Logistics/Supply Chain Customer Service

"Logistics is no longer the 'last frontier of cost reduction,' it's the new frontier of demand generation."

Customer Service in 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
Customer Service Defined

- Customer service is generally presumed to be a means by which companies attempt to differentiate their product, keep customers loyal, increase sales, and improve profits.

- Its elements are:
  - Price
  - Product quality
  - Service

- It is an integral part of the marketing mix of:
  - Price
  - Product
  - Promotion
  - Physical Distribution

- Relative importance of service elements
  - Physical distribution variables dominate price, product, and promotional considerations as customer service considerations
  - Product availability and order cycle time are dominant physical distribution variables

Customer Service Elements

```
Pretransaction elements
- Written statement of policy
- Statement in hands of customer
- Organizational structure
- System flexibility
- Technical services

Transaction elements
- Stockout level
- Ability to back order
- Elements of order cycle
- Time
- Transship
- System accuracy
- Order conveniences
- Product substitution

Posttransaction elements
- Installation, warranty alterations, repairs, parts
- Product tracking
- Customer claims, complaints
- Product packaging
- Temporary replacement of product during repairs
```
### Common Customer Service Complaints

- **31%** Product or quality mistakes
- **12%** Damaged goods
- **6%** Frequently cut items
- **7%** Other
- **44%** Late delivery

### Penalties for Customer Service Failures

- **29%** Reduced the volume of business
- **16%** Discontinued items
- **26%** Called in salesman or manager
- **9%** Refused to purchase new items
- **18%** Stopped all purchases with supplier
- **2%** Refused to support promotion

Most Important Customer Service Elements

- On-time delivery
- Order fill rate
- Product condition
- Accurate documentation

Appraise This Measure of Logistics Customer Service

Percent of customer orders shipped by customer request date

Parker-Hannifin Corp.
Order Cycle Time

- Order cycle time contains the basic elements of customer service where logistics customer service is defined as:

  *the time elapsed between when a customer order, purchase order, or service request is placed by a customer and when it is received by that customer.*

- Order cycle elements
  - Transport time
  - Order transmittal time
  - Order processing and assembly time
  - Production time
  - Stock availability

- Order cycle time is expressed as a bimodal frequency distribution

- Constraints on order cycle time
  - Order processing priorities
  - Order condition standards (e.g., damage and filling accuracy)
  - Order constraints (e.g., size minimum and placement schedule)

Components of a Customer Order Cycle
Importance of Logistics Customer Service

- Service affects sales
  - From a GTE/Sylvania study:
    
    ...distribution, when it provides the proper levels of service to meet customer needs, can lead directly to increased sales, increased market share, and ultimately to increased profit contribution and growth.
  
  - Service differences have been shown to account for 5 to 6% variation in supplier sales

- Service affects customer patronage
  - Service plays a critical role in maintaining the customer base:
    
    On the average it is approximately 6 times more expensive to develop a new customer than it is to keep a current one.

Service Observations

- The dominant customer service elements are logistical in nature

- Late delivery is the most common service complaint and speed of delivery is the most important service element

- The penalty for service failure is primarily reduced patronage, i.e., lost sales

- The logistics customer service effect on sales is difficult to determine
Modeling a Sales-Service Relationship

- A mathematical expression of the level of service provided and the revenue generated
- It is needed to find the optimal service level
- A theoretical basis for the relationship
- Methods for determining the curve in practice
  - Two-points method
  - Before-after experiments
  - Game playing
  - Buyer surveys

Remember
Revenue in ROLA

Sales-Service Relationship by the Two-Points Method

Approximation by two-points method
Determining Optimum Service Levels

- Cost vs. service
- Theory
  - Optimum profit is the point where profit contribution equals marginal cost
- Practice
  - For a constant rate,
    \[ \Delta P = \text{trading margin} \times \text{sales response rate} \times \text{annual sales} \]
    \[ \Delta C = \text{annual carrying cost} \times \text{standard product cost} \times \text{demand standard deviation} \times \text{over replenishment lead-time} \times \Delta z \]
  - Set \( \Delta P = \Delta C \) and find \( \Delta z \) corresponding to a specific service level
Determining Optimum Service Levels  
(Cont’d)

- Example
  - Given the following data for a particular product

  Sales response rate = 0.15% change in revenue for a 1% change in the service level (fill rate)

  Trading margin = $0.75 per case
  Carrying cost = 25% per year
  Annual sales through the warehouse = 80,000 cases
  Standard product cost = $10.00
  Demand standard deviation = 500 cases over LT
  Lead time = 1 week
Determining Optimum Service Levels  
(Cont’d)

Find $\Delta P$

$$\Delta P = 0.75 \times 0.0015 \times 80,000$$

$$= \$90.00 \text{ per year}$$

Find $\Delta C$

$$\Delta C = 0.25 \times 10.00 \times 500 \times \Delta z$$

$$= 1250 \Delta z$$

Set $\Delta P = \Delta C$ and solve for $\Delta z$, i.e., $\frac{90.00}{1250} = \Delta z$

$$\Delta z = 0.072$$

For the change in $z$ found in a normal distribution table, the optimal in-stock probability during the lead time ($SL^*$) is about 92%.

