



Estimation, planning & monitoring

MDA402 Project Management

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Lecture Overview

1. Tools for estimation, planning & monitoring

- Work Breakdown Structure

- Program Evaluation and Review Technique

- Gantt Chart

- Critical Path Method

- Responsibility Assignment Matrix

2. Agile specific tools

- User Stories

- Burndown Chart

- Team Velocity

- Definition of Done

Work Breakdown Structure

Definition

Definition 8.1

Work breakdown structure (WBS) is a **hierarchical decomposition** of the total scope of work to be carried out by the project team to complete project deliverables. [11]

- creates **baseline** for project planning and project schedule
- closely follows agreed deliverables and breaks them down into small unique task → **work packages**

Definition 8.2

Work package is work defined at the **lowest level** of the WBS. [11]

- each work package is **estimated** in terms of time and cost
- work package is **unique** task that is considered as **measurable** deliverable

Work Breakdown Structure

Every WBS needs to have at least these basic levels [1]:

1. Level 1: Parent task

- most simplified form of the project
- usually its **project objective**
- example: launch new web application to support this course

2. Level 2: Dependencies and tasks

- slightly more granular as level 1, but still high-level
- example: design, implementation, testing

3. Level 3: Subtasks

- work packages
- example: database design, UI design, front-end implementation

Work Breakdown Structure

Example

1. Launch new web application to support this course

1.1 Design

1.1.1 Requirements documentation

1.1.2 Database design

1.1.3 UI Design

1.2 Implementation

1.2.1 Back-end implementation

1.2.2 Front-end implementation

1.2.3 Integration

1.2.4 Unit testing

1.3 Testing

1.3.1 User acceptance testing

1.3.2 E2E testing

1.3.3 Performance testing

Work Breakdown Structure

Example

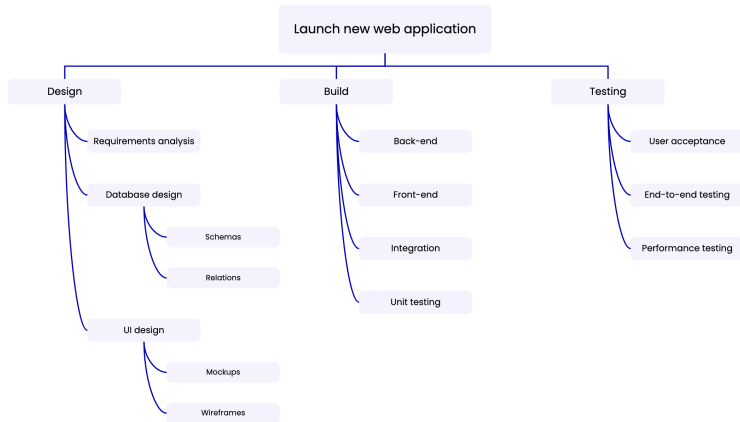


Figure: WBS example

Program Evaluation and Review Technique

Definition 8.3

Program Evaluation and Review Technique (PERT) is a tool for **estimation** of time needed for completion of smallest tasks (work packages) to visualize project's timeline.

- three types of estimation:
 - **optimistic** time (o)
 - **realistic** / **most likely** time (m)
 - **pessimistic** time (p)
- expected effort in man-days: $(o + 4m + p) / 6 = te$

Definition 8.4

Man-day represents a day of work of one person. [2]

Program Evaluation and Review Technique

Example

Work package	Optimistic	Most likely	Pessimistic	Expected time in MD
1.1.3 UI Design	4	5	10	7,33
1.2.2 Front-end	10	12	24	17,66
...

Table: PERT evaluation

Program Evaluation and Review Technique

Estimating time effort

Work package	o	m	p	te (MD)	Assignment	Effort per assignment	Effort in calendar days
1.1.3 UI Design	4	5	10	7,33	Designer	7,33	8
1.2.2 Front-end	10	12	24	17,66	Developer	15,55	17,50
					Architect	2,11	
...

Table: Estimating time effort with PERT evaluation

Gantt Chart

Definition

Definition 8.4

Gantt chart is a tool used for **project planning**.

