PMA
CREATE TRUE VALUE

Project Schedule Management

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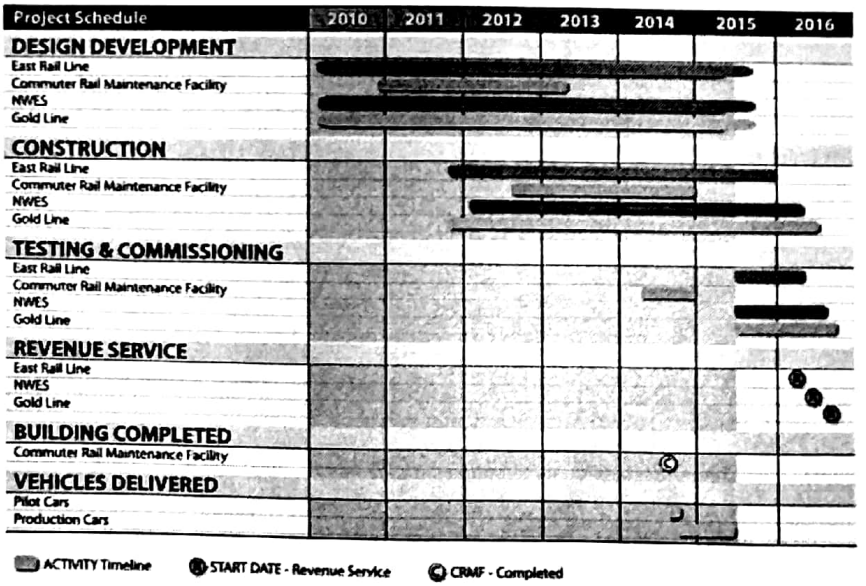
What is project schedule?

PMA

- A schedule is a listing of a project's milestones, deliverables, and activities usually with intended start and finish dates.



Why schedule management?

Milestone

- Major accomplishments or a significant event of the project and mark the completion of major deliverables or some other key event in the project.
- It represents nothing more than a moment in time; hence, when scheduling, milestones should be assigned zero duration.
- **Duration: 0**

Why schedule management?

Risk & Uncertainty

- **Murphy's law:** What can go wrong, will go wrong

Padding

- Team members have a tendency to pad activity duration estimates to account for uncertainties.

- **Student Syndrome:** Waiting until the latest possible time to start
- **Parkinson's law:** Work expands to fill available time

Project Schedule Management Processes

Initiating	Planning	Executing	Monitoring & Controlling	Closing
	1. Plan Schedule Management 2. Define Activities 3. Sequence Activities 4. Estimate Activity Duration 5. Develop Schedule		6. Control Schedule	

6.1 Plan Schedule Management

What?

- Process of establishing the policies, procedures, and documentation for developing, managing, and controlling the project schedule.

Why?

- Provide project team and stakeholders with guideline and direction on how the project schedule will be developed, managed and controlled.

When?

- Once or at predefined points in the project.

6.1 Plan Schedule Management: Tools And Techniques

1. Data analysis

- **Alternatives analysis.** Evaluate the different methods to manage project schedule.

2. Expert Judgment

- Any group or person with expertise in developing schedule management plan

3. Meetings

- Attendees at these meetings may anyone with responsibility for any of the schedule management processes

6.1 Plan Schedule Management: Outputs

1. Schedule management plan

- Formal or informal, highly detailed, or broadly framed based on the needs of the project
- That establishes the procedure, policies and the activities for developing, monitoring, and controlling the schedule.
- A component of the project management plan

Schedule management plan

- Project schedule model development (and tool)
- Release and iteration length
- Level of accuracy
- Units of measure
- Rules of performance measurement.
  - % complete
  - Schedule variance (SV) and schedule performance index (SPI)
- Control thresholds
- Project schedule model maintenance.
- Reporting formats.

6.1 Plan Schedule Management: Inputs

1. Project charter

- Summary milestone

2. Project management plan

- **Scope management plan:**
  - Scope baseline
- **Development approach:**
  - Sequential, iterative, incremental or agile/adaptive .

3. Enterprise environmental factors

- Scheduling software,
- Commercial databases, such as standardized estimating data.

4. Organizational process assets

- Historical information and lessons learned repositories;
- Existing formal and informal schedule development, management- and control-related policies, procedures, and guidelines;
- Templates and forms; and monitoring and reporting tools.

6.1 Plan Schedule Management

Inputs	Tools & Techniques	Outputs
1. Project charter 2. Project management plan 3. Enterprise environmental factors 4. Organizational process assets	1. Data analysis 2. Expert judgment 3. Meetings	1. Schedule management plan

6.2 Define Activities

What?

- Process of identifying and documenting the specific actions (activities) to be performed to produce the project deliverables.

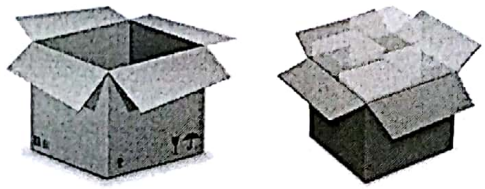
Why?

- Basis for estimating, scheduling, executing, monitoring, and controlling the project work.

When?

- Performed throughout the project.

Work Package	Activity
• Work package is a set of activities needed to produce deliverables • Work packages often involves multiple groups of people.	• The activity is an effort needed to complete work package. • Should be decomposed into individual schedule activities.

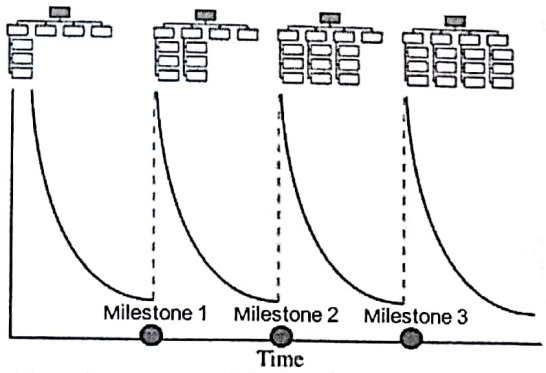


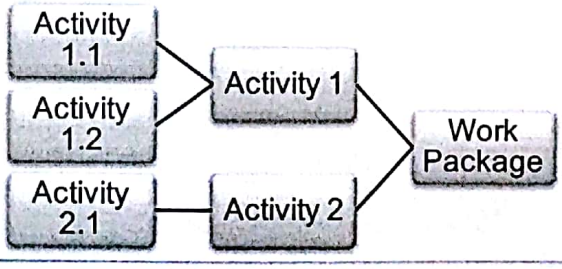
6.2 Define Activities

How?

