

# Facilities planning

## Overview

# Syllabus

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## INE423 Material handling system management

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### ■ Description of Course

The objective of this course is to develop an understanding of the principles of facilities location, layout, and material handling systems and to practice designing facilities. The course will emphasis on modeling, design, and analysis techniques.

# Syllabus



## Class schedule

- Overview
  - 1week: Introduction(ch1)
- Facilities layout design
  - 2week: Flow analysis
  - 3week: Systematic Layout Planning(ch6)  
Algorithmic approaches(ch6)
  - 4week: CRAFT(ch6)  
ALDEP(ch6)
  - 5week: Quantitative models
- Material Handling system design
  - 6week: Introduction (ch5)  
Conveyor (ch10)
  - 7week: Automated Guided Vehicle (ch10)
- 8week: mid-term exam

# Syllabus



## Class schedule

- Warehouse design
  - 9week: Introduction (ch7)  
Layout model (ch10)
  - 10week: Conventional warehouse (ch10)
  - 11week: Automated Storage/Retrieval System (ch10)
- Facilities location
  - 12week: Single facility–minisum problem (ch10)
  - 13week: Single facility–minimax problem (ch10)
- 14week: Evaluating and selecting the facility plan
- 15week: Project presentation
- 16week: Final exam

# Syllabus



## ■ Evaluation

- Attendance: 10%
- Mid-term exam: 30%
- Final exam: 30%
- Homework: 10%
  - No late homework will be accepted
  - You may discuss with other students but final report must be your own.
- Design project 20%:
  - Students are asked to work as teams to provide solution of an design case study project provided by the instructor.
  - Students are required to submit a typewritten report and present solutions to class in 20 minutes presentation.

## ■ Text book

- "Facilities Planning", 3th edition, Tompkins, White, Bozer and Tanchoco. John Wiley & Sons, 2003
- Class materials are downloadable from HY-IN

# Supply Chain



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- Supply chain: network of organizations that are involved through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of ultimate consumer (Christopher, 1998)
- SC consists of organizations being linked by material, information and financial flows.

