Research Methodology

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- Their goals:
    - Supervision generally does not entail monitory benefits
    - Clearly your supervisor's goal is not (directly) money
    - So what is motivating them?
    - Besides, professional advancement, this is "YOU" who will motivate your supervisor
    - You have to understand their skills on which you can bank upon
    - Similarly, you need to understand their hates
    - Their Limitations
    - Remember that they are not superman/super woman
    - Be understanding

Manipulating your supervisor

- Be positive; Your supervisor is more likely to want to help you
- Honestly inform about your
    - Scientific hurdles
    - Personal obstacles
- Work hard
- They will be more willing to work hard too
- Pamper them with
    - Internal research notes
    - Conference papers
    - Journal articles

- Surprise them by
  - Discovering exceptions and analogies
  - Finding interesting results
  - Proposing some theorems
  - Demonstrating that your knowledge has overtaken their's even if by epsilon
  - Make yourself invaluable and indispensable by
    - Reviewing papers
    - Helping to run conferences
    - Running the lab/group
    - Helping out the newbies

- Bypassing your supervisor
  - by making decisions without due consultation
  - communicating papers without taking prior permission from supervisor
- Accusing
  - Your supervisor for misdeeds
- Hiding
  - yourself
  - some findings
  - some information
- Ignoring
  - advice you don't understand; advice you don't like

9 ways to undermine your guide contd.

- Mixing
    - professional and personal relationship
- Gossiping
    - about your supervisor or colleagues behind their backs
- Denigrating
    - your supervisor, department or institution
- Assuming
    - what something meant; what you're entitled to do
- Sinning
    - Plagiarize, fake results

Time and Effort Management

- PhD research is a special type of project, called an iterative project, where:
    - New tasks may be defined as a consequence of current findings
    - Some steps may have to be performed again if errors or incompleteness are detected
    - Some steps may have to be dropped as a consequence of current findings
- Iterative project requires that:
    - A project plan exists and
    - The plan is periodically revised

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- Project management is not only important for very lengthy, expensive and technically demanding projects like launching a satellite, it is also required for a PhD research project
- Most funding agencies require a project plan as a precondition and use such plan for monitoring
- Though project management is of central importance, few researchers have project management skills or even are aware of the project management principles

Project Management Terminology

- Project:
    - A sequence of activities designed to achieve a specific outcome within a defined budget and time limit
- Goals:
    - Describe what is to be achieved. (often qualitative, e.g. Get a Ph D degree)
- Objectives:
    - Provide a specific, measurable description of what is to be achieved
    - In research, objectives correspond to research questions
- Tasks/activities:
    - Units of work which constitutes the project, e.g. "prepare draft of thesis"

Project Management Terminology Contd.

- Deliverables:
  - Defined outputs/ product from the project
  - e.g. Final draft of the "Introduction" chapter
- Events:
  - A point of time when a tasks starts or finishes, also when external deadline happens
  - e.g. Final draft of the "Introduction" chapter submitted
- Dependencies
  - Tasks and deliverables have dependencies
  - Certain tasks cannot begin until another task is completed
  - E.g. unless you build the bubble column, apparatus you cannot perform an experiment in it

- Schedule:
  - timing of a list of tasks to be performed (with begin and end times and dependencies)
- Milestone:
  - Defines a time point (event) when a series of related tasks are to be completed
- Deadlines
  - Defines a time point by when deliverables must be produced so as not to upset the schedule or due to external conditions
  - like last date of depositing fees

- Project plan
  - A written description of the work needed to complete the project, including a description of the tasks, organization and management of the project.
- Planning
  - Development of a detailed scheme (project plan) to attain the objectives of the project

"A person with an ideal (plan) may make thousand mistakes. A person without an ideal (plan) would make twenty thousands" (Swami Vivekananda)

Advantages of Planning

- A plan
    - tells what to do next
    - reduces the risk of overlooking something important
    - forewarns about the dependencies between activities
    - orders the activities so that the researcher would not have to tackle too many activities all at once
    - provides discipline and motivation by indicating targets or milestones
    - allows scrutiny whether milestones are feasible in the time available
    - if not, something needs to change (resources, delivery schedule, follow up external suppliers)

- A plan
  - allows prioritization
  - prevents too much time from being spent on long, only vaguely relevant activities just because they are the most enjoyable
  - reduces anxiety by externalizing what has to be done so that it need not constantly occupying one's mind
  - provides a sense of security that one is on track
  - allows one to relax and to take a certain amount of time off with a clear conscience

Advantages of Planning Contd.

