PMBA8155 Operations Management

Process Analysis

Learning Objectives

- Understand
  - Process flowcharting
  - Types of Process:
    - multistage vs. single stage
    - make-to-order vs. make-to-stock
  - Blocking vs. starving
- Understand and Calculate Various Measures of Process Performance

What Is A Process?

- A process is a collection of activities that transforms inputs into outputs that are valuable to the customer
- Any part of an organization that takes inputs and transforms them into outputs is a process
- Process analysis is to systematically examine all aspects of a process to improve its operations with regard to cost, quality, speed, and responsiveness
**Process Flowchart**

- Diagram showing the major elements of a process and their interconnections
  - tasks or operations
  - flows of materials or customers
  - storage areas or queues.

**Process Flowchart**

**Symbols**

- Tasks or operations
- Decision Points
- Storage areas or queues
- Flows of materials or customers

**Process Flowchart**

**Examples:** Hamburger Making Process

1. **McDonald's**

   - Customer order
   - Cook
   - Assemble
   - Finished burgers
   - Deliver

2. **Burger King**

   - Customer order
   - Cook
   - Decide
   - Assemble
   - Custom or Standard?
   - Assemble
   - Deliver

3. **Wendy's**

   - Customer order
   - Cook
   - Assemble
   - Chili
   - Deliver
Types of Processes

- Single-stage vs. Multistage

![Diagram of Single-stage vs. Multistage Processes]

Types of Process

Multistage Process with Buffer

- What might happen without buffers?
  - Blocking: occurs when the activities in a stage must stop because there is no place to deposit the item (Stage 1 when it is faster)
  - Starving: occurs when the activities in a stage must stop because there is no work (Stage 2 when it is faster)
  - Bottleneck: the stage that limits the capacity of the process (the slowest stage)

Types of Process

Make-to-stock vs. Make-to-order

Make-to-stock Process

![Diagram of Make-to-stock Process]

Make-to-order Process

![Diagram of Make-to-order Process]
Types of Process

Paced vs. Non-paced

- Pacing refers to the fixed timing of the movement of items through the process
- Assembly lines are often paced (e.g. every 30 seconds, there is a movement of items from stage to stage)
- Most service processes are non-paced

"You can not improve what you can't measure"

Process Performance Metrics

- **Operation time** = Setup time + Run time
- **Flow time** = Average time for a unit to move through the system
- **Cycle time** = Average time between completion of successive units
- **Throughput rate** = \( \frac{1}{\text{Cycle time}} \)

Important Notice Regarding the Use of Performance Measures

- These measures are designed to be used when a production system has reached *steady state*
- A steady state is the state of the system when the system characteristics such as production rate do not change over time
- Typically, the steady state is reached after the system has been in operations for some time
  - For example, the production rate at the beginning of the day when the system is idle is different than when the system has been operated for a while
### Example 1

Cycle time = 3 minutes

Throughput rate = \( \frac{1}{3} \) units/min = 20 units/hr = 120 units/day

Flow time = 3 + 3 + 3 = 9 minutes

### Example 2

Cycle time = 3 minutes

Throughput rate = 120 units/day

Flow time = 3 + 3 + 1 = 7 minutes

### Example 3

Cycle time = 3 minutes

Throughput rate = 120 units/day

Flow time = A fairly big number

At the end of the day, how many items are in the buffer? = \( \frac{1}{2} - \frac{1}{3} \) x 60 x 8 = 80
Lesson 1: The throughput rate (capacity) of a process is determined by the bottleneck stage, not the flow time.

Lesson 2: Adding buffer (inventory holding area) doesn’t change the capacity of a process but can make it slower in terms of the flow time.

In-Class Exercise

Driver License Renewals

- How many applications per hour can be reviewed?
- What is the cycle time of this process?
- What is the process throughput rate per hour?
- If two buffers are added right before and after Check Violations, how many applicants will be in after one hour of operations?
- How many applications can be processed per hour if a second clerk is added to check for violations?