- Determine milestones and associated deliverables
- Define activities needed to produce deliverables
- Describe activity detailed enough to estimate, schedule, monitor and control.
- **Rolling wave planning:** the work to be accomplished in the near term is planned in detail, while work further in the future is planned at a higher level.

Activity → gán duoc cho Any -

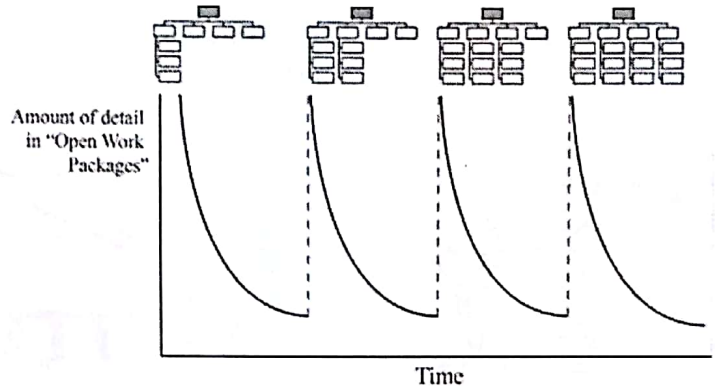




6.2 Define Activities - Tools and Techniques

1. Rolling WAVE planning (1)

- **An iterative planning technique:** work that is imminent is planned in detail while work that is way off in the future is planned at a high level.
- As the work in the future approaches more and more details are available enabling team to do further planning.



6.2 Define Activities - Tools and Techniques

1. Rolling WAVE planning (2)

- **Near term deliverables:** are decomposed into activities nessesary to produce the deliverables. Deliverables are also called as **Work packages.**
- **Long term deliverables:** are more broadly defined, called as **Planing packages.**

Work package	Planning package
• Lowest level element of WBS	• Lowest level element of WBS at a given point of time
• No further decomposition (in term of Scope management)	• Will get decomposed into work packages at later stage
• Primary input to identify activities process	• Decomposed into work package or they get converted into work package when work get more visibility • Planning package will not have activities under them

6.2 Define Activities - Tools and Techniques

Activity : Team Member list.

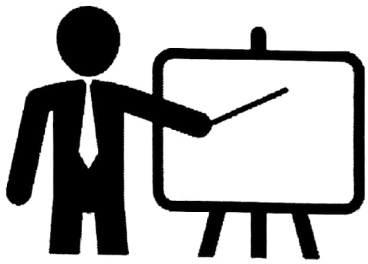
2. Decomposition

When to stop decomposition?

- Can have their progress determined and tracked, their expected costs reasonably established, their resource needs estimated
- Are assignable to **one person**

3. Expert Judgment

- **Best source:** The person who will ultimately be responsible for executing the work package or the schedule activity, although that may not be known at this point.
- Team members, consultants, functional managers, etc.



6.2 Define Activities - Outputs

1. Milestone List

- A **milestone list** is a project management document that identifies all project **milestones**.

2. Activity list

- List of activities to be included on a project schedule that includes:
  - The activity name
  - An activity identifier or number
  - A brief description of the activity

3. Activity attributes

- Describe the characteristics of the activities and are an extension of the activity list.

4. Chang request

- Work that was not initially part of the project baselines

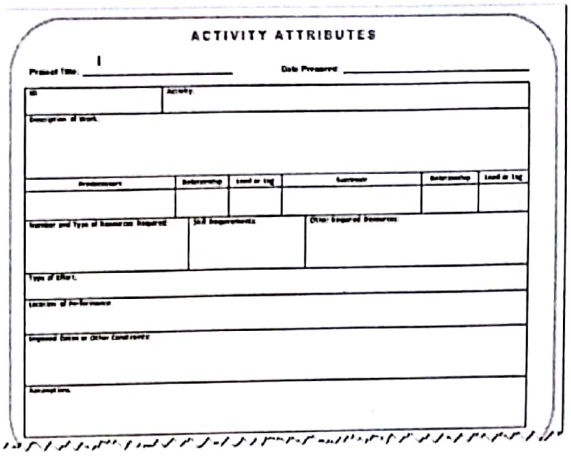
5. Project management plan updates

- Schedule baseline.
- Cost baseline.

6.2 Define Activities - Outputs

Activity attributes

- Describe the characteristics of the activities and are an extension of the activity list. The details may include but not limited:
  - predecessors,
  - successors,
  - logical relationships,
  - leads and lags,
  - resource requirements,
  - constraints,
  - imposed dates,
  - and assumptions related to the activity



6.2 Define Activities - Inputs

1. Project Management Plan

- **Schedule Management Plan**
  - Level of detail necessary to manage the work
- **Scope Baseline**
  - Project Scope Statement
  - WBS
  - WBS Dictionary

2. Enterprise environmental factors

- Project management information system (PMIS)

3. Organizational process Assets

- The scheduling methodology
- Lessons-learned knowledge base
- Previous similar projects

6.2 Define Activities

Inputs	Tools & Techniques	Outputs
1. Project management plan • Schedule management plan • Scope baseline 2. Enterprise Environmental factors 3. Organizational process Assets	1. Rolling WAVE planning 2. Decomposition 3. Expert judgment 4. Meeting	1. Milestone list 2. Activity list 3. Activity attributes 4. Change request 5. Project management plan updates

6.3 Sequence Activities

What is it?

- Process of converting the project activities from a list to a logical sequence.

Why?

