CHAPTER 4

Development of Networks

Contents

- To develop a concept of breaking down a project into activities to draw the Network.
  - Includes the basic calculations required for scheduling and analysis
  - Includes construction and understanding the network diagram
  - Portraying each of the activities and maintain predecessor-successor relationshipa

Planning for Network Construction

Networks can be constructed by either:

- Forward Planning
- Backward Planning
- Combined Planning

Forward Planning

This technique is also known as forward pass or forward scheduling.

In forward planning, the project schedule is created by starting with the earliest start time for the first activity in the project, and then moving forward through each subsequent activity. The earliest start time is determined by the project start date, as well as any dependencies or constraints that may impact the activity.

To perform the forward planning technique, the following steps are typically followed:

- Define the project scope
- Identify the activities:
- Determine dependencies
- Determine activity durations
- Calculate the earliest start time
- Determine the critical path

Backward Planning

In this method, the planner starts with the end event, and arranges the events and activities until the initial event is reached. Keeping the goal in view, the planner asks himself 'if we want to achieve this, what events or activities should have taken place ?'

Combined Planning

In practice, a combination of both forward planning and backward planning is followed. At any stage, the planner may need traverse the network back and forth several times until it is found to be satisfactory. In this method, the planner must ask himself the following questions, at any stage of network planning :

(a) What event or events must be completed before the particular event can start ?

(b) What event or events follows this ?

(c) What activities can be accomplished simultaneously ?

Modes of Network Construction

- Event Oriented Diagrams
- Activity Oriented Diagrams

Activity-oriented and event-oriented network diagrams are two different types of project management tools that are used to create visual representations of a project schedule.

Activity-oriented network diagrams focus on the individual activities, representing each activity as a box or node in the diagram, and using arrows to indicate the dependencies between activities. In this type of diagram, the emphasis is on the duration and sequence of each activity, and the relationships between them.

Another key difference between activity-oriented and event-oriented network diagrams is that activity-oriented diagrams are more commonly used in project management, while event-oriented diagrams are more commonly used in construction and engineering projects.

In summary, the main difference between activity-oriented and event-oriented network diagrams is the approach they take to representing project activities and dependencies, with activity-oriented diagrams focusing on the individual activities, while event-oriented diagrams focus on the milestones or events that must be reached to complete the project.

On the other hand, event-oriented network diagrams focus on the events or milestones that must be reached in order to complete the project. Each event is represented as a node in the diagram, and the arrows between the nodes represent the activities required to reach the event. In event-oriented diagrams, the emphasis is on the completion of each milestone, and the activities required to achieve it.

Steps in Development of Network

1. OBJECTIVE	:	set down in words.
2. PLAN BREAK-DOWN	:	depending upon the management level of use, activities and events identified and listed in general list.
3. SEQUENCING	:	the activities and events thus prepared, *i.e.* marshalling the data.
4. DEVELOPMENT	:	of predecessor and successor relationship in events through *location* of nodes in rough layout, giving events usual relative time effect through position.
5. DRAWING	:	activities by connecting pair of events with arrows.
6. CHECK	:	network diagram (*a*) in respect of content, sequence and sense, and (*b*) for degree of detail.

