

Multidisciplinary Projects

Class 1: Multidisciplinary Projects as Software Projects

Agenda

- Learning Objectives
- Introduction to Software Project Management

Learning Objectives

- Understanding the motivation of project management.
- Understanding the definition of a multidisciplinary project.
- Understanding a multidisciplinary project under an IT/SE project.

What Went Wrong?

- IT Projects have a terrible track record, as described in the What Went Wrong?
- A 1995 Standish Group study (CHAOS) found that only 16.2% of IT projects were successful in meeting scope, time, and cost goals; over 31% of IT projects were canceled before completion
- A PricewaterhouseCoopers study found that over half of all projects fail and only 2.5% of corporations consistently meet their targets for scope, time, and cost goals for all types of project

Formal Project Management

- Advantages of Using Formal Project Management:
 - Better control of financial, physical, and human resources
 - Improved customer relations
 - Shorter development times
 - Lower costs and improved productivity
 - Higher quality and increased reliability
 - Higher profit margins
 - Better internal coordination
 - Positive impact on meeting strategic goals
 - Higher worker morale

What Is a Project?

- A project is “a temporary endeavor undertaken to create a unique product, service, or result” (PMBOK® Guide, Sixth Edition, 2017)
- Operations is work done to sustain the business
- Projects end when their objectives have been reached or the project has been terminated

Project Attributes

- A project
 - has a unique purpose
 - is temporary
 - drives change and enable value creation
 - is developed using progressive elaboration
 - requires resources, often from various areas
 - should have a primary customer or sponsor
 - The project sponsor usually provides the direction and funding for the project
 - involves uncertainty
- Project managers work with project sponsors, team, and other people involved in a project to achieve project goals

Project Constraints



FIGURE 1-1 Project constraints

What is Project Management?

- Project management is “the application of knowledge, skills, tools and techniques to project activities to meet project requirements” (PMBOK® Guide, Sixth Edition, 2017)
- Project managers strive to meet the triple constraint (project scope, time, and cost goals) and also facilitate the entire process to meet the needs and expectations of project stakeholders

