Production and Operations Management

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Outline
- Production and Operations
- Systems Approach to P/OM
- Modeling Production Systems
- Course Topics

P/OM
- Production management
  - Historically associated with manufacturing
- Operations management
  - Emphasis on services applications
- P/OM
  - The fields have merged
  - Common approaches to managing the creation of products & services

Objective of P/OM
- The efficient creation of quality goods and services
- Is accomplished by designing and optimizing production facilities and processes

Production Manager's Job
- Planning
  - Capacity
  - Location
  - Products and services
  - Make or buy
  - Layout
  - Projects
  - Scheduling
- Controlling
  - Inventory
  - Quality
- Organizing
  - Degree of centralization
  - Subcontracting
- Staffing
  - Hiring/laying off
  - Use of overtime
- Directing
  - Incentive plans
  - Issuance of work orders
  - Job assignments
Systems Approach to P/OM

What is a System?
- A collection of related parts forming an integrated whole
- Examples:
  - Information system
  - Transportation system
  - Educational system
  - Marketing system
  - Production system

Elements of a System
- The parts or elements of a system should be designed to work together to achieve the overall system goal
  - Systems have objectives
  - Better systems achieve those objectives efficiently
  - The best systems optimize the elements and their interactions

Example: A Car
- A car is a transportation system with:
  - Power-transmission system: for movement
  - Braking system: to retard movement
  - Steering system: for guidance
- All subsystems work together to achieve the car’s objectives

Businesses as Systems
A business is a system with a set of goals

Business Subsystems
- Component subsystems include:
  - Production system — to create goods and services
  - Marketing system — to sell goods and services produced
  - Financial system — to manage funding
Optimizing Systems

- Optimizing the individual components
  - Production system:
    - Create only one product/service
    - Specialize process for optimal production
  - Marketing system:
    - Sell many products and services
    - Satisfy all customer demands to maximize revenues generated

For the best overall system solution
- Make several products/services
- Neither subsystem is optimized in isolation
- The overall organization benefits
- Optimize globally, not locally

Six Elements of Systems

- Objectives
- Constraints
- Inputs
- Outputs
- Processing
- Control

1. Objectives

- Goals of a business?
- Other tempering objectives:
- For measuring and evaluating a system
- May be undefined or unstated

2. Constraints

- Limits on possible actions
- Some come from other entities in the operating environment, such as:
Example Constraints

- Legal
- Financial
- Labor
- Technology

System as Transformer

- A system can be viewed as a transformer
- Processing "inputs" into "outputs"
- Inputs are resources used to create the performance/quality outputs

3. Inputs

- Those resources used to create system outputs
- Business examples:

4. Outputs

- That which is to be produced
- Usually contribute to achieving objectives

5. Processing

- Manipulation of the inputs to achieve the outputs
- How work is accomplished
- How value is added

Food Manufacturing System

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Processing</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Vegetables</td>
<td>Cleaning</td>
<td>Canned vegetables</td>
</tr>
<tr>
<td>Metal Sheets</td>
<td>Making cans</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Cutting</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>Cooking</td>
<td></td>
</tr>
<tr>
<td>Labor</td>
<td>Packing</td>
<td></td>
</tr>
<tr>
<td>Building</td>
<td>Labeling</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hospital Service System

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Processing</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors, nurses</td>
<td>Examination</td>
<td>Healthy patients</td>
</tr>
<tr>
<td>Hospital</td>
<td>Surgery</td>
<td></td>
</tr>
<tr>
<td>Medical Supplies</td>
<td>Monitoring</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>Medication</td>
<td></td>
</tr>
<tr>
<td>Laboratories</td>
<td>Therapy</td>
<td></td>
</tr>
</tbody>
</table>

Types of Processing

- Three basic processing arrangements:
  - Project: one-time piece of work
    - Construction, political convention
  - Flow-shop: highly repetitive, continuous process
    - Auto & paper production, directory assistance
  - Job-shop: small batches of large variety
    - Machine shop, hospital, restaurant
- Each covered in detail later in course

6. Monitoring and Control

- Control: the ability to regulate the operation of the system
- Purposes:
  - Insure accuracy by detecting errors
  - Prevent system misuse or destruction
  - Direct the system toward its objectives

Example System Controls

- Information and computer systems:

- Air transportation systems:

- Production systems:

Value Added

\[
\text{Value added} = \text{the difference between the cost of inputs and the value or price of outputs.}
\]

Modeling Production & Operations Systems
### Models

- Simplified representations of reality
  - Useful model: accurate enough
- Many types of system models:
  - Physical: wind-tunnel
  - Schematic: blueprints, road maps
  - Mathematical: spreadsheets, simulation, optimization (variables, equations, program)

### Production/Operations Models

- Systems Planning
  - Forecasting
  - Decision analysis
  - Linear programming
  - Network flow
  - Facility location
  - Facility layout
- Projects
  - CPM, Pert
  - Resource constraints
- Job Shop
  - Aggregate scheduling
  - Sequencing and scheduling

### Production/Operations Models

- Flow-shop:
  - Line balancing
  - Queuing
  - Simulation
- Process Improvement
  - Total quality management
  - Cycle-time reduction
- Control
  - Quality control
  - Inventory control
  - MRP
  - Just-in-time