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School of Business

37E01500 Project Management and Consulting
Practice

Project planning and creating a WBS

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Lecture 3, Wed 24.4.2019

Learning objectives

- **Describe the project time management planning tasks, and prepare a project schedule based on activity and milestone lists, activity sequencing, durations, and resources.**
 - Understand the process of managing a project.
 - Develop the skills required to be an effective project manager.
 - Know project management activities during project planning & execution.
 - Understand critical path scheduling, Gantt charts, and Network diagrams.



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23 April 2019
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Contents

- **Project scope and WBS**
- **Project scheduling**
- **Cost estimation**
- **Summary**

This lecture refers to the course book

- Schwalbe (2013) Revised An Introduction to Project Management, Fourth edition.
- *Ch. 4: Planning projects, Part 1*
- *Ch. 5: Planning projects, Part 2*

Challenges in information systems project management

- **Planning**
 - Difficulties in defining & specifying intended solutions
 - Planning the obscure future work
- **Management**
 - Managing knowledge work
 - Sharing knowhow
- **Leadership**
 - Leading & motivating experts
- **Control**
 - Understanding interdependencies
 - Identification of risks

Typical contents of a project plan

- **Project Description**
- **Objectives and definitions**
- **Schedule**
 - Development & implementation divided into clear goal-oriented phases
- **Budget and effort estimation**
- **Risk management**
 - Technical risks
 - Resource risks
 - Business risks
- **Project organization**

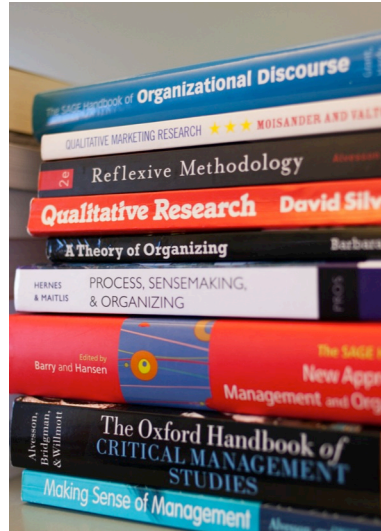
A good project plan is:

- **A map for project implementation**
- **A simulation of project**
- **An agreement between the vendor and consignee**
- **A budget for the project**
 - Little money in planning can save much in implementation
- **Frame for project documentation**
 - Assign documents for tasks or milestones
- **Learning tool**
 - A tool for gathering experience



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Project scope and WBS



Project planning

- Step 1: Defining the Project Scope**
- Step 2: Establishing Project Priorities**
- Step 3: Creating the Work Breakdown Structure**
- Step 4: Integrating the WBS with the Organization**
- Step 5: Scope, time & budget estimation**

Step 1: Defining the scope

- **Project Scope**
 - A definition of the end result or mission of the project— a product or service for the client/customer— in specific, tangible, and measurable terms.
- **Purpose of the Scope Statement**
 - To clearly define the deliverable(s) for the end user.
 - To focus the project on successful completion of its goals.
 - To be used by the project owner and participants as a planning tool and for measuring project success.

Project scope checklist

- Is the objective clear?
- What are the key deliverables?
- What are the main milestones?
- Technical requirements?
- Limits and exclusions?
- Reviews with customer?

Step 2: Establishing the priorities

- **Causes of Project Trade-offs**
 - Shifts in the relative importance of criteria related to cost, time, and performance parameters
 - Budget–Cost
 - Schedule–Time
 - Performance–Scope
- **Managing the Priorities of Project Trade-offs**
 - Constrain: a parameter is a fixed requirement.
 - Enhance: optimizing a parameter over others.
 - Accept: reducing (or not meeting) a parameter requirement.