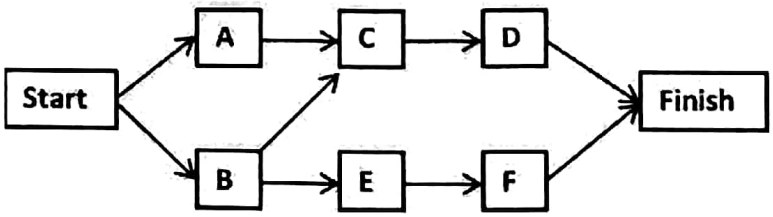
- Logical relationships is the basis to create a realistic project schedule given all project contraints.

When?

- Throughout the project.

How?

- Determine dependencies between activities
- Sequence activities by using appropriate diagraming technique
- Applying leads and lags if necessary to support a realistic and achievable schedule



1. Dependency Determination

1.1 Internal dependencies

- As its name implies, these are dependencies inside of the project's control.
- Example: project schedule is very rush but engineer team have not finished the engine design.

1. Dependency Determination

1.2 External dependencies

- As its name implies, these are dependencies outside of the project's control.
- Example: the delivery of deliverable of another project, or the decision of a committee, lawsuit, or expected new law.

1. Dependency Determination

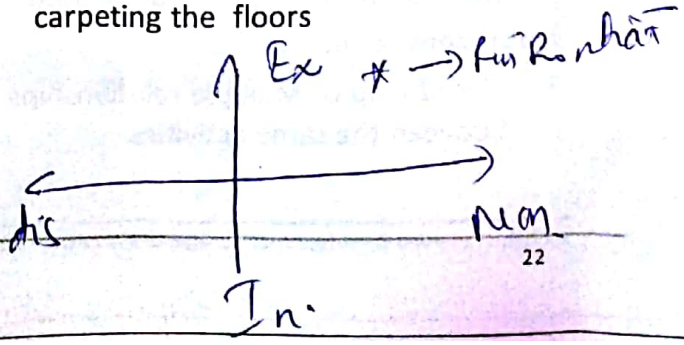
1.3 Mandatory Dependencies

- Legally or contractually required or inherent in the nature of work.
- This dependency is also called **Hard Logic.**
- Example: You can't begin building your house until your foundation is in place.
- Contract says prototype must be approved prior to start work.

1. Dependency Determination

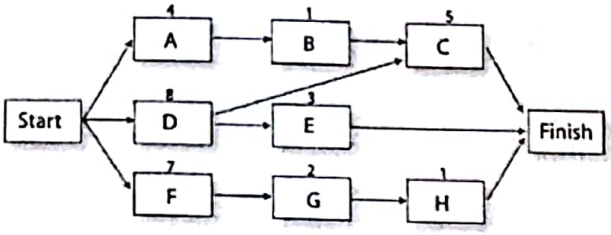
1.4 Discretionary dependencies

- Preferred order of activities. It is defined by the project management team based on the knowledge of best practice in each field.
- These relationship are also known as **soft logic, preferred logic, or preferential logic.**
- Example: Painting the walls and carpeting the floors



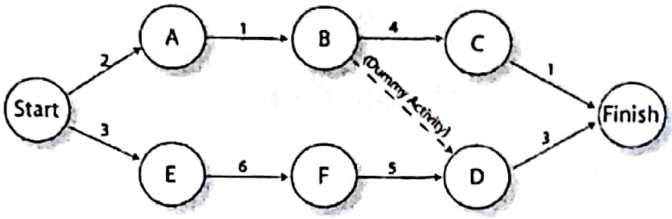
Precedence Diagramming Method (PDM)

- **Activity on Node (AON)**
- Activity is presented as a box



Arrow Diagramming Method (ADM)

- **Activity on Arrow (AOA)**
- Activity is presented as an arrow



ADM can only show **finish-to-start** (FS) relationships. In order to show relationships between tasks on different node branches, ADM diagrams use **dummy activities.**

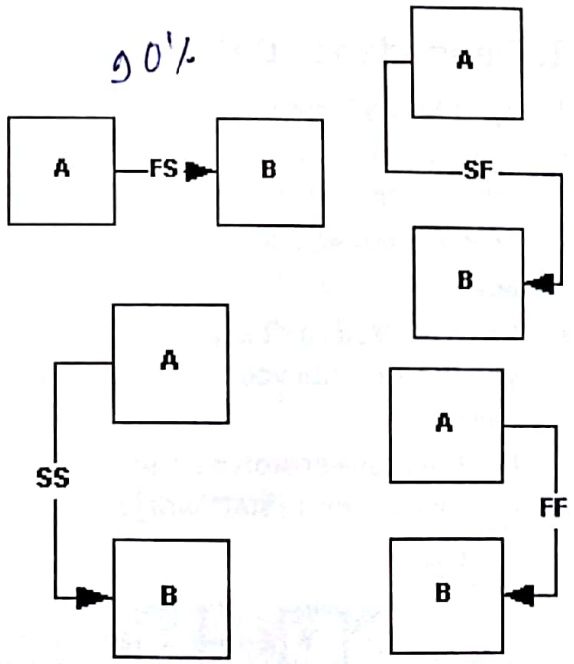
2. Precedence Diagramming Method (PDM)

4 logical relationships

- **Finish-to-start (FS):** most common type of relationship
  - **Activity A:** Predecessor
  - **Activity B:** Successor
- Finish-to-finish (FF)
- Start-to-start (SS)
- Start-to-finish (SF): very rarely used

Not recommend:

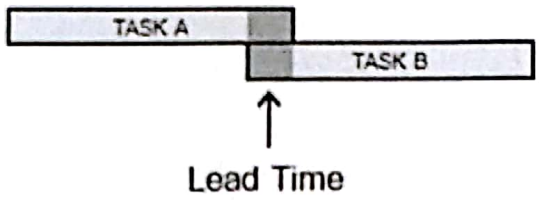
- Closed loop or Multiple relationships between the same activities



3. Leads and Lags

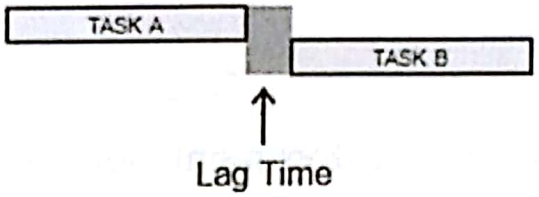
Lead

- The amount of time that a successor activity may be started prior to completion or predecessor.
- Ex: the landscaping could be scheduled to start 2 weeks prior to the scheduled punch list completion.



