



GSOE9820 – Engineering Project Management

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Never Stand Still

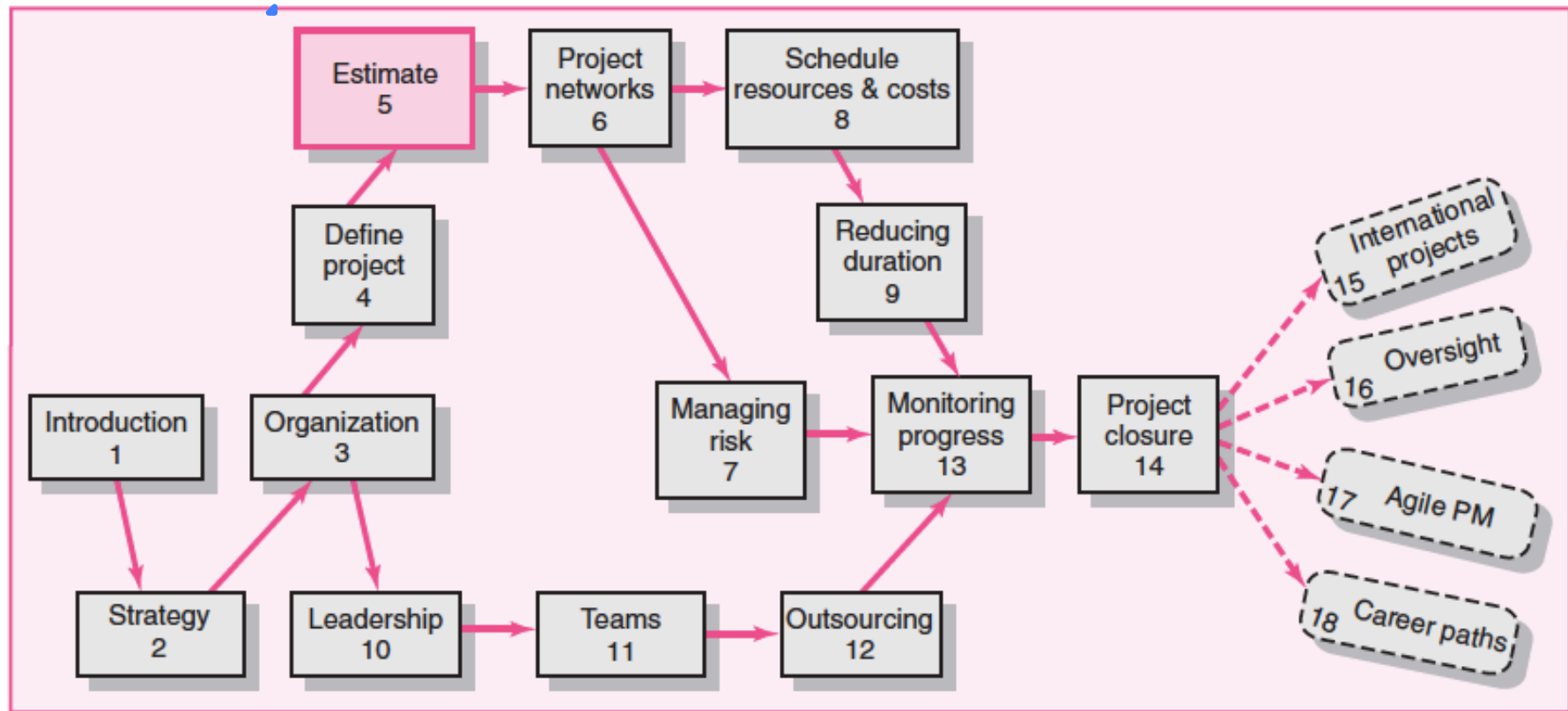
Faculty of Engineering

School of Mechanical and Manufacturing Engineering

Week 5

Estimating project times and costs

Course Roadmap



Reference: Gray, C & Larson, E, Project Management, 5th Ed. McGraw-Hill

What is estimating?

The process of forecasting or approximating the time and cost of completing project deliverables

The task of balancing expectations of stakeholders and need for control while the project is implemented



Some reasons for estimating

- To support good decisions
- To schedule work
- To determine how long the project should take and its cost
- To determine whether the project is worth doing
- To develop cash flow needs
- To determine how well the project is progressing
- To develop time-phased budgets and establish the project baseline

Factors influencing the quality of estimates



Estimating guidelines

- Have people familiar with the tasks make the estimate and encourage responsibility.
- Use several people to make the estimate
- Base estimates on normal conditions, efficient methods, and a normal level of resources
- Use consistent time units in estimating task times
- Treat each task as independent, don't aggregate
- Do not make allowances for contingencies
- Adding a risk assessment helps avoid surprises to stakeholders