# Supply Chain example

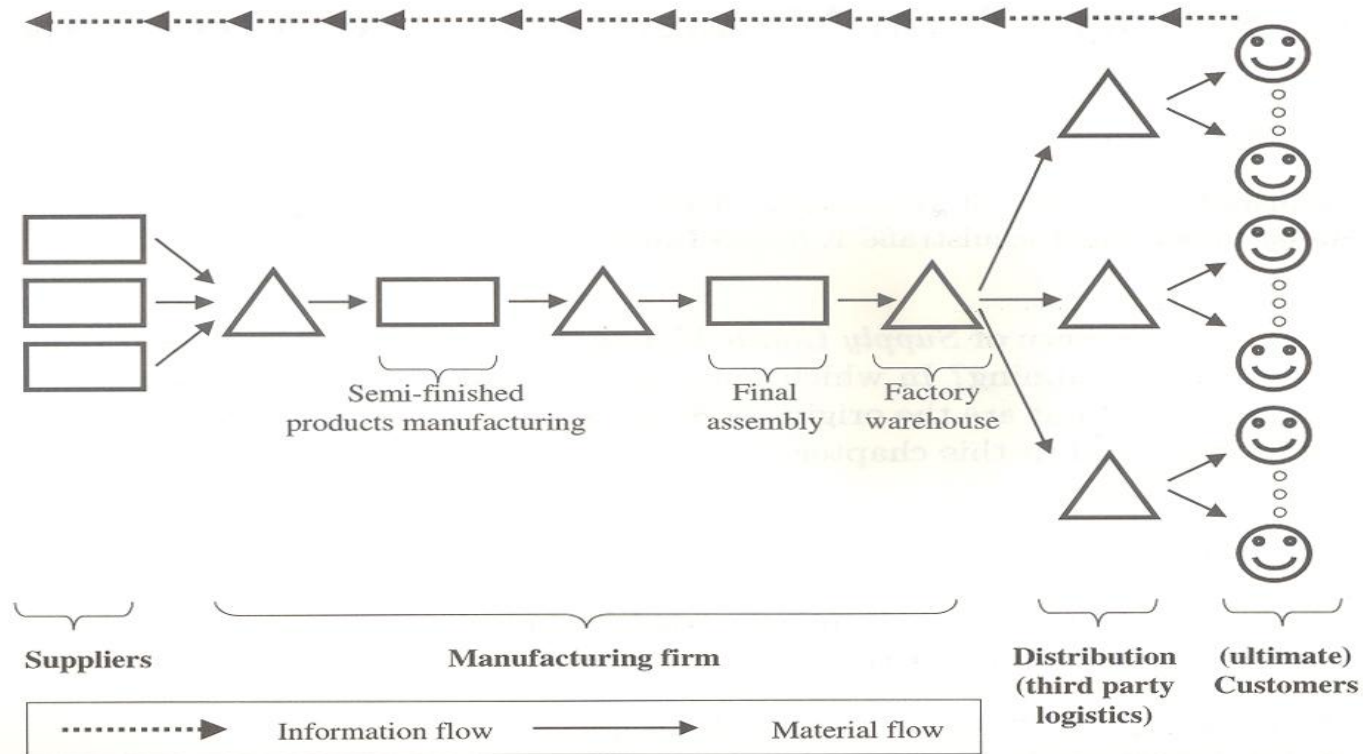


Fig. 1.1. Supply chain (example)

# Supply Chain Management



- To improve the competitiveness of a supply chain→needs integration of organizations and coordination of material, information and financial flows
- Supply Chain Management (SCM): the task of integrating organizational units along a supply chain and coordinating material, information and financial flows in order to fulfill customer demands with the aim of improving the competitiveness of a supply chain as a whole (Stadtler, 2004)
- Simchi-Levi et al (1991): Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses and stores so that merchandise is produced and distributed at the right quantities, to the right locations and at the right time, in order to minimize system-wide costs while satisfying service level requirements



# Supply Chain Excellence



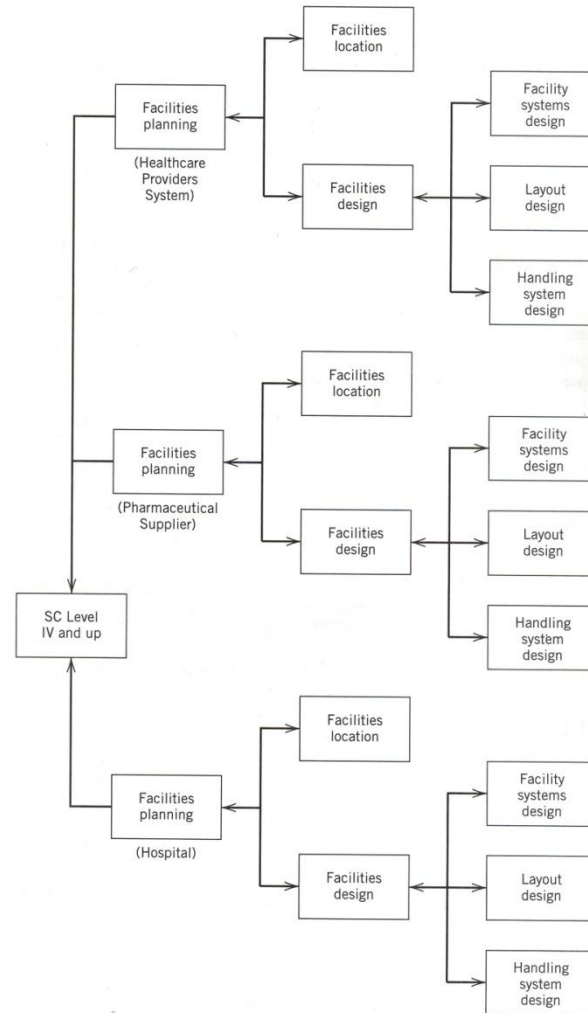
- Six levels of supply chain excellence
  - Level 1. Business as usual: company works hard to maximize its individual functions. Organizational effectiveness is not the emphasis.
  - Level 2. Link excellence: To achieve link excellence, companies must eliminate and blur any boundaries between department and facilities e.g., plants, warehouses and distribution centers.
  - Level 3. Visibility: It provides the information links need to understand everyone along the supply chain. It is the first real level toward supply chain excellence.
  - Level 4. Collaboration: Through collaboration, the supply chain can determine how best to meet the demands of the marketplace. The supply chain works as a whole to maximize customer satisfactions while minimizing inventories. Collaboration is achieved through the proper application of technology and true partnership

