Chapter 11 Distribution - Managing Fulfillment Operations

- **Modern distribution focuses on the flow of products at lowest cost and meeting customer expectations**
  - Not just traditional long term storage
  - Provide many value added functions
  - Cross docking
  - E-commerce fulfillment

- **Both speed and efficient management of distribution network are critical**
  - Opportunities include limited product handling, facility consolidation and streamlining inventories

The Role of Distribution in SCM

- **Stockpile inventory to balance supply and demand**
  - Seasonal production for year-round demand (e.g. corn)
  - Year round production for seasonal demand (e.g. X'mas lights)
- **Hold inventory for protection against uncertainty**
  - Protection against forecast errors, supply disruptions, and demand spikes
- **Bring products closer to market**
  - Reduce length & variability of transit time
- **Enable quantity purchase discounts**.
  - Accommodate larger purchase quantities to reduce cost per unit.
- **Support production requirements**.
  - Provide for long production runs or aging/ripening of product (e.g., wine, cheese, ham).
- **Promote transport economies**.
  - Enable full utilizing transport equipment capacity and movement of product in larger quantities.

Distribution Facility Functionality

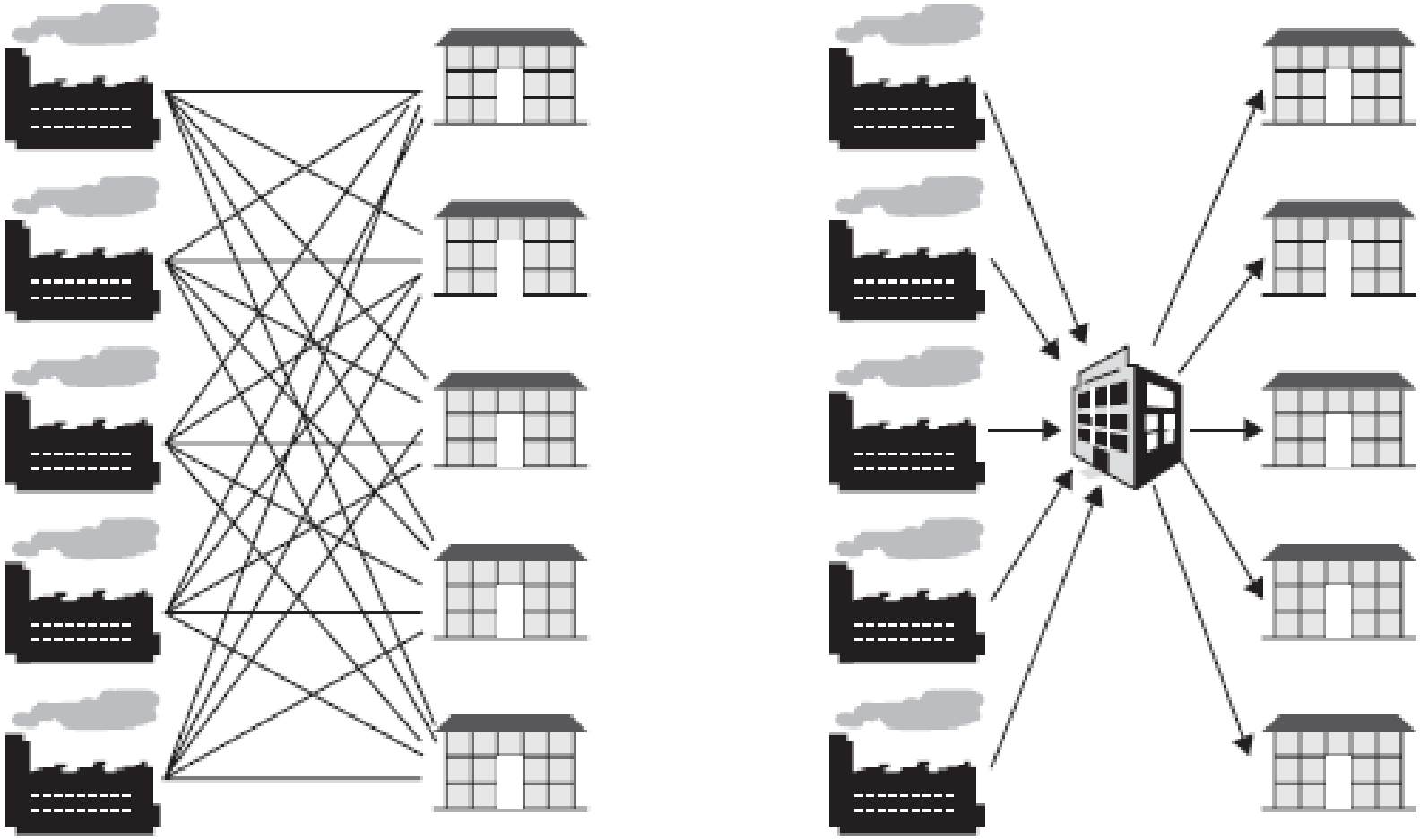
Four primary functions are:

