Conducting a Literature Review

Conducting a Literature Review (1)

1. Choose a topic. Define your research question.

Your literature review should be guided by a central research question. Remember, it is not a collection of loosely related studies in a field but instead represents background and research developments related to a specific research question, interpreted and analyzed by you in a synthesized way.

Tips:

- Make sure your research question is not too broad or too narrow. Is it manageable?
- Begin writing down terms that are related to your question. These will be useful for searches later.
- Further discuss the details of your topic with your advisor.

2. Decide on the scope of your review.

How many studies do you need to look at? How comprehensive should it be? How many years should it cover?

Tip:

- This may depend on your assignment.

Conducting a Literature Review (2)

3. Select the databases you will use to conduct your searches.

Make a list of the databases you will search. (Note: there are comprehensive databases such as WorldCat -- include Dissertations & Theses, if you need to).

- The library also creates research guides for all of the disciplines on campus!
- Patent databases are also very valuable sources of information!

4. Conduct your searches and find the literature. Keep track of your searches!

- Aim at finding books and survey / overview / tutorial articles first! Read, consult them first. Then consider and obtain the sources referenced at the end of these survey articles or books. Be careful not to select too many papers. Ask your advisor or other experts about good references.
- Review the abstracts of research studies carefully. This will save you time.
- Write down the searches you conduct so that you may duplicate them if you need to later (or avoid searches that you'd already tried)

Conducting a Literature Review (3)

5. Review in more detail the literature

- What was the research question of the study you are reviewing? What were the authors trying to discover?
- What were the research methodologies? Analyze its literature review, the samples and variables used, the results, and the conclusions. Does the research/project seem to be complete? Could it have been conducted more soundly? What further questions does it raise?
- If there are conflicting studies, why do you think that is?
- How are the authors viewed in the field? Has this study been cited? if so, how has it been analyzed?
- Was the research funded by a source that could influence the findings?

Tips:

- Again, review the abstracts carefully.
- Keep careful notes so that you may track your thought processes during the research process. Make your own summaries of the papers.

CMPE 490
Design Principles in Engineering & Computer Engineering

Managing Projects/Your CMPE Project

Introduction

- Engineers design things
- We are expected to construct an ″object″ or ″objects″
  - Watch over the budget
  - Get the work done in a timely manner
  - Ensure that the final product satisfies the end users
- Until the modern age, little attention was given to the financial aspect of a project
  - Egyptians: pyramids
  - Romans: roads and bridges
  - Europe: cathedrals
  - Ottomans: mosques
  - ...

Introduction

- In the past, engineering design relied on guess; no plans
- After WW II, engineers started to establish *best practices*
  - Engineers began to gather best practices for running a project
  - The work then becomes an engineering *project*
- Running a project draws on principles common to all engineering fields (hence also applies to computer engineering)
- What are the best processes of Project Management?
- By the way, what is a ”project”?

Example: Software Engineering

- Software is ubiquitous
  - In essentially every device now manufactured
  - Your electric razor has 2000 lines of C-code in it
  - A pacemaker has about 500’000
  - Your cell phone?
- Software has some very strange properties
  - Once constructed, we can make an unlimited number of copies
  - It is long lived (because expensive to build)
  - As it ages, it is ‘enhanced’ by developers
- Software engineering tends to be complex (messy?)
  - How should we engineer it for increased reliability?

When is a Project Successful?

- Rule of thumb: For a project to be considered successful it has to be within 20% of the originally estimated time, cost and quality (we have seen the importance of ”specs” last time)
- It has been claimed that the average North American software project is one year late and 100% over budget
- Why is the success rate so low?
  - Many projects start with inaccurate or nonexisting estimates
  - Scopes constantly changing
  - Constrained by short duration and limited resources
  - Faced with risks maturing into real problems
  - Project staff may not be properly trained
  - ...

Some Very Expensive Engineering Failures (1)

- Suez Canal: 1900% over budget
  - ”Not-for-profit” megaproject
  - Opened in November 1869 after 10 years of construction
  - Cost deliberately underestimated to start the project
- Boston’s Big Dig: 370% over budget, 320% over schedule
  - Megaproject to reroute Interstate 93 from above ground to a 5.6-km underground tunnel
  - Estimated to cost $6 billion and 5 years to complete
  - Final cost over $22 billion, took 16 years to complete (1991-2007)
  - Failure was a combination of unkown terrain, poor engineering, and fraud

Some Very Expensive Engineering Failures (2)

