Logistics/supply chain
Product Management

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“Logistics/Supply Chain managers are ‘owners’ of the product-flow process from raw material sources to final consumers, not activity administrators.”
Product in the Planning Triangle

- **Inventory Strategy**
  - Forecasting
  - Inventory decisions
  - Purchasing and supply scheduling decisions
  - Storage fundamentals
  - Storage decisions

- **Transport Strategy**
  - Transport fundamentals
  - Transport decisions

- **Customer service goals**
  - The product
  - Logistics service
  - Ord. proc. & info. sys.

- **Location Strategy**
  - Location decisions
  - The network planning process
Product

- **Product**
  - Consumer Product
  - Industrial Products
- **Consumer Product**
  - convenience product
  - shopping product
  - specialty product
- **Industrial Products**
  - To produce other products or services
- **Convenience product**
  - To improve customer’s patronage, product availability and accessibility should be maintained at high level.
Product Life-Cycle Curve

Sales volume

Time

Introduction Growth Maturity Decline
Product Life Cycle & Distribution Strategy

• The **introductory stage** occurs just after a new product is introduced into the marketplace.

• Sales are not at a high level because there is not yet wide acceptance of the product.
  – The typical physical distribution strategy is a cautious one, with stocking restricted to relatively few locations.
  – Product availability is limited.
**Product Life Cycle & Distribution Strategy**

- **Growth stage**: If the product receives market acceptance, sales are likely to increase rapidly.
- Physical distribution planning is particularly difficult in this stage.
- Often there is not much of a sales history to guide inventory levels at stocking points or even the number of stocking points to use.
- Distribution is frequently under managerial judgment and control during this expansion stage.
- However, product availability is also increasing rapidly over a wide geographic area in support of the growing customer interest in the product.
Product Life Cycle & Distribution Strategy

- **Maturity stage**: The growth stage may be fairly short, followed by a longer stage called maturity stage.
- Sales growth is slow or stabilized at a peak level.
- The product volume is no longer undergoing rapid change and, therefore, can be assimilated into the distribution patterns of similar, existing products.
- At this time, the product has its widest distribution.
- Many stocking points are used with good control over product availability throughout the marketplace.
Product Life Cycle & Distribution Strategy

- **Decline stage**: Eventually, the sales volume declines for most products as a result of technological change, competition, or waning consumer interest.
- To maintain efficient distribution, patterns of product movement and inventory deployment may have to be adjusted.
- The number of stocking points is likely to be decreased and the product stocking reduced to fewer, more centralized locations.
Product Life Cycle & Distribution Strategy

- The product life cycle phenomenon has an influence on distribution strategy.
- The logistician needs to be continually aware of a product's life cycle stage so that distribution patterns may be adjusted for maximum efficiency in that stage.
- The life cycle phenomenon in products allows the logistician to anticipate distribution needs and plan for them well in advance.
- Because a firm's different products are typically in different stages of their life cycles, the product life cycle serves as a basis for the 80-20 curve.
80-20 Curve

‘Pareto’s Law’

• Sales amount would rely on some main products.
• 80% of Sales amount is from 20% of product lines.
80-20 curve and ABC method

• Upper 20% of sales amount: A product group
• Next 30%: B product group
• Rest of them: C product group

• A group: large area with many W/S’s
• C group: from one central W/S
• B group: kept in small number of W/S’s
Cumulative 80-20 Curve
## ABC Classification for 14 Products

<table>
<thead>
<tr>
<th>Product Number</th>
<th>Product Rank by Sales(^a)</th>
<th>Monthly Sales (000s)</th>
<th>Cumulative Percent of Total Sales(^b)</th>
<th>Cumulative Percent of Total Items(^c)</th>
<th>An ABC Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-204</td>
<td>1</td>
<td>$5,056</td>
<td>36.2%</td>
<td>7.1%</td>
<td>A</td>
</tr>
<tr>
<td>D-212</td>
<td>2</td>
<td>3,424</td>
<td>60.7%</td>
<td>14.3%</td>
<td></td>
</tr>
<tr>
<td>D-185-0</td>
<td>3</td>
<td>1,052</td>
<td>68.3%</td>
<td>21.4%</td>
<td>B</td>
</tr>
<tr>
<td>D-191</td>
<td>4</td>
<td>893</td>
<td>74.6%</td>
<td>28.6%</td>
<td></td>
</tr>
<tr>
<td>D-192</td>
<td>5</td>
<td>843</td>
<td>80.7%</td>
<td>35.7%</td>
<td></td>
</tr>
<tr>
<td>D-193</td>
<td>6</td>
<td>727</td>
<td>85.7%</td>
<td>42.9%</td>
<td></td>
</tr>
<tr>
<td>D-179-0</td>
<td>7</td>
<td>451</td>
<td>89.1%</td>
<td>50.0%</td>
<td></td>
</tr>
<tr>
<td>D-195</td>
<td>8</td>
<td>412</td>
<td>91.9%</td>
<td>57.1%</td>
<td>C</td>
</tr>
<tr>
<td>D-196</td>
<td>9</td>
<td>214</td>
<td>93.6%</td>
<td>64.3%</td>
<td></td>
</tr>
<tr>
<td>D-186-0</td>
<td>10</td>
<td>205</td>
<td>95.1%</td>
<td>71.4%</td>
<td></td>
</tr>
<tr>
<td>D-198-0</td>
<td>11</td>
<td>188</td>
<td>96.4%</td>
<td>78.6%</td>
<td></td>
</tr>
<tr>
<td>D-199</td>
<td>12</td>
<td>172</td>
<td>97.6%</td>
<td>85.7%</td>
<td></td>
</tr>
<tr>
<td>D-200</td>
<td>13</td>
<td>170</td>
<td>98.7%</td>
<td>92.9%</td>
<td></td>
</tr>
<tr>
<td>D-205</td>
<td>14</td>
<td>159</td>
<td>100.0%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Product rank by sales
\(^b\) Cumulative percent of total sales
\(^c\) Cumulative percent of total items