- Accumulation (consolidate)
- Sortation (SKU)
- Allocation (fulfill)
- Assortment (assemble a variety of SKU)

Value-adding roles:

- Assembly (filling in-store display units)
- Inventory Management (VMI)
- Kitting (all components needed for certain function)
- Product packaging, labeling, tagging
- Sequencing (set up parts for JIT manufacturing)
- Recycle, repair and returns management

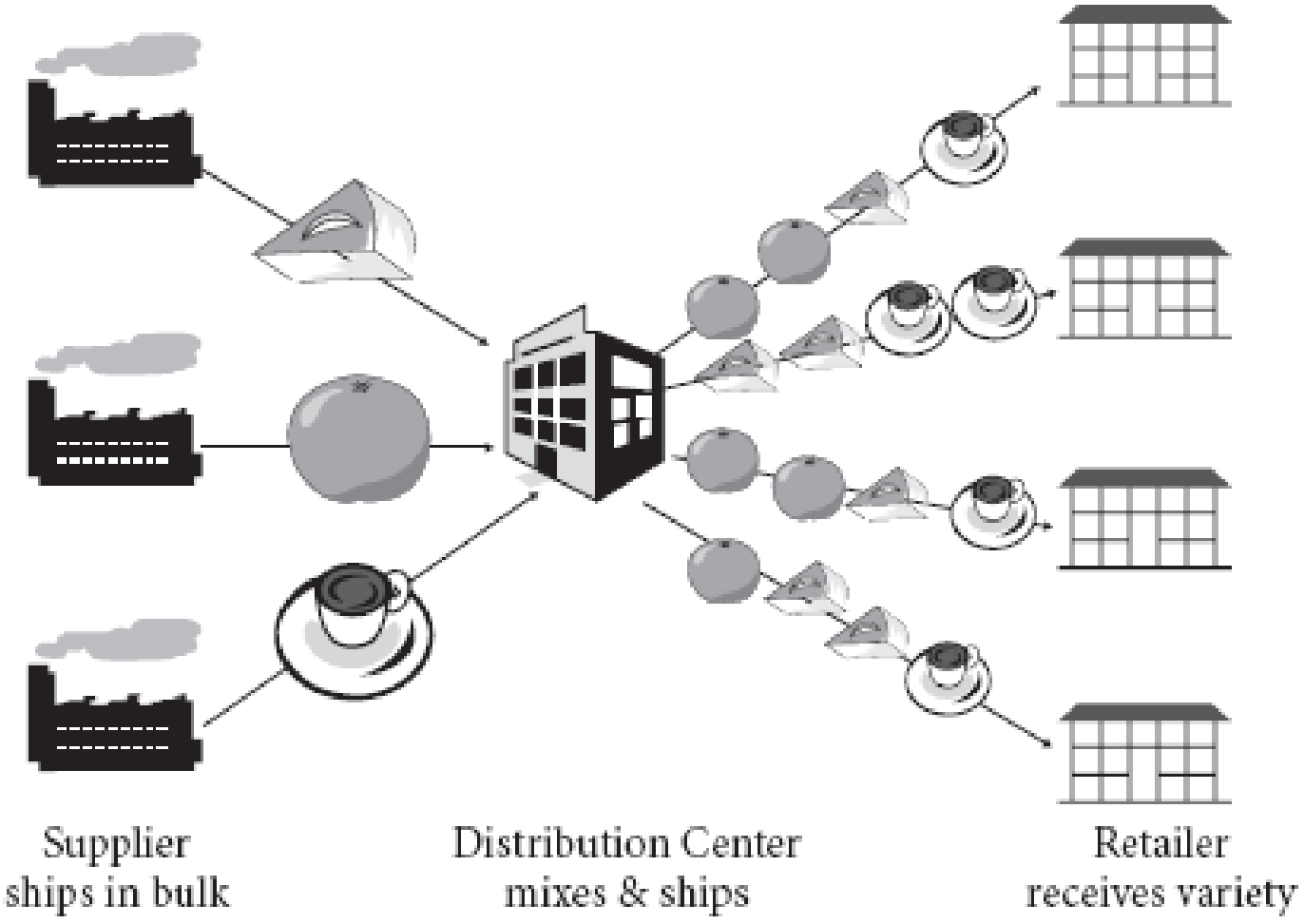
Figure 11-1 The Distribution Center's Accumulation Role