$\Delta SL$ Levels in % for Various $\Delta z$ Values

<table>
<thead>
<tr>
<th>$\Delta SL$ (%)</th>
<th>$z_U$</th>
<th>$z_L$</th>
<th>$\Delta z$</th>
</tr>
</thead>
<tbody>
<tr>
<td>87-86</td>
<td>1.125</td>
<td>1.08</td>
<td>0.045</td>
</tr>
<tr>
<td>88-87</td>
<td>1.17</td>
<td>-1.125</td>
<td>0.045</td>
</tr>
<tr>
<td>89-88</td>
<td>1.23</td>
<td>-1.17</td>
<td>0.05</td>
</tr>
<tr>
<td>90-89</td>
<td>1.28</td>
<td>-1.23</td>
<td>0.05</td>
</tr>
<tr>
<td>91-90</td>
<td>1.34</td>
<td>-1.28</td>
<td>0.06</td>
</tr>
<tr>
<td>92-91</td>
<td>1.41</td>
<td>-1.34</td>
<td>0.07</td>
</tr>
<tr>
<td>93-92</td>
<td>1.48</td>
<td>-1.41</td>
<td>0.07</td>
</tr>
<tr>
<td>94-93</td>
<td>1.55</td>
<td>-1.48</td>
<td>0.07</td>
</tr>
<tr>
<td>95-94</td>
<td>1.65</td>
<td>-1.55</td>
<td>0.10</td>
</tr>
<tr>
<td>96-95</td>
<td>1.75</td>
<td>-1.65</td>
<td>0.10</td>
</tr>
<tr>
<td>97-96</td>
<td>1.88</td>
<td>-1.75</td>
<td>0.13</td>
</tr>
<tr>
<td>98-97</td>
<td>2.05</td>
<td>-1.88</td>
<td>0.17</td>
</tr>
<tr>
<td>99-98</td>
<td>2.33</td>
<td>-2.05</td>
<td>0.28</td>
</tr>
</tbody>
</table>

*Developed from entries in a normal distribution table
Graphically Setting the Service Level

![Graph showing probability of being in stock during replenishment lead time, change in gross profit, and change in safety stock cost.]

Optimizing on Service Performance Variability

Setting service variability according to Taguchi

- A loss function of the form $L = k(y - m)^2$
  - $L = \text{loss in } \$$
  - $k = \text{a constant to be determined}$
  - $y = \text{value of the service variable}$
  - $m = \text{the target value of the service variable}$

- Service penalty only if outside this range—Traditional
- Missing target causes increasing penalty — Taguchi
Setting the allowable deviation from the target service level \( m \) is to optimize the sum of penalty cost for not meeting the service target and the cost of producing the service.

\[
TC = \text{service penalty cost} + \text{service delivery cost}
\]

If the service delivery cost is of the general form \( DC = A - B(y-m) \), then find the optimum allowed deviation from the service target.

\[
\frac{dTC}{d(y-m)} = 2k(y-m) + 0 - B = 0
\]

\[
y - m = \frac{B}{2k}
\]

Marginal delivery cost = marginal penalty cost

If \( m \) is set to 0, \( y \) is the optimal deviation allowed from target

---

### Service Variability Example

*Example*  Pizzas are to be delivered in 30 minutes (target.) Pizzas delivered more than 10 minutes late incur a penalty of $3 off the pizza bill. Delivery costs are estimated at $2, but decline at the rate of $0.15 for each minute deviation from target. How much variation should be allowed in the delivery service?

Find \( k \)

\[
L = k(y - m)^2
\]

\[
3 = k(10 - 0)^2
\]

\[
k = \frac{3}{10^2} = 0.03
\]

and \( y \) if \( m \) is taken as 0

\[
y - 0 = \frac{0.15}{2(0.03)} = 2.5 \text{ minutes}
\]

No more than 2.5 minutes should be allowed from the 30-minute delivery target to minimize cost.
Setting Service Levels

- Service treated as a constraint on design
- Planning for service contingencies

Measuring Service Performance

- Percent of sales on backorder
- No. of stockouts
- Percent of on-time deliveries
- No. of inaccurate orders
- Order cycle time
- Fill rate--% of demand met, % of orders filled complete, etc.

Service Contingencies

System Breakdown Actions

- Insure the risk
- Plan for alternate supply sources
- Arrange alternate transportation
- Shift demand
- Build quick response to demand shifts
- Set inventories for disruptions

Product Recall Actions

- Establish a task force committee
- Trace the product
- Design a reverse logistics channel