Step 3: Creating the Work Breakdown Structure (WBS)

- **WBS is a hierarchical outline (map) that identifies the products and work elements involved in a project.**
- **Defines the relationship of the final deliverable (the project) to its subdeliverables, and in turn, their relationships to work packages.**
- **Best suited for design and build projects that have tangible outcomes rather than process-oriented projects.**

Sample WBS

Work Breakdown Structure (WBS) for the Just-In-Time Training Project August 1

1. Initiating
 - 1.1. Prepare stakeholder analysis
 - 1.2. Prepare business case
 - 1.3. Create project charter
 - 1.4. Hold project kickoff meeting
 - 1.5. Develop preliminary scope statement
2. Planning
 - 2.1. Project integration management
 - 2.1.1. Create team contract
 - 2.1.2. Develop project management plan
 - 2.2. Project scope management
 - 2.2.1. Develop scope statement
 - 2.2.2. Create WBS and WBS dictionary
 - 2.3. Project time management
 - 2.4. Project cost management
 - 2.5. Project quality management
 - 2.6. Project human resource management
 - 2.7. Project communications management
 - 2.8. Project risk management
 - 2.9. Project procurement management

Sample WBS (cont.)

3. Executing
 - 3.1. Course design and development
 - 3.1.1. Supplier management training
 - 3.1.1.1. Needs assessment
 - 3.1.1.1.1. Develop survey
 - 3.1.1.1.2. Administer survey
 - 3.1.1.1.3. Analyze survey results
 - 3.1.1.2. Research of existing training
 - 3.1.1.3. Partnerships
 - 3.1.1.3.1. Research potential partners for providing training
 - 3.1.1.3.2. Meet with potential partners
 - 3.1.1.3.3. Develop partnership agreements
 - 3.1.1.4. Course development
 - 3.1.1.4.1. Develop executive course
 - 3.1.1.4.2. Develop introductory course
 - 3.1.1.4.3. Develop advanced course
 - 3.1.1.5. Pilot course
 - 3.1.1.5.1. Plan pilot course
 - 3.1.1.5.2. Hold pilot course
 - 3.1.1.5.3. Prepare report on pilot course
 - 3.1.1.5.4. Review results of pilot course
 - 3.1.2. Negotiating skills training
 - 3.1.3. Project management training
 - 3.1.4. Software applications training
 - 3.2. Course administration
 - 3.3. Course evaluation
 - 3.4. Stakeholder communications
 - 3.4.1. Communications regarding project and changes to training
 - 3.4.1.1. Prepare emails, posters, memos, and other information
 - 3.4.1.2. Plan and hold meetings
 - 3.4.1.3. Prepare information for the corporate intranet
 - 3.4.2. Communications regarding productivity improvements
4. Monitoring and controlling
5. Closing

Creating a good WBS

- It is difficult to create a good WBS
- The project manager and the project team must decide as a group how to organize the work and how many levels to include in the WBS
- It is often better to focus on getting the top levels of the WBS done well to avoid being distracted by too much detail
- Many people confuse tasks on a WBS with specifications or think it must reflect a sequential list of steps

Work packages

- **A work package is the lowest level of the WBS.**
 - It is output-oriented in that it defines work (what).
 - Identifies time to complete a work package (how long)
 - Identifies a time-phased budget to complete a work package (cost)
 - Identifies resources needed to complete a work package (how much)
 - Identifies a single person responsible for units of work (who)
 - Identifies monitoring points (milestones) for measuring success.

Step 4: Integrating the WBS with the organization

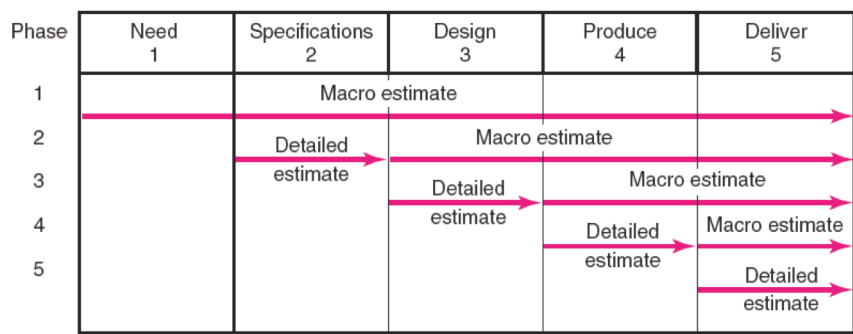
- **Organizational Breakdown Structure (OBS)**
 - Depicts how the firm is organized to discharge its work responsibility for a project, and
 - Provides a framework to summarize organization work unit performance.
 - Identifies organization units responsible for work packages.
 - Ties the organizational units to cost control accounts.