Types of estimates

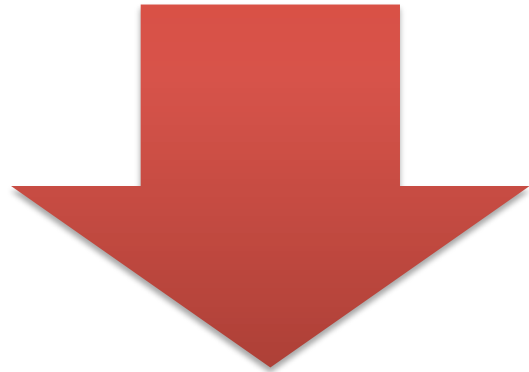
Top-down (macro)

- analogy
- group consensus
- mathematical relationships

Bottom-up (micro)

- estimates of elements of the work breakdown structure

Top-down vs bottom-up estimating



Top-down estimates:

- are usually derived from someone who uses experience and/or information to determine the project duration and total cost
- are made by top managers who have little knowledge of the processes used to complete the project



Bottom-up approach

- can serve as a check on cost elements in the WBS by rolling up the work packages and associated cost accounts to major deliverables at the work package level



Conditions for selecting estimating method

Top-down estimates	Bottom-up estimations
Strategic decision making	Cost and time important
High uncertainty	Fixed-price contract
Internal, small project	Customer wants details
Unstable scope	

Top-down approaches

Consensus
methods

Ratio methods

Apportionment
methods

Function point
methods for
software and
system projects

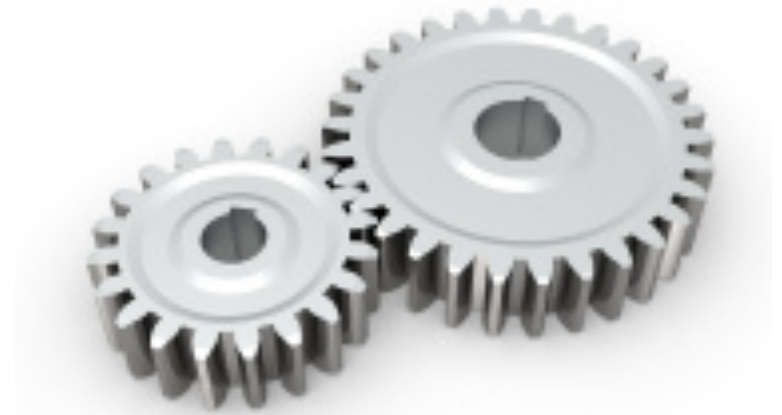
Learning curves

Consensus methods

- Typically involves a meeting where experts discuss, argue and reach a decision as to their “*best guess*” estimate
- Accuracy of the estimate can be improve further by the use of “*Delphi Method*”
- Helpful in determining whether the project warrants more formal planning

Ratio methods

- Also known as “parametric methods”
- Usually use ratios or surrogates to estimate project times or costs
- Often obtain initial estimates based on prior experience



Apportionment methods

- Is an extension of the Ratio method
- Is used when projects closely follow past projects in features and costs
- Useful for projects that are relatively standard, but have some small variation or customisation



Function point methods

- Is often used for software projects
- Uses weighted macro variables called “function points”
- A function point is a unit of measurement to express the amount of business functionality an information system provides to a user. Function points are used to measure software size.

Learning curves

- Also known as the “improvement curve”, “experience curve” and “industrial progress curve”
- Useful for tasks which are repeated several times
- Based on the principle that in general, the time to perform a task improves with repetition.
- Each time the output quantity doubles, the unit labour hours are reduced at a constant rate
- Most applicable to projects that are labour intensive.

Bottom-up approaches

Template
methods

Parametric
procedures
applied to
specific tasks

Range
estimating

A hybrid: phase
estimating

Template methods

- If the project is similar to past projects the cost and time estimates from these past projects can be used as a starting point for the new project.
- Differences are noted and estimates adjusted
- Enables development of a budget in a very short time

Parametric procedures applied to specific tasks

- Similar to the ratio and apportion methods from top-down estimation
- This method begins with ratio at the lowest possible level of a WBS (work package)

Range estimating

- Instead of using a point estimate (e.g. 5 days)
- Range estimating usually use three estimates
 - Low-Average-High;
 - Pessimistic-Most likely-Optimistic
- Work best when the work packages have significant uncertainty associated with time and cost

A hybrid: phase estimating

- Uses a two-estimate system over the life of the project
- A detailed (micro) estimate is developed for the immediate phase
- A macro estimate is made for the remaining phases of the project

Top-down and bottom-up comparison

Top-Down Estimates	Bottom-Up Estimates
Intended Use Feasibility/conceptual phase Rough time/cost estimate Fund requirements Resource capacity planning	Intended Use Budgeting Scheduling Resource requirements Fund timing
Preparation Cost 1/10 to 3/10 of a percent of total project cost	Preparation Cost 3/10 of a percent to 1.0 percent of total project cost
Accuracy Minus 20%, to plus 60%	Accuracy Minus 10%, to plus 30%
Method Consensus Ratio Apportion Function point Learning curves	Method Template Parametric WBS packages Range estimates

Estimating projects: preferred approach

Make rough top-down estimates.

