

Chapter 5 Process Analysis

October 8, 2008

OBJECTIVES

- ▶ **Process Analysis**
- ▶ **Process Flowcharting**
- ▶ **Types of Processes**
- ▶ **Process Performance Metrics**

Process Analysis Terms

- ▶ **Process:** Is any part of an organization that takes inputs and transforms them into outputs
- ▶ **Cycle Time:** Is the average successive time between completions of successive units
- ▶ **Utilization:** Is the ratio of the time that a resource is actually activated relative to the time that it is available for use

Process Flowcharting *Defined*

- ▶ **Process flowcharting** is the use of a diagram to present the major elements of a process
- ▶ The basic elements can include tasks or operations, flows of materials or customers, decision points, and storage areas or queues
- ▶ It is an ideal methodology by which to begin analyzing a process

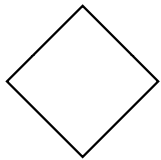
Flowchart Symbols

Purpose and Examples



Tasks or operations

Examples: Giving an admission ticket to a customer, installing an engine in a car, etc.



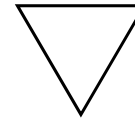
Decision Points

Examples: How much change should be given to a customer, which wrench should be used, etc.

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Flowchart Symbols

Purpose and Examples



Storage areas or queues

Examples: Sheds, lines of people waiting for a service, etc.

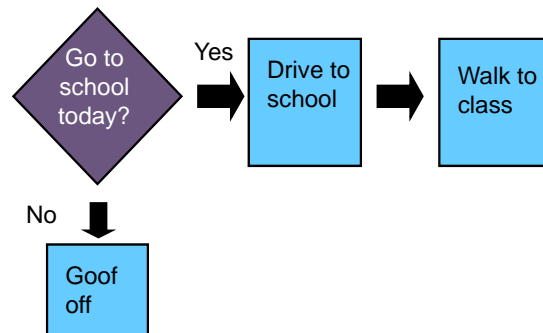


Flows of materials or customers

Examples: Customers moving to a seat, mechanic getting a tool, etc.

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Example: Flowchart of Student Going to School

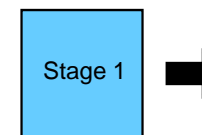


cf. p. 157

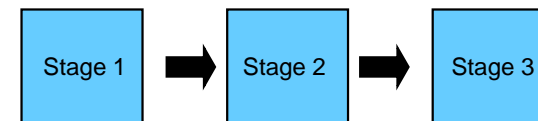
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Types of Processes

Single-stage Process



Multi-stage Process

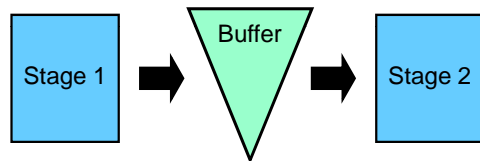


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Types of Processes (Continued)

A **buffer** refers to a storage area between stages where the output of a stage is placed prior to being used in a downstream stage

Multi-stage Process with Buffer



Other Process Terminology

▶ Blocking

- ▶ Occurs when the activities in a stage must stop because there is no place to deposit the item just completed
- ▶ If there is no room for an employee to place a unit of work down, the employee will hold on to it and not able to continue working on the next unit

▶ Starving

- ▶ Occurs when the activities in a stage must stop because there is no work
- ▶ If an employee is waiting at a work station and no work is coming to the employee to process, the employee will remain idle until the next unit of work comes

Other Process Terminology (Continued)

▶ Bottleneck

- ▶ Occurs when the limited capacity of a process causes work to pile up or become unevenly distributed in the flow of a process
- ▶ If an employee works too slow in a multi-stage process, work will begin to pile up in front of that employee. In this case, the employee represents the limited capacity causing the bottleneck.

▶ Pacing

- ▶ Refers to the fixed timing of the movement of items through the process

Other Types of Processes

▶ Make-to-order

- ▶ Only activated in response to an actual order
- ▶ Both work-in-process and finished goods inventory kept to a minimum

▶ Make-to-stock

- ▶ Process activated to meet expected or forecast demand
- ▶ Customer orders are served from target stocking level

▶ Hybrid

- ▶ Combine the features of both make-to-order and make-to-stock.

▶ cf. p. 161.

Process Performance Metrics

- ▶ Operation time = Setup time + Run time
- ▶ Throughput time = Average time for a unit to move through the system
- ▶ Velocity = $\frac{\text{Throughput time}}{\text{Value-added time}}$

Process Performance Metrics (Continued)

- ▶ Cycle time = Average time between completion of units
- ▶ Throughput rate = $\frac{1}{\text{Cycle time}}$.
- ▶ Efficiency = $\frac{\text{Actual output}}{\text{Standard Output}}$.

Process Performance Metrics (Continued)

- ▶ Productivity = $\frac{\text{Output}}{\text{Input}}$
- ▶ Utilization = $\frac{\text{Time Activated}}{\text{Time Available}}$.

Cycle Time Example

Suppose you had to produce 600 units in 80 hours to meet the demand requirements of a product. What is the cycle time to meet this demand requirement?

Answer: There are 4,800 minutes (60 minutes/hour x 80 hours) in 80 hours. So the average time between completions would have to be: Cycle time = $4,800/600$ units = 8 minutes.

Process Throughput Time Reduction

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- ▶ Perform activities in parallel
- ▶ Change the sequence of activities
- ▶ Reduce interruptions

- ▶ cf. New product/process design- Gortac Manufacturing (GTE6.avi)

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Question Bowl

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- Which of the following are possible examples of “cycle times”?
- a. Time for each television to come off an assembly line.
 - b. Time it takes for a stock purchase
 - c. Time it takes for an instructor to grade an exam
 - d. Time it takes to build an automobile
 - e. All of the above

Answer: e. All of the above

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Question Bowl

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Which of the following are used as symbols in a Process Flowchart?

- a. Decision points
- b. Blocking
- c. Starving
- d. Bottleneck
- e. All of the above

Answer: a. Decision points (A diamond shaped symbol.)

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Question Bowl

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Which type of process is configured as follows?



- a. Single-stage process
- b. Multi-stage process
- c. Make-to-order process
- d. Make-to-stock process
- e. All of the above

Answer: b. Multi-stage process

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Question Bowl

When an assembly line employee is waiting for a unit of work to come down the line so they can stop being idle and get back to work, it is an example of which of the following process terms?

- a. Buffering
- b. Blocking
- c. Starving
- d. Bottleneck
- e. All of the above

Answer: c. Starving

Question Bowl

When a company waits until they have an order for their product in hand before beginning any production for that order, we can characterize their operation as which of the following processes?

- a. Single-stage process
- b. Multi-stage process
- c. Make-to-order process
- d. Make-to-stock process
- e. All of the above

Answer: c. Make-to-order process

Question Bowl

If the Run Time for a batch of parts is 45 minutes on a machine, and the Setup Time is 65 minutes, which of the following is the Operation Time?

- a. 75 minutes
- b. 110 minutes
- c. Only 45 minutes
- d. 65/45 minutes or 1.44 hours
- e. Can not be computed on the data above

Answer: b. 110 minutes (Operation Time is the sum of Run Time and Setup Time, or $65 + 45 = 110$ minutes)

Question Bowl

If the standard expected phone calls for a telephone marketers is 24 per hour, and one telephone marketer did 27 per hour, which of the following can be used to describe their Efficiency?

- a. 88.8%
- b. 100%
- c. 112.5%
- d. Well over 150%
- e. Can not computed on the information given.

Answer: c. 112.5%

(Ratio of actual performance/expected performance, or $(27/24) \times 100 = 110$ minutes)

Course Project Proposal

- ▶ **October 22, 2008**
- ▶ **At most ten minutes**
- ▶ **Content should cover:**
 - ▶ Group members
 - ▶ A detailed description of your product or service
 - ▶ Idea development
 - ▶ Preliminary design
 - ▶ Description of resources necessary to manufacture your product
 - ▶ Preliminary process flowchart
- ▶ **Each team member must have taken part in the presentation**
- ▶ **Prepare a hard copy of your slides to instructor**