Step 5: Project estimation

- **Make rough top-down estimates**
-> **Develop the WBS/OBS.**
- **Make bottom-up estimates**
-> **Develop schedules and budgets.**
- **Reconcile differences between top-down and bottom-up estimates**

Project scheduling

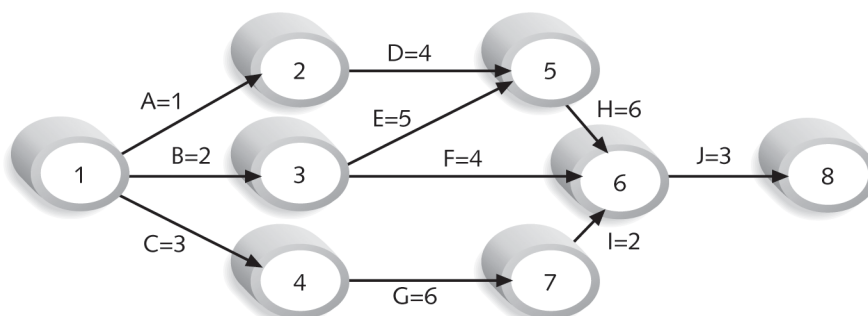
Combining the macro and micro approaches: Phase estimating over project life cycle



Defining the project schedule

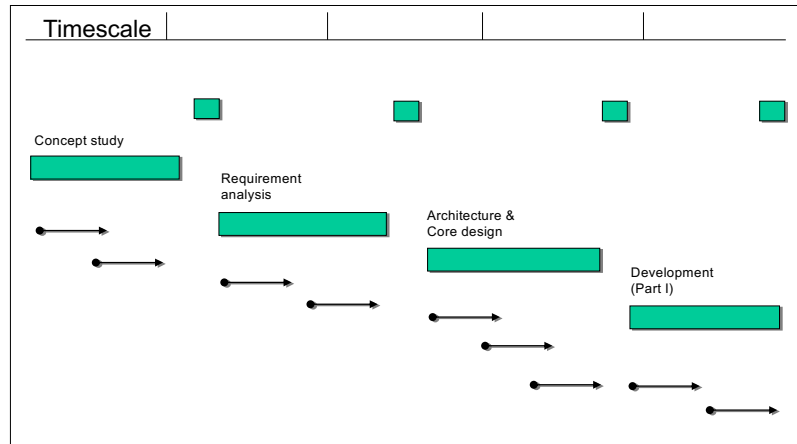
- **The Project Network** is a flow chart that graphically depicts the sequence, interdependencies, and start and finish times of the project job plan of activities that is the *critical path* through the network.
 - Provides the basis for scheduling labor and equipment.
 - Enhances communication among project participants.
 - Provides an estimate of the project's duration.
 - Provides a basis for budgeting cash flow.
 - Identifies activities that are critical.
 - Highlights activities that are “critical” and can not be delayed.
 - Help managers get and stay on plan.

An Activity-On-Arrow (AOA) network diagram for project x

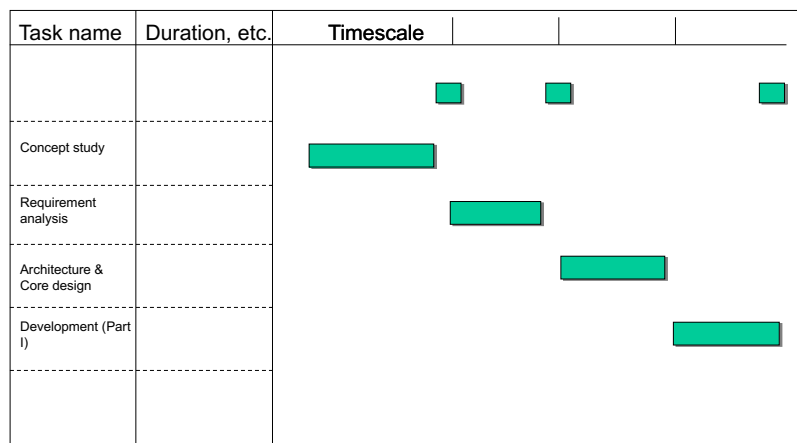


Note: Assume all durations are in days; A=1 means Activity A has a duration of 1 day.

