Lecture 3: Project Management

Project: A project is a series of related jobs, usually directed toward some major output
Project Management: Planning, Implementing and controlling resources to meet constraints and costs of the project

Project management:

- Planning, directing, controlling resources (people, equipment, material, etc.)
- to meet the technical, cost, and time constraints of the project.
- One time occurrences, but many projects can be repeated or transferred to other settings or products.
- The result would be another project output.
- *Important*- At the highest levels of an organization, management often involves juggling a portfolio of projects.
- Portfolio of new products, revision to old products, new marketing plans.

Categorized by

1. Type of change- changing the product or process
2. Amount of change- minor tweaks or major redesign
    a. **Derivative**: incremental changes e.g. new packaging or no-frills versions
    b. **Platform**: fundamental improvements to existing products
    c. **Breakthrough**: major changes that create entirely new markets

Project Structure:

- **Pure Project:** A self-contained team works full-time on the project.

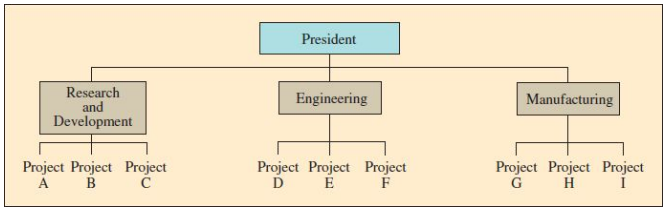
Advantages	Disadvantages
- Project manager has full authority - Team members report to one boss- no dividing of loyalty - Lines of communication short; quick DM - Team pride, motivation and commitment high	- Duplication of resources - Organizational goals and policies are ignored - Lack of technology transfer - Team members have no functional area "home" - After project finished, no more jobs for TM

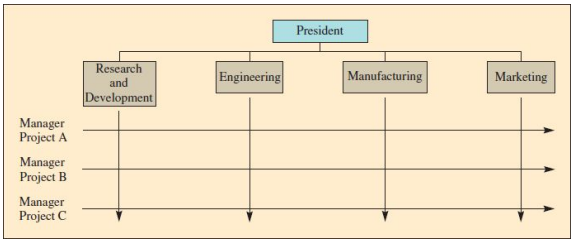
- **Functional Project:** team members are assigned from the functional units of the organization.
    - The team members remain a part of their functional units and typically are not dedicated to the project.
    - Responsibility for the project lies within one functional area of the firm.
    - Employees from that area work on the project, usually only part-time.

Advantages	Disadvantages
- A team member can work on several projects - Technical expertise maintained in functional area - Functional area is “home” after project completed- own department, not lose job - Critical mass of specialized knowledge	- Aspects of the project that are not directly related to the functional area get short-changed - Motivation of team members is often weak - Needs of the client are secondary and are responded to slowly

- **Matrix Project** A blend of pure and functional project structures – people from different functional areas work on the project, possibly only part-time.
    - Each project uses people for different functional areas.
    - A dedicated project manager decides what tasks need to be performed and when, but the functional managers control which people to use.

Advantages	Disadvantages
- Better communications between functional areas - Project manager held responsible for success - Duplication of resources is minimized - Functional “home” for team members - Policies of the parent organization are followed	- Too many bosses - Depends on project manager’s - Potential for sub-optimization



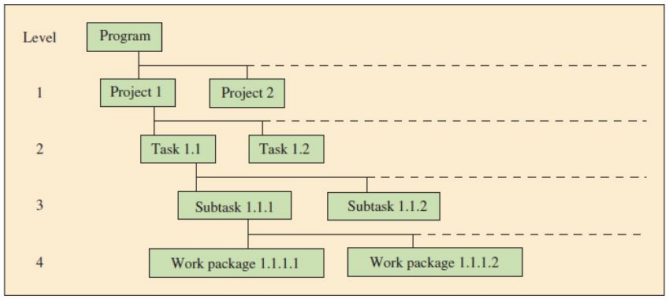


Organizing Project Tasks

- **Statement of Work**: A written description of the objectives to be achieved.
- **Task**: A further subdivision of a project – less than several months/performed by a single group or organization.
- **Subtask**: further sub-divide the project into more meaningful pieces.
- **Work Package**: A group of activities combined to be assignable to a single organizational unit
    - The package provides a description of what is to be done
    - When it is to be started and completed, the budget, measures of performance
    - Specific events to be reach at points in time.
- **Project Milestone**: Specific events in the life of the project e.g. design, prototype, pilot testing
- **Activities**: Pieces of work that consume time.
    - The completion of all activities of a project marks the end of the project.
    - does not always require the expenditure of effort. E.g. waiting for paint to dry.