\$13,966
An empirical relationship for 80-20 curve

\[ Y = \frac{(1+A)X}{A+X} \]

where

- \( Y \) = cumulative fraction of sales
- \( X \) = cumulative fraction of items
- \( A \) = constant to be determined
- The constant is found by \( A = \frac{X(1-Y)}{Y-X} \)
Numerical Example

**Example**

- Suppose that in an inventory of 10 items, 15% of the items for 80% the volume account of sales volume.
- The total sales of all 10 items is $90,000 per year.
- How much inventory can be expected if turnover for A items = 8, B items = 5, and C items = 2.
Numerical Example

First, find \( A \).

\[
A = \frac{0.15(1-0.80)}{0.80-0.15} = 0.0462
\]

• Then, using \( A = 0.0462 \) and the first item (1/10), we project the sales volume to be:

\[
Y = \frac{(1+0.0462)\times10}{0.0462+0.10} = 0.7156, \text{ or } 71.6\% \text{ of the sales}
\]

• The inventory for this item is expected to be \( 0.716(90,000)/8 = $8,055 \).
• Continue for the remaining items and generate the following table.
### Numerical Example

<table>
<thead>
<tr>
<th>Item (X) no.</th>
<th>Cumulative item fraction</th>
<th>Projected cumulative sales fraction</th>
<th>Projected cumulative sales (Y)</th>
<th>Projected item sales</th>
<th>Turnover ratio</th>
<th>Average inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.10</td>
<td>.716</td>
<td>$64,440</td>
<td>$64,440</td>
<td>8:1</td>
<td>$8,055</td>
</tr>
<tr>
<td>2</td>
<td>.20</td>
<td>.850</td>
<td>76,500</td>
<td>12,060</td>
<td>8:1</td>
<td>1,508</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>.30</td>
<td>.907</td>
<td>81,630</td>
<td>6,630</td>
<td>5:1</td>
<td>1,326</td>
</tr>
<tr>
<td>4</td>
<td>.40</td>
<td>.938</td>
<td>84,420</td>
<td>2,790</td>
<td>5:1</td>
<td>558</td>
</tr>
<tr>
<td>5</td>
<td>.50</td>
<td>.958</td>
<td>86,220</td>
<td>1,800</td>
<td>5:1</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>.60</td>
<td>.971</td>
<td>87,390</td>
<td>1,170</td>
<td>2:1</td>
<td>585</td>
</tr>
<tr>
<td>7</td>
<td>.70</td>
<td>.981</td>
<td>88,290</td>
<td>900</td>
<td>2:1</td>
<td>450</td>
</tr>
<tr>
<td>8</td>
<td>.80</td>
<td>.989</td>
<td>89,010</td>
<td>720</td>
<td>2:1</td>
<td>360</td>
</tr>
<tr>
<td>9</td>
<td>.90</td>
<td>.995</td>
<td>89,550</td>
<td>540</td>
<td>2:1</td>
<td>270</td>
</tr>
<tr>
<td>10</td>
<td>1.00</td>
<td>1.000</td>
<td>90,000</td>
<td>450</td>
<td>2:1</td>
<td>225</td>
</tr>
</tbody>
</table>

$90,000

$13,697
Product characteristics

• Product characteristics affect logistics strategy
• Product characteristics affect type of storage, inventory, transportation, unloading, order processing.
• Following are important characteristics
  – Weight-bulk ratio
  – Value-weight ratio
  – Substitutability
  – Risk
Product characteristics