Project network diagram (combining activity on arrow & project network techniques)



Gantt chart diagram (a common technique in most US-based PM software tools)



Program Evaluation and Review Technique (PERT)

- PERT is a network analysis technique used to estimate project duration when there is a high degree of uncertainty about the individual activity duration estimates.
- PERT weighted average =

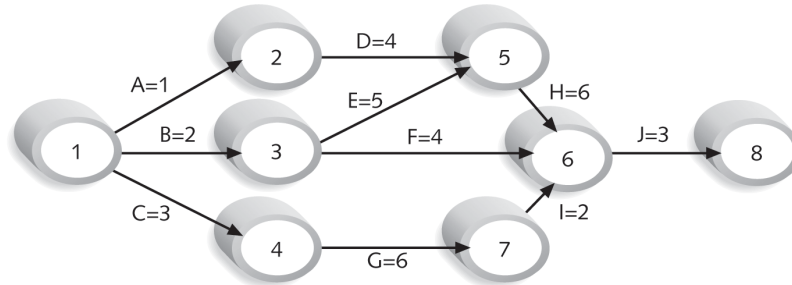
$$\frac{\text{optimistic time} + 4 \times \text{most likely time} + \text{pessimistic time}}{6}$$
- Example: PERT weighted average =

$$(1 \text{ workday} + 4 \times 2 \text{ workdays} + 9 \text{ workdays}) / 6 = 3 \text{ workdays}$$
- Instead of using the most likely time of two workdays for this task, you'd use three workdays with a PERT estimate

Critical path analysis

- Critical path method (CPM)—also called critical path analysis—is a network diagramming technique used to predict total project duration.
- A critical path for a project is the series of activities that determine the *earliest* time by which the project can be completed. It is the *longest* path through the network diagram and has the least amount of slack or float.
 - **Slack** or **float** is the amount of time an activity may be delayed without delaying a succeeding activity or the project finish date.
- The longest path or the path containing the critical tasks is what is driving the completion date for the project.

A critical path calculation for project x



Note: Assume all durations are in days.

Path 1: A-D-H-J Length = $1+4+6+3 = 14$ days

Path 2: B-E-H-J Length = $2+5+6+3 = 16$ days

Path 3: B-F-J Length = $2+4+3 = 9$ days

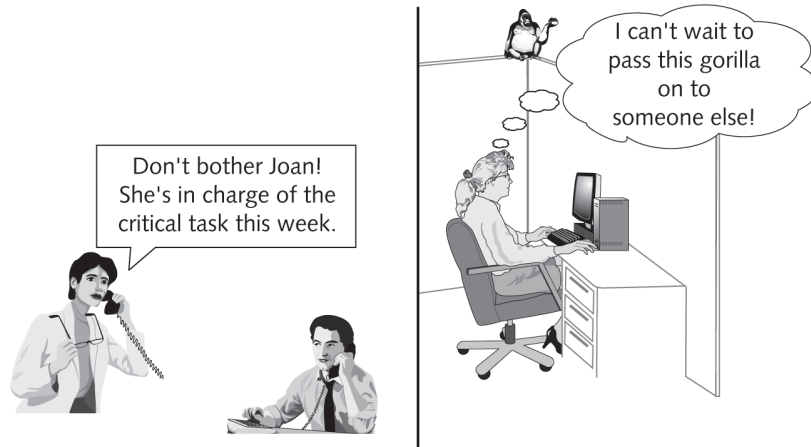
Path 4: C-G-I-J Length = $3+6+2+3 = 14$ days

Because the critical path is the longest path through the network diagram, Path 2, B-E-H-J, is the critical path for Project X.

