Inventory Management

SCM301.004

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Outline

- Inventory – General Introduction
  - Various types of inventories, their functions
  - Independent and dependent demands, lead time
  - Costs associate with inventories
  - Overview of inventory management, performance measures
  - Inventory counting systems
Introduction

- What is inventory?
- Why is it needed?
- Where do you see it?
  - Manufacturers
  - Retailers
  - Service sectors
Inventory Basics

Is inventory a boon or bane?

- Too much inventory – cash trapped in inventory
- Too less inventory – stockout

Imagine yourself with a flat tire and no spare in the car!
How Large Can the Inventory Be?

- **Balance Sheet of The Boeing Company**

- In FY 2011, \(\frac{32,240,000}{79,986,000} \times 100\% = 40\%\) of Total Assets were in Inventory.

- In 2010 and 2009, those numbers were 35% and 27%.


<table>
<thead>
<tr>
<th>Assets</th>
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<tbody>
<tr>
<td>Current Assets</td>
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<td>Cash and Cash Equivalents</td>
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<td>Short Term Investments</td>
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<td>Net Receivables</td>
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<td><strong>Inventory</strong></td>
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<tr>
<td><strong>Total Current Assets</strong></td>
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<td><strong>40,572,000</strong></td>
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<td>5,506,000</td>
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<td>Property Plant and Equipment</td>
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<td>Goodwill</td>
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<td>4,937,000</td>
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<td>Accumulated Amortization</td>
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<td>1,643,000</td>
<td>1,609,000</td>
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<td><strong>Deferred Long Term Asset Charges</strong></td>
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<td><strong>Total Assets</strong></td>
<td><strong>79,986,000</strong></td>
<td><strong>68,585,000</strong></td>
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<table>
<thead>
<tr>
<th>Liabilities</th>
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<tbody>
<tr>
<td>Current Liabilities</td>
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<td>Account Payable</td>
<td>38,921,000</td>
<td>34,447,000</td>
<td>32,176,000</td>
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<td>Short/Current Long Term Debt</td>
<td>2,353,000</td>
<td>948,000</td>
<td>707,000</td>
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<td>Other Current Liabilities</td>
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<td><strong>Total Current Liabilities</strong></td>
<td><strong>41,274,000</strong></td>
<td><strong>35,395,000</strong></td>
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<td>Long Term Debt</td>
<td>10,018,000</td>
<td>11,473,000</td>
<td>12,217,000</td>
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<td>Other Liabilities</td>
<td>25,086,000</td>
<td>18,835,000</td>
<td>14,728,000</td>
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<td><strong>Deferred Long Term Liability Charges</strong></td>
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<tr>
<td>Minority Interest</td>
<td>93,000</td>
<td>96,000</td>
<td>97,000</td>
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<tr>
<td>Negative Goodwill</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>Total Liabilities</strong></td>
<td><strong>76,471,000</strong></td>
<td><strong>65,799,000</strong></td>
<td><strong>59,925,000</strong></td>
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<table>
<thead>
<tr>
<th>Stockholder's Equity</th>
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<tbody>
<tr>
<td>Misc Stock Options Warrents</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Redeemable Preferred Stock</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Preferred Stock</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Common Stock</td>
<td>5,061,000</td>
<td>5,061,000</td>
<td>5,061,000</td>
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<tr>
<td>Related Earnings</td>
<td>27,524,000</td>
<td>24,784,000</td>
<td>22,746,000</td>
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<tr>
<td>Treasury Stock</td>
<td>(16,603,000)</td>
<td>(17,187,000)</td>
<td>(15,911,000)</td>
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<tr>
<td>Capital Surplus</td>
<td>4,033,000</td>
<td>3,866,000</td>
<td>3,724,000</td>
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<tr>
<td>Other Stockholder Equity</td>
<td>(16,500,000)</td>
<td>(13,758,000)</td>
<td>(13,492,000)</td>
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<tr>
<td><strong>Total Stockholder Equity</strong></td>
<td><strong>3,515,333</strong></td>
<td><strong>2,766,000</strong></td>
<td><strong>2,128,000</strong></td>
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<tr>
<td><strong>Net Tangible Assets</strong></td>
<td><strong>(4,474,000)</strong></td>
<td><strong>(5,150,000)</strong></td>
<td><strong>(5,068,000)</strong></td>
</tr>
</tbody>
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* Currency in USD, all numbers in thousands.

Source: [http://finance.yahoo.com](http://finance.yahoo.com)
GM to Match Volt Production to Inventory, CEO Akerson Says

By Jordan Robertson - Mar 7, 2012 10:06 PM ET

General Motors Co (GM), which is halting production of its Volt plug-in hybrid for five weeks, plans to pace production of the vehicle according to inventory levels. Chief Executive Officer Dan Akerson said:

“We are going to match production to inventory,” he said today in San Francisco. “If you were owners of this business, that’s exactly what you would do.”

The company said this month it will stop making Volts at its Detroit-Hamtramck assembly plant from March 19 until April 23. The factory had ramped up to full-speed production Feb. 6 after the New Year’s shutdown.

“We saw inventory building and we wanted to get it into line,” Akerson said. “You’ve got to accept that there is some intelligence behind our decisions.”