**Weight/Bulk Ratio**

- **Related to transportation and storage cost**
- **High Ratio product**: ex. steel plate, printed materials, cans, etc.
  - Efficient use of transportation and storage equipment is important.
- **Low Ratio product**: ex. ball, potato chip
  - Transportation and storage cost is high compared with sale price.
  - Efficient use of volume capacity and volume reducing is important.
Product characteristics

- Effect of Weight-Bulk Ratio on Logistics Costs
Product characteristics

Value/Weight Ratio

- **Low:**
  - Products that have low value-weight ratios (e.g., coal, iron ore, bauxite, and sand) also have low storage costs but high movement costs as a percentage of their sales price.
  - Inventory carrying costs are computed as a fraction of the product's value.
  - Low product value means low storage cost, since inventory-carrying cost is the dominant factor in storage cost.
  - Transport Cost are pegged to weight. When the value of the product is low, transport costs represent a high proportion of the sales price.
Value/Weight Ratio

- **High:**
  - High value-weight ratio products (e.g., electronic equipment, jewelry and musical instruments) show higher storage and lower transport costs.
  - This results in a U-shaped total logistics cost curve. Hence, firms dealing with low value-weight ratio products frequently try to negotiate more favorable transportation rates (rates are generally lower for raw materials than for finished products of the same weight).
  - If the product has a high value-weight ratio, minimizing the amount of inventory maintained is a typical reaction. Of course, some firms attempt to adjust an unfavorable value-weight ratio by changing accounting to alter value or by changing procedures packaging requirements to alter weight.
Product characteristics

- Effect of Value-Weight Ratio on Logistics Costs

![Graph showing the effect of value-weight ratio on logistics costs, with curves indicating total costs, transportation costs, and storage costs as a function of value-weight ratio.](image)
Product characteristics

Substitutability

• Products is highly substitutable, when customers find no difference between a firm's product and those of competing suppliers.
• The customer is readily willing to take a second-choice brand when the first is not immediately available.
• Many food and drug products have a highly substitutable characteristic.
• Distribution managers try to provide product availability at a level so that customers will not have to consider a substitute product.
• Logistician has no control over a product's substitutability, yet he must plan for the distribution of products with varying degrees of substitutability.
• Substitutability can be viewed in terms of lost sales to the supplier.
• Higher substitutability usually means a greater chance for a customer to select a competing product, thus resulting in a lost sale for the supplier.
• The logistician generally deals with lost sales through transportation choices, storage choices, or both.
• To illustrate, consider Figure (next slide).
Product characteristics

- Effect of Transport Service and Inventory Level on Logistics Costs
Product characteristics

Risk characteristics

• Product risk characteristics refer to features such as perishability, flammability, value, tendency to explode, and ease of being stolen such as pens, watches, or cigarettes.
• When a product shows high risk in one or more of these features, it simply forces certain restrictions on the distribution system.
• Both transport and storage costs are higher in absolute dollars and as a percentage of the sales price, as shown in Figure (next slide).
• Special care must be taken in their handling and transport.
• Inside warehouses, special fenced-in and locked areas are set up to handle these and similar products.
• Highly perishable products (e.g., fresh fruits and whole blood) require refrigerated storage and transportation, and products that may have a tendency to contaminate fresh food products, such as automobile tires, cannot be stored near them in a warehouse.
• Whether in transportation, storage, or packaging, special treatment adds to the cost of distribution.
Product characteristics

- Effect of Product Risk on Logistics Costs

![Graph showing the effect of product risk on logistics costs](image)
Product Packaging

- Protective packaging is a particularly important dimension of the product for logistics planning.
- In many respects, it is the package that must be the focus of planning, with the product itself of secondary concern.
- It is the package that has shape, volume, and weight. The product may not have the same characteristics.
- The protective package is an added expense that is counterbalanced with lower transportation and storage rates as well as fewer and less extensive damage claims.
- The logistician brings these costs into balance while working closely with sales and engineering to achieve the overall objectives for packaging.
Reasons for Product Packaging

• Facilitate storage and handling
• Promote better utilization of transport equipment
• Provide product protection
• Promote the sale of the product
• Change the product density
• Facilitate product use
• Provide reuse value for the customer
Product Pricing

• Geographic pricing methods
  – F.o.b.(free on board) pricing
  – Zone pricing
  – Single or uniform pricing
  – Freight equalization
  – Basing point pricing

• Incentive pricing
  – quantity discount
  – deal
Product Pricing

UPS Pricing Zones

Zone 8
$147.38

Zone 7
$144.81

Zone 6
$142.43

Zone 5
$140.00

Zone 4
$138.33

Zone 3
$137.38

Zone 2
$136.31

Boston
Product Pricing

- Per-Case Logistics Costs for Price Discounts