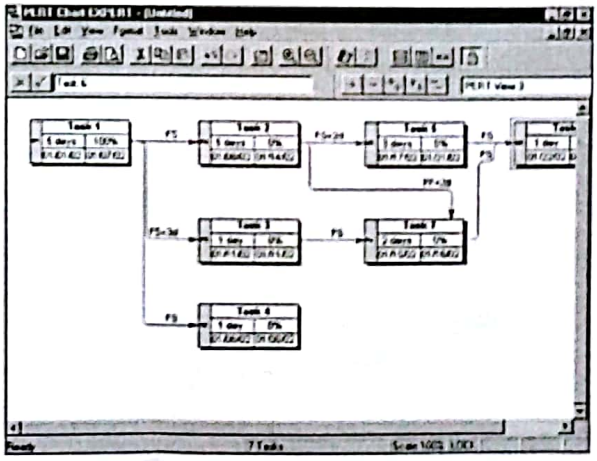
Lag

- The waiting time that a sucessor activity may have to wait after the completion of predecessor.
- Ex: construction only starts after finish foundation 3 days



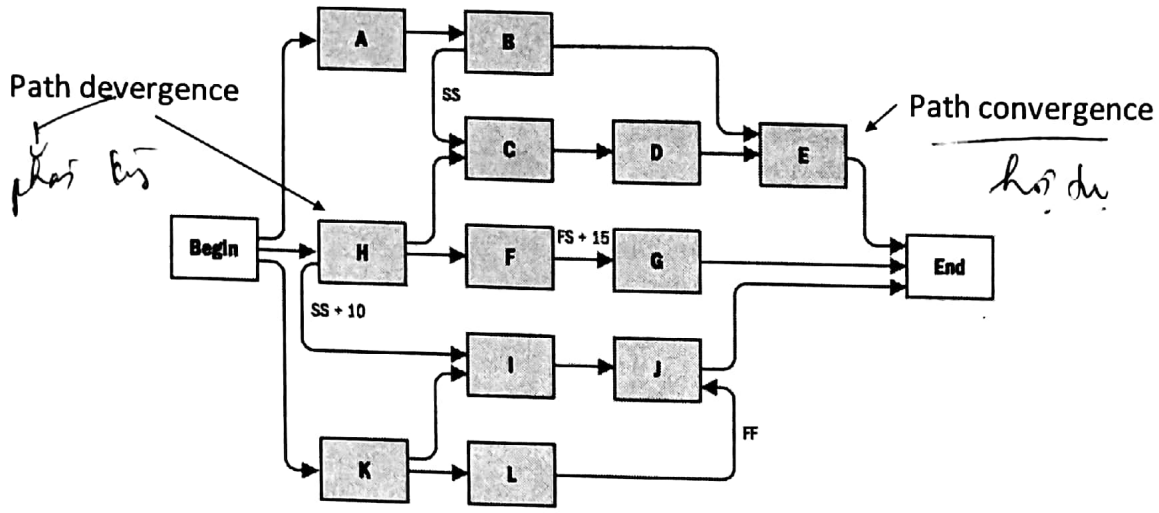
4. Project management information system (PMIS)

- Sequencing can be performed by using project management software or by using manual or automated techniques.
- Project management information systems includes scheduling software that has the capability to help plan, organize, and adjust the sequence of the activities; insert the logical relationships, lead and lag values; and differentiate the different types of dependencies.



6.3 Sequence Activities - Outputs

1. Project Schedule Network Diagrams



2. Project Document Updates:

- Activity lists, Activity attributes, Milestone list, and Risk register.

6.3 Sequence Activities - Inputs

1. Project management plan

- **Schedule management plan**
  - Scheduling tool and method to be used
  - How activities may be sequenced
- **Scope baseline**
  - Characteristics that may affect activity sequencing

2. Project documents

- **Milestone list:** Predetermined date for specific milestones
- **Activity List**
- **Activity attributes:** Predecessor or successor relationships
- **Assumption log**

3. Organizational Process Assets

4. Enterprise environmental factors

6.3 Sequence Activities

Inputs	Tools & Techniques	Outputs
1. Project management plan • Scope baseline 2. Project documents • Activity list • Activity attributes • Milestone list 3. Organizational process Assets 4. Enterprise environmental factors	1. Dependency determination and integration 2. Precedence diagramming method (PDM) 3. Applying leads and lags 4. Project management information system	1. Project schedule network diagrams 2. Project document Updates

6.4 Estimate Activity Durations

What is it?

- Estimate the duration needed to complete each activity with estimated resources.

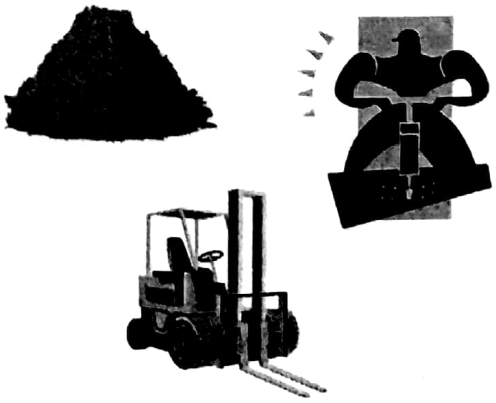
Why?

- Under-estimate the amount of time each activity will take to complete.
- Estimate without correlation with resource availability.

When?

- Throughout the project.

