - Facilitates coordination and face-to-face communication

# Production Process Layouts

- Project layout
  - fixed location layout where the product remains in place for the duration of production
- Workcenter
  - process-focused layout that groups together similar equipment or functions
- Manufacturing cell
  - process-focused layout that dedicates production areas to a narrow range of products that are similar in processing requirements
- Assembly line
  - product-focused layout in which machines and workers are arranged according to the progressive sequence of operations
- Continuous process facilities
  - similar to assembly lines, with product flowing through a predetermined sequence of stops.

Figure 14-5

Facility Layout Matrix



Source: Adapted from Jacobs and Chase, *Operation and Supply Management: The Core* (Boston, MA: McGraw-Hill Irwin, 2008).



# Packaging

- Protects goods in the package
- Design can affect labor and facility efficiency
- Design can also impact ability to use space and equipment
- Attractive packaging provides another level of product differentiation
- Packaging affects materials handling and transportation



# Production Metrics

- Properly aligned with corporate objectives (help achieve goals that are important to the overall success of the business)
- Keep metrics simple (5-6 per team or function)
- Measure activity performance as input to overall production or supply chain performance
- Refrain from using metrics that are too narrow (e.g. using labor cost as surrogate for overall cost)
- Eliminate measurements that encourage wrong outcomes (e.g. using standard cost measures that promote labor efficiency, machine utilization at expense of inventory and quality)





# Golden Production Metrics

- Total cost
  - all manufacturing cost on cash basis, compare to previous period
- Total Cycle Time
  - measure number of days of major components on hand in various forms as compared to planned usage per day of such components
- Delivery performance
  - % of orders shipped in accordance with customer request
- Quality
  - focus on quality from the perspective of the customer
- Safety
  - accident frequency, severity, and cost



# Roles Operations Play in Supply Chain

- Key concept is the critical and co-dependent link between production and logistics.
- Production and logistics must be synchronized to move product efficiently and effectively through the supply chain.
- Fast, flexible and responsive production makes supply chain more dynamic and competitive
- Packaging plays an important role in transfer of finished product from plant to DC to customer
- Key production metrics should be linked to overall corporate objectives