- provides necessary information about **schedule**
- work packages are listed on the vertical axis
- dates are listed on horizontal axis
- work package durations are shown as horizontal bars placed according to start and finish dates

Gantt chart

Precedence Diagramming Method

Definition 8.5

Precedence diagramming method:

- a technique used for constructing a **schedule model**
- work packages (as nodes) are **linked** by one or more logical relationships to show the **sequence**:
 - **Finish-to-start (FS)** → successor task cannot start until predecessor task is finished
 - **Finish-to-finish (FF)** → successor task cannot finish until predecessor task is finished
 - **Start-to-finish (SF)** → successor task cannot finish until predecessor task is started
 - **Start-to-start (SS)** → successor task cannot start until predecessor task is started
- links can be added to the Gantt chart [10]

Gantt chart

Precedence Diagramming Method

Examples

- **Finish-to-start (FS)** → front-end implementation can start only after UI design is finished
- **Finish-to-finish (FF)** → fixing all the defects is required before regression testing can be finished
- **Start-to-finish (SF)** → new platform has to work before old one can be shut down
- **Start-to-start (SS)** → creating solution documentation cannot start until high-level requirements analysis starts

Gantt chart

Precedence Diagramming Method

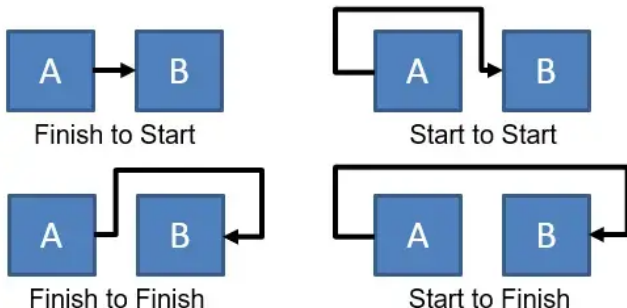


Figure: PDM relationships [3]

Gantt Chart

Example

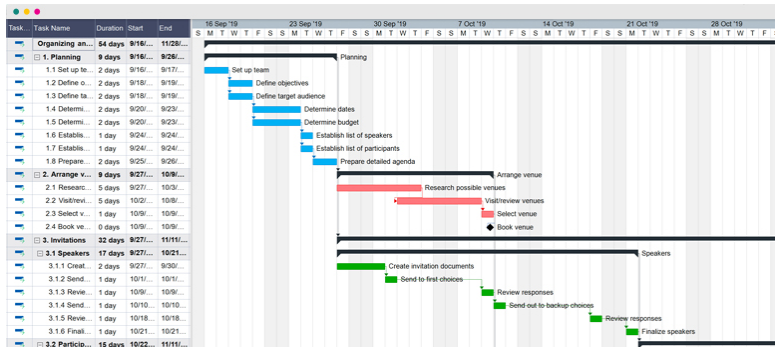


Figure: Gantt chart example [4]

Gantt Chart

Predictive vs. Agile

Predictive

- planning is done upfront → Gantt chart reflects whole schedule of the project with all its iterations or sub tasks

Agile

- adaptable approach with expected changes → Gantt chart is initially created for first iteration / sprint
- can be created for whole duration of project, but the sections for sprints will be the same plus initiation and closing of the projects

Critical Path Method

Definition 8.6

Critical Path is the sequence of activities that represents the **longest path** through a project → it determines the **shortest possible duration** [11].

Definition 8.7

Critical Path Method is a method used to estimate the **minimum project duration** and determine the amount of schedule flexibility [11].

Critical Path Method

Example

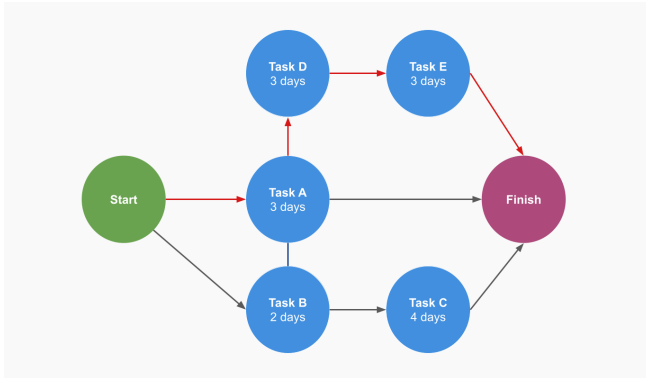


Figure: Critical Path Method example [5]

Responsibility Assignment Matrix

Definition 8.8

Responsibility Assignment Matrix (RAM) is a grid that shows the project resources assigned to each work package [11]

- a common way to represent RAM is **RACI chart** → responsible, accountable, consulted, informed stakeholders

Work package	James	Patrick	Emma	Ellen
1.1.3 UI Design	A/C	I	R	C
1.2.2 Front-end	A/C	R	I	R
...