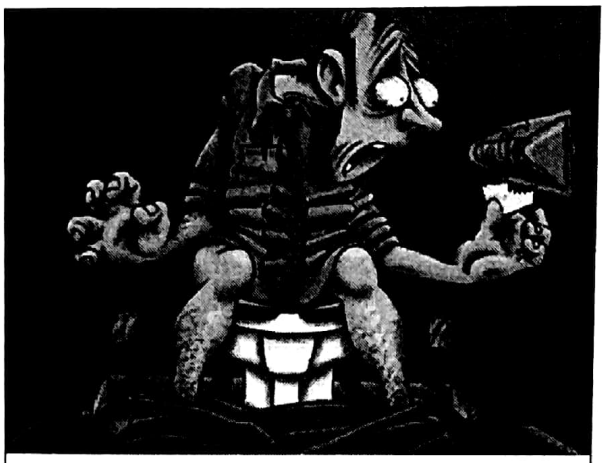
Project resources: They can be material, people, equipment, or anything else capable of definition (usually other than labour) required for the completion of a project activity.



6.4 Estimate Activity Durations

How?

- Consider the **given assumptions and constraints** (quality and quantity of resources, motivation of staff, deadline, ...)
- Estimate **activity duration** with appropriate techniques
- Determine the uncertainty and estimate **contigent reserve**.
- Re-evaluate and determine the optimal way to complete the activity if needed
- Finalize and document the duration estimates



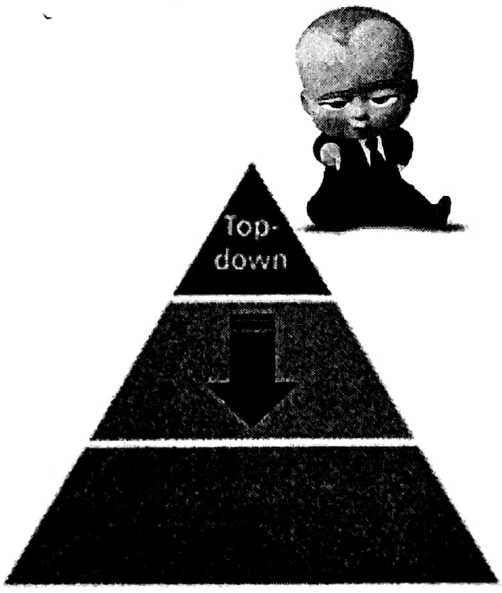
Management Lesson

Never start a project unless all resources are available

6.4 Est. Activity Durations - Tools & Techniques

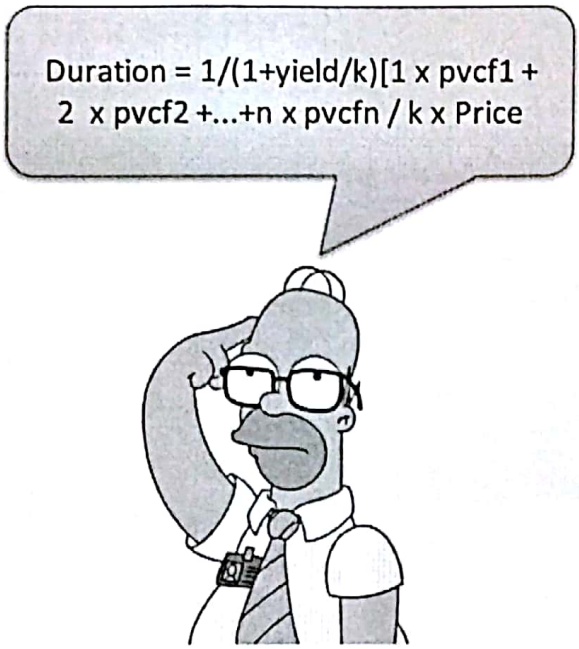
1. Analogous Estimating

- Uses information from a previous, similar project, such as duration, budget, size and complexity for future project.
- Analogous estimate is generally less costly and time consuming but generally less accurate.
- This estimate will be more accurate if previous project is similar in nature and not just in appearance.
- Analogous estimating is also known as top-down estimating and is a form of expert judgment using historical information.



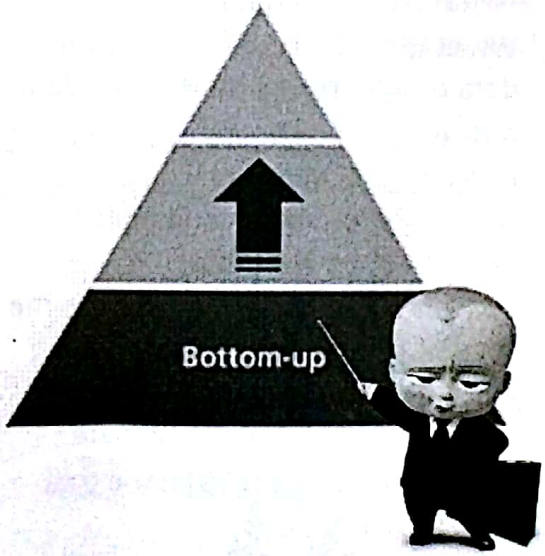
2. Parametric Estimating

- Parametric estimate uses a statistical relationship between historical data and other variables.
- More accurate than analogous estimate
- Example - A resource will take 20hrs per module and hence 50 modules will take 1000hrs (50X20 = 1000hrs)
- Estimation is done by multiplying quantity of work by labor hours per unit of work.

