4 - 5 | Process Strategy and Analysis

OM 201
Principles of operations management

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Lecture Outline

Topics

- Process Analysis
- Systematic Process Analysis
- Process Flowcharting
- Types of Process
- Process Performance Measure
- *Case Study: Kristen's Cookie*

Learning Objectives

- *Be able to analyze process systematically*
- *Be able design an efficient process*

Reference

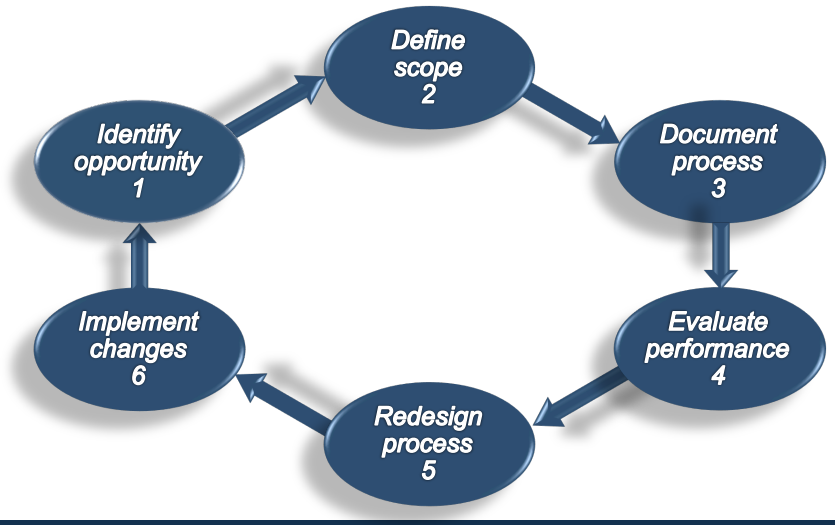
- Roberta Russell & Bernard W. Taylor, (2009), *Operations Management along the supply chain* (CHAPTER 6) Ed 6, John Wiley &Son

Process Analysis in Practice
McDonald's

Objective of Process Analysis

To be able to answer the following key questions:

- How many customers can the process handle per hour?
- How long will it take to serve a customer?
- What change is needed in the process to expand capacity?
- How much does the process cost?
- What part of process should be improved or eliminated in order to reduce ***non-value added cost or activity***?

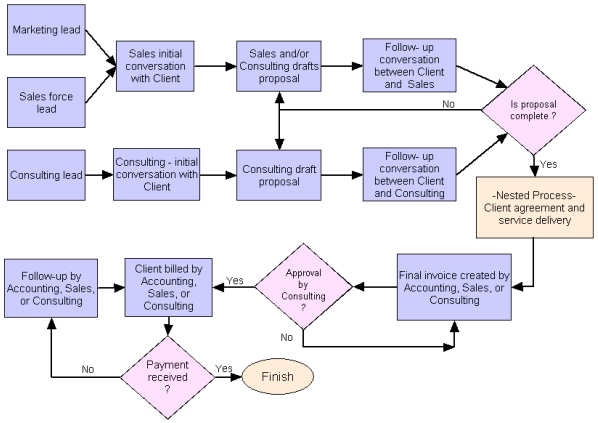


Process Flowcharting

Process flowcharting is the use of a diagram to present the major elements of a process

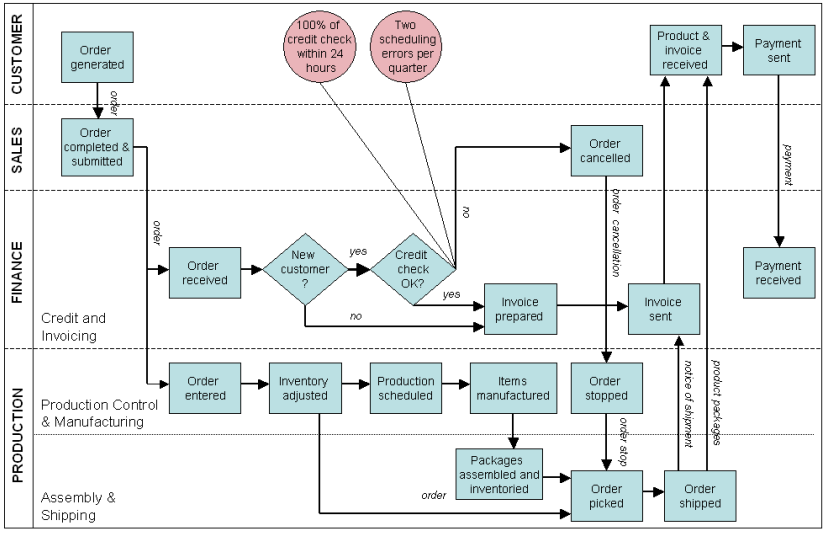
It is an ideal methodology by which to begin analyzing a process