# Supply Chain Excellence



- Six levels of supply chain excellence (cont.)
  - Level 5. Synthesis: is the unification of all supply chain links to form a whole. The results of synthesis are increased ROA (Return On Asset)=(Revenue–Costs(Expenses))/Assets, improved customer satisfaction, reduced costs, an integrated supply chain.
  - Level 6. Velocity: is the synthesis with speed.
- Facilities are critical components of supply chain necessary for supply chain excellence
- Proper facilities planning along the supply chain ensures that the product will be manufactured and shipped to the satisfaction of the ultimate customers.

# Facilities planning as part of supply chain excellence



**Figure 1.2** Facilities planning as part of Supply Chain Excellence. Continuous improvement of each operation within each supply chain link takes an organization through the first three levels of Supply Chain Excellence. To move to levels 4, 5, and 6, the links must collaborate, as illustrated above, to synthesize their operations and continue to improve the chain.

# Facilities planning

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- Facilities planning
  - Facilities location: The location of the facility refers to its placement with respect to customer, suppliers and other facilities with which it interfaces.
  - Facilities design
    - Facilities system design: The facility systems consist of structural systems, the atmospheric systems, the lightning/electrical/communication systems, the life safety systems and the sanitation systems
    - Layout design: The layout consists of all equipments, machinery, furnishing within the building envelope.
    - Handling system design: The handling system consists of the mechanisms needed to satisfy the required facility interactions.

# Facilities planning for specific types of facilities

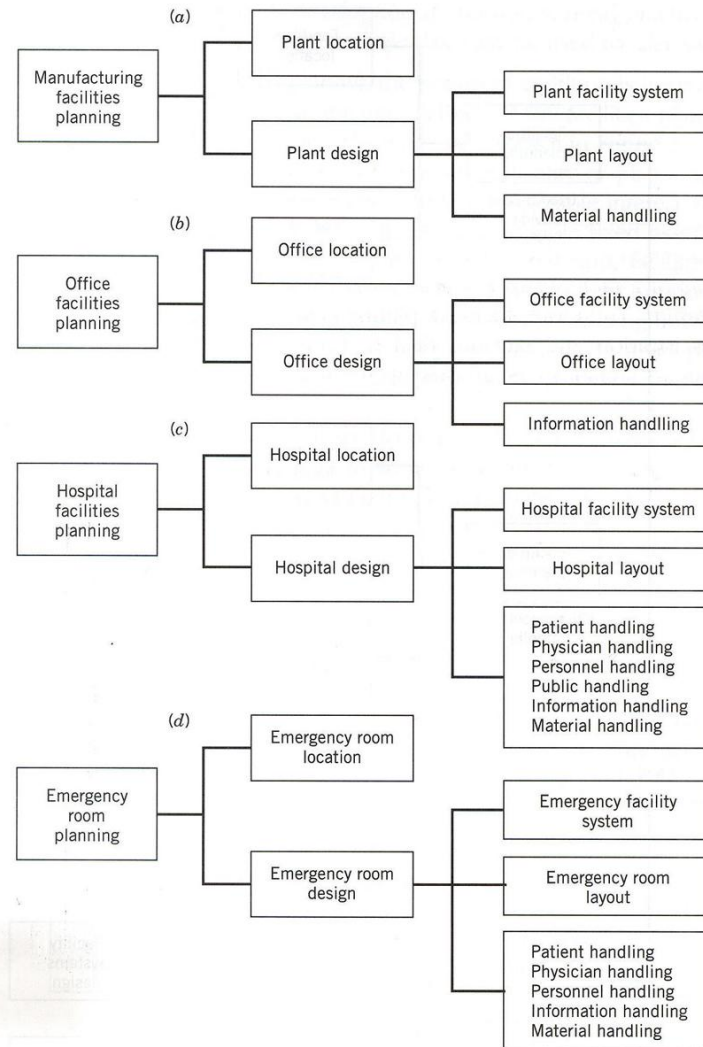


Figure 1.3 Facilities planning for specific types of facilities. (a) Manufacturing plant. (b) Office. (c) Hospital. (d) Emergency room.