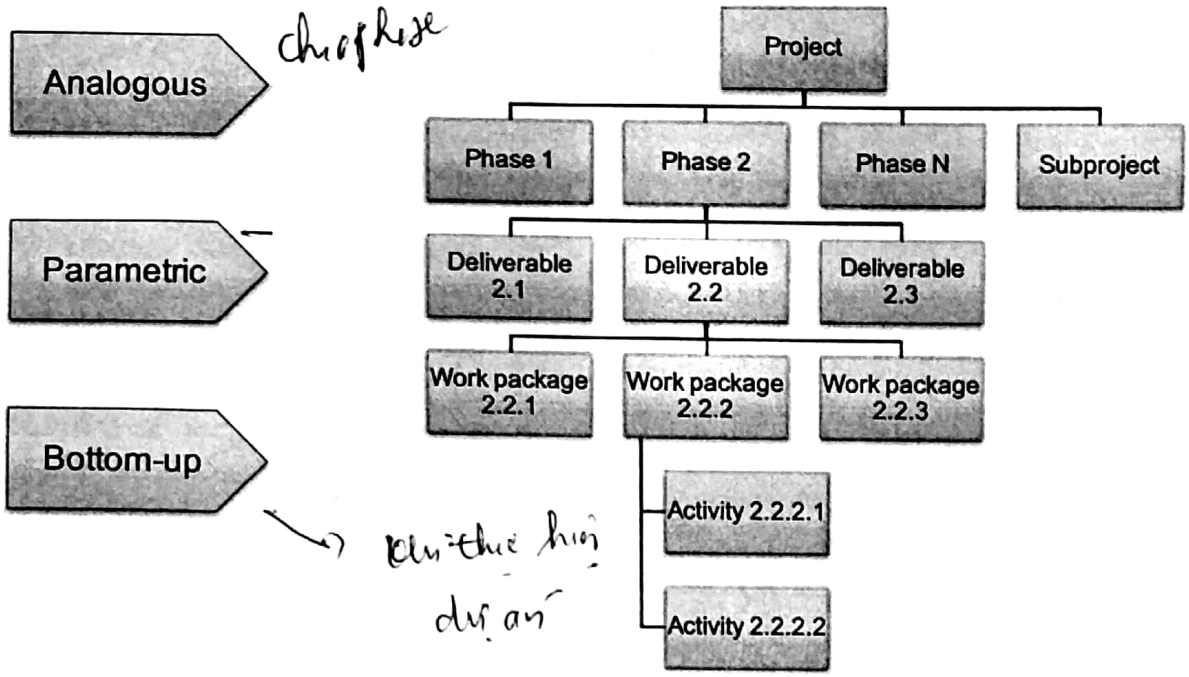


3. Bottom-up Estimating

- When an activity cannot be estimated with a reasonable degree of confidence, the work within the activity is decomposed into more detail.
- Once these estimations have been performed, the pieces may be summed up from the bottom back to activity level.
- The most accurate



6.4 Est. Activity Durations - Tools & Techniques



6.4 Est. Activity Durations - Tools & Techniques

4. Three point estimates (PERT)

- When there is insufficient historical data or when using judgmental data.
- A three-point estimate uses average of optimistic, most likely, and pessimistic estimates and hence improving the accuracy.
- **Pessimistic estimate (P)** assumes the worst case scenario
- **Most likely estimate (M)** – The realistic and most likely estimate
- **Optimistic estimate (O)** is the best case scenario.

Triangular distribution: E = (P + M + O) / 3

Beta distribution: E = (P + 4M + O) / 6

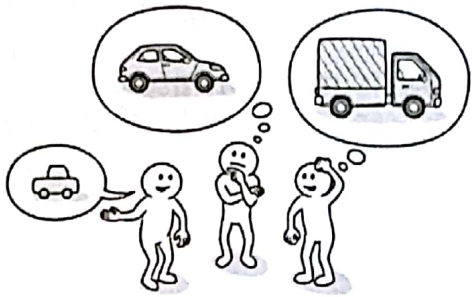
6.4 Est. Activity Durations - Tools & Techniques

5. Data analysis (1)

- **Reserve Analysis** – chủ động cải vấn đề
- Contingency Reserve time —also called **time reserves** nhận diện thức
- You might choose to add a percentage of time or a set number of work periods to the activity or the overall schedule.
- Contingency reserve shall be clearly identified and documented for future analysis

5. Data analysis (2)

- **Alternatives analysis.**
- Many activities can be completed in different ways and using various resource allocations.
- Alternative analysis is used to choose the best way to complete an activity.



6.4 Est. Activity Durations - Tools & Techniques

6. Decision-Making Technique

- Voting techniques
  - Unanimity: Fist-of-five
  - Majority
  - Plurality
  - Dictatorship

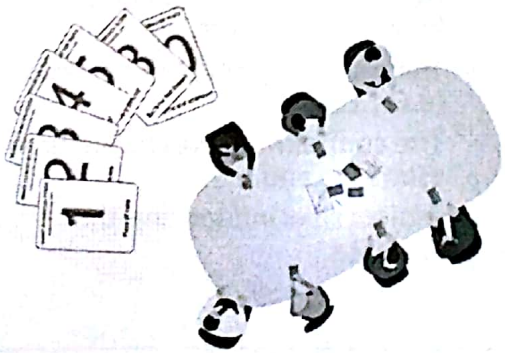
Fist-of-five voting

7. Expert judgment

- The person or group who is most familiar with the nature of the work in the specific activity.

8. Meetings

- Planning poker



6.4 Estimate Activity Durations - Outputs

1. Activity duration estimates

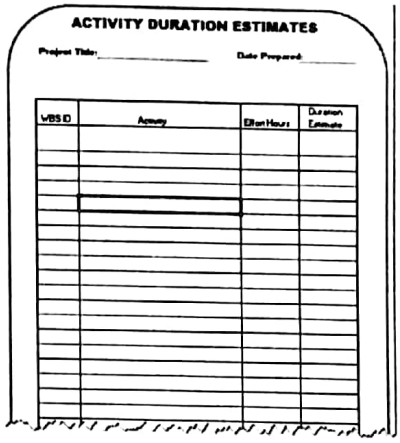
- Quantitative assessments of the likely number of time periods that are required to complete an activity, a phase, or a project.
- Do not include any lags
- May include some indication of the range of possible results. Ex: 15 days ± 2 days, or 80% probability of exceeding 1 month

2. Basis of estimates

- Additional details supporting the duration estimate

2. Project document updates

- Activity attributes
- Assumptions
- Lessons learned register.