- A plan
  - provides a focus in discussion with supervisors and others
  - allows review of the plan based on new situation and findings
  - if you have a plan, you can modify it. If you have none, you never know what to do next.
  - helps to ensure that the required resources are available when needed.
  - provides a basis for reflection so that future planning can be more realistic

- Start the plan activity as early as possible
- Prepare your thesis proposal
- List the activities in paper and pencil
- For a PhD research project, the steps and tasks are fairly known in advance

How to Plan Contd.

- In the first list, the activities could be too generic. This is expected
- Against each activity, allocate the approximate time needed and also any special resources needed (equipment, data logger etc,)
- Fix the time period for each activity from 2 to 4 months (it will depend on the type of activity)
- For example, if it is literature survey, then 1 to 2 months are sufficient, however, if it is hypothesis testing period it might be 3 to 4 months long

- Draw a rough dependency diagram between tasks, again using paper, pencil and eraser
- Prepare a Gantt chart (coming next, preferred) or a network diagram (not preferred)
- Reorganize the Gantt chart to avoid too many overlapping activities
- Insert a date and take photocopies of the list and the chart. Paste these in your bound notebook
- Save the pencil copies for the next revision
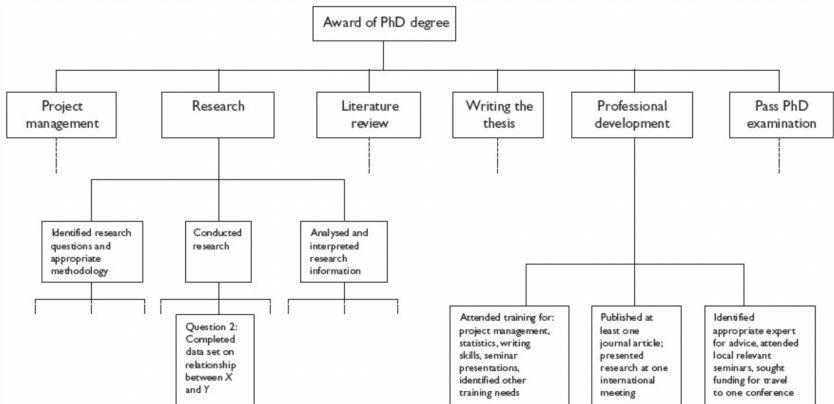
Example of a Goal-Task Breakdown

Figure:

Example of an Outline Plan for the First Year of a Doctoral Research Project

Table 3.3 Example of an outline plan for the first year of a doctoral research project

| Tasks	Oct–Dec	Jan–Feb	Mar–Apr	May–June	July–August	Sept–Oct
Meetings with supervisor	Discuss and clarify objectives of project	Discuss literature review and project outline and get feedback on selected research questions	Discuss experimental design and sampling methodology	Inform supervisor of progress of fieldwork	Inform supervisor of progress of fieldwork	Discuss detailed plans for year 2 and outline plan for year 3
Project planning	Clarify objectives of project	Submit project outline to supervisor; prepare project schedule for fieldwork season (Mar–Oct)	Plan experimental design of pilot experiments; refine experimental design and sampling protocols; assess health and safety issues; meet statistician to discuss experimental design; create record sheets and spreadsheet for raw data	Enter raw data from record sheets into spreadsheet; file record sheets	Enter raw data from record sheets into spreadsheet; file record sheets	Preliminary analyses of data; start detailed planning for year 2

Figure:

Gantt. Chart

- A Gantt chart is a simple but effective tool for scheduling activities in a project
- It is a type of bar chart that illustrates the start and finish dates of the activities (tasks), which constitute a project
- It is fairly simple for standard projects like PhD research
- Some Gantt charts also show the dependency relationships between activities