Project Management

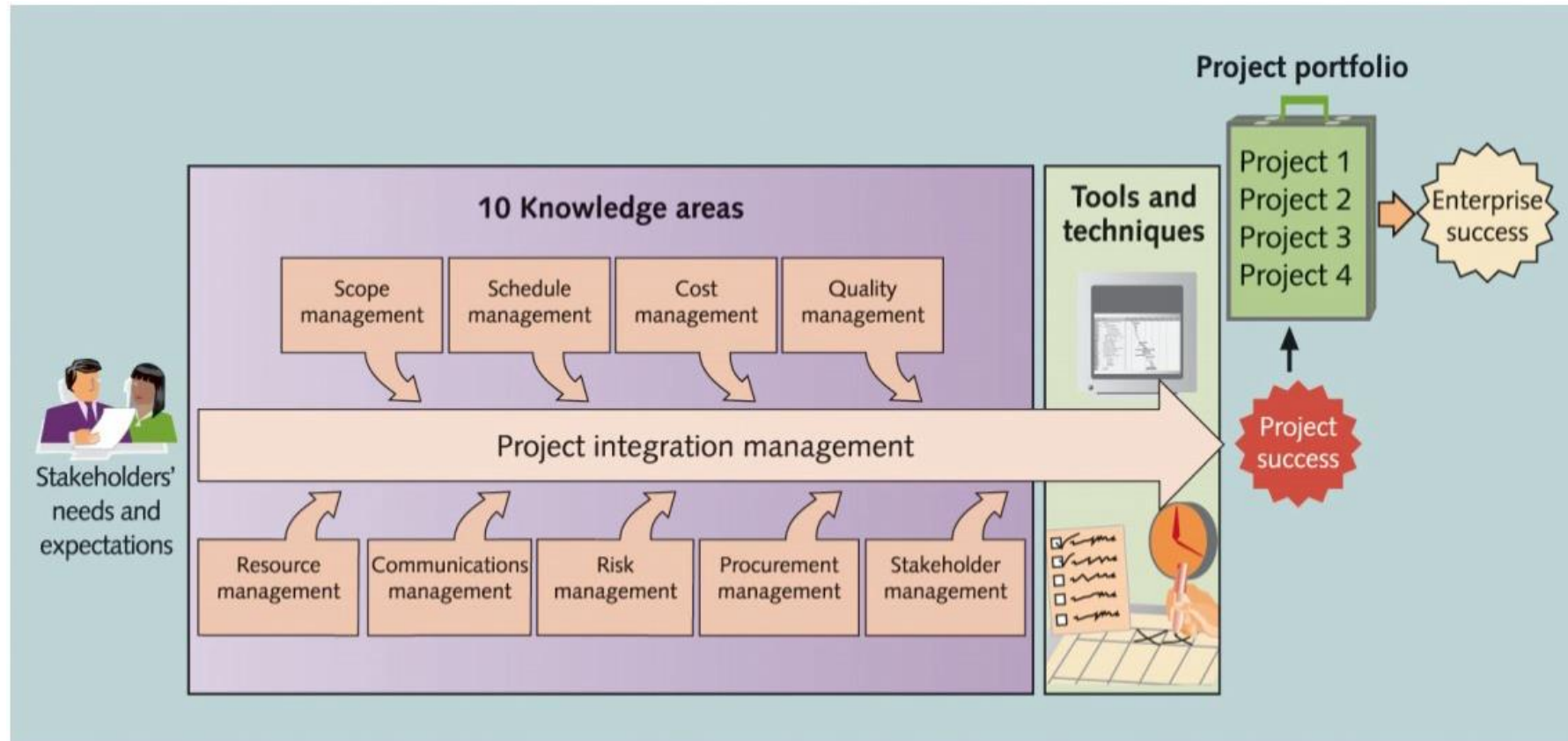


FIGURE 1-2 Project management framework

The Aim of Project Management

- To complete a project:
 - On time
 - On budget
 - With required functionality
 - To the satisfaction of the client
 - Without exhausting the team
- To provide visibility about the progress of a project

The Aim of Project Management

- Clients wish to know:
 - Will the system do what was promised?
 - When will it be delivered? If late, how late?
 - How does the cost compare with the budget?
- Often the software is part of a larger activity
 - If the system is a product, marketing and development must be combined (e.g., Microsoft Office)
 - If the system has to work with other systems, developments must be coordinated (e.g., embedded systems in an automobile)

Aspects of Project Management

- Planning
 - Outline schedule during feasibility study (needed for SE)
 - Fuller schedule for each part of a project (e.g., each process step, iteration, or sprint)
- Contingency planning
 - Anticipation of possible problems (risk management)
- Progress tracking
 - Regular comparison of progress against plan
 - Regular modification of the plan
 - Changes of scope, etc. made jointly by client and developers
- Final analysis
 - Analysis of project for improvements during next project

Terminology

- Deliverable
 - Work product that is provided to the client (mock-up, demonstration, prototype, report, presentation, documentation, code, etc.)
 - Release of a system or subsystem to customers or users
- Milestone
 - Completion of a specified set of activities (e.g., delivery of a deliverable, completion of a process step)
- Activity
 - Part of a project that takes place over time (also known as a task)

Terminology

- Event
 - The end of a group of activities, e.g., agreement by all parties on the budget and plan
- Dependency
 - An activity that cannot begin until some event is reached
- Resource
 - Staff time, equipment, or other limited resources required by an activity

Standard Approach to Project Management

- The scope of the project is defined early in the process.
- The development is divided into tasks and milestones.
- Estimates are made of the time and resources needed for each task.
- The estimates are combined to create a schedule and a plan.
- Progress is continually reviewed against the plan, perhaps weekly.
- The plan is modified by changes to scope, time, resources, etc.
- Typically the plan is managed by a separate project management team, not by the software developers.