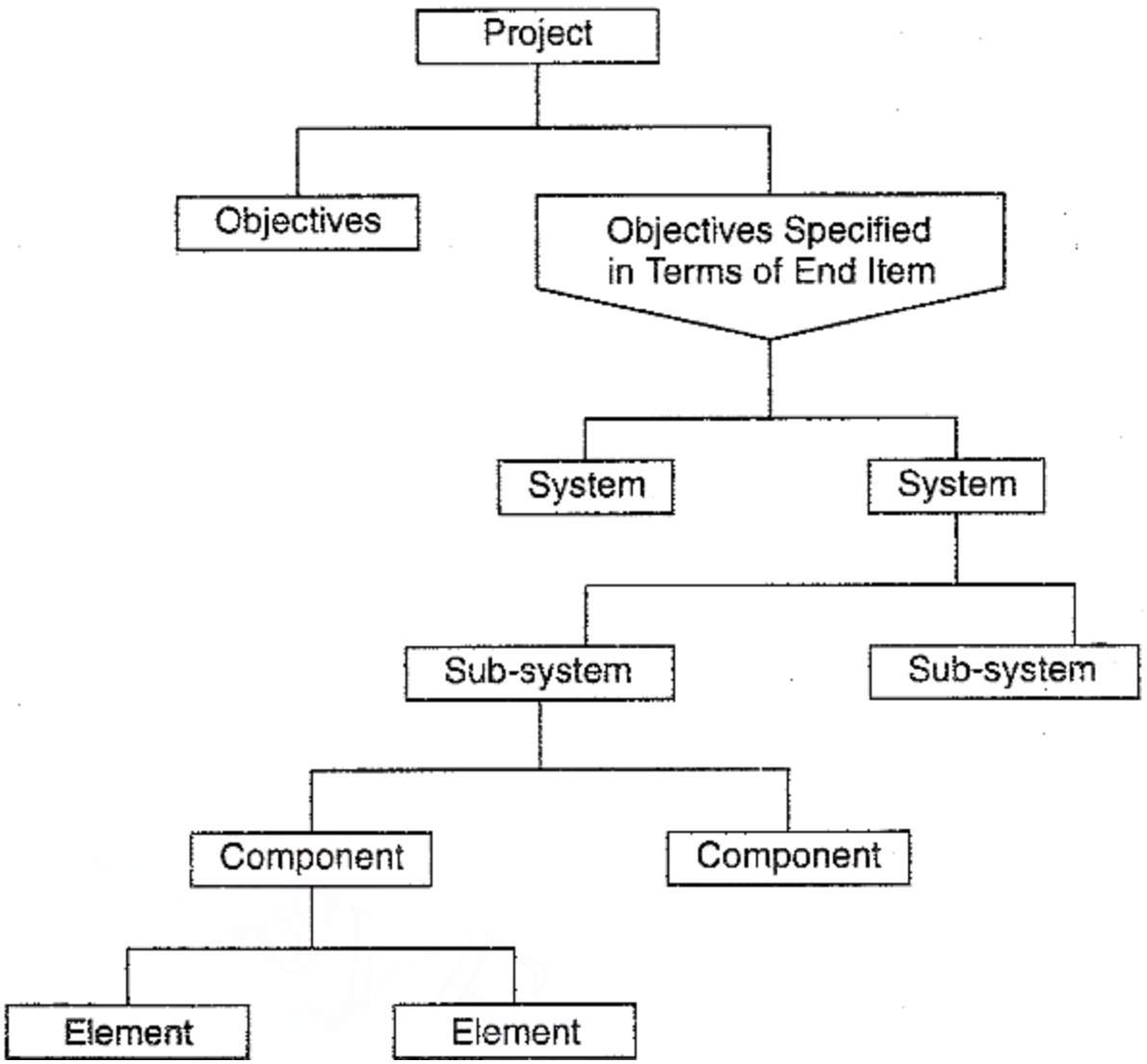
7. REDRAW and	:	network diagram to eliminate errors and attain style.
INTRODUCE	:	uniqueness dummies for grammar of network.
8. NUMBER	:	events for identification.

Each of the steps in the construction of network require some discussion and will involve some perception to establish the conditions under which task will be performed.

