EENGM0004: Engineering Research Skills

ASync 2: Project Planning

2021-2022

Dr. Fan (Aaron) Zhang

fan.zhang@bristol.ac.uk

Identify Project Types

Research Projects

- Basic research
  - **Aim**: production of new knowledge
  - **Outcome**: unknown and cannot be pre-defined
  - Long-term, blue sky, fundamental research
- Applied research
  - **Aim**: find a solution to a specific problem
  - **Outcome**: an innovative method or technology

Development Projects

- **Aim**: advance the readiness of a specific technology, or improve the performance of a product.
- **Outcome**: higher technological readiness (i.e., bringing a technology closer to a new product or service), or better performance of an existing product / service

The Key Elements of Project Planning

1. Background
2. Statement of a problem
3. Aims and objectives
4. Methodology
5. Project workplan
6. Risk management
7. Resource planning

Background

What is the context of this project

- Social, economical, technological background.

Why the project needs to be done

- What is the big problem to be solved / question to be answered?

What would be the impact?

- Technological, economical and social benefits.

What would be the disadvantage if the project is not implemented?

- Urgency and importance.

The Statement of the Problem

State of the arts

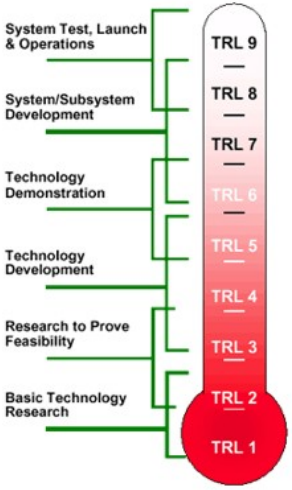
- What do we know and what we don't yet know.
- What are the 'known unknowns' and what may be the 'unknown unknowns'.

Existing solutions

- The problem to be solved: whether it is a new problem, what solutions exist, what their advantages and disadvantages are.

Current levels of technological readiness (TRL)

- TRL: how close the technology is from practical applications.
- For a technology, how ready (or how far) it is for application.
- For a product/service, how well / badly it is performing.



Project Aims

An aim is a broad statement of the general purpose of this research project.

Basic research projects

- What new knowledge does the project aim to produce?
- What hypothesis does the project aim to prove or disprove?

Applied research projects

- What solution the project aims to find for a problem?
- How this solution will compare to other solutions (if they exist)?

Development projects

- What kind of technological advances the project aims to bring about?

Project Objectives

Objectives are achievable and measurable outcomes of project activities that clearly demonstrates the progress towards the aims of the project.

Clear demonstration

- What will be delivered by the project at different stages?
- How much would be delivered by the project in each stage?
- How good would be the outcome?

Measurability

- Objectives must be clearly described in their substance.
- Objectives must be quantified as much as possible.
- Multiple objectives should be ordered in priority and defined in their levels of advance beyond the state of the arts.

The Difference between Aims and Objectives

Aims, objectives and approach

- **Aim**: general direction/final destination
- **Objective**: where you can reach in each step
- **Approach**: path leading towards objectives

Frequent problems when defining Aims

- Describing the process, not the destination.
- Not identifying the expected innovations.
- Not putting the expected innovation into perspective/context.

Frequent problems when defining Objectives

- Not specified in contents/substance, parameters, levels of progress it represents.
- Too vague to be measurable and not ordered in priority.

An Example of Project Aims and Objectives

Project title

- Video Quality Assessment through Crowdsourcing-based Subjective Experiments

Aims

- We will contribute a new testing methodology for crowd-sourced quality evaluation that will significantly increase both accuracy and scale. We will then use this to build and validate a large database for perceptual quality metric development.

Objectives

- To collect video clips with a wide coverage of texture, motion and structural content.
- To develop a user-friendly experimental platform for collecting subjective opinion data.
- To deploy this platform to acquire robust ground truth subjective data.
- To use the developed database to train and evaluate various video quality assessment methods.

Methodology

Methodology in project planning

- How will you carry out your project?
- What scientific principles, theories, experiments, tools, etc., will be used?
- How they would work **together** to achieve your Objectives?
- Logical relationship between various methods likely to be used in your project must be stated.
- Feasibility analysis of the methodology/approach? Why they should work?

Work packages/Tasks/Activities

- Divide the whole project into several WPs / tasks / activities?
- What is the logical relationship between these WPs? In parallel or sequential?
- What is the objective, approach and deliverable (outcome) of each WP?
- What resources would each WP require?

Deliverables

Deliverables are the actual products of the project, which prove and demonstrate the achievement of project milestones and objectives.

Types of Deliverables

- **Documents**: e.g., dissertations, reports, and papers.
- **Hardware**: e.g., materials, devices, components, equipment and set-ups.
- **Software**: e.g., source code and applications.
- **Data**: e.g., data sets and results.
- **Activities**: e.g., demonstrations, presentations, and workshops.