6.4 Estimate Activity Durations - Outputs

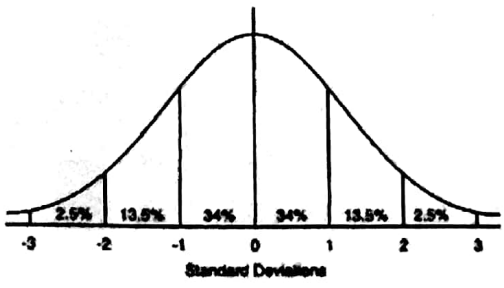
Chg 2 activity

Basis of estimates

- The supporting documentation provide a clear and complete understanding of how the duration estimate was derived.
- Supporting detail for duration estimates may include:
  - The basis of the estimate (i.E., How it was developed),
  - All assumptions made or any known constraints,
  - The range of possible estimates (e.G., ±10%)
  - The **confidence level** of the final estimate, and
  - Project risks influencing this estimate.

Beta Distribution

- E = (P+4M+O)/6, SD = (P-O)/6:
- Confidence level in E value +/- SD is approximately 68%
- Confidence level in E value +/- 2 × SD is approximately 95%
- Confidence level in E value +/- 3 × SD is approximately 99.7%



6.4 Estimate Activity Durations - Inputs

1. Project management plan

- Schedule management plan
- Project scope baseline

2. Project documents

- Milestone list
- Activity list
- Activity attributes
- Assumption logs: assumption and constraints
- Lessons learned register

2. Project documents (cont)

- Project team assigments
- Resource requirements: resource skill influence most on activity duration
- Resource breakdown structure
- Resource calendars
- Risk register

3. Enterprise environmental factors

4. Organizational process assets

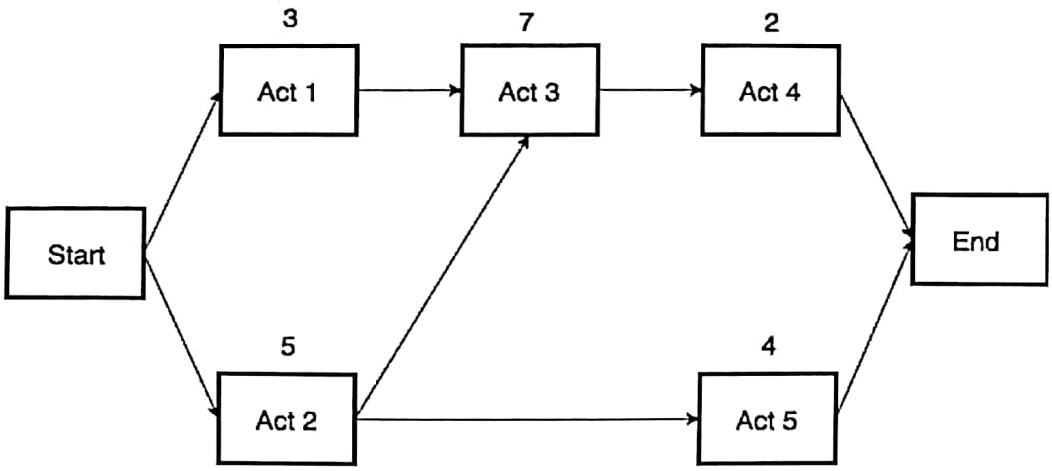
6.4 Estimate Activity Durations

Inputs	Tools & Techniques	Outputs
1. Project management plan 2. Project documents 3. Enterprise environmental factors 4. Organizational process assets	1. Analogous estimating 2. Parametric estimating 3. Bottom-up estimating 4. Three-point estimates 5. Data analysis 6. Decision-making 7. Expert judgment 8. Meetings	1. Activity duration estimates 2. Project documents updates

Review

- Time management process
- Activity list
- Milestones
- Precedence diagramming method (PDM)
- Network diagram
- Activity Relationship types:
  - Finish to Start
  - Finish to Finish
  - Start to Finish
  - Stalrt to Start
- Dependencies
  - Mandatory
  - Discretionary
  - External
  - Internal
- Leads and lags
- Analogous estimating
- Parametric estimating
- Three- point estimate
- Bottom-up estimating
- Reserve analysis

Project Schedule Management



1. Để hoàn thành tất cả các Activities, cần bao nhiêu thời gian ?
2. Activity 5 được phép trễ tối đa bao nhiêu ngày mà không ảnh hưởng tới đến ngày kết thúc (End)?
3. Xác định ngày sớm nhất Activity 5 có thể bắt đầu, ngày trễ nhất có thể bắt đầu ? (Start bắt đầu từ ngày 1)
4. Activity 1 được phép trễ bao nhiêu lâu mà không làm ảnh hưởng tới Activity 3?
5. Customer muốn chuyển giao vào ngày thứ 10. Có những phương án nào để đẩy nhanh tiến độ?

Project Schedule Management 1st

1. Resource requirements are determined:

A. Before the project schedule and after the network diagram

B. After the project schedule and project scope statement

C. After the project schedule and WBS

D. Before the project scope statement and the network diagram

2. A heuristic is BEST described as a:

A. Control tool

B. Scheduling method

C. Planning tool

D. Rule of thumb

3. Which of the following is a benefit of an analogous project estimate?

A. It is based on a detailed understanding of what the work requires

B. It will be closer to what the work will actually require

C. It help the project manager determine if the project will meet the schedule

D. It gives the project team an understanding of management's expectation

4. A project manager is using weighted average duration estimates to perform schedule network analysis. Which type of mathematical analysis is being used?

A. Monte Carlo

B. PERT

C. Resource leveling

D. Critical path method

5. A dependency requiring that design be completed before manufacturing can start is an example of a:

A. Scope dependency

B. External dependency

C. Mandatory dependency

D. Discretionary dependency

6. All of the following are used in estimating EXCEPT:

A. Scope validation

B. Team

C. WBS

D. Network diagram

7. Who of the following would be LEAST likely to be involved in the Define Activities process?

A. Project manager

B. Experts

C. Team

D. End user

8. Which of the following needs to be completed before resources can be finalized for the project?

A. Validate Scope

B. WBS

C. Estimate Activity Duration

D. Bar chart

9. Which of the following is generally the MOST CORRECT use of a project network diagram?

A. Showing the project schedule

B. Defining the project costs

C. Documenting activity interdependencies

D. Defining project resources

10. A discretionary dependency is one that is based on:

A. The needs of the project sponsor

B. The nature of the work being done

C. The needs of someone outside the project

D. Experience

11. The outputs of the Define Activities process include all the following EXCEPT:

A. All activities that will be performed on the project

B. A network diagram

C. Activity attributes

D. Milestone list

12. If the optimistic estimate is 1, the pessimistic estimate is 9, and the most likely estimate is 8, what is the PERT estimate?