- **Work Breakdown Structure**: Defines the hierarchy of project tasks, subtasks, and work packages.
    1. Completion of one or more work packages result in the completion of a subtask.
    2. Completion of one or more subtasks results in the completion of a task.
    3. Completion of all tasks is required to complete the project.

Overview



Details

Network Planning models (CPM)

- A project is made up of a sequence of activities that form a network representing a project.
- The path taking longest time through this network of activities is called the "critical path."
- The critical path provides a wide range of scheduling information useful in managing a project.
- **Critical path method (CPM)** helps to identify the critical path(s) in the project networks.

Critical path: the sequence(s) of activities in a project that form the longest chain in terms of their time to complete

- Assumes that project activity times can be estimated accurately and that they do not vary.
- If any one of the activities are delayed, the entire project is delayed.
- Determining scheduling information about each activity in the project is the major goal of CPM techniques.

CPM Activity Designations and Time Estimates

Activity	Designation	Immediate Predecessors	Time (weeks)
Design	A	–	21
Build prototype	B	A	5
Evaluate equipment	C	A	7
Test prototype	D	B	2
Write equipment report	E	C, D	5
Write methods report	F	C, D	8
Write final report	G	E, F	2

Steps for Critical Path Analysis:

1. *Identify each activity to be done and estimate how long it will take.*
    - Number is the expected duration of the activity
    - E.g. A(1), B(2), C(1), D(1)

2. *Determine the required sequence and construct a network diagram.*
    - **Immediate processors:** activities that need to be completed immediately before another activity.
    - e.g Activity A needs to be completed before B and C can start. B and C need to be completed before D can start.

3. *Determine the critical path.*
    - Consider each sequence of activities that runs from the beginning to the end of the project.
    - E.g. A-B-D (4 weeks) and A-C-D (3 weeks).
    - Critical path is the sum of activity times that is the longest.
    - Therefore, A-B-D is the critical path.

4. *Determine the early start/finish and late start/finish schedule.*
    - Find when each activity needs to start and finish.
    - **Slack time:** the time an activity can be delayed without delaying the entire project; the difference between the late and early start times of an activity.
    - Late start time – early start time
    - **Early start, Early finish:** earliest times the activity can start and be finished.
    - **Late start, Late finish:** latest times the activity can start can be finished; without delaying the project.

- **Early start schedule:** a project schedule that lists all activities by their early start times
- **Late start schedule:** a project schedule that lists all activities buy their late start times. This schedule may create savings by postponing purchases of materials and other costs associated with the project

CPM with Activity Time estimates

- When activity times vary, a single time estimate may not be reliable.
- Instead, estimate three values
    - Minimum
    - Maximum
    - Most likely
- This allows calculation of a probability estimate of completion time.
- This is the distinguishing characteristic of the PERT (Program Evaluation and Review Technique) method.

We can determine a probability of a completion time: **PERT method calculations**

- a = minimum
- b = maximum
- m = most likely
- ET = expected time
- σ^2 = variance

$$ET = \frac{a + 4m + b}{6}$$

$$\sigma^2 = \left(\frac{b - a}{6}\right)^2$$

Time cost models and project crashing:

- **Time-cost model:** extension of the critical path models that considers the trade-off between the time required to complete an activity and the total project cost.
    - Considers direct activity costs, indirect costs of project, and activity completion times
    - It is often referred to as “crashing” the project to reduce overall duration.

- **Crashing**: compression or shortening of the time to complete the project

Activity direct costs: costs associated with expediting activities. Add to the project direct costs**.** E.g. overtime work, hiring more workers, transferring workers, buying or leasing addition or more efficient equipment, additional support facilities.

Project indirect costs: Costs that are not directly accountable to a cost object. E.g. overhead, facilities, resource opportunity costs, penalty costs and lost incentive payments.