Work Breakdown Structure

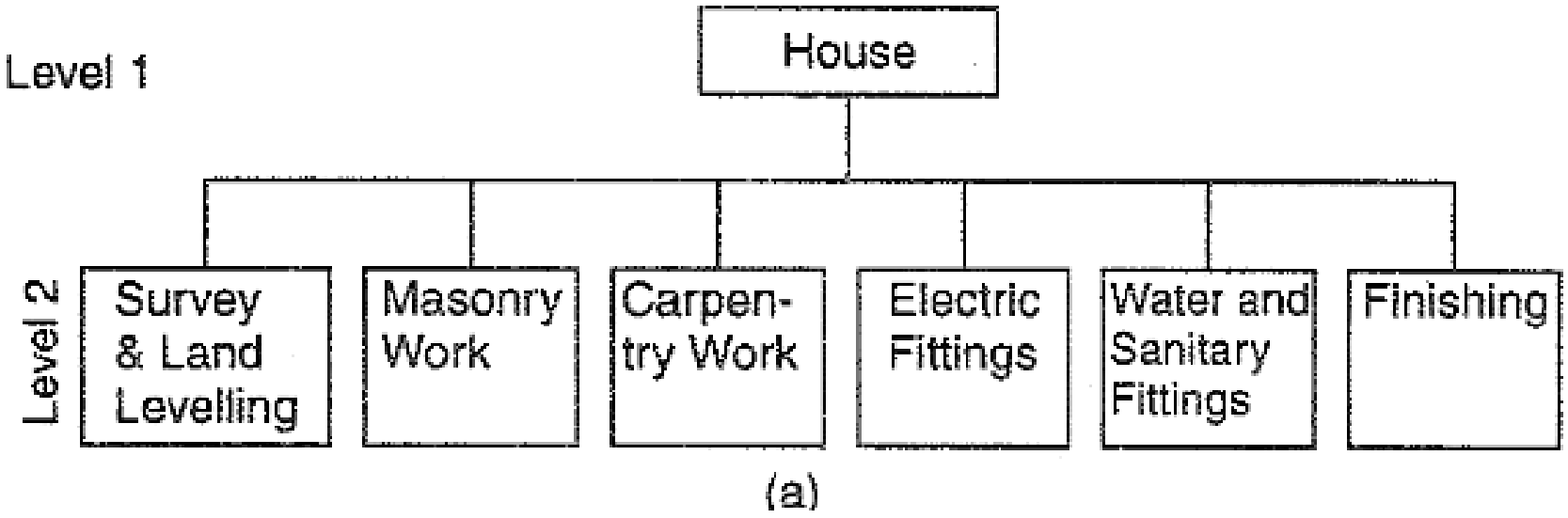
A Work Breakdown Structure (WBS) is a hierarchical decomposition of the project deliverables into smaller, more manageable components. It is a key tool in project management as it helps to organize and structure the work required to complete the project.

The WBS breaks down the project scope into smaller, more manageable pieces called work packages. Each work package should be a manageable and clearly defined piece of work that can be completed in a set amount of time. The WBS can be developed using a variety of methods, including top-down, bottom-up, or a combination of both.

