31272 Project Management and the Professional
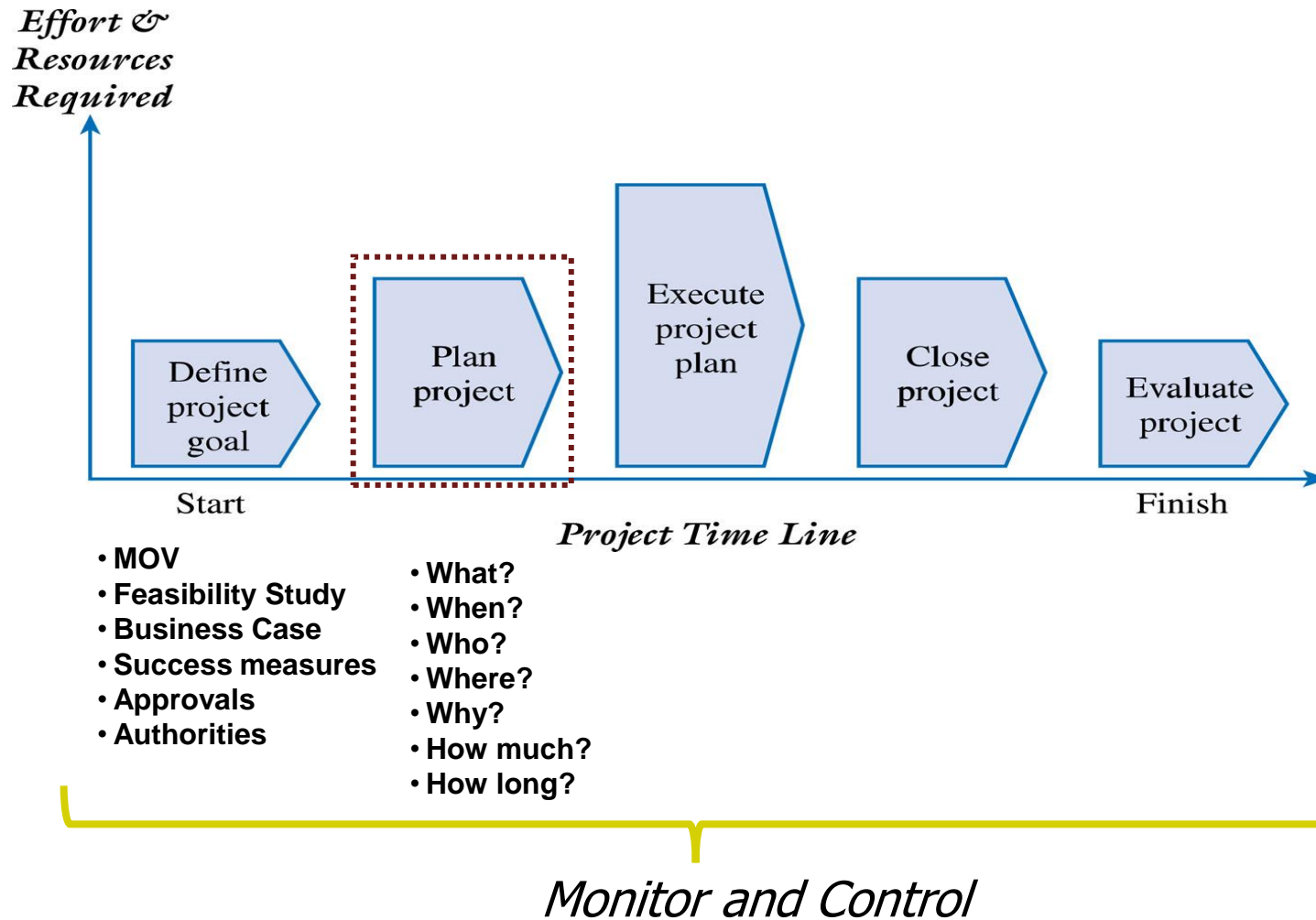
Lecture 7: : Schedule Management (Task dependency and Estimation)
Subject Coordinator | Lecturer: Dr Safa Ghannam
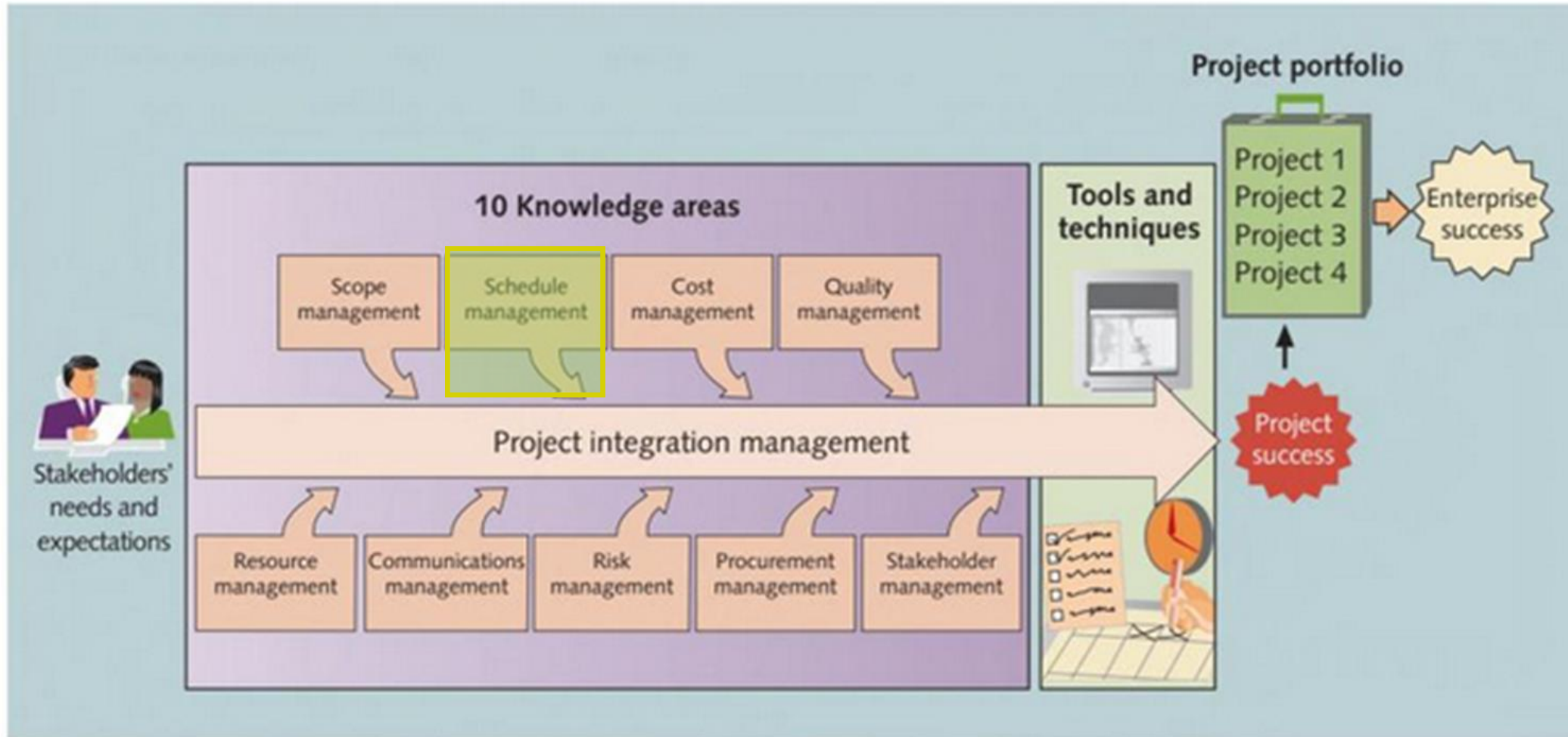31272@uts.edu.au