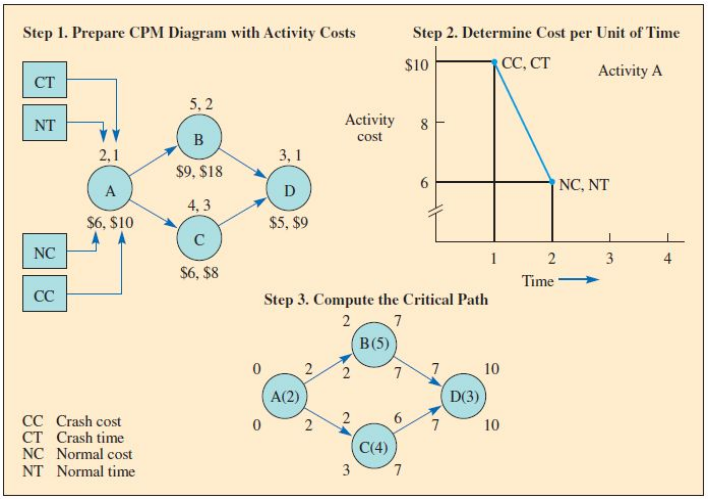
- Opposing costs dependent on time, the scheduling problem is essentially one of finding the project duration that minimizes their sum of; finding the optimum point in a time-cost trade off.

Project crashing- Time-cost trade off procedure (examples on lecture slides Week 3)

1. *Prepare a CPM-type network diagram.*
    - NC: lowest expected activity costs
    - NT: time associated with each normal cost
    - CT: the shortest activity time
    - CC: the cost associated with each crash time.
2. *Determine the cost per unit of time (assume days) to expedite each activity.*
    - Graphing CC and CT coordinates and connecting them to NC and NT coordinates.

$$Cost\ per\ unit\ time = \frac{CC - NC}{NT - CT}$$

3. *Compute the critical path.*
4. *Shorten the critical path at the point where costs are lowest.*
5. *Plot project, indirect, and total cost curves to find the minimum-cost schedule.*



Managing resources

- In addition to scheduling tasks, resources must also be assigned to specific tasks.
- Software can be used to spot over-allocation.
    - Planned use exceeds available supply
- When resources are over-allocated, either more resources are required or rescheduling is necessary.
    - Taking advantage of task slack can free resources

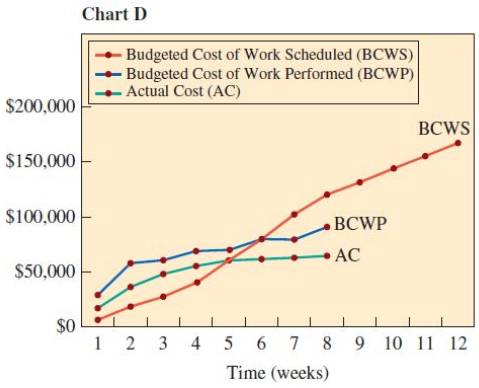
Managing projects:

- Project Control Charts (more examples on lecture slides Week 3)
- Charts provide an easily understood visual presentation.
- Software can be used to create the charts.
- **Gantt charts:** shows in a graphic manner, the amount of time involved and the sequence of activities. Often referred to as a bar chart.

Earned Value Management (EVM):

EVM: A technique for measuring project progress in an objective manner

- Has the ability to combine measurements of scope, schedule, and cost in a project
- Provides a method for evaluating the relative success of a project at a point in time



Essential features:

1. A project plan that identifies the activities to be accomplished
2. A valuation of each activity work
3. Predefined *earning* or *costing rules* to quantify accomplishment of work

Project tracking with EVM: a combined view gives an overview of project performance in terms of the original plan.
Project tracking without EVM: Missing is the understanding of how much work has been accomplished during the project.

- A method needed to measure technical performance objectively and quantitatively, and this is what EVM accomplishes.

Tutorial 2 notes:

- Assessment task 2 - select a topic and provide a short description of it
- Document name should be your group name and tutorial number (8)/tutor
- Group leader sends the email to the tutor
- Decide on assessment task 2 topic

Q1. Project Control should always focus on CPR:

- HIgh variation activities - not critical activities
- CPR is all about time, but time is no the only factor (e.g. Cost, quality)
- So not good to focus only on the critical path
- But it is good for finding out which activity has the highest uncertainties

Q2. What are some reason project scheduling is not done well?

- Communication problem
- HR issues - absence, non productivity
- Long project duration
- Complicated project and team does not understand Ineffective project manager
- Managers are not coordinating resources properly

Numerical question 1:

- Learn how to draw up critical path
- What is the critical path (A, Cm D, E, G)
- And calculate how many weeks it will take to draw it up (6+7+2+4+7 = 26)
- Critical activities do not have any slack
- Activity B has 6 weeks of slack (difference between its early and late start times)