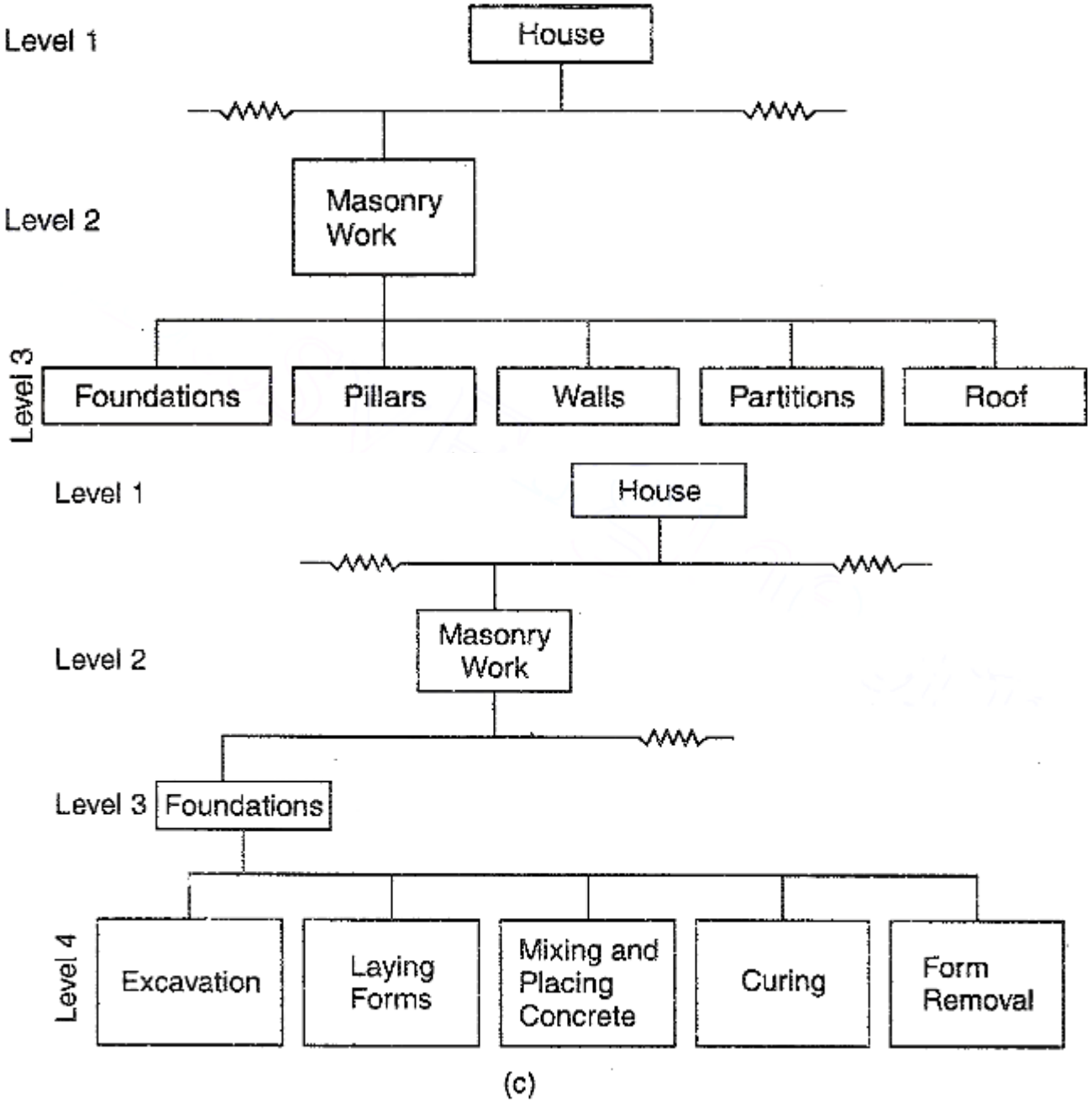


Work Breakdown Structure

Example of a House Construction Project



(a)


Level 1
House
Level 2
Masonry Work
Level 3
Foundations
Pillars
Walls
Partitions
Roof
Level 1
House
Level 2
Masonry Work
Level 3
Foundations
Level 4
Excavation
Laying Forms
Mixing and Placing Concrete
Curing
Form Removal

(c)

HIERARCHIES

Large and complex networks contain more than two to five hundred work operations. If all of these operations are represented on one single network diagram, it will become clumsy. Since all of these work operations are to be represented, one can successfully use a *hierarchy or family of networks* of increasing detail. There may be several stages in the hierarchy, each to be used by different set of people, *i.e.* top management people, middle, and upper-management people etc. The number of stages in the hierarchy may reflect not only the complexity of the project but also the structure of the company management, and the systems of control and reporting that are in use.