Table: RACI chart

User Stories

Definition

Definition 8.9

User Story is a brief description of an outcome for a specific user:

- usually used in agile projects with **iterative** and **incremental** approach
- user story should represent **work package** → smallest unit of work
- structure:
 - **As a** ... (actor)
 - **I want** ... (need)
 - **so that** ... (outcome)
- **example**: As a client user, I want to see my portfolio details, so that I can have clear overview of my investments.
- user stories are estimated with **story points**

User Stories

Story Points

Definition 8.10

Story Point is a **relative** unit of measure, decided upon and used by individual Scrum teams, to provide **relative** estimates of effort for completing requirements. [6]

- intended to make estimation **easier** for the team
- are strongly **subjective** because they are relative to items in product backlog
- based on **difficulty**, not time spent
- norm is to use numbers from Fibonacci sequence: 0.5, 1, 2, 3, 5, 8, 13, ...

User Stories

Story Points

Definition 8.11

Planning poker is a way of **estimating** (deciding on delivery effort) items in Product Backlog using Story Points. [7]

Planning Poker steps:

1. Pick **item** from Product Backlog and discuss.
2. Each team member will write down on a card **number** of Story Points estimating effort of the item. (e.g. 1 Story Point)
3. All members reveal the **cards** at the same time
 - 3.1 IF all cards are the **same** → item is **estimated**
 - 3.2 IF not all cards are the same → discussion until agreement is reached

User Stories

Story Points

User Story

As a client user, I want to see my portfolio details, so that I can have clear overview of my investments.

Assessment from 7 developers:



→ after discussion this story was given **3 story points**

Burndown Chart

Definition

Definition 8.12

Burndown chart is a graph displaying **comparison** between **estimated** amount of work to be done vs. **actual** amount of work done in selected time period:

- time period can be: **sprint**, **increment** (more sprints), **whole project**
- story points are used to **visualize** amount of work
- it is valuable tool used for project management → teams can effectively **monitor** and **communicate** progress
- enables team to **adapt** to changes, **optimize** their workflow, and continuously **deliver value** to their customers [8]

Burndown Chart

Example

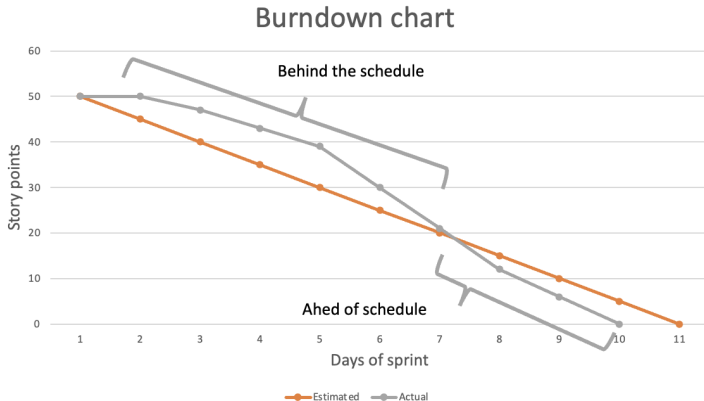


Figure: Burndown chart example

Team Velocity

Definition

Definition 8.13

Team velocity is a metric to measure **amount** of work done by a team within one sprint:

- it is expressed in **story points**
- it is used to **forecast** future sprints and set **realistic** goals
- it helps teams to develop **stable rhythm** and actually should **increase** over time to show growing experience and progress of the team
- can be also part of burndown chart for easier reporting [9]

Team Velocity

Example

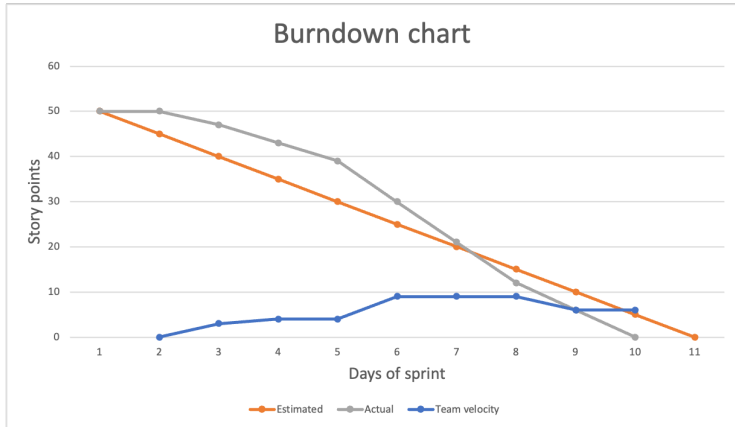


Figure: Burndown chart with team velocity

Definition of Done

Definition

Definition 8.14

Definition of Done is a checklist of all the **criteria** required to be met so that a deliverable can be considered **ready for customer use** [11]:

- those criteria are not pre-defined → should be agreed among **key stakeholders** (client and project leads) at the start of the project
- it is crucial that all interested parties are informed about the Definition of Done → sets up **clear expectations**
- usually it means that all tasks under User Story are finished, functionality is implemented and tested and all user acceptance criteria are met

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Thank You for Your Attention!