GM Month-End Dealer Inventory

Different categories of inventories

Suppose You’re in Doughnut Business!

- Raw materials and purchased parts
- Work-in-process (WIP)
- Finished goods inventories
- Goods-in-transit (to warehouses, distributors or customers)
- Tools and supplies
- Maintenance and repairs inventory
Functions of inventory

Let’s Continue the Doughnut Business...

- To meet anticipated demand
- To smooth production requirements
- To decouple operations
- To reduce setup cost
- To take advantage of economic lot sizes
- To hedge against price increase
Independent vs. Dependent Demand

- Independent: demand not related to other items.
  - Forecasted

- Dependent: demand linked to the need for another one (usually a high level item).
  - Derived

Lead-Time

- Time interval between placing an order and receiving it.
  - For buyers it is important to know the lead time for their orders.
  - The more the expected lead time (and its variability), the more the need for additional inventory to reduce shortage risk.
Tug-of-War in Apparel World


Head-to-Head
Tension is rising between apparel retailers and their suppliers during the economic recovery. Scarred during the recession, both sides are pushing their own—often competing—agendas.

SUPPLIERS
- Cautious about restarting capacity, due in part to labor shortage and a fear of idle factory time
- Seeking firm commitment for orders as far in advance as possible
- Passing through material and labor costs to preserve profit margins

RETAILERS
- Willing to move production to other geographic locales to keep retail prices as low as possible
- Seeking to follow up quickly with new orders if styles take with customers
- Placing smaller initial orders with less lead time

Sources: Josh Green, Panjiva; Jeremy Rubman, Kurt Salmon Associates
Inventory Costs

- **Holding (or carrying) cost**
  (includes the costs for storage facilities, handling, insurance, pilferage, obsolescence, and opportunity cost of capital)

- **Setup cost**
  (different products need different equipment setups)

- **Ordering cost**
  (managerial and clerical costs to prepare the purchase or production order)

- **Shortage cost**
  (order loss, dissatisfied customers, loss of goodwill; frequently, the assumed cost is a little more than a guess)
What is Inventory Management?

Source: http://money.cnn.com/video (Inside one of Amazon’s busiest days)
Effective Inventory Management

- Keeping track of the inventory on hand and on order
- Forecasting the demand
- Finding the lead times (and lead time variability)
- Estimating the inventory holding costs, ordering costs, and shortage costs
- Finding a classification system for these items

Objectives of Inventory Control

- Balance between inventory cost and the customer service level.

Why Cost Reduction Important?

- Average cost of inventory in the United States is 30% to 35% of its value.
Performance Measures of Inventory Control

- **Fill Rate** = \( \frac{\text{Number of demands met on time}}{\text{Total demand}} \times 100\% \)

- **Inventory Turnover** = \( \frac{\text{Cost of goods sold}}{\text{Average aggregate inventory value}} \)

Let’s consider the current inventory of GM

GM has sold 209,306 vehicles in the last month, and the inventory at the end of last month was 667,096. What is inventory turnover for that period?

- **Inventory turnover** = \( \frac{209,306}{667,096} = 0.3137 \) turns/month.
Inventory Counting Systems

- **Review:**
  - **periodic system**
    (more economical, but lack of control between reviews)
  - **continual system** (or, perpetual inventory system)
    (better control, but added cost of record keeping)

Types of continual systems:

- two-bin system
- universal product Code (UPC)
- point-of-sale (POS) system
- Radio frequency identification (RFID)
Questions

➤ Distinguish between dependent and independent demands in a McDonald's store.

Questions

Why might it be inappropriate to use inventory turnover ratios to compare inventory performance of companies that are in different industries?

[Textbook]
Access to the Lecture Notes

▶ You can download the lecture notes by visiting my website:

http://filebox.vt.edu/users/sourish/includes/teach.htm
(The link will remain valid for the next seven days)

▶ My email: sourish@vt.edu

Thank You!

Questions? Comments?
Classification System

- **A-B-C approach**
  - Dividing inventory items into three classes based on their dollar usage (i.e., dollar value per unit multiplied by annual usage rate).
  - Allocate more control efforts on items that have the highest dollar value.

- A items: 10 to 20 percent of the number of items, but about 60 to 70 percent of the annual dollar value.

- C items: 50 to 60 percent of the number of items, but about 10 to 15 percent of the annual dollar value.

**Smartphone Market Share in 2011**

![Pie chart showing market share of various smartphone models.]

- Apple iPhone
- HTC Desire HD
- Blackberry Torch 9800
- Motorola ATRIX
- Samsung Infuse
- LG Thrill

Next in this Chapter...

- Inventory Ordering Policies: how much to order, when to order

Classifying Inventory Models

- Repeat Purchase
  - Fixed Order Qty. (Continuous Review)
    - EOQ
      - Fixed demand
      - Setup cost
    - (Q, R)
      - Random demand
      - Setup cost
  - Fixed Time Period (Periodic Review)
    - Base Stock
      - Random demand
      - No setup cost
    - (s, S)
      - Random demand
      - Setup cost
- One-shot (Newsvendor)
  - "Fashion" type
  - Random demand