- Sydney Opera House: 1400% over budget, 350% over schedule
  - Cost overruns due to novel construction techniques
  - Political problems
  - One of the most beautiful buildings in the world
- Concorde: 1100% over budget
  - Joint French-British project of a supersonic aircraft (Mach 2.04)
  - Entered service in 1976 and continued commercial flights for 27 years
  - Never achieved profitability
  - Superb aircraft


BRITISH AIRWAYS
G-BOAE

Some Very Expensive Engineering Failures (3)

- CONFIRM: IT project
  - Idea: combine ordering of an air flight with a hotel and car reservation, partnering of AMR, Marriott, Hilton and Budget Rent-a-Car
  - A consortium of 3 companies joined together, each worked on a different part of the project
  - As the project proceeded, each company posted incorrect completion numbers
  - No process in place, no possibility to measure completion rates
  - Project cancelled (1992) after 3 years, loss of 125 M$

Some Very Expensive Engineering Failures (4)

- AT&T: IT project
  - Software upgrade in all the long-distance telephone switches
  - The software upgrade informs, in case of a failure, all the neighboring switches that the switch goes down → find another route
  - Network instability caused 16 hours of outage
  - Business loss of 500 M$
  - Inappropriate software testing before upgrading

Some Very Expensive Engineering Failures (5)

- Mars Probes: IT project
  - JPL adopted a new project management model: faster, better, cheaper
  - *Mars Orbiter* positioned itself perfectly in the Martian atmosphere – then stayed silent
  - Four major modules in the software: 3 treated the measurements in the SI unit and 1 in the Imperial unit
  - *Mars Lander* crashed into the Martian surface
  - Two computers giving contradictory orders (slow down vs speed up) – software was not designed to resolve such situations (cost: 300 M$)

Some Very Expensive Engineering Failures (6)

- Ariane 5 rocket: IT project
  - Odometer problem
  - At 39 seconds after launch, as the rocket reached an altitude of about 4 km, a self-destruct mechanism finished off Ariane 5, along with its payload of four expensive and uninsured scientific satellites
  - Shutdown occurred 36.7 seconds after launch, when the guidance system's own computer tried to convert one piece of data -- the sideways velocity of the rocket -- from a 64-bit format to a 16-bit format. The number was too big, and an overflow error resulted

Some Very Expensive Engineering Failures (7)

- Patriot missile: IT project
  - Patriot missile had a 24-bit timer driving its navigational system
  - At the flying speeds of the missile, it rolled over after about 23 km – flying blind beyond that
  - Unable to intercept SCUD missiles in Irak
  - The timer was eventually increased to 32 bits

The Need for Project Management in Engineering

- Why is it needed?

The Need for Project Management in Engineering

- Good project management increases the chances of bringing a project to a successful completion enormously
- Allows the Project Manager to know at all times what the state of the project is from the point-of-views of
  - costs
  - schedule
  - quality
  - completion dates
  - exposure to risks
  - maintenance of quality

➢ Hence Project Management is the KEY competency for the 21st century engineering profession

How Can We Formalize Project Management?

- Project management is a fairly new profession
- Various international organizations have attempted to standardize the process of project management
  - Perhaps the most influential standard today: the Project Management Body of Knowledge (PBOK) issued by the Project Management Institute (PMI)
  - IEEE (Institute of Electrical & Electronics Engineers)
  - PRINCE (PRojects IN Controlled Environments)
  - …

Why the Emphasis on Project Management?

- Many tasks do not fit neatly into business-as-usual
  - New events and objectives force companies and organizations to change their process, take action,… adaptivity and flexibility are key
- Organizations need to assign responsibility and authority for the achievement of their goals
- Each such work activity is called a project
- Project vs nonproject

Characteristics of Projects

- Projects
  - are unique
  - have specific deliverables aimed at meeting specific requirements
  - and a specific due date

- Routine activities are usually not projects
- Are the day-to-day activities associated with running a machine in a factory a project?

Other Common Characteristics of Projects

- Multidisciplinary
  - Inputs from people with different expertise
- Complex
  - Globalization of P&G
- Often involve conflicts
  - Schedule/budget/specs
  - Client/project team
  - Senior management/other groups
- Part of programs
  - Overall activity

Trends in Project Management

- Many recent developments in project management are driven by quickly changing global markets, technology, and education
- Global competition is putting pressure on prices, response times, and product/service innovation
- The most important recent developments put emphasis on:
  - Achieving strategic goals
    - Existing major projects screened to make sure that their objectives support the organization's strategy and mission
    - Projects without clear ties to the strategy are not approved
  - Achieving routine goals
    - Artificial deadlines and budgets created to help accomplish (routine) tasks (e.g., machine or software maintenance) ("projectizing")

Trends in Project Management (cntd)

- Improving project effectiveness
- Virtual projects
  - Global teams, team members may never meet physically
- Quasi-projects
  - Objectives not well understood, deadlines unknown, or budget undetermined
  - These undefined projects are very difficult to conduct
  - New tools for such projects are being developed (prototyping, phase gating, ...)

