ISM 270

Service Engineering and Management
Lecture 5: Facility Location, Project Management, Forecasting
Announcements

- Assignment 2 is Due May 12, 2009
- Read Chapters 7, 8 and 9 for April 30 Class
- Read Chapters 10 and 11 for May 5 Class
- Read Growing Negative Services by Morgan and Rao for May 5 Class
- Project Progress
  - Submit Report Draft: June 2, 2009
Class Project: New Service Development

- Individual Projects, unless otherwise arranged
- Choose a new service idea
  - (a) Develop a prototype or overview
  - (b) Develop the business case as to why idea is profitable, competitive, etc.
- Both of these must be included, but emphasis can be on either (a) or (b) above
Project Deliverables

- Preliminary Proposal (April 28)
- Written Report Draft (June 2)
  - Include both business plan and service description
  - Can focus more heavily on either plan or prototype
- Presentation on June 9
  - 20 minutes + 10 minutes questions
Written Report

- Think 10-page
- Professional presentation
- Make use of charts, tables
- Include some estimates of numbers (even if preliminary)
  - Market size
  - Profit potential
Project Presentation

- 30 minutes – 20 min presentation, 10 min questions
- Clear presentation of service idea
  - Prototype demonstration/screenshot/outline
  - Differentiate from competition
  - Give market estimation
    - How many potential customers?
    - How will you make money?
    - What are the risks?
  - Argue why this will lead to successful service business
Today’s Themes

- Designing a Service Facility
  - Where
  - What components?
  - What does the process look like to deliver service?
  - (loosely taken from ‘the supporting facility’ and ‘facility location’ chapters)
Process Analysis Terminology

- **Cycle Time** is the average time between completions of successive units.
- **Bottleneck** is the factor that limits production usually the slowest operation.
- **Capacity** is a measure of output per unit time when *fully busy*.
- **Capacity Utilization** is a measure of how much output is actually achieved.
- **Throughput Time** is the time to complete a process from time of arrival to time of exit.
Process Analysis Terminology (cont.)

- **Rush Order Flow Time** is the time to go through the system without any queue time.
- **Direct Labor Content** is the actual amount of work time consumed.
- **Total Direct Labor Content** is the sum of all the operations times.
- **Direct Labor Utilization** is a measure of the percentage of time that workers are actually contributing value to the service.
Process Flow Diagram of Mortgage Services

- Mortgage Applications
- Property Survey CT=90 min.
- Credit Report CT=45 min.
- Title Search CT=30 min.
- Completed Applications
- Final Approval CT=15 min.
- Unapproved Mortgages
- Approved Mortgages

Operation and cycle time
Decision
Wait
Flow of customers/goods/information
Product Layout: Work Allocation Problem

Automobile Driver’s License Office

<table>
<thead>
<tr>
<th>Activity</th>
<th>Number(s)</th>
<th>Capacity per hour</th>
<th>Cycle Time in seconds</th>
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<tbody>
<tr>
<td>Review</td>
<td>1, 2, 3</td>
<td>15, 30, 60</td>
<td>120</td>
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<tr>
<td>Payment</td>
<td>2, 6</td>
<td>120, 30</td>
<td>60</td>
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<tr>
<td>Violations</td>
<td>3, 5</td>
<td>60, 40</td>
<td>90</td>
</tr>
<tr>
<td>Eye Test</td>
<td>4, 6</td>
<td>40, 20</td>
<td>180</td>
</tr>
<tr>
<td>Photograph</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issue</td>
<td>5, 6</td>
<td>30, 120</td>
<td></td>
</tr>
</tbody>
</table>

Where will bottleneck occur? What could be done about it?
Automobile Driver’s License Office (Improved Layout)
Process Layout
Relative Location Problem
Operations Sequence Analysis
Ocean World Theme Park Daily Flows

Flow matrix

Triangularized matrix

Description of attractions: A=killer whale, B=sea lions, C=dolphins, D=water skiing, E=aquarium, F=water rides.
Ocean World Theme Park  
(Proposed Layout)