Develop the WBS/OBS.

Make bottom-up estimates.

Develop schedules and budgets.

Reconcile differences between top-down and bottom-up estimates.

Level of detail

- Level of detail is different for different levels of management.
- Level of detail in the WBS varies with the complexity of the project.
- Excessive detail:
 - is costly
 - fosters a focus on departmental outcomes
 - creates unproductive paperwork.
 - Insufficient detail:
 - fosters a lack of focus on goals
 - leads to wasted effort on non-essential activities

Types of costs

Direct costs

- Costs that are clearly chargeable to a specific work package
- E.g. labour, materials, equipment and other

Direct (project) overhead costs

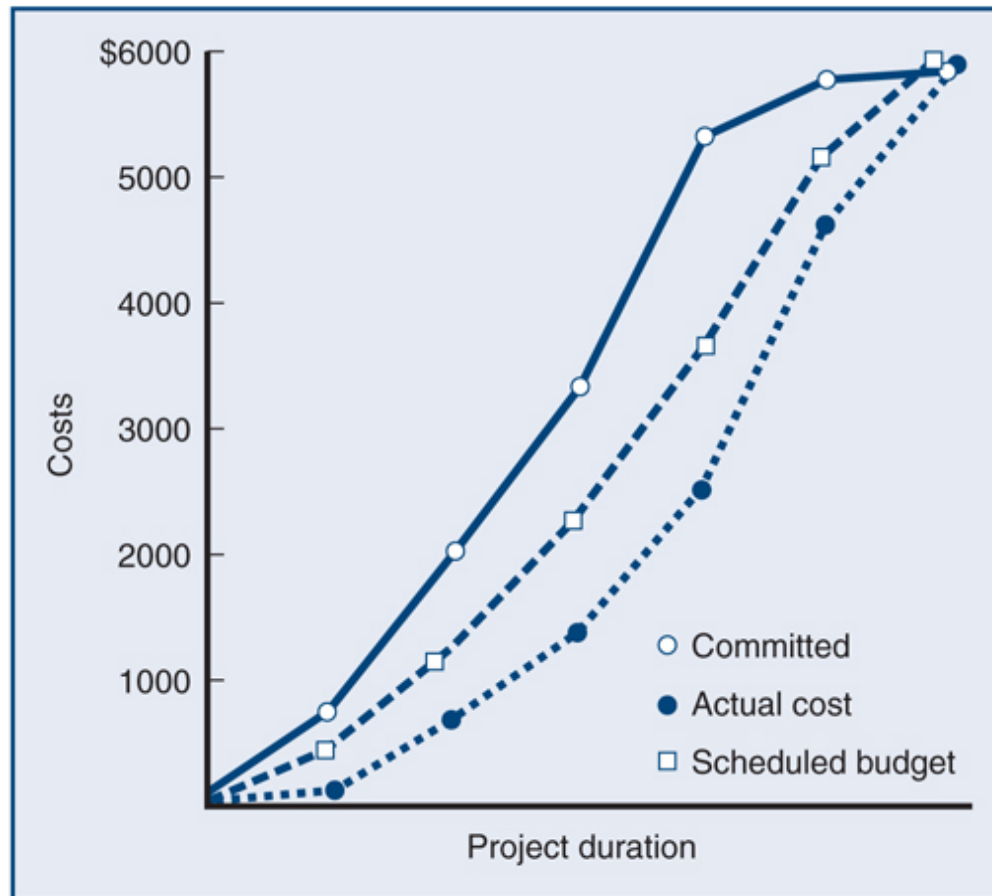
- Costs incurred that are directly tied to an identifiable project deliverable or work package
- E.g. salary, rents, supplies, specialised machinery

General and administrative overhead costs

- Organisation costs indirectly linked to a specific package that are apportioned to the project

Three views of cost

Figure 5.6 THREE VIEWS OF COST



Refining estimates

Reasons for adjusting estimates

- Interaction costs are hidden in estimates.
- Normal conditions do not apply.
- Things go wrong on projects.
- Changes in project scope and plans.

Adjusting estimates

- Time and cost estimates of specific activities are adjusted as the risks, resources and situation particulars become more clearly defined.

Creating a database for estimating

Figure 5.7

ESTIMATING DATABASE TEMPLATES