Comparison of Project Management and General Management

Dimension	Project Management	General management
Type of work activity	Unique	Routine
Management approach	Ability to adapt to change	Manage by exception
Planning	Critical	Important
Budgeting	Start from scratch, multiple budget periods	Modify budget from previous budget period
Sequence of activities	Must be determined	Often predetermined
Location of work	Crosses organizational units	Within an organizational unit
Managerial hierarchy	Informal	Well defined

Project Budgetting

- **Project budgeting** is determining the total amount of money that is allocated for the project to use. The budget is an estimate of all the costs that should be required to complete the project.
- Project budgeting differs from standard budgeting in the way budgets are constructed
- Budgets for non-projects are primarily modifications of budgets for the same activity in the previous period
- Project budgets are newly created for each project and often cover several “budget periods” in the future

Project Budgetting (ctd)

Methods of budget estimation:

- **Analogous estimation**

  If the current project is similar to past ones, take the data from previous work and extrapolate it to provide estimates for the new project. But make sure to check whether those projects were successful!

- **Top-down**

  Using a high-level work breakdown structure and data from previous projects, add estimates for each project work item to determine the overall effort and cost. The top-down method lacks detailed analysis, which makes it best suited for a quick first-pass at a prospective project to assess its viability.

- **Bottom-up**

  This method uses a detailed work breakdown structure. Each task is estimated individually, and then those estimates are rolled up to give the higher-level numbers. (Note: project management software is available for this). More accurate results are obtained than in the top-down method, but it is also a greater investment of time.

- **Parametric model estimating**

  This is a more scientific method that essentially auto-calculates estimates using detailed data from previous activities. Assume for example that you have data from your last three office network installation projects. You can use this to get, e.g., a days-per-workstation value. You can then input the number of workstations for the new installation and obtain the estimates. This can be a quick method but needs robust data to feed it. It may be hard to adjust for the environmental, political and cultural differences between projects.

Project Scheduling

- In manufacturing, the sequence of activities is set when production line is designed
  - Sequence is not altered when new models are produced

- Each project has a schedule of its own
  - Previous projects with deliverables similar to current one may provide a rough template
  - However, specifics unique to project at hand

Project Scheduling (ctd)

Two methods of project scheduling:

Method	Explanation	Pros	Cons
Task list	This is a list of tasks per team member, documented in a spreadsheet or word processor. This method is simple and familiar to most people, and is especially useful for smaller projects; however, for large projects with multiple tasks, dependencies and resources, a task list is not feasible for having an overall view and tracking the project. If the spreadsheet is not web-based, there are extreme limitations when it comes to collaborating and commenting on the document. There is also no versioning offered, which leads to mistakes, loss of productivity results in duplicate copies and different versions of the same document. It's also near impossible to track the progress of the project, since the spreadsheet is not part of a bigger system and everything needs to be updated manually.	• Easy to create • The only tool required is Microsoft Office • Ability to assign tasks to resources	• No global view of the project timeline • Limited collaboration • No versioning • No progress tracking

Project Scheduling (ctd)

Two methods of project scheduling:

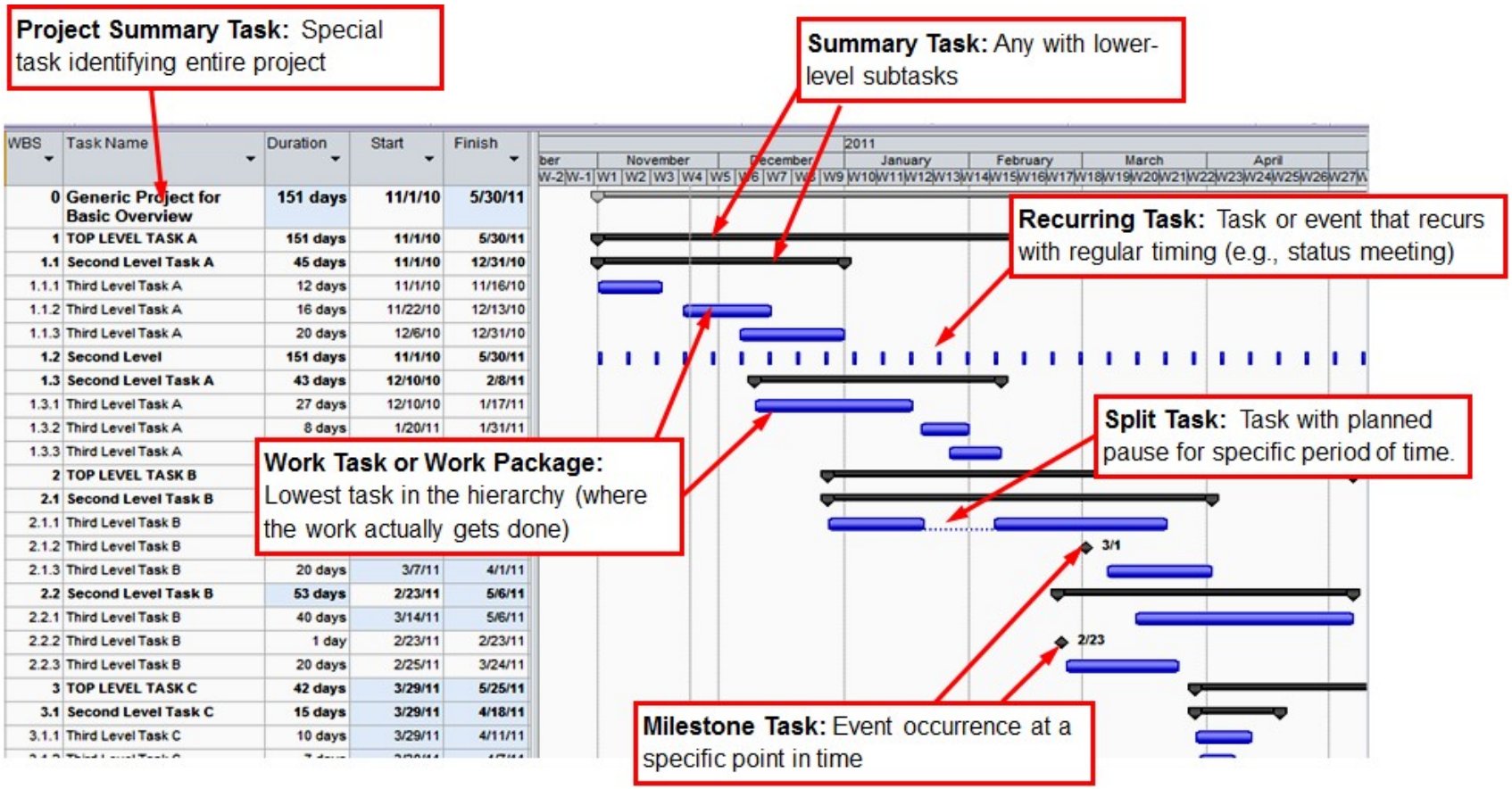
Method	Explanation	Pros	Cons
Gantt Chart	A useful visualization technique for progress tracking and reporting purposes. Chosen by most Project Managers when they want to get a quick estimate of the time it will take to complete all the project activities. A project schedule Gantt chart is a bar chart that displays key activities in sequence on the left (first activity is at the top left and last activity ends in the bottom right corner) vs time (on the top or bottom). Each task is represented by a bar that reflects the start and date of the activity, and therefore its duration. The chart shows all the activities, when they're set to start and end, how long each activity will last, where there are overlaps of activities, dependencies between activities, which are connected with arrows and the start/end date of the entire project.	• Adaptable to all industries and projects • Easy to view progress • Ability to set accurate deadlines and define dependencies • Easily modified • Can be created in Microsoft Excel or in a project management system • Ability to assign tasks to resources	• No versioning • Limited collaboration • No progress tracking

Project Scheduling (ctd)

Gantt Chart:

Project Scheduling (ctd)

Gantt Chart:



Project Organizational Structure

- Routine work of organizations takes place within a well-defined structure
  - The divisions, departments, sections, and similar subdivisions of the total unit
- Typical project cannot thrive in this structure
- The need for technical knowledge, information, and special skills requires that departmental lines be crossed
  - Another way of describing the multidisciplinary character of projects

Note on Globalization

- When large firms establish manufacturing plants or distribution centers in different countries, a management team is established on site
- For projects, globalization has a different meaning
- Members of project teams may be spread across countries and speak different languages
- Some project team members may never have a face-to-face meeting