(a) Initial layout

<table>
<thead>
<tr>
<th>Pair</th>
<th>Flow distances</th>
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<tbody>
<tr>
<td>AC</td>
<td>30 * 2 = 60</td>
</tr>
<tr>
<td>AF</td>
<td>6 * 2 = 12</td>
</tr>
<tr>
<td>DC</td>
<td>20 * 2 = 40</td>
</tr>
<tr>
<td>DF</td>
<td>6 * 2 = 12</td>
</tr>
<tr>
<td>Total</td>
<td>124</td>
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(b) Move C close to A

<table>
<thead>
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<th>Flow distances</th>
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<tbody>
<tr>
<td>CD</td>
<td>20 * 2 = 40</td>
</tr>
<tr>
<td>CF</td>
<td>8 * 2 = 16</td>
</tr>
<tr>
<td>DF</td>
<td>6 * 2 = 12</td>
</tr>
<tr>
<td>AF</td>
<td>6 * 2 = 12</td>
</tr>
<tr>
<td>CE</td>
<td>8 * 2 = 16</td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
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(c) Exchange A and C

<table>
<thead>
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<th>Pair</th>
<th>Flow distances</th>
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</thead>
<tbody>
<tr>
<td>AE</td>
<td>15 * 2 = 30</td>
</tr>
<tr>
<td>CF</td>
<td>8 * 2 = 16</td>
</tr>
<tr>
<td>AF</td>
<td>6 * 2 = 12</td>
</tr>
<tr>
<td>AD</td>
<td>0 * 2 = 0</td>
</tr>
<tr>
<td>DF</td>
<td>6 * 2 = 12</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
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(d) Exchange B and E and move F

<table>
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<th>Pair</th>
<th>Flow distances</th>
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</thead>
<tbody>
<tr>
<td>AB</td>
<td>15 * 2 = 30</td>
</tr>
<tr>
<td>AD</td>
<td>0 * 2 = 0</td>
</tr>
<tr>
<td>FB</td>
<td>8 * 2 = 16</td>
</tr>
<tr>
<td>FD</td>
<td>6 * 2 = 12</td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
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Servicescapes

*Designing Physical Surroundings to Affect Employee and Customer Behavior*

- **Ambient Conditions**: background characteristics such as noise level, music, lighting, temperature, and scent.

- **Spatial Layout and Functionality**: reception area, circulation paths of employees and customers, and focal points.

- **Signs, Symbols, and Artifacts**: selection, orientation, location, and size of objects.
## Typology of Servicescapes

<table>
<thead>
<tr>
<th>Who Performs in Servicescape</th>
<th>Physical Complexity of the Servicescape</th>
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</thead>
<tbody>
<tr>
<td><strong>Self-service (customer only)</strong></td>
<td>Golf course Water slide park</td>
</tr>
<tr>
<td><strong>Interpersonal (both)</strong></td>
<td>Luxury hotel Airline terminal</td>
</tr>
<tr>
<td><strong>Remote service (employee only)</strong></td>
<td>Research lab L.L. Bean</td>
</tr>
</tbody>
</table>
Facility Design Considerations

- Nature and Objectives of Service Organization
- Land Availability and Space Requirements
- Flexibility
- Security
- Aesthetic Factors
- The Community and Environment
Environmental Orientation Considerations

- Need for spatial cues to orient visitors
- Formula facilities draw on previous experience
- Entrance atrium allows visitors to gain a quick orientation and observe others for behavioral cues
- Orientation aids and signage such as “You Are Here” maps reduce anxiety
Service Facility Location
Service Facility Location Planning

- Competitive positioning: *prime location can be barrier to entry.*
- Demand management: *diverse set of market generators.*
- Flexibility: *plan for future economic changes and portfolio effect.*
- Expansion strategy: *contiguous, regional followed by “fill-in,” or concentrated.*
Geographic Representation

Location on a Plane

Euclidean

\[ d_{ij} = \left( (x_i - x_j)^2 + (y_i - y_j)^2 \right)^{1/2} \]

Metropolitan

\[ d_{ij} = |x_i - x_j| + |y_i - y_j| \]
Effect of Optimization Criteria

1. **Maximize Utilization**
   (City C: elderly find distance a barrier)

2. **Minimize Distance per Capita**
   (City B: centrally located)

