



GSOE9820 – Engineering Project Management

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Never Stand Still

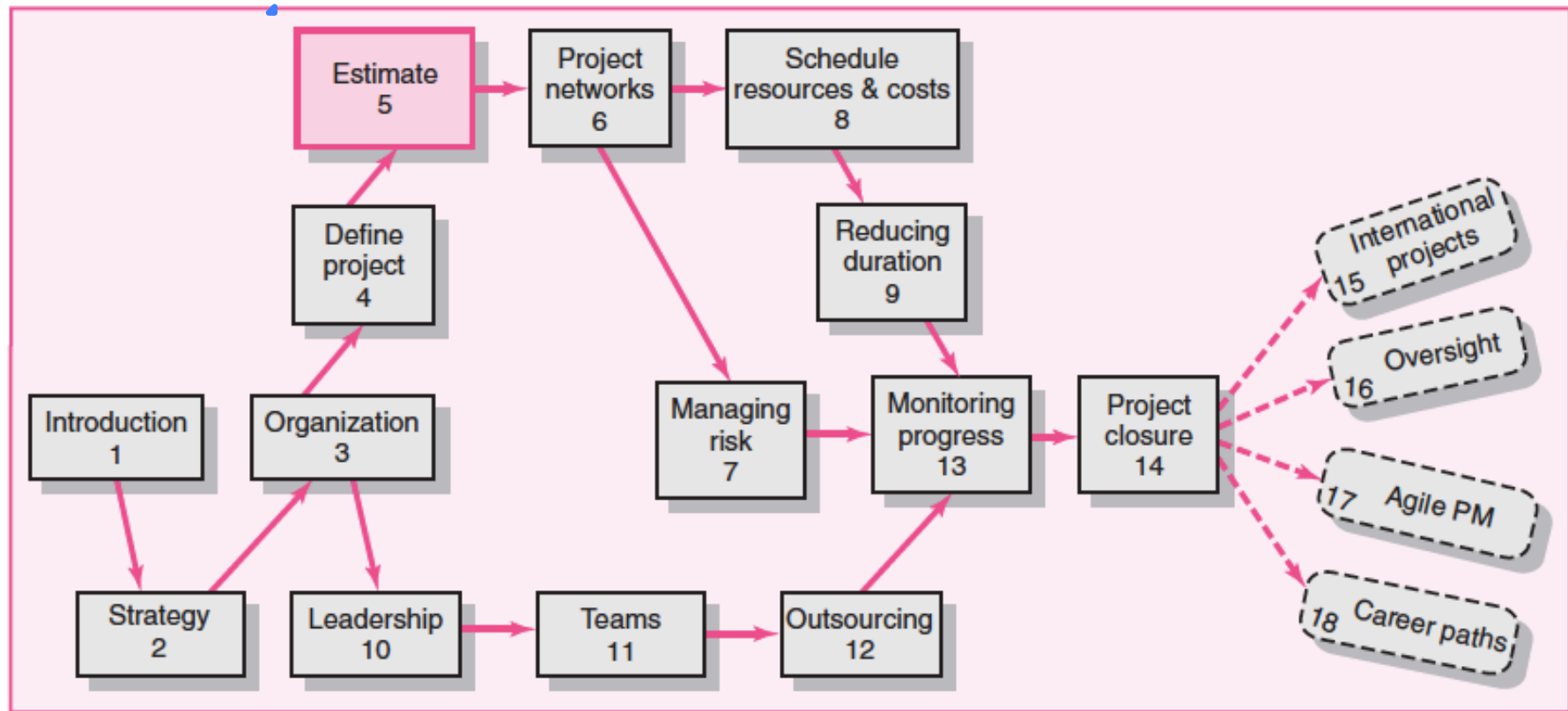
Faculty of Engineering

School of Mechanical and Manufacturing Engineering

# Week 5

## Estimating project times and costs

# Course Roadmap



Reference: Gray, C & Larson, E, Project Management, 5<sup>th</sup> 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

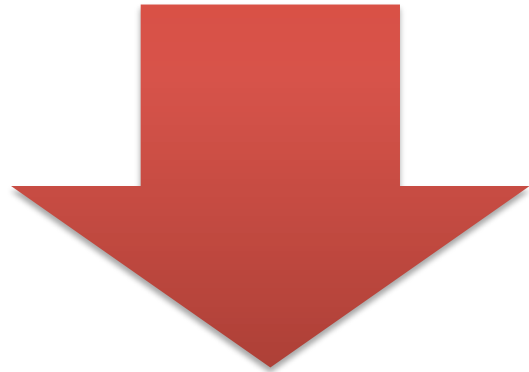
## Top-down (macro)

- 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

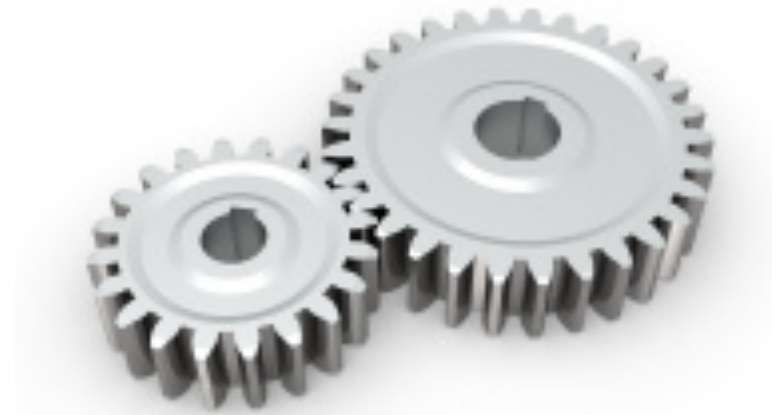
Learning curves

# 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
<b>Intended Use</b> Feasibility/conceptual phase Rough time/cost estimate Fund requirements Resource capacity planning	<b>Intended Use</b> Budgeting Scheduling Resource requirements Fund timing
<b>Preparation Cost</b> 1/10 to 3/10 of a percent of total project cost	<b>Preparation Cost</b> 3/10 of a percent to 1.0 percent of total project cost
<b>Accuracy</b> Minus 20%, to plus 60%	<b>Accuracy</b> Minus 10%, to plus 30%
<b>Method</b> Consensus Ratio Apportion Function point Learning curves	<b>Method</b> 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

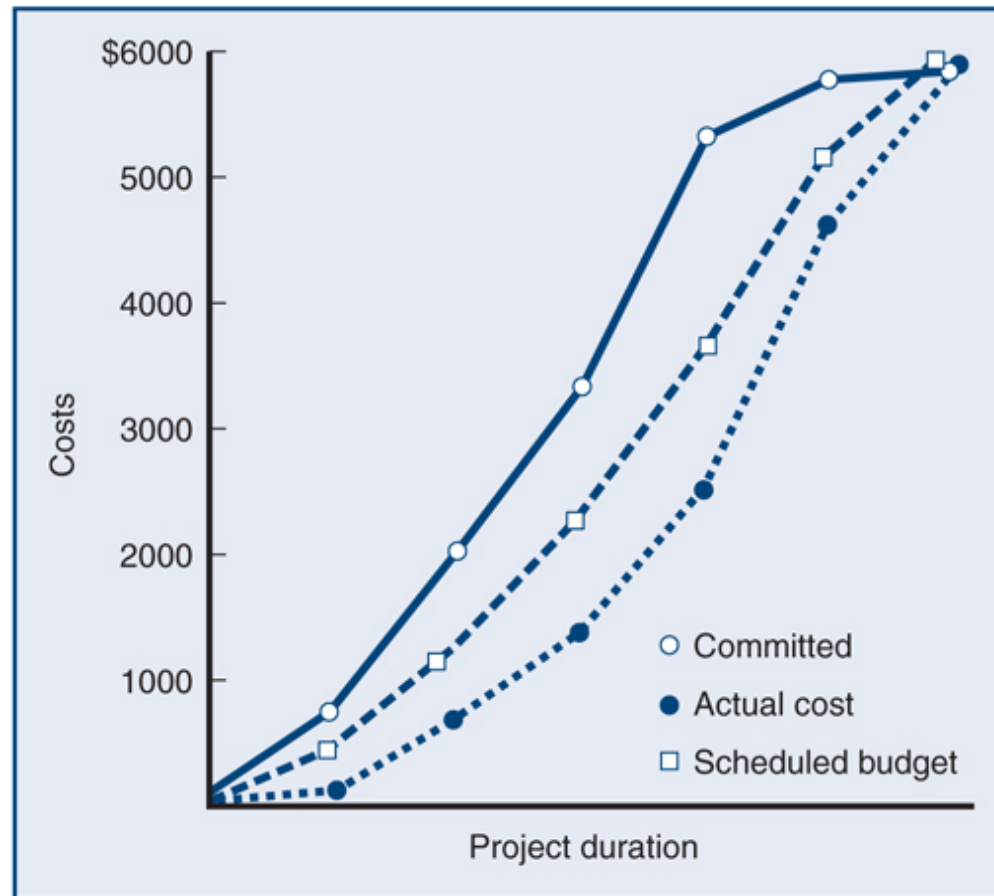
## General and administrative overhead costs

- 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