The hierarchy may have generally two or three *stages* or *levels*. The number of *arrows* (work operations) at each stage of the hierarchy will depend on the following factors :

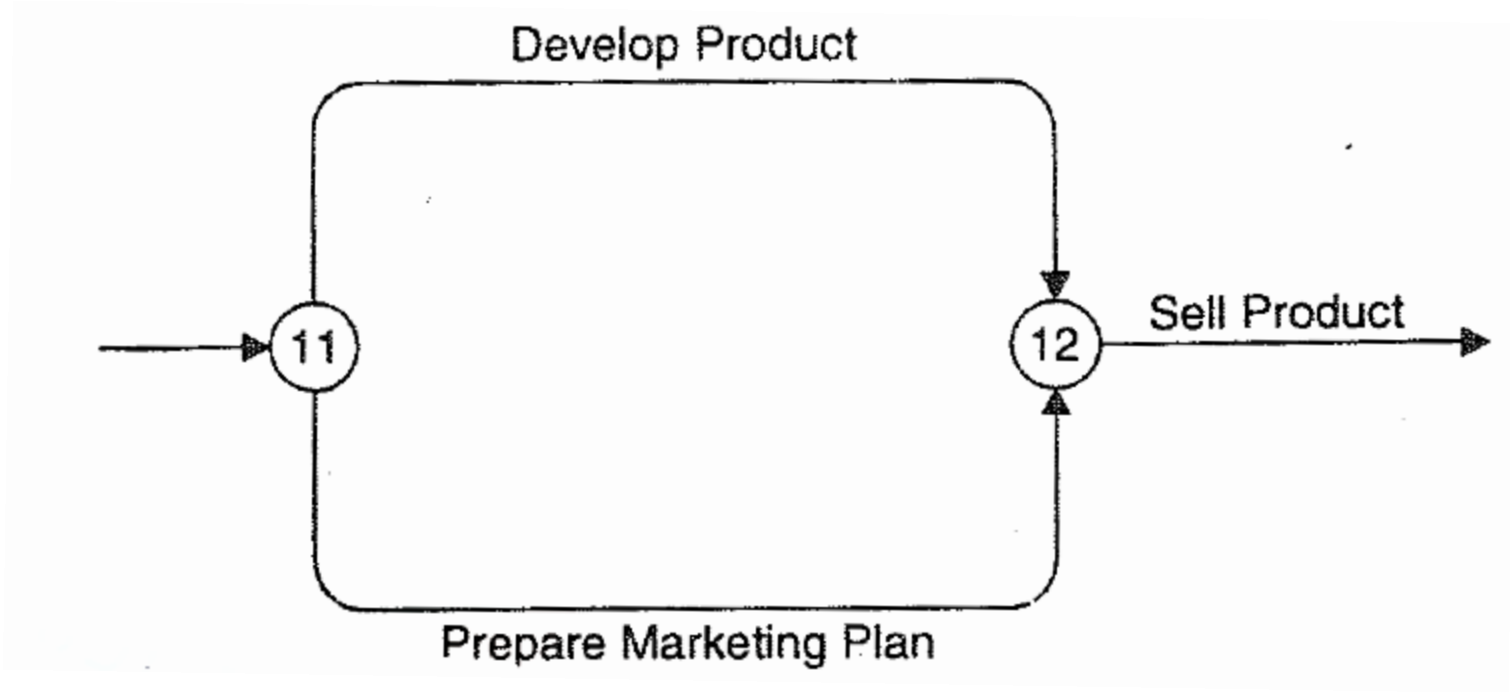
(*i*) Purpose of the diagram,

(*ii*) Degree of control desired,

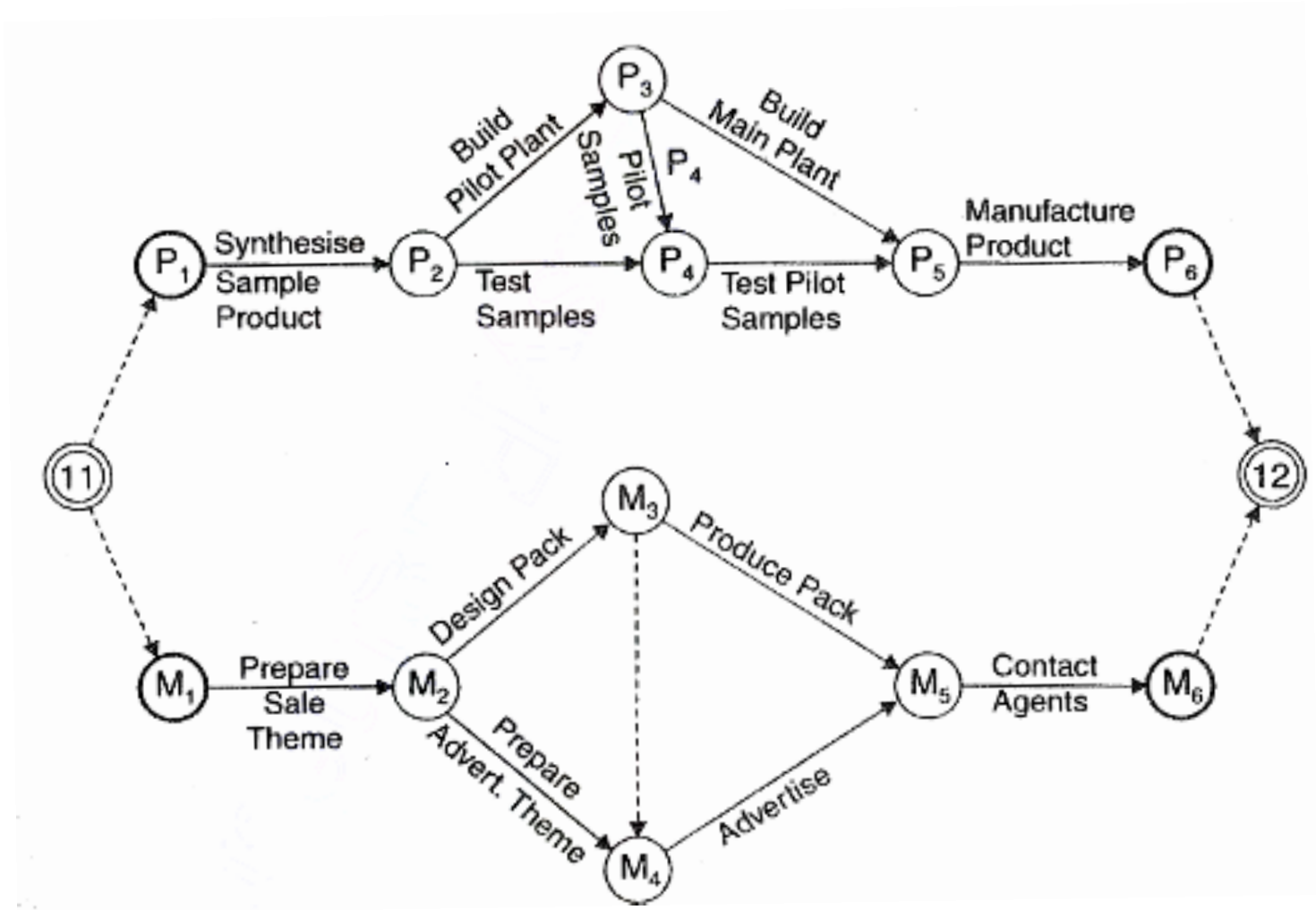
(*iii*) Extent of available information, and

(*iv*) How the diagram is to be used.

The *first level diagrams* are primarily used for general information. The purpose is to describe in general terms to top management, clients or the public, the over all nature of the project and how it is to be accomplished. The diagram will contain very few arrows, each representing a piece of work of fairly broad scope. The diagram at this stage need not be strictly correct logically. Each arrow may represent a *project* itself for the second level diagram.