3. **Minimize Distance per Visit**
   (City A: many frequent users)
Estimation of Geographic Demand

- Define the Target Market
  (Families with income above $60k)
- Select a Unit of Area
  (Census track, ZIP code)
- Estimate Geographic Demand
  (Regression analysis)
- Map Geographic Demand
  (3D visual depiction)
Single Facility Location Using Cross Median Approach

1 \( (W_1=7) \)  
2 \( (W_2=1) \)  
3 \( (W_3=3) \)  
4 \( (W_4=5) \)
Single Facility Location Using Cross Median Approach

Solution is line segment y=2, x=2,3
Huff Retail Location Model

First, a gravity analogy is used to estimate attractiveness of store $j$ for customers in area $i$.

$A_{ij} = \text{Attraction to store } j \text{ for customers in area } i$

$S_j = \text{Size of the store (e.g. square feet)}$

$T_{ij} = \text{Travel time from area } i \text{ to store } j$

$\lambda = \text{Parameter reflecting propensity to travel}$
Huff Retail Location Model

*Second, to account for competitors we calculate the probability that customers from area i will visit a particular store j.*

\[ P_{ij} = \frac{A_{ij}}{\sum_{j=1}^{n} A_{ij}} \]
Huff Retail Location Model

Third, annual customer expenditures for item $k$ at store $j$ can now be calculated.

$P_{ij} = \text{Probability customers from area } i \text{ travel to store } j$

$C_i = \text{Number of customers in area } i \text{ (e.g. census track)}$

$B_{ik} = \text{Annual budget for product } k \text{ for customers in area } i$

$m = \text{Number of customer areas in the market region}$

$$E_{jk} = \sum_{j=1}^{m} \left( P_{ij} C_i B_{ik} \right)$$
Fourth, market share of product $k$ purchased at store $j$ can now be calculated.

$$M_{jk} = \frac{E_{jk}}{\sum_{i=1}^{m} (C_i B_{ik})}$$
Site Selection Considerations

1. Access:
   - Convenient to freeway exit and parking
   - Entrance ramps
   - Served by public transportation

2. Visibility:
   - Set back from street
   - Surrounding clutter
   - Sign placement

3. Traffic:
   - Traffic volume on street that may indicate potential impulse buying
   - Traffic congestion that could be a hindrance (e.g., fire stations)

4. Parking:
   - Adequate off-street

5. Expansion:
   - Room for expansion

6. Environment:
   - Immediate surroundings should complement the service

7. Competition:
   - Location of competitors

8. Government:
   - Zoning restrictions
   - Taxes
Breaking the Rules

- **Competitive Clustering** (Among Competitors)
  (e.g. Auto Dealers, Motels)

- **Saturation Marketing** (Same Firm)
  (e.g. An Bon Pain, Ice Cream Vendors)

- **Marketing Intermediaries**
  (e.g. Credit Cards, HMO)

- **Substitute Electronic Media for Travel**
  (e.g. telecommuting, e-Commerce)

- **Impact of the Internet on Service Location**
  (e.g. Amazon.com, eBay, FedEx)
## Strategic Location Considerations

<table>
<thead>
<tr>
<th></th>
<th>Front Office</th>
<th>Back Office</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Customer</strong></td>
<td><em>Is travel out to customer or customer travel to site?</em></td>
<td><em>Is service performed on person or property?</em></td>
</tr>
<tr>
<td>(consumer)</td>
<td><em>Can electronic media substitute for physical travel?</em></td>
<td><em>Is co-location necessary?</em></td>
</tr>
<tr>
<td></td>
<td><em>Is location a barrier to entry?</em></td>
<td><em>How is communication accomplished?</em></td>
</tr>
<tr>
<td><strong>Internal Customer</strong></td>
<td><em>Availability of labor?</em></td>
<td><em>Are economies of scale possible?</em></td>
</tr>
<tr>
<td>(employee)</td>
<td><em>Are self-service kiosks an alternative?</em></td>
<td><em>Can employees work from home?</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Is offshoring an option?</em></td>
</tr>
</tbody>
</table>
Discussion

- How do the rules change when service encounter is offered over web?