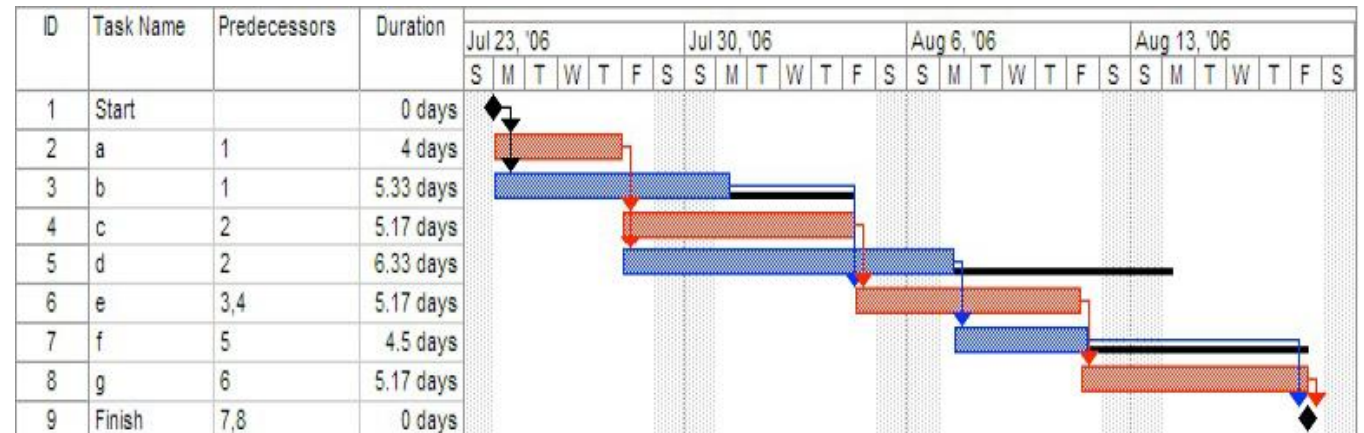
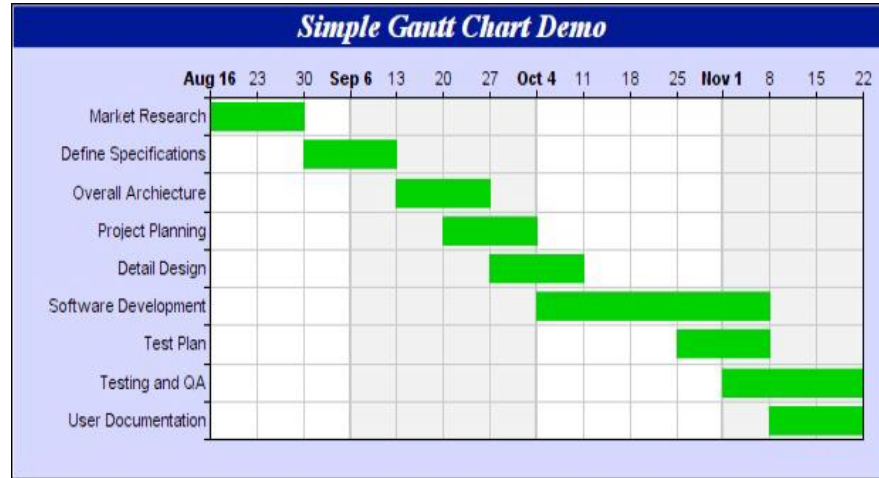
Agile Approach to Project Management

- Planning is divided into high level release forecasting and low level detailed planning.
- Release planning is a best guess, high level view of what can be achieved in a sequence of time-boxes (sprint).
- Release plans are continually modified, perhaps daily.
- Clients and developers take joint control of the release plans and choice of sprints.
- For each time-box, the team plans what it can achieve. The team may use Gantt charts or other conventional planning tools.