Example of a Gantt. Chart
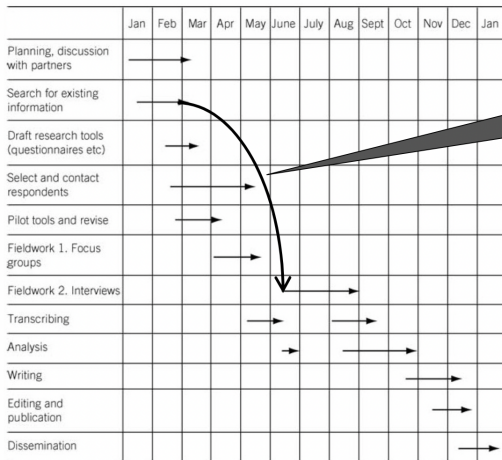
Figure:

Another Example

No	Activity	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	5th Qtr	6th Qtr	7th Qtr	8th Qtr	Ext Agency
1.	Literature survey- Phase-1	■								
2.	Literature survey- Phase-2					■				
3.	Problem formulation and Bench mark selection (Transfer Alignment)	■								
4.	Algorithm development for TA with unscented transform approach		■							
5.	Dev. of TA algorithm with particle filter			■						
6.	Transfer alignment Numerical trial						■			
7.	Transfer alignment HILS trial							■		
8.	Bench mark problem selection (Target Tracking)	■								
9.	Glint Model Consolidation		■							
10.	Selection of best non-Kalman filter for tracking in glint noise removal				■					
11.	Selection of the optimal target maneuver detection algorithm					■				
12.	Development and numerical trial of on-board variants of particle filters							■		
13.	Final Report and Documentation								■	
	Project Review Meetings			1st			2nd		3rd	

Figure:

Pert Chart

- A PERT chart is a graphic representation of a project's schedule,
  - showing the sequence of tasks,
  - dependencies of tasks,
  - which tasks can be performed simultaneously.
- It also identifies the critical path of tasks that must be completed on time in order for the project to meet its completion deadline.
- The chart allows a team
  - to avoid unrealistic timetables and schedule expectations,
  - to help identify and shorten tasks that are bottlenecks, and
  - to focus attention on most critical tasks

Pert Chart Contd.

- Steps
    - Identify all tasks or project components.
    - Identify the first task that must be completed.
    - Identify any other tasks that can be started simultaneously with task #1.
    - Identify the next task that must be completed.
        - Select a task that must wait to begin until task #1(or a task that starts simultaneously with task #1) is completed. Place the appropriate box to the right of the box showing the preceding task.
    - Identify any other tasks that can be started simultaneously with task #2.
        - Align these tasks either above or below task #2 on the working surface

Pert Chart Contd.

- Continue this process until all component tasks are sequenced
- Identify task durations
- Duration of the time is usually considered to be a period of time, say two/three months, for the task, rather than actual number of hours/days spent doing the work
- Construct the PERT chart consists of the following
  - Number each task, draw connecting arrows, and add task characteristics such as duration, anticipated start date, and anticipated end date
  - Determine the critical path (optional)
  - The project's critical path includes those tasks that must be started or completed on time to avoid delays to the total project. Critical paths are typically displayed in red
  - Note: Most commercially available project management software will routinely generate a PERT chart.
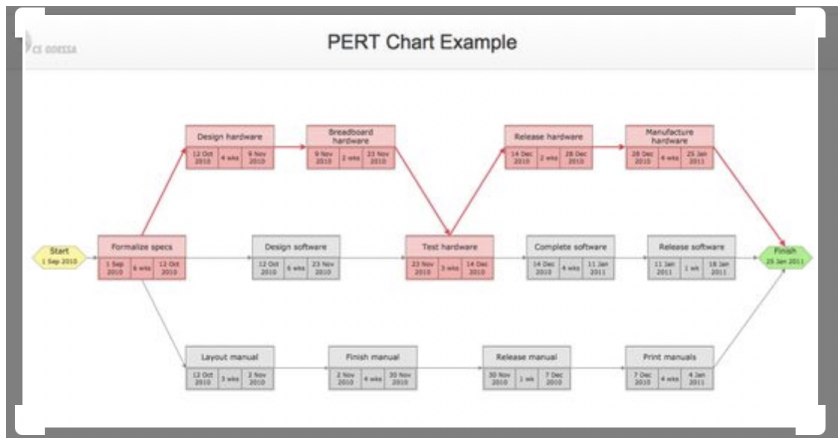
Pert Chart Example

Figure:

- Slides are taken from Research Methodology, Prof. T. K. Ghosal,
  Jadavpur University, 2013

  In the next class we will continue the topic