Direct Delivery—No Accumulation

Distribution Center—Accumulation

Figure 11-2 The Distribution Center's Mixing Capability



Distribution Planning & Strategy

- Product characteristics (e.g. product value, durability, temperature sensitivity, obsolescence, volume) must drive the design of the distribution process
- Match distribution processes to the items being handled to protect product integrity, promote customer satisfaction, and provide greater control of the inventory.
- Two options for product flow:
  - Direct shipment from production site to customers
  - Movement through distribution facilities to customers

Analyze inventory, transportation, and service trade offs before choosing direct shipping or movement through distribution facilities. Many companies have successfully use “cross docking” to improve distribution process.

Figure 11-5 Cross-Docking Process

In cross-dock operations, goods flow from receiving to shipping with minimal interim sorting, thus eliminating storage and order picking—two costly, time-consuming activities—from the fulfillment process.

Receive

Sort/stage

Load

Deliver

Basic or "Low Tech" Option–relies heavily on manual labor.

Advanced or "High Tech" Option–relies heavily on automation.

Freight is received, checked for accuracy & prepared (auto ID labels applied to cartons) for induction.

Cartons travel thru facility on conveyor system to reduce labor and speed transfer of goods.

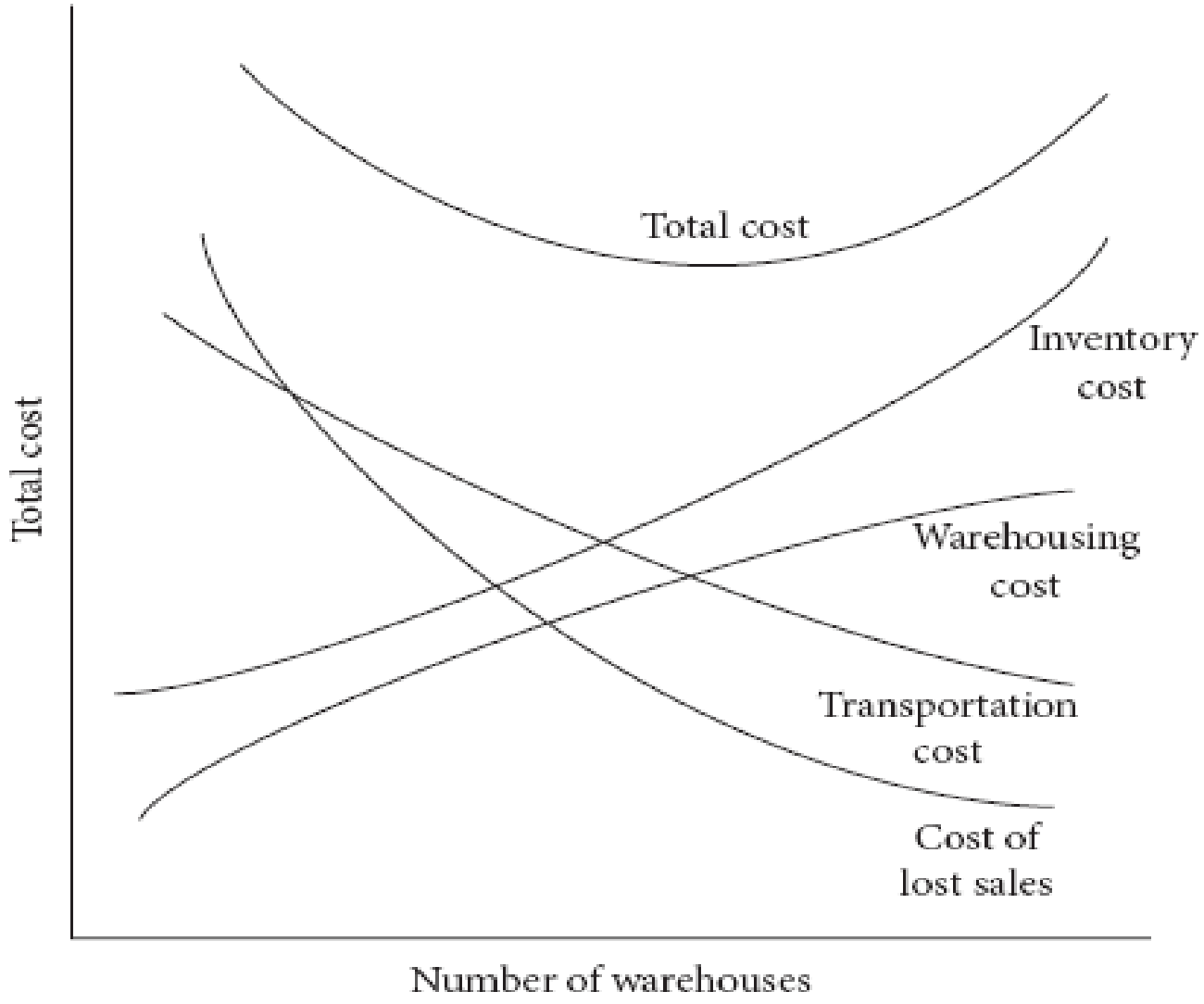
Bar code reader identifies products and diverts cartons down appropriate loading line.