What does the critical path really mean?

- **The critical path shows the shortest time in which a project can be completed.**
- **If one or more of the activities on the critical path takes longer than planned, the whole project schedule will slip *unless* the project manager takes corrective action.**
- **For example: Apple Computer team members put a stuffed gorilla on top of the cubicle of whoever was in charge of a critical task, so they would not distract him or her.**

Critical path: Who's stuck with the gorilla this week?



Using critical path analysis to make schedule trade-offs

- It is important to know what the critical path is throughout the life of a project so that the project manager can make trade-offs.
- If one of the tasks on the critical path is behind schedule, should the schedule be renegotiated with stakeholders, or should more resources be allocated to other items on the critical path to make up for that time?
- It is also common for project stakeholders to want to shorten project schedule estimates, so you need to know what tasks are on the critical path

Schedule compression techniques

- **Crashing is a technique for making cost and schedule trade-offs to obtain the greatest amount of schedule compression for the least incremental cost.**
 - If two critical tasks each take two weeks, and it will take \$100 to shorten Task 1 by a week and \$1,000 to shorten Task 2 by a week, shorten Task 1.
- **Fast tracking involves doing activities in parallel that you would normally do in sequence.**
 - Instead of waiting for Task 1 to be totally finished before starting Task 2, start Task 2 when Task 1 is halfway done.
- **Schedule compression often backfires by causing cost, human resource, and quality problems, which lead to even longer schedules.**

Buffers and critical chain

- **A buffer is additional time to complete a task.**
- **Murphy's Law states that if something can go wrong, it will.**
- **Parkinson's Law states that work expands to fill the time allowed.**
- **In traditional estimates, people often add a buffer to each task and use it if it's needed or not.**
- **Critical chain scheduling removes buffers from individual tasks and instead creates:**
 - A **project buffer** or additional time added before the project's due date.
 - **Feeding buffers** or additional time added before tasks on the critical path

Creating a milestone list

- A milestone is a significant event in a project
- It often takes several activities and a lot of work to complete a milestone, but the milestone itself is like a marker to help identify necessary activities
- There is usually no cost or duration for a milestone
- Project sponsors and senior managers often focus on major milestones when reviewing projects
- Sample milestones for many projects include:
 - Sign-off of key documents, Completion of specific products
 - Completion of important process-related work, such as awarding a contract to a supplier

A sample milestone list

Milestone	Initial Estimated Completion Date*
Draft survey completed	8/3
Survey comments submitted	8/8
Survey sent out by IT	8/10
Percentage of survey respondents reviewed	8/17
Survey report completed	8/22
Survey results reported to steering committee	8/24

*Note: Dates are in U.S. format. 8/3 means August 8.

Project milestones

A good milestone is:

- **Clear**
 - Understandable to everybody involved in the project
 - A feasible tool for commitment to targets
- **Manageable**
 - Comprises exact definition of the target ‘
 - Both quantity and quality are measurable
- **Viable**
 - Centered around essential goals and decisions
- **Logical**
 - It is possible to realize in the planned sequence of activities

Summary

- **Plans remove uncertainties and reduce risks of projects**
- **Key planning activities are:**
 - Defining a detailed work breakdown list
 - Defining a time table for the project based on activity sequences
 - Defining budget for the project

Thank you for your attention!



Other methodologies

- **PRjects IN Controlled Environments (PRINCE2)**
 - Developed for IT projects, PRINCE2 was released in 1996 as a generic project management methodology. It is the defacto standard in the U.K. and is used in over 50 countries
- **Agile methodologies**
 - Many software development projects use an iterative workflow and incremental delivery of software.
 - See: <https://www.cio.com/article/3156998/agile-project-management-a-beginners-guide.html>
- **Rational Unified Process (RUP) framework**
 - RUP is an iterative software development process that focuses on team productivity and delivers software best practices to all team members
- **Six Sigma**
 - Many organizations have projects underway that use Six Sigma methodologies (based on quality control principles).