Objectives and Topics

- Activity Decomposition
- Activity Sequencing
- Network Dependency Diagrams
- Estimating

Project Management Planning

Project Management Planning: Schedule

Project Schedule Management

Ensures timely completion of a project

- Task definition
- Task sequencing
- Task resource planning
- Task duration estimating
- Schedule development

- Task list
- Milestone list, Network Diagram
- Resource requirements
- Task duration estimates
- Project schedule

You can't manage what you don't know

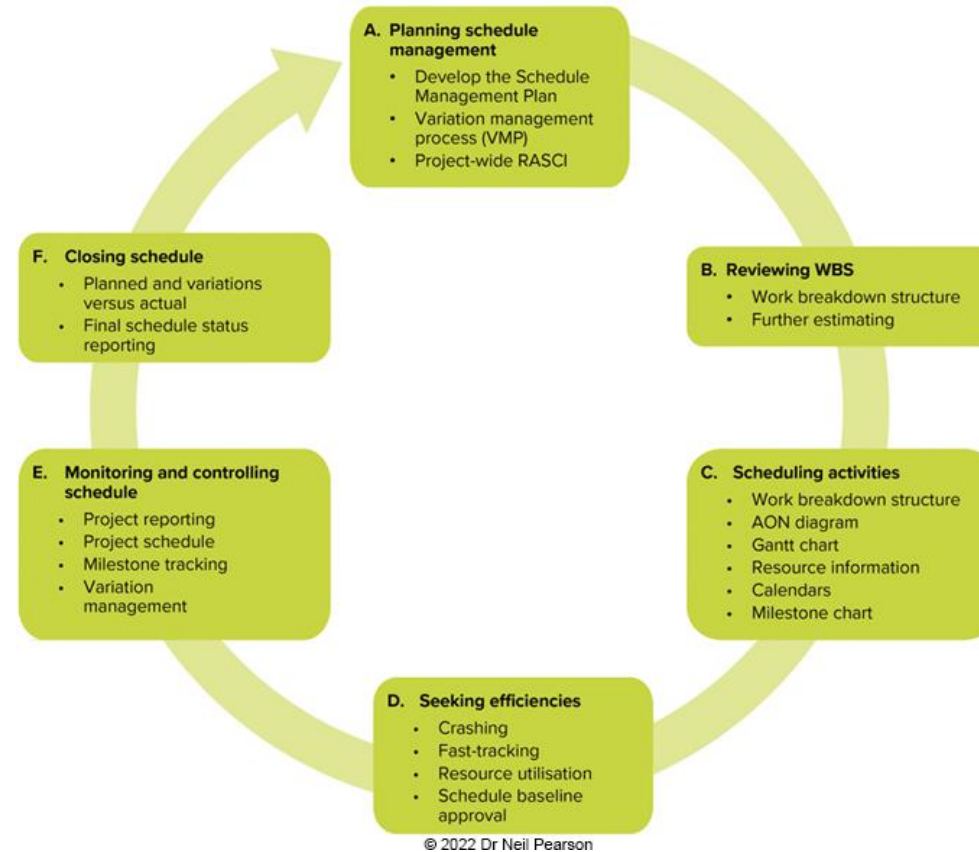# Project Schedule Management – why?

Many managers cite delivering projects on time as a major challenge
Time has very little flexibility
it passes no matter what happens on a project

Schedule issues are cause for conflicts on projects
Many projects have 'fixed' delivery dates so time management is crucial

Project Schedule Management – how?

1. Define Activities.   Planning
2. Sequence activities.
3. Estimate duration.   Organising
4. Develop schedule.
5. Monitor & Control schedule. Part of Leading & execution

Scheduling activities

A. Planning schedule management
- Develop the Schedule Management Plan
- Variation management process (VMP)
- Project-wide RASCI

B. Reviewing WBS
- Work breakdown structure
- Further estimating

C. Scheduling activities
- Work breakdown structure
- AON diagram
- Gantt chart
- Resource information
- Calendars
- Milestone chart

D. Seeking efficiencies
- Crashing
- Fast-tracking
- Resource utilisation
- Schedule baseline approval

E. Monitoring and controlling schedule
- Project reporting
- Project schedule
- Milestone tracking
- Variation management

F. Closing schedule
- Planned and variations versus actual
- Final schedule status reporting
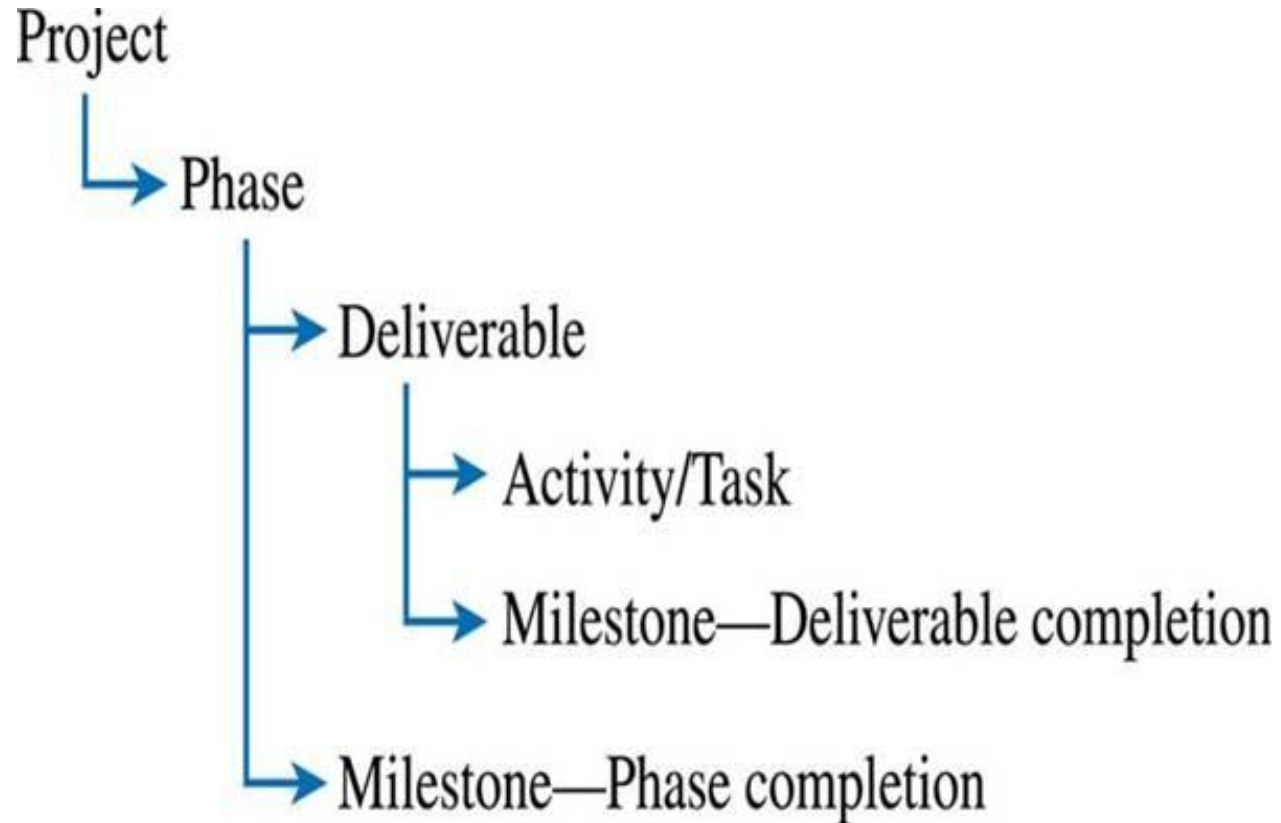
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The WBS Revisited: Overview

"The WBS represents a logical decomposition of the work to be performed and focuses on how the product, service, or result is naturally subdivided. It is an outline of what work is to be performed."

Haugan (2002) in Marchewka (2012) p157

- Helps to structure work and develop the project plan
- Links the scope to the budget and schedule
- Should be flexible ➔ use how it is needed
- Subdivides the project into small manageable units (work packages) ➔ several iterations are needed

1. Develop Project Plan
   1.1. Create Work Breakdown Structure
      1.1.1. Divide the Project into Major Deliverables
      1.1.2. List major activity groups for each deliverable
      1.1.3. Breakdown the activity groups into specific tasks
      1.1.4. Submit WBS to Project Sponsor
      1.1.5. WBS approved and finalized
   1.2. Develop Network Diagram
      1.2.1. Organize WBS into a Logical Sequence
         1.2.1.1. Show all Work Packages (Deliverables)
         1.2.1.2. Establish dependencies (Predecessors & Successors)
         1.2.1.3. Identify Major Milestones
         1.2.1.4. Diagram tasks and milestones (Start-to-Finish Relationships)
      1.2.2. Complete Network Diagram
   1.3. Determine Resource Requirements
      1.3.1. Develop Responsibility Assignment Matrix (RAM)
         1.3.1.1. Show major project Activities
         1.3.1.2. Show Project Team Members & Key Stakeholders
         1.3.1.3. Determine level of participation by resource
         1.3.1.4. RAM delivery to Project Sponsor
      1.3.2. RAM approved and finalized
   1.4. Develop Project Budget
      1.4.1. Develop Resource-Loaded Schedule for each Work Package
      1.4.2. Bottom-Up Estimate for each Work Package
      1.4.3. List Assumptions for each estimate
      1.4.4. Include indirect costs
      1.4.5. Summarize Budget
      1.4.6. Submit to Project Sponsor
      1.4.7. Finalize Budget as "Cost Baseline"
   1.5. Provide Project Organization
   1.6. Specify the Change Control Methodology
   1.7. Define Project Constraints, Assumptions and Risks
   1.8. Create a Communications Plan
   1.9. Provide a Quality Management Plan
   1.10. Develop a Procurement Plan
   1.11. Complete Project Plan

The WBS Revisited: Work Packages

Project
→ Phase
  → Deliverable
    → Activity/Task
    → Milestone—Deliverable completion
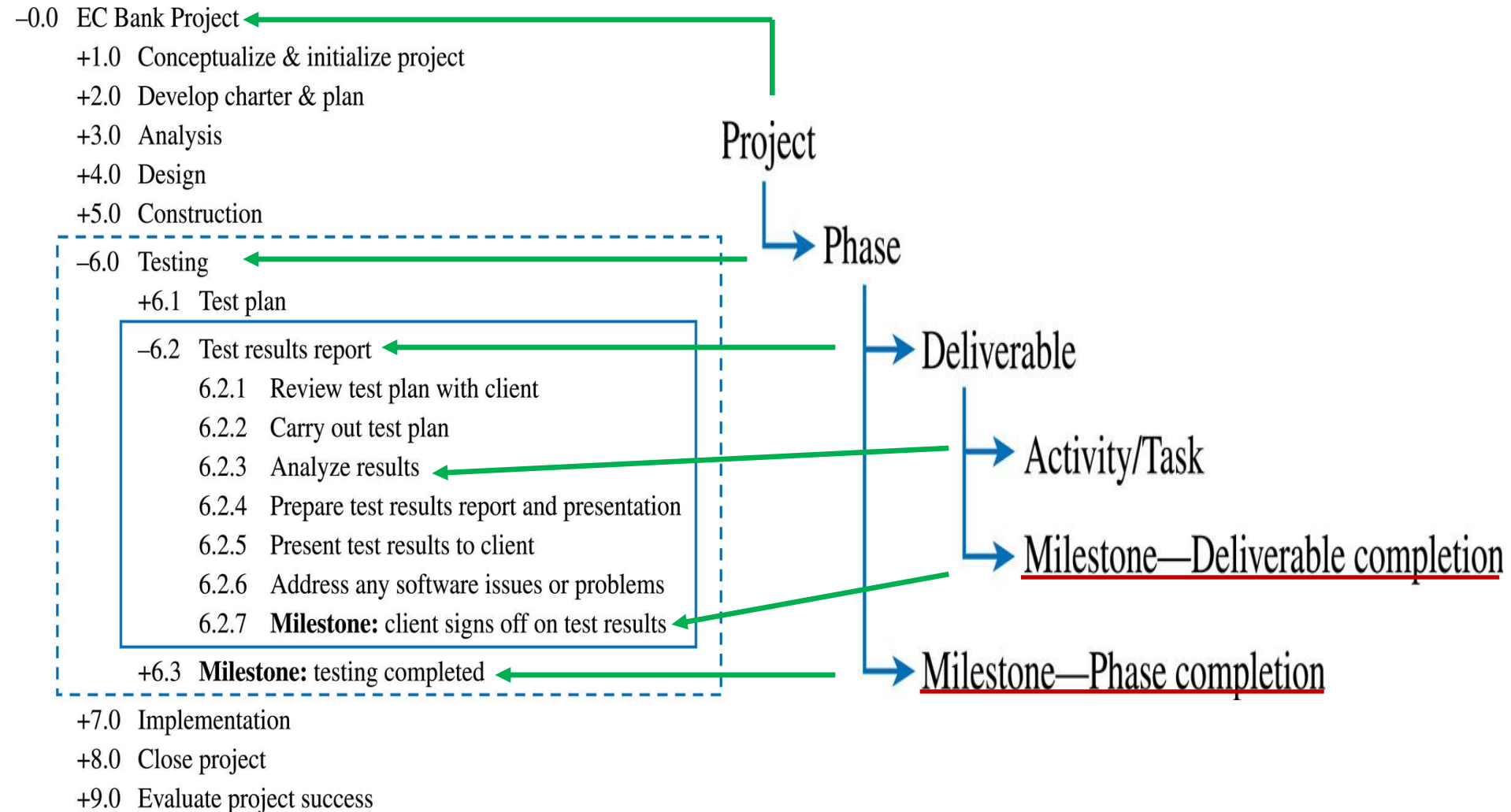 → Milestone—Phase completion

Each work package has a tangible, verifiable work product (e.g. report, presentation, prototype, etc.)

Marchewka (2012) p 158

The WBS Revisited: Milestones

- Significant event or achievement (e.g. phase completion or acceptance of deliverables)
- Zero duration and no resources required
- Milestone list keeps team focused
- Proof of concept
- Quality control
- Reduce risk

The WBS Revisited: The Work Package Concept

–0.0 EC Bank Project
  +1.0 Conceptualize & initialize project
  +2.0 Develop charter & plan
  +3.0 Analysis
  +4.0 Design
  +5.0 Construction
 –6.0 Testing
   +6.1 Test plan
   –6.2 Test results report
     6.2.1 Review test plan with client
     6.2.2 Carry out test plan
     6.2.3 Analyze results
     6.2.4 Prepare test results report and presentation
     6.2.5 Present test results to client
     6.2.6 Address any software issues or problems
     6.2.7 **Milestone:** client signs off on test results
   +6.3 **Milestone:** testing completed
  +7.0 Implementation
  +8.0 Close project
  +9.0 Evaluate project success

Project
  Phase
  Deliverable
    Activity/Task
    Milestone—Deliverable completion
   Milestone—Phase completion

Adapted from Marchewka (2012) p 158, 160

Activity Sequencing

For each WBS activity, answer the following:

1. Which activity does this activity follow (logically depends upon)?

2. Which activity does this activity logically precede?

3. What other activities can be done in parallel (at the same time) as this activity?
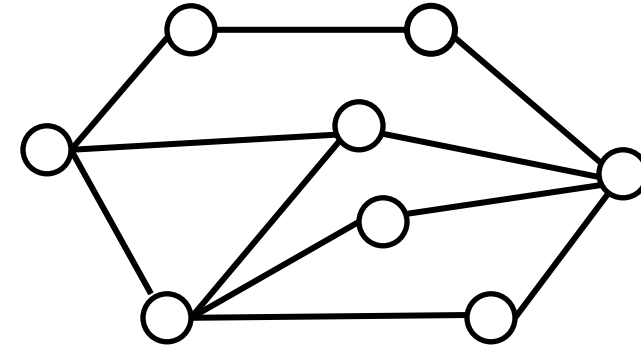
Tasks can be linked into a logical network
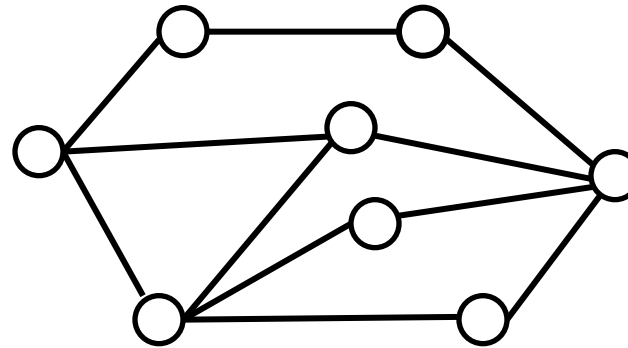
Network Display Diagram

Each task node has characteristics

- Start time
- Finish time
- Duration
- It may come before another task (predecessor)
- It may come after another task (successor)

What tasks can be done in parallel?

Tasks can be linked into a logical network

Sequencing is initially resource (people) independent and without constraints. At first just consider activities/deliverables.

# Task List Example: Car Wash Project

Task No	Description	Deliverable
T01	Park car in yard	Car parked
T02	Locate sponges, buckets, soap	Supplies acquired
T03	Take supplies to yard	Supplies put near car
T04	Get hose	Hose acquired
T05	Connect hose to water supply	Hose connected
T06	Turn on water	Verified water running
T07	Wet sponges with water + soap	Sponges wet and soapy
T08	Wet the car with hose	Car wet
T09	Sponge wash car body	Car body clean
T10	Sponge wash car windscreen	Car windscreen clean
T11	Sponge wash car tyres	Car tyres clean
T12	Rinse soap from car body	Excess soap/dirt removed
T13	Rinse soap from car windscreen	Excess soap/dirt removed
T14	Rinse soap from car tyres	Excess soap/dirt removed
T15	Wipe and polish the car	Verified car clean/polished

Network Display Diagram: Car Wash Project

T01	Park car in yard	T06	Turn on water	T11	Sponge wash car tyres
T02	Locate sponges, buckets, soap	T07	Wet sponges with water + soap	T12	Rinse soap from car body
T03	Take supplies to yard	T08	Wet the car with hose	T13	Rinse soap from windscreen
T04	Get hose	T09	Sponge wash car body	T14	Rinse soap from tyres
T05	Connect hose to water supply	T10	Sponge wash car windscreen	T15	Wipe and polish the car
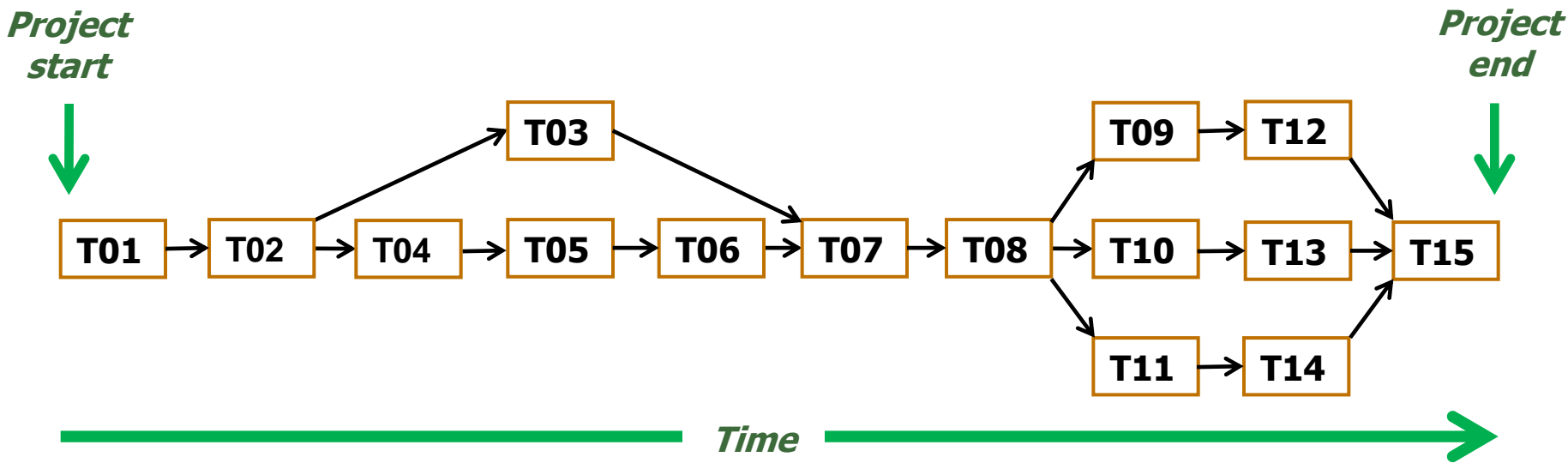
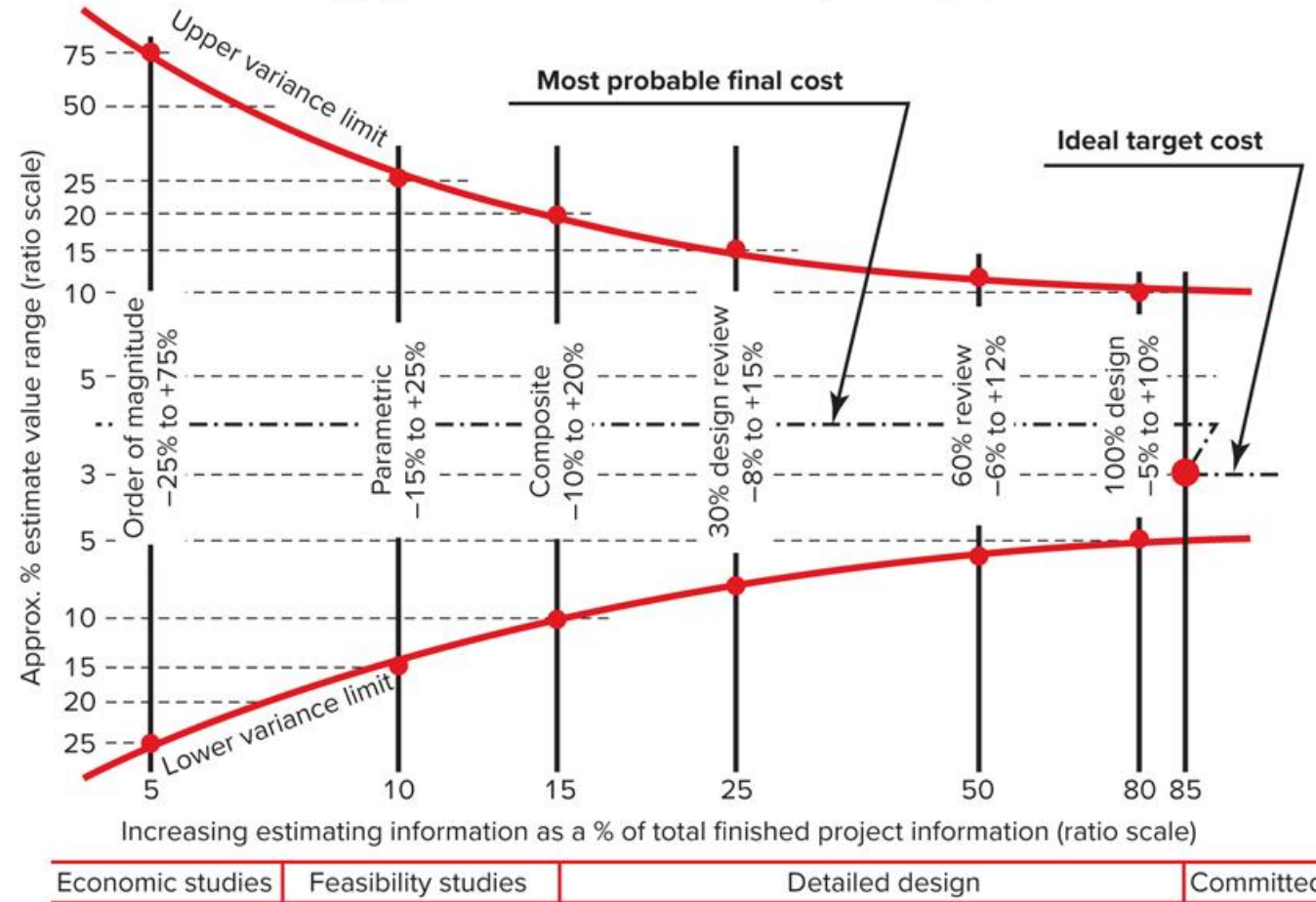# Gantt chart (from MS project)
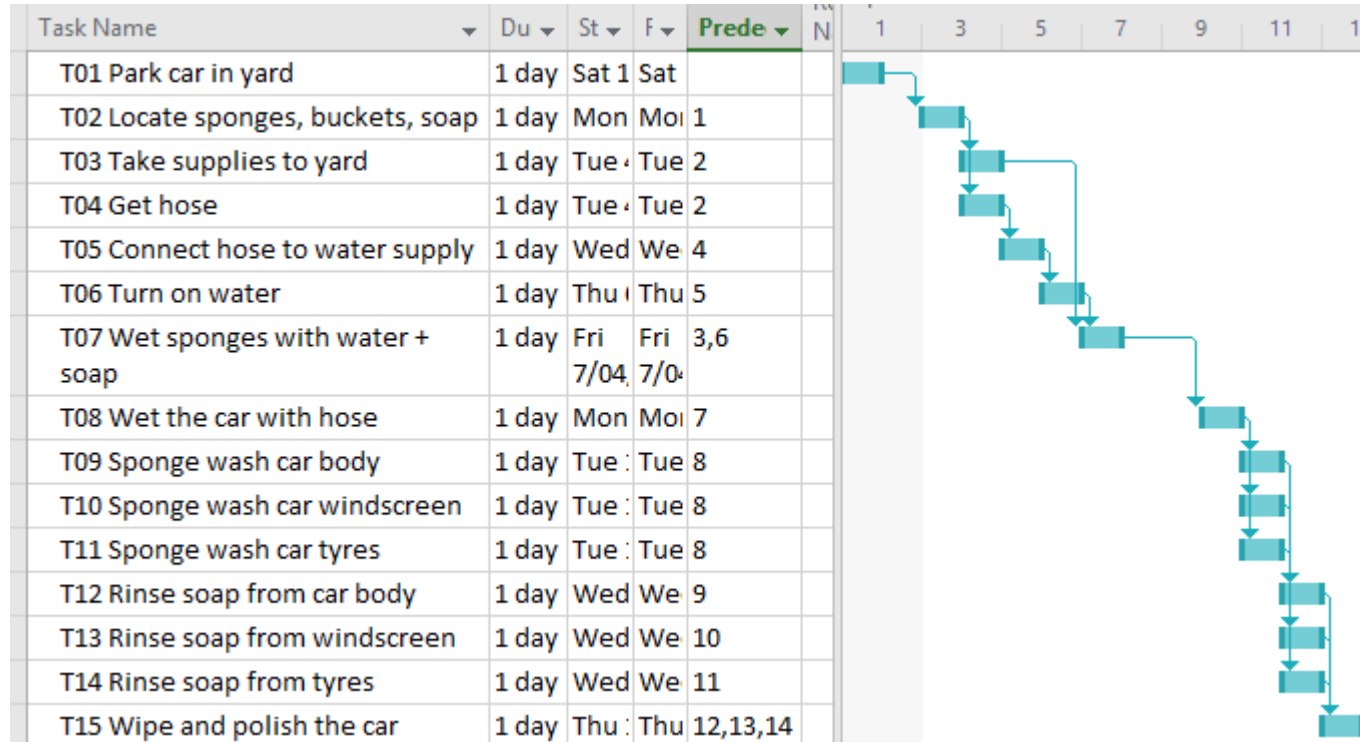
Estimating

Estimating is the science of placing a number of resources, for a required period of time, with known costs against a work package or the tasks of a work package.

- The **resources** required

- The **effort/duration** required from each **resource**

- The **cost** of using each **resource**.

Estimating accuracy

Estimating workflow

Have a process in your projects.

Know in advance what tools and resources are available to assist you.

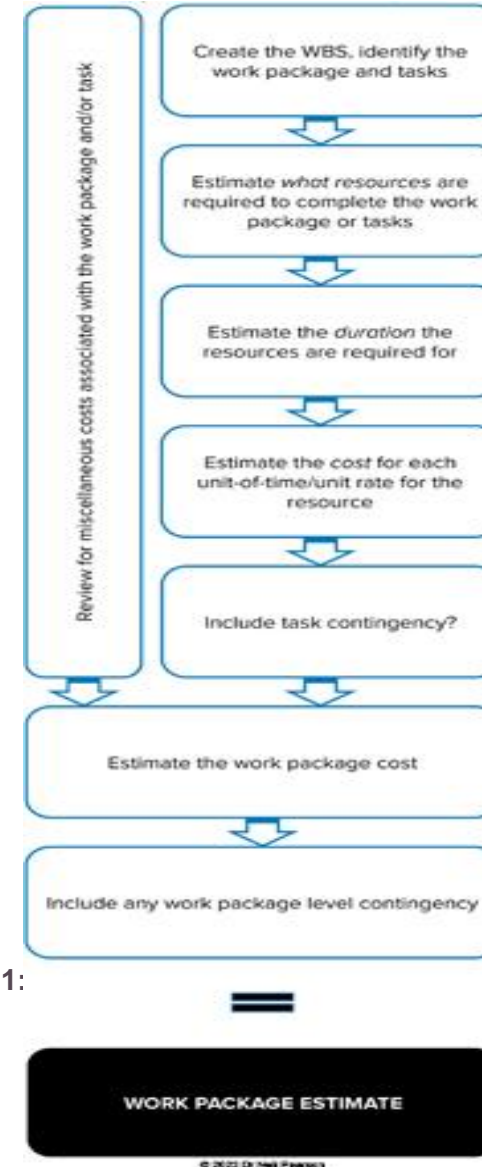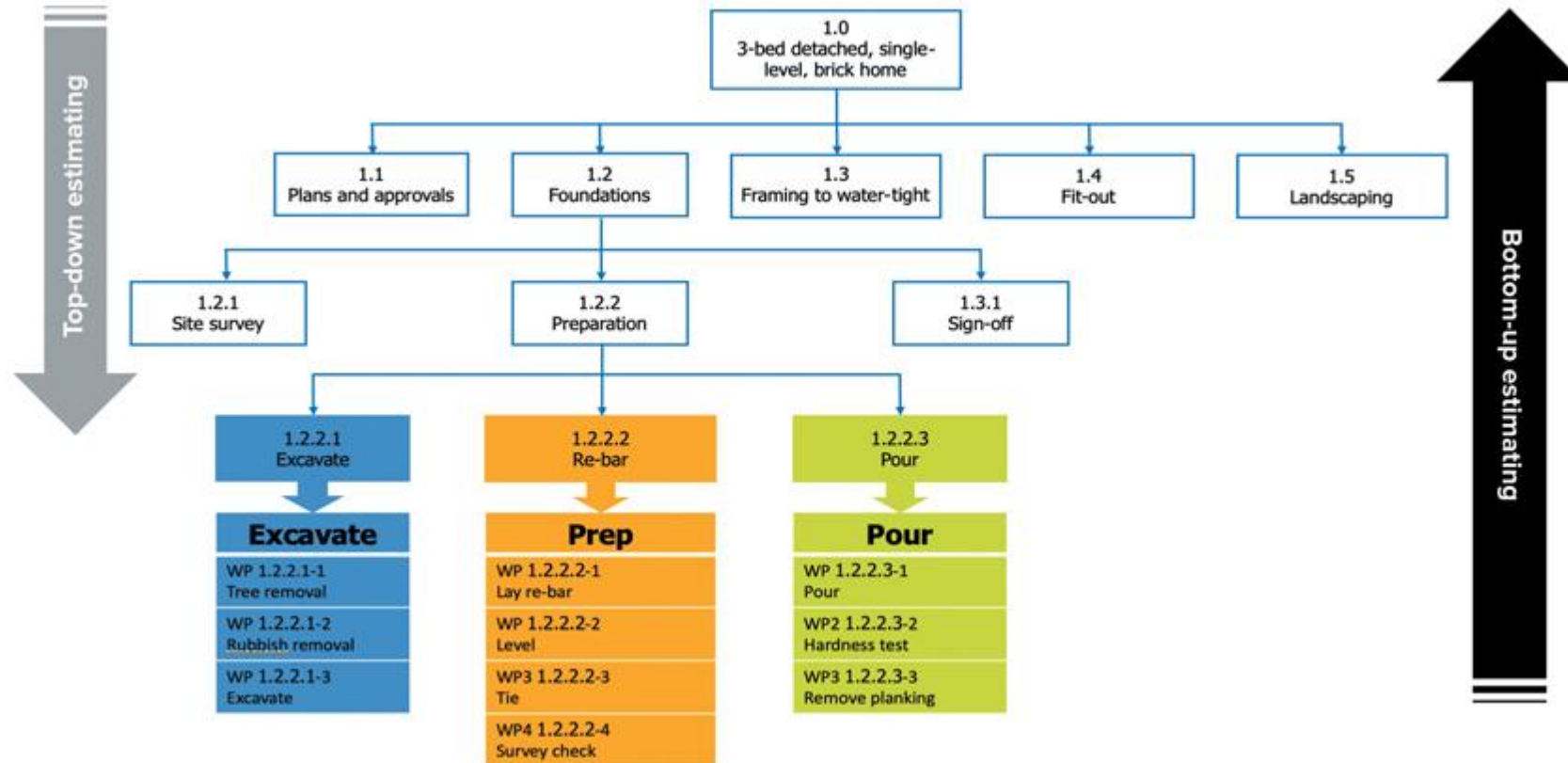