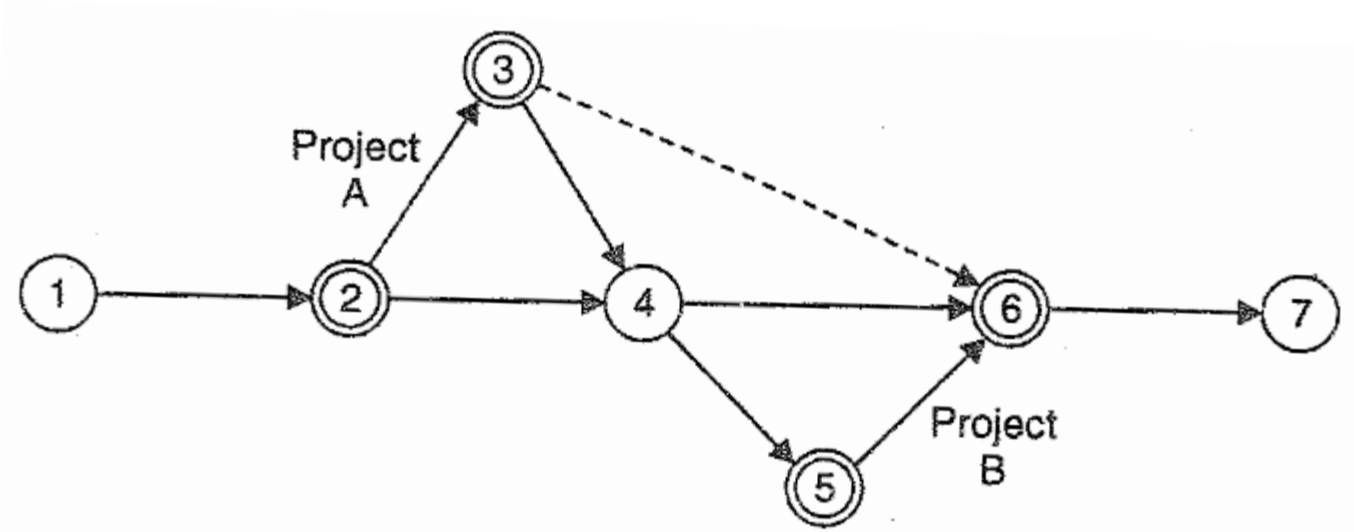
First Stage network is intended for the top management of the company. The activities '*develop product*' and '*prepare marketing plan*' run concurrently, and are operated by different groups or divisions of the company.



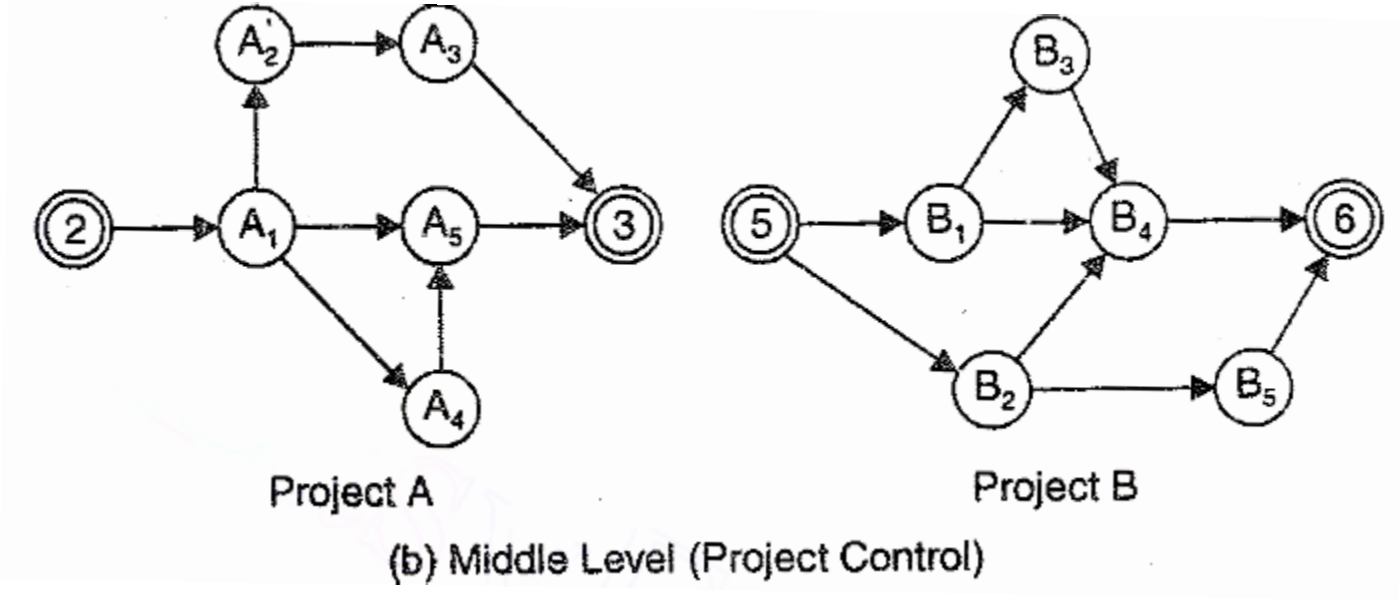
Second Stage Network: *Shows the three stages of Network for a certain building construction company*