# Objectives of facilities planning



- Facilities planning must be done within the context of the supply chain
- Objectives of facilities planning
  - Improve customer satisfaction by being easy to do business with, conforming to customer promise and responding to customer needs.
  - Increase return on asset (ROA) by maximizing inventory turns, minimizing obsolete inventory, maximizing employee participant and maximizing continuous improvement
  - Maximize speed for quick customer response
  - Reduce costs and grow the supply chain profitability
  - Integrate the supply chain through partnership and communication.
  - Support the organization's vision through improved material handling, material control and good housekeeping.
  - Effectively utilize people, equipment, space and energy.

# Objectives of facilities planning

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- Objectives of facilities planning (cont.)
  - Maximize return on investment (ROI) on all capital expenditures.
  - Be adaptable and promote ease of maintenance.
  - Provide for employee safety and job satisfaction.

# Facilities planning process

Table 1.3 *Comparison of the Engineering Design Process, Facilities Planning Process, and Winning Facilities Planning Process*

Phase	The Engineering Design Process	The Facilities Planning Process	The Wining Facilities Planning Process
Phase I	Define problem.	<ol style="list-style-type: none"> <li>1. Define or redefine objective of the facility.</li> <li>2. Specify primary and support activities.</li> </ol>	<ol style="list-style-type: none"> <li>1A Understand the organization Model of Success.</li> <li>1B Understand external issues.</li> <li>1C Understand internal issues.</li> <li>2. Establish facilities planning design criteria.</li> <li>3. Obtain organizational commitment.</li> </ol>
Phase II	Analyze the problem. Generate alternatives. Evaluate the alternatives. Select the preferred design.	<ol style="list-style-type: none"> <li>3. Determine the inter-relationships.</li> <li>4. Determine space requirements.</li> <li>5. Generate alternative facilities plan.</li> <li>6. Evaluate alternative facilities plan.</li> <li>7. Select a facilities plan.</li> </ol>	<ol style="list-style-type: none"> <li>4. Establish teams.</li> <li>5. Assess present status.</li> <li>6. Identify specific goals.</li> <li>7. Identify alternative approaches.</li> <li>8. Evaluate alternative approach.</li> <li>9. Define improvement plans.</li> <li>10. Obtain support for improvement plans.</li> </ol>
Phase III	Implement the design.	<ol style="list-style-type: none"> <li>8. Implement the plan.</li> <li>9. Maintain and adopt the facilities plan.</li> <li>10. Redefine the objective of the facility</li> </ol>	<ol style="list-style-type: none"> <li>11. Implement plans.</li> <li>12. Audit results</li> </ol>



# Facilities planning process



- Define the problem
  - Define or redefine the objective of the facility: the role of the facility within the supply chain must be defined.
  - Specify the primary and support activities to be performed in accomplishing the objective: support activities allow primary activities to function with minimal interruption and delay. As an example, maintenance is a support activity for manufacturing.
- Analyze the problem
  - Determine the interrelationships among all activities: establish whether and how activities interact or support one another within the boundaries of the facilities. Both quantitative and qualitative relationship should be defined.
  - Determine the space requirements for all activities:

# Facilities planning process

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- Generate alternatives
  - Generate alternative facilities plan: The alternative facilities plans will include both alternative facilities locations and alternative designs for the facility.
- Evaluate the alternatives
  - Evaluate the alternative facilities plans: On the basis of accepted criteria, rank the plans specified. For each, determine the subjective factors involved and evaluate whether and how these factors will affect the facility or its operation.
- Select the preferred design
  - Select a facilities plan: Most often, cost is not the only major consideration when evaluating a facilities plan.

# Facilities planning process

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- Implement the design
  - Implement the facilities plan: Actual construction of facility or the layout of an area.
  - Maintain and adapt the facilities plan: Changes in product design or mix may require changes in handling equipment or flow patterns that require an updated facilities plan.
  - Redefine the objective of the facility: In the case of potential modifications and expansions for existing facilities, all changes must be considered.