Project Planning Tools

- Critical Path Method, Gantt charts, Activity bar charts, etc.
 - Build a work-plan from activity data.
 - Display work-plan in graphical or tabular form.
- Project planning software (e.g., Microsoft Project)
 - Maintain a database of activities and related data
 - Calculate and display schedules
 - Manage progress reports

Gantt Chart Example

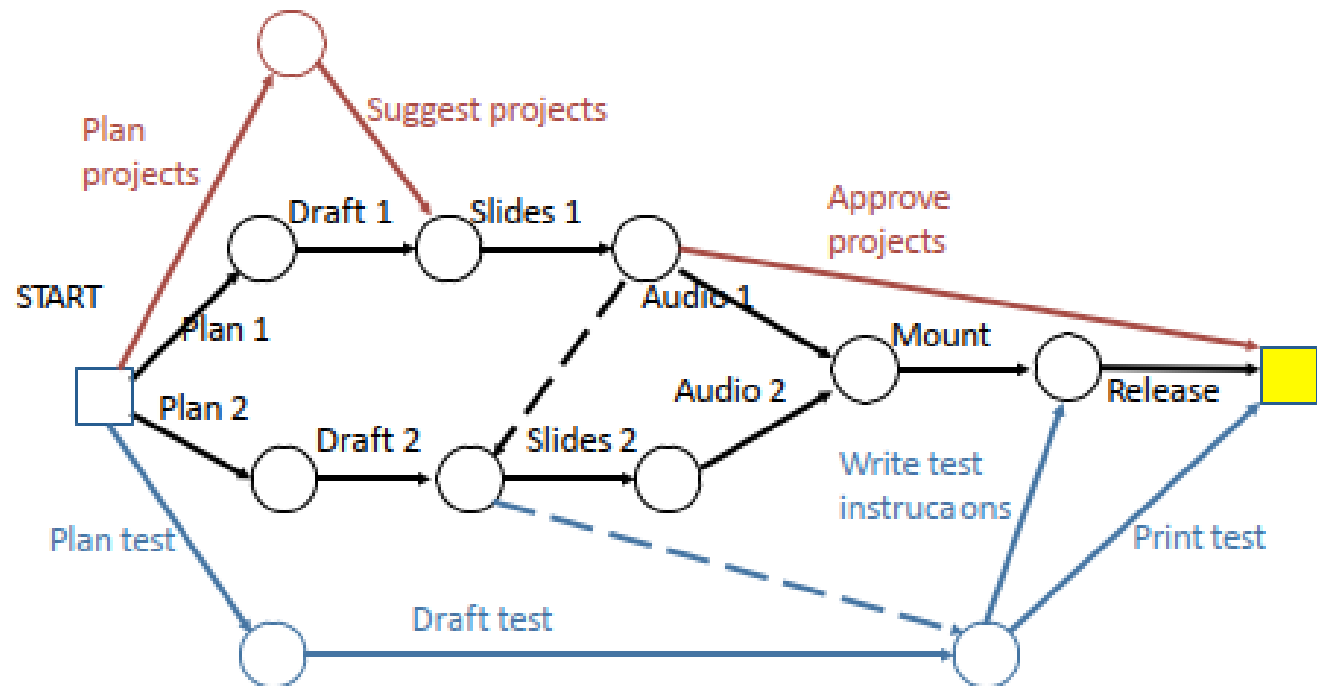


Gantt Chart

- Used for small projects, single time-boxes, and sprints
 - Dates run along the top (days, weeks, or months).
 - Each row represents an activity. Activities may be sequential, in parallel or overlapping.
 - The schedule for an activity is a horizontal bar. The left end marks the planned beginning of the task. The right end marks the expected end date.
 - The chart is updated by filling in each activity to a length proportional to the work accomplished.
 - Progress to date can be compared with the plan by drawing a vertical line through the chart at the current date.

Activity Graph

- An activity (task)
- - - - -> A dummy activity (dependency)
- An event
- A milestone



Multi-disciplinary Project

- Multi-disciplinary Project means a project comprising building work, together with its associated engineering work, where the engineer is subject to the authority of another professional acting as the Principal Agent while financial and administrative matters are dealt with by another professional.

Feasibility Study

- A feasibility study is a study made before committing to a project. A feasibility study leads to a decision:
 - go ahead
 - do not go ahead
 - think again
- In production projects, the feasibility study often leads to a budget and resource request.
- A feasibility study may be in the form of a proposal.