When hierarchy principle is used for large project to split it up, the first level or overall network should be prepared by the top administrator, in consultation with the representatives of various divisions so that inter-departmental constraints are introduced properly. The representatives of each division will then prepare more detailed sub-networks for middle level (project control) and lower level (site/production control) implementation.

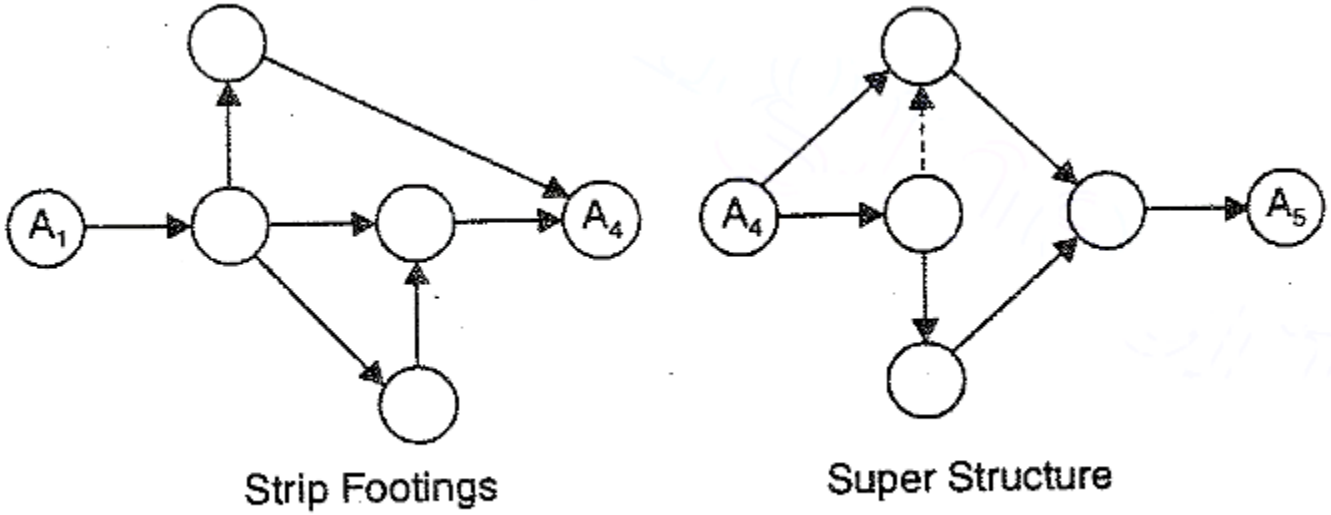
HIERARCHIES



(a) Top Level (Management of Several Projects)



(b) Middle Level (Project Control)



(c) Lower Level (Site Control)