The basic elements can include tasks or operations, flows of materials or customers, decision points, and storage areas or queues

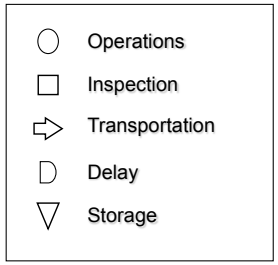


Example of Flowchart of the Sales Process for a Consulting Company

Flowchart of the Process Showing Handoffs Between Departments



Process Flowchart

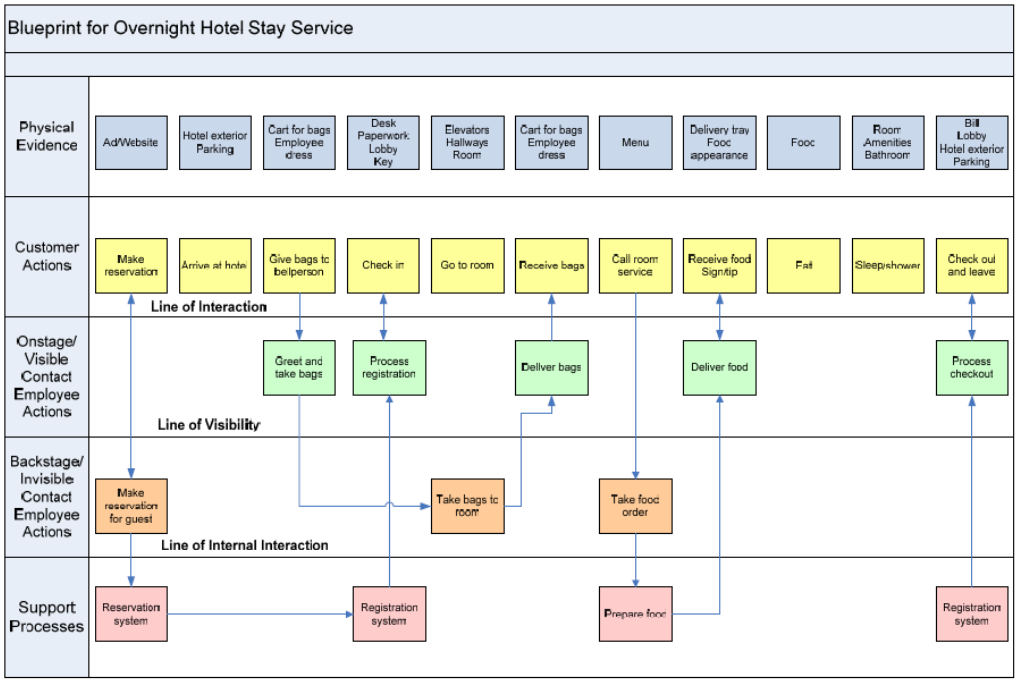


Date: 9-30-02 Location: Graves Mountain
Analyst: TLR Process: Apple Sauce

Step	Operation / Transport / Inspect / Delay / Storage	Description of process	Time (min)	Distance (feet)
1	● ⇨ □ D ▽	Unload apples from truck	20	
2	○ ⇨ □ D ▽	Move to inspection station		100 ft
3	○ ⇨ ■ D ▽	Weigh, inspect, sort	30	
4	○ ⇨ □ D ▽	Move to storage		50 ft
5	○ ⇨ □ D ▽	Wait until needed	360	
6	○ ⇨ □ D ▽	Move to peeler		20 ft
7	● ⇨ □ D ▽	Apples peeled and cored	15	
8	○ ⇨ □ D ▽	Soak in water until needed	20	
9	● ⇨ □ D ▽	Place in conveyor	5	
10	○ ⇨ □ D ▽	Move to mixing area		20 ft
11	○ ⇨ ■ D ▽	Weigh, inspect, sort	30	
	Page 1 of 3	Total	480	190 ft