A. 7

B. 3

C. 8

D. 9

13.If the optimistic estimate for an activity is 12 days, and the pessimistic estimate is 18 days, what is the standard deviation of this activity?

A. 1

B. 3

C. 6

D. 13

14. During the Define Activities process, the team discovers that they do not know enough to define the activities for 30% of the work packages. What would be the BEST course of action?

A. Review the project charter with the sponsor and the team

B. Include this problem as part of risk identification

C. Redo the Define Scope process

D. Continue on to the Sequence Activities process and define the activities at a later date

15. A team member from research and development tell you that her work is too creative to provide you with a fixed single estimate for the activity. You both decide to use the average labor hours per installation from past projects to predict the future. This is an example of which of the following?

A. Analogous estimating

B. Monte Carlo analysis

C. Parametric estimating

D. Three-point estimating

16. During the Define Activities process, a team member begins talking about activities the project manager has never heard discussed. What should the project manager do?

A. Make sure the entire team agrees that the activities should be done

B. Make sure he has a good understanding of the activities and include the activities in the activity list

C. Ask the team member to explain why such an activity would be needed to complete the work package

D. Evaluate the impact of the change

17. Which of the following is an output of the Define Activities process?

A. A network diagram

B. An activity list

C. A project schedule

D. A WBS

18. What is another name for the waiting time between two activities?

A. Total float

B. Free float

C. Lag

D. CPM

19. During project planning, you estimate the time needed for each activity and then add the estimates to create the project estimate. You commit to completing the project by this date. What is wrong with this scenario?

A. The estimate is too long and should be create by management

B. The team did not create the estimate, and estimating takes too long using that method

C. The team did not create the estimate, and a network diagram was not used.

D. The project estimate should be the same as the customer's required completion date

20. Lag means:

A. The amount of time an activity can be delay without delaying the project finish date

B. The product of a forward and backward pass

C. The amount of time an activity can be delayed without delaying the early start date of its successor

D. Waiting time

21. In an activity represent:

A. Ac

21. In an activity-on-node diagram, the nodes represent:

A. Activities

B. Discretionary

C. Dependencies

D. Work packages

22. Company A is developing a project similar to one it delivered nearly 12 months earlier. What is the MOST likely approach to defining project activities?

A. Hire a third party expert to avoid mistakes that were encountered during previous projects

B. Add similar, if not the same, skill sets to the project team

C. Review organizational process assets

D. Gather the team for a brainstorming session

23. You are a project manager on a $5,000,000 software development project. While working with your project team to develop a network diagram, you notice a series of activities that can be worked in parallel but must finish in a specific sequence. What type of activity sequencing method is required for these activities?

A. Precedence diagramming method

B. Critical path method

C. Operational diagramming method

D. Arrow diagramming method

24. Under which circumstances is it BEST to use a network diagram rather than a bar chart?

A. To report to the sponsor

B. To show interdependencies between activities

C. To create a WBS

D. To track progress or to report to the team

25. What is a GERT chart?

A. A chart showing loops between activities

B. A bar chart showing project activities and their schedule

C. A chart showing causes of issues

D. A chart showing the upper and lower control limits

26. What is the duration of a milestone?

A. It has no duration

B. It is shorter than the duration of the longest activity

C. It is shorter than the activity it represents

D. It is the same length as the activity it represents

27. While planning the project, you discover an expert resource might be available to work on your project. However, the resource manager will not commit to the resource being on your team at the present time. The BEST thing to do would be to estimate the activity:

A. As though you had an average resource doing the activity

B. Using the expert judgment like Delphi technique

C. As if the expert resource were available

D. As if you had an inexperienced resource

28. All of the following are true statements about parametric estimating EXCEPT:

A. Estimates are based on inputs from the team

B. The model is scalable

C. Historical information is used in the model

D. The parameters used in the model are readily quantifiable

29. How many types of relationships between activities can be found on a precedence (AON) diagram?

A. 2

B. 3

C. 1

D. 4

30. Which of the following is true of the Estimate Activity Duration process?

A. Estimates should be made by resource managers in order to increase the accuracy of the estimates.

B. Historical information is too old to use in estimating

C. Estimates should always indicate the range of possible results

D. Critical paths should be taken into account when an activity is first estimated

31. Inputs to Define Activities include all the following EXCEPT:

A. A project scope statement

B. A team

C. A project schedule

D. WBS

32. A project manager needs to determine the resources needed for the project. Select the primary process from the following choices:

A. Estimate Activity Resources

B. Develop Schedule

C. Develop Human Resource Plan

D. Expert advice from functional managers

33. You are a project manager on a $5,000,000 software development project. While working with your project team to develop a network diagram, your data architects suggest that quality could be improved if the data model is approved by senior management before moving on to other design elements. They support this suggestion with an article from a leading software development journal. Which of the following BEST describes this type of input?

A. Discretionary dependency

B. Heuristic

C. External dependency

D. Mandatory dependency

34. Identifying and documenting the specific activities that must be performed to produce work packages is called:

A. Decomposition

B. Define Scope

C. Sequence Activities

D. Define Activities

35. What is the BEST method of estimating the time for an activity that has not previously been done by your company?

A. Monte Carlo analysis

B. Three-point estimating

C. Parametric estimating

D. Analogous estimating

36. Activities in the Define Activities process should meet:

A. Cost incentives

B. The Resource breakdown structure

C. Project deliverables

D. Schedule objectives

37. Which of the following includes all of the relationships represented on an activity-on-node diagram?

A. Finish-to-start

B. Start-to-start, start-to-finish

C. Finish-to-finish

D. Finish-to-start, start-to-finish, finish-to-finish, start-to-start