An Example of Project Methodology

Project title

- Video Quality Assessment through Crowdsourcing-based Subjective Experiments

Methodology

- WP1: Video clip specification and collection
  - **Objective**: To obtain video clips with diverse source content.
  - **Approach**: collect exiting data; capture new content; selection criteria;copyright; distorted versions.
  - **Deliverable**: a dataset containing 1620 test sequences, generated from 45 original source clips.
- WP2: Experimental interface development (**Objective**, **Approach** and **Deliverable**)
- WP3: Subjective experiment and data analysis (**Objective**, **Approach** and **Deliverable**)
- WP4: VQA training and benchmarking (**Objective**, **Approach** and **Deliverable**)

Work Plan

Critical Path

- The longest route from the start to the aims.
- It defines the shortest possible time needed to complete the project.

Milestones

- What are the stage targets that must be achieved during the project?
- When they should be achieved?

Graphic representations

- PERT Chart, activity-on-node diagram and Gantt Chart.

PERT Chart: Activity-on-arrow Diagram

Design a Pert Chart

- Each activity/task is represented by an arrow.
- The time needed is labelled next to the arrow.
- The milestones are shown as the nodes, and numbered.
- Milestones need to be defined in separate texts.
- The path with the longest time is the critical path.

In this example

- The project consists of 6 activities (A-F).
- Path A-D-F and B-C are the critical paths, because they all take 7 months to complete.
- Path A-E is a sub-critical path because it takes shorter times.
- The shortest possible time to complete the project is therefore 7 months.

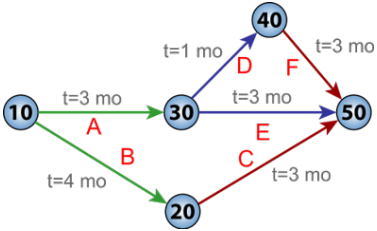


Figure: PERT chart for a project. Source from Wikipedia.

Activity-on-node Diagram

Design an Activity-on-node diagram

- Each activity/task is a node.
- Arrows show their logical relations.
- This allows more detailed analysis of project timings.

Time management

- DUR: duration of an activity.
- DRAG: the amount of time it adds to the project .
- TF (total float): how much delay this activity can suffer without affecting the amount of time needed for the whole project.
  - This depends on the duration of other activities that are in parallel with it

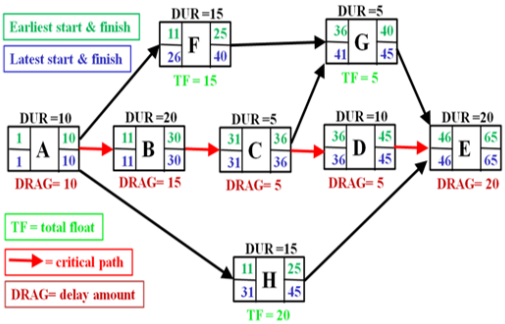
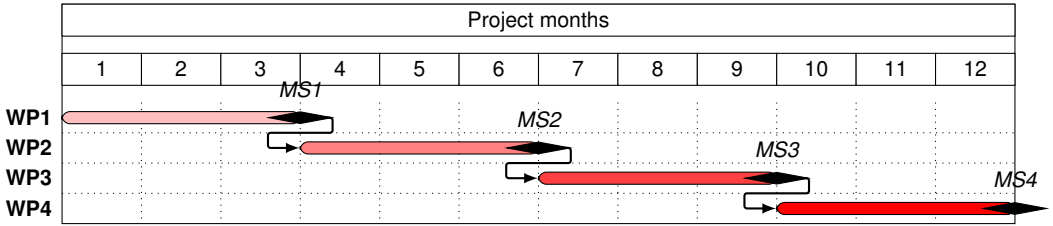


Figure: An example of activity-on-node diagram. Image from [Kundu, 2014].

Gantt Chart

Design a Gantt Chart

- Left column contains a list of activities, each of which uses a horizontal bar indicating the required time.
- Time scales (weeks or months) are available in the top (or bottom) row.
- Arrows between end and start of different bars indicate their sequential relationships.
- Additional information (responsible persons, Milestones, Deliverables) can be labelled on the chart.



Tools for Gantt Chart Drawing

Key steps when using Excel to create a simple Gantt chart

- Create a project table including start/end dates.
- Generate an Excel Bar chart based on start dates.
- Add duration data to the chart.
- Add task descriptions to the Gantt chart.
- Output the Gantt Chart as a figure.

Using Latex to create Gantt charts

- There are several packages for creating Gantt charts in Latex, e.g. *pgfgantt*.
- Existing templates can be used for Gantt charts in various styles.
- They can be directly designed in any Latex files for reports, posters and slides.
- Detailed demonstration will be provided in a sync session.

Risk Management

What is a Risk?

- The effect of uncertainty on achieving planned objectives.

Risk Management Process

- The identification, evaluation, and prioritization of risks.
- Establish the context: e.g., human resources, existing software and hardware.
- Identification of risks: source analysis and problem analysis.
- Risk assessment: negative impact, probability of occurrence.
- Impact scales: High/Medium/Low, Negligible/Marginal/Important/Serious/Catastrophic.
- Risk Mitigation: avoidance, reduction, sharing, retention.
- Is the project still reasonably certain to deliver?

For each risk

- Number/Description/Activity number/Impact level/Mitigation measures.