Feasibility Study-Benefits

- Organization benefits
 - Create a marketable product
 - Improve the efficiency of an organization (e.g., save staff)
 - Control a system that is too complex to control manually
 - New or improved service (e.g., faster response to customers)
 - Safety or security
- Professional benefits are not the reason for doing a project

Feasibility Study-Technical

- A feasibility study needs to demonstrate that the proposed system is technically feasible. This requires:
 - an outline of the requirements
 - a possible system design (e.g., database, distributed, etc.)
 - possible choices of software to be acquired or developed
 - estimates of numbers of users, data, transactions, etc.
- These rough numbers are part of the provisional plan that is used to estimate the staffing, timetable, equipment needs, etc. The technical approach actually followed may be very different.

Feasibility Study-Planning and Resources

- The feasibility study must include an outline plan:
 - Estimate the staffing and equipment needs, and the preliminary timetable
 - Identify major milestones and decision points
 - Identify interactions with and dependences on external systems
- Provide a preliminary list of deliverables and delivery dates

Feasibility Study-Alternatives and Risks

- A feasibility study should identify risks and alternatives.
 - What can go wrong?
 - How will progress be monitored and problems identified (visibility)?
 - What are the fall back options?
- Alternatives
 - Continue with current system, enhance it, or create new one?
 - Develop in-house, or contract out? (How will a contract be managed?)
 - Phases of delivery and possible points for revising plan.

Techniques for Feasibility Studies

- The highest priority is to ensure that the client and development team have the same understanding of the goals of the system.
- For the development team to understand the goals:
 - Interviews with client and the staff of the client's organization
 - Review of existing systems (including competitors')
- For the client to appreciate the proposed system:
 - Demonstration of key features or similar systems
 - Walk through typical transactions or interactions

Techniques for Feasibility Studies

- Outline budget:
 - n people for m months at $\$x$ per month
 - equipment, buildings, etc.
 - contingency (at least 50% is needed)
- Phases/milestones:
 - specify deliverables and approximate dates
 - planned releases

Feasibility Study-Decision

- Different organizations and senior managers have different styles for feasibility studies, e.g., some decision makers:
 - Monitor the team and the process
 - Rely on detailed reading of a written report
 - Rely on face-to-face questioning of knowledgeable people
- But they must understand the decision.

Feasibility Report

- Specific Requirements for the Feasibility Report
 - Outline plan, showing principal activities and milestones.
 - Discussion of Business Considerations.
 - Risk analysis. What can go wrong? What is your fall back plan?

How to Minimize Risk?

- Techniques for managing risk
 - Several target levels of functionality: required, desirable, optional phases
 - Visible software process: intermediate deliverables
 - Good communication within the team, with the client, and with the experts.
 - Well defined development process

How to Minimize Risk?

- The report is vague about the scope. Without a clear definition of scope, it is not clear that the project is feasible.
- The plan does not describe the activities in enough detail to estimate the effort convincingly.
- The project is too ambitious. The report needs to describe how will you monitor the progress and adjust the scope if necessary.

Uncertainty Study

- Clients may be unsure of the scope of the project.
- Benefits are usually very hard to quantify.
- Approach is usually ill-defined. Estimates of resources and timetable are very rough.
- Organizational changes may be needed.

Feasibility Study Difficulties

- Feasibility studies rely heavily on the judgment of experienced people.
- Mistakes made at the beginning of a project are the most difficult to correct.
- **Advocacy** is needed to build enthusiasm for a project: to convince an organization to undertake an expensive, complex project with many risks.
- **Enthusiasm** is good, but enthusiasts usually emphasize potential benefits and downplay risks.

Personnel Performance

- In the project computing, not all people are equal
 - The best are ten times more productive.
 - Some tasks are too difficult for everybody.
- Adding more people adds communications complexity
 - Some activities need a single mind.
 - Sometimes, the elapsed time for an activity can not be shortened.
- Adding more people may increase the time to complete a project.

Project Manager

- Create and maintain the schedule.
- Track progress against schedule.
- Keep some slack in the schedule (minimize risk).
- Continually make adjustments:
 - Start activities before previous activity complete
 - Sub-contract activities
 - Renegotiate deliverables
- Keep senior management informed (visibility).
- The project manager needs the support of the head of the development team and the confidence of the team members.