Cartons are loaded in trailer. Load of mixed product is shipped to retail outlet when full.

Network Design Issues

- Inventory positioning focuses on the issue of where inventory is located within the supply chain
  - Single vs. multiple locations
- Number of facilities needed for a supply chain involves the evaluation of cost tradeoffs:
  - Transportation costs
  - Cost of lost sales
  - Warehousing costs
  - Inventory costs

Figure 11-6 Distribution Cost Tradeoffs



Distribution Facility Ownership

- Private or public distribution?
  - Private DCs are internally owned facilities
  - Contract warehousing is a customized version of public warehousing where a 3PL provides a variety of distribution services
- Choice between private and public distribution options requires significant planning and analysis

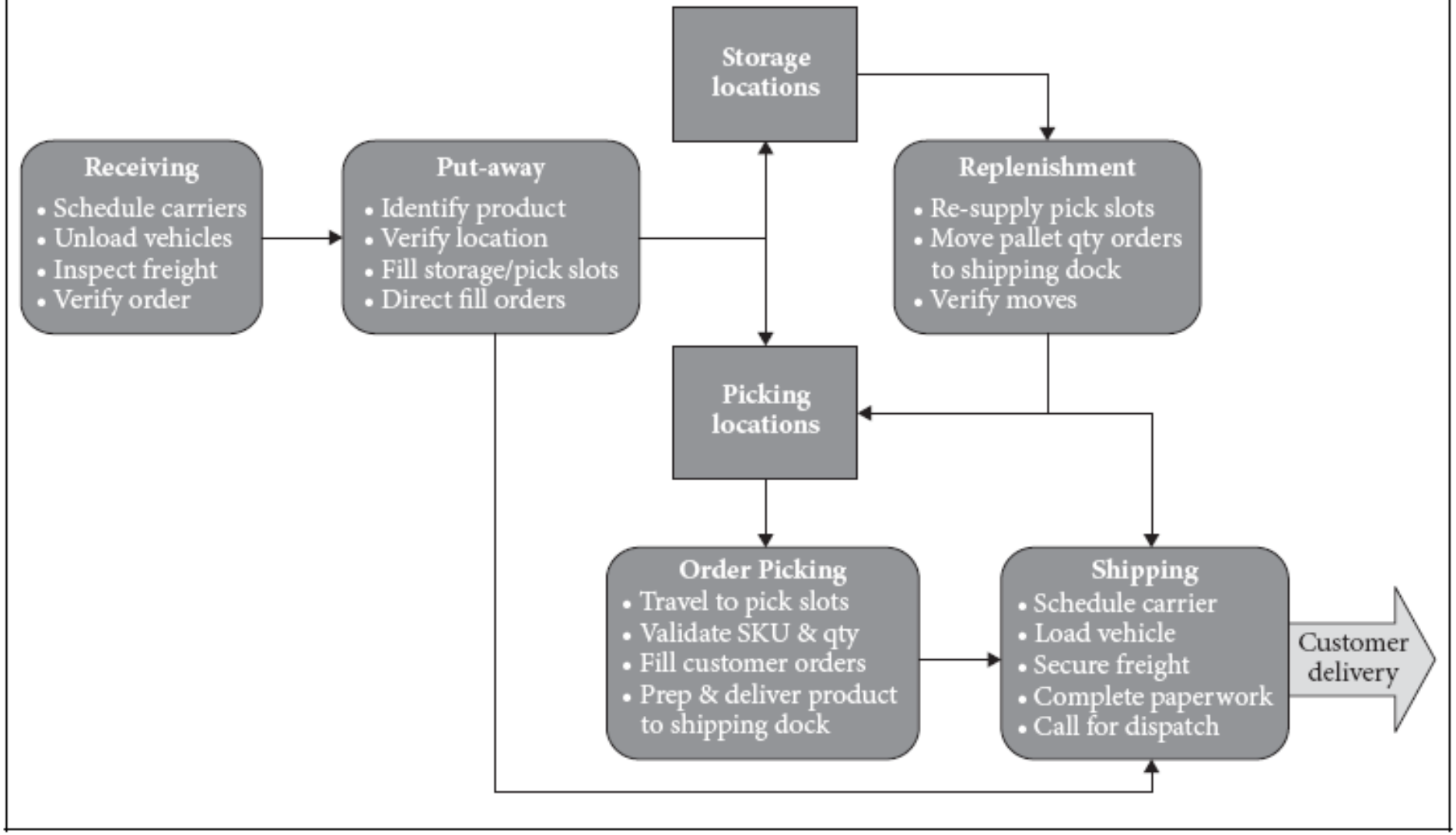
Table 11-2 Factors Affecting Distribution Facility Ownership

FIRM CHARACTERISTICS	FAVORS PRIVATE DISTRIBUTION	FAVORS 3PL DISTRIBUTION
Throughput volume	Higher	Lower
Demand variability	Stable	Fluctuating
Market density	Higher	Lower
Special physical control needs	Yes	No
Security requirements	Higher	Lower
Customer service requirements	Higher	Lower
Multiple use needs	Yes	No

Proper product slotting improve labor productivity and generate other advantages:

- Reduce order-picking labor requirements by locating product in the optimal pick sequence
- Reduce replenishment labor requirements by matching unit loads with the appropriate size storage slot
- Reduce response time and improve flow by balancing workload between operators
- Increase picking accuracy by separating similar products to avoid proximity picking errors
- Reduce product damage by organizing heavier product first in the pick path, ahead of crushable product
- Increase palletizing productivity by arranging product by case height, allowing the building of tighter pallets
- Defer capital expansion by maintaining the optimum warehouse layout and cube utilization, reducing the need for building expansion
- Increase store-level productivity by organizing product in family groups to eliminate or reduce sorting of product for restocking at the store level

Figure 11-8 Primary DC Processes



Distribution Metrics

- Distribution KPIs are objective measures of fulfillment performance that are critical to the success of the supply chain
- Important issues:
  - cost efficiency
  - inventory accuracy
  - order fill rates
  - capacity utilization

Customer Facing Measures

- Order accuracy and order completeness
  - Customers want to receive the exact products and quantities that they ordered, not substitute items, incorrectly shipped items, or wrong quantities
  - Timeliness is a critical component of customer service
- Perfect order index (POI)
  - Delivered to the right place
  - At the right time
  - In defect-free condition
  - With correct documentation, pricing, and invoicing

Distribution Technology

- **Warehouse Management Systems (WMS)**
  - Software system that improves product movement and storage through efficient management of information & assignment of tasks.
  - Value-added capabilities
    - generate performance reports
    - support paperless processes
    - enable integration of materials handling equipment
    - picking systems
    - sorting systems
    - leverage wireless communication

Table 11-5 Top Distribution Measures and Benchmarks

MEASURE USED	REPORTED USAGE BY RESPONDENTS	BEST PRACTICE PERFORMANCE LEVEL
On-time shipment	96%	99–100%
Percent of overtime hours	92%	0–4%
Inventory count accuracy	91%	100%
On-time receipts	90%	98–100%
Percent of orders shipped complete	87%	99–100%
Order-picking accuracy	84%	100%
Annual workforce turnover	83%	0–3%
Percent of orders shipped without errors	83%	100%
Order fill rate	81%	99–100%
Average warehouse capacity used	81%	93–100%
On-time delivery	81%	Varies by definition

Source: Karl B. Manrodt and Kate L. Vitasek, "DC Measures," *WERCwatch* (Summer 2005).

WMS Automatic Identification Tools

- WMS utilizes Auto-ID data capture technologies to track, locate, and move product quickly—with near-perfect accuracy :
  - Barcode scanners
  - RFID readers
  - Mobile computers
  - Wireless local area networks (LAN)