Operation A large circle indicates an operation such as	Drive nail	Mix	Drill hole
Transportation An arrow indicates a transportation, such as	Move material by truck	Move material by conveyor	Move material by carrying (messenger)
Storage A triangle indicates a storage, such as	Raw material in bulk storage	Finished stock stacked on pallets	Protective filing of documents
Delay A large capital D indicates a delay, such as	Wait for elevator	Material in truck or on floor at bench waiting to be processed	Papers waiting to be filed
Inspection A square indicates an inspection such as	Examine material for quality or quantity	Read steam gauge on boiler	Examine printed form for information

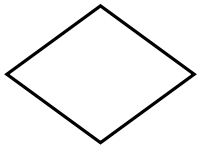
Service Blueprint



Flowchart Symbols

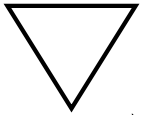
Tasks or operations

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



Decision Points

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



Storage areas or queues

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

Flows of materials or customers

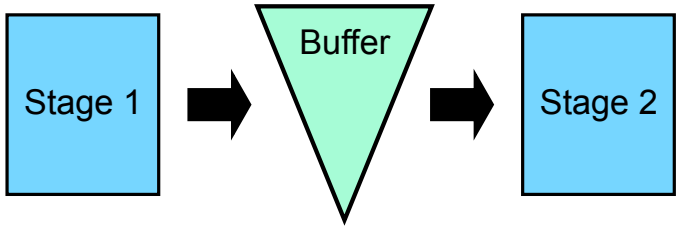
Examples: Customers moving to a seat, mechanic getting a tool, etc.

Types of Processes

Based on how the process is designed

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



Workshop

Select a process
Draw a flowchart




Paperclip Workshop

Process Analysis

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 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

Process Analysis

Process Terminology

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 is case the employee represents the limited capacity causing the bottleneck.

Process Performance Measures

Cycle Time (minutes)

The average time between completions of units

Throughput Rate (units/minute)

$$\text{Throughput Rate} = \frac{1}{\text{Cycle time}}$$

Utilization (%)

The ratio of the time that a resource is actually activated relative to the time that it is available for use

Productivity

Ratio of output to input

Usually in monetary form ($)

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

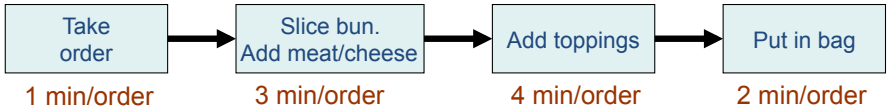
Efficiency (%)

Ratio of actual output of a process relative to some standard

$$\text{Efficiency}(\%) = \frac{\text{Actual Output}}{\text{Standard}} \times 100\%$$

Example: *Sandwich Shop*

Given that
- The shop operates 8-hour a day
- Each task is staffed by 1 worker



1. Where do you expect to have highest work-in-process inventory?
2. What are *cycle time* and *throughput rate* of this process?
3. What is *the current maximum output* of the process?
4. Is there a benefit if we can reduce 1 minute at task 2?
5. If we can add another person, where should we add and why?

Types of Processes

Based on Production & Inventory Strategy

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

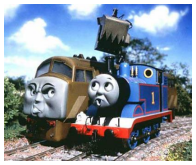
Customer orders are served from target stocking level

Assemble-to-order (Hybrid)

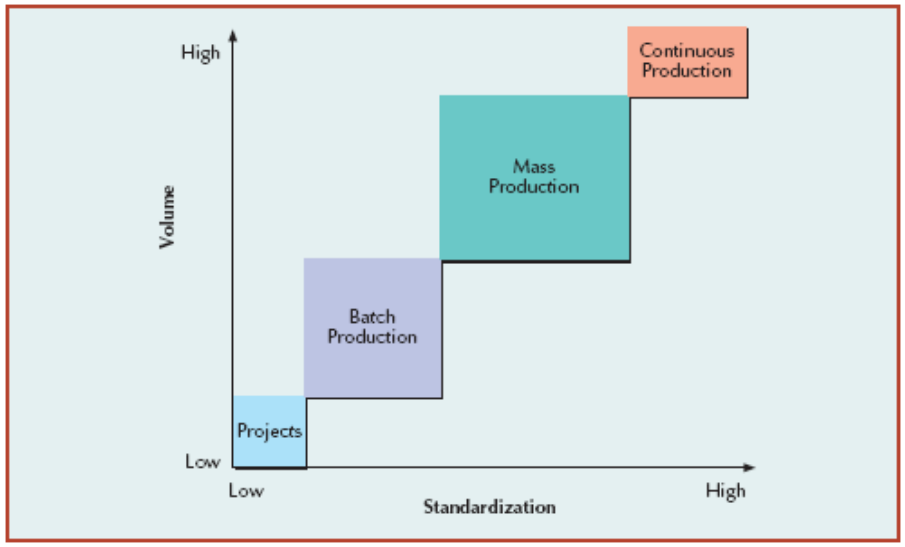
Standard modules with added option

Process Selection

Projects	• one-of-a-kind production of a product to customer order
Batch production	• processes many different jobs at the same time in groups or batches
Mass production	• produces large volumes of a standard product for a mass market
Continuous production	• used for very-high volume commodity products



Product –Process Matrix



Process Selection with Break-Even Analysis

Break-even point

The volume at which total revenue = total cost

Break-even analysis can be used to compare processes by finding the volume at which two different processes has equal total costs

Variable costs: Total cost varies directly with volume of output

Fixed costs: Total cost remains constant regardless of changes in levels of output

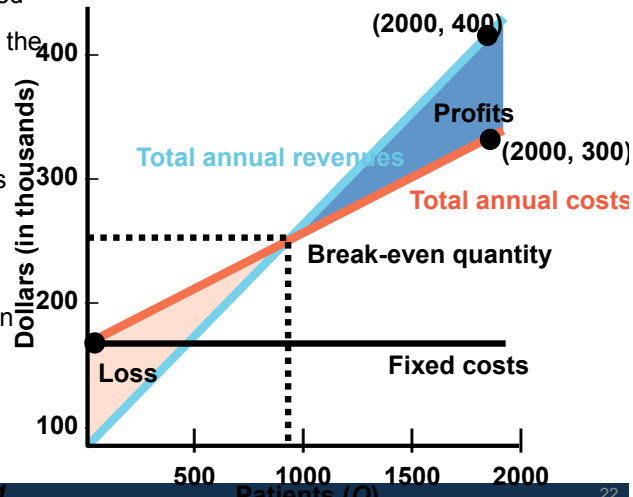


Figure A.1

Ex 1: Break-even analysis

[Break even volume]

The owner of a small manufacturing business has patented a new device for washing dishes and cleaning dirty kitchen sinks. Before trying to commercialize the device and add it to her existing product line, she wants reasonable assurance of success. Variable costs are estimated at $7 per unit produced and sold. Fixed costs are about $56,000 per year.

•If the unit selling price is set at $25, how many units must be produced and sold to break even?

•Forecasted sales for the first year are 10,000 units if the price is reduced to $15. With this pricing strategy, what would be the profit in the first year?

Ex 2: Break-even analysis

[Process selection]

(Midterm exam 04)

The bakery owner is now deciding on replacing the current oven. There are 2 oven systems from 2 companies in consideration. The first company proposes "Oven A" in which can bake two 8-inch pies simultaneously. In other words, there are 2 pies can be processed in a baking batch. On the other hand, Oven B can bake four 8-inch pies simultaneously. The details of relevant costs and oven capacities are as follows:

	Oven A	Oven B
Capacity Number of pies that can be baked simultaneously (number of pie per baking batch)	2 pies	4 pies
Variable Cost per baking batch		
Electricity	$6	$8
Cleaning Staff	$10	$10
Fixed Cost per month		
- Loan payment	$400	$800
Depreciation and others	$100	$200

Determine the break-even point for the two oven alternatives. Which oven should the owner select and why?

Ex 3: Break-even analysis

[Multiple process selection]

Nano Tech is ready to begin production of its exciting new technology. The company is evaluating three methods of productions

A: a small production facility with older equipment

B: a larger production facility that is more automated, and

C: subcontracting to an electronics manufacturer in Singapore

	Fixed Cost	Variable Cost
A	$ 200,000	$40
B	$ 600,000	$20
C	$ 0	$60

Determine for what level of demand each production process should be chosen.

Kristen's Cookie Company

in textbook page 178 – 179

Chase & Aquilano, Operations Management for Competitive Advantage, McGraw-Hill, 2007

1. Identify the followings:
   Product / Service
   Competitive priorities
   Production processes
   Flow chart
2. How long does it take to fill a rush order? Try with 1 order = 1 dozen; 1 order = 2 dozens
3. How many order can you fill in a night – 4 hours/ night? Assume 1 order = 1 dozen.
4. Are there any change your should make in your process to improve the number of cookies output?





Group Assignment

- Observe any existing process
- Develop a flowchart
- Identify bottleneck, cycle time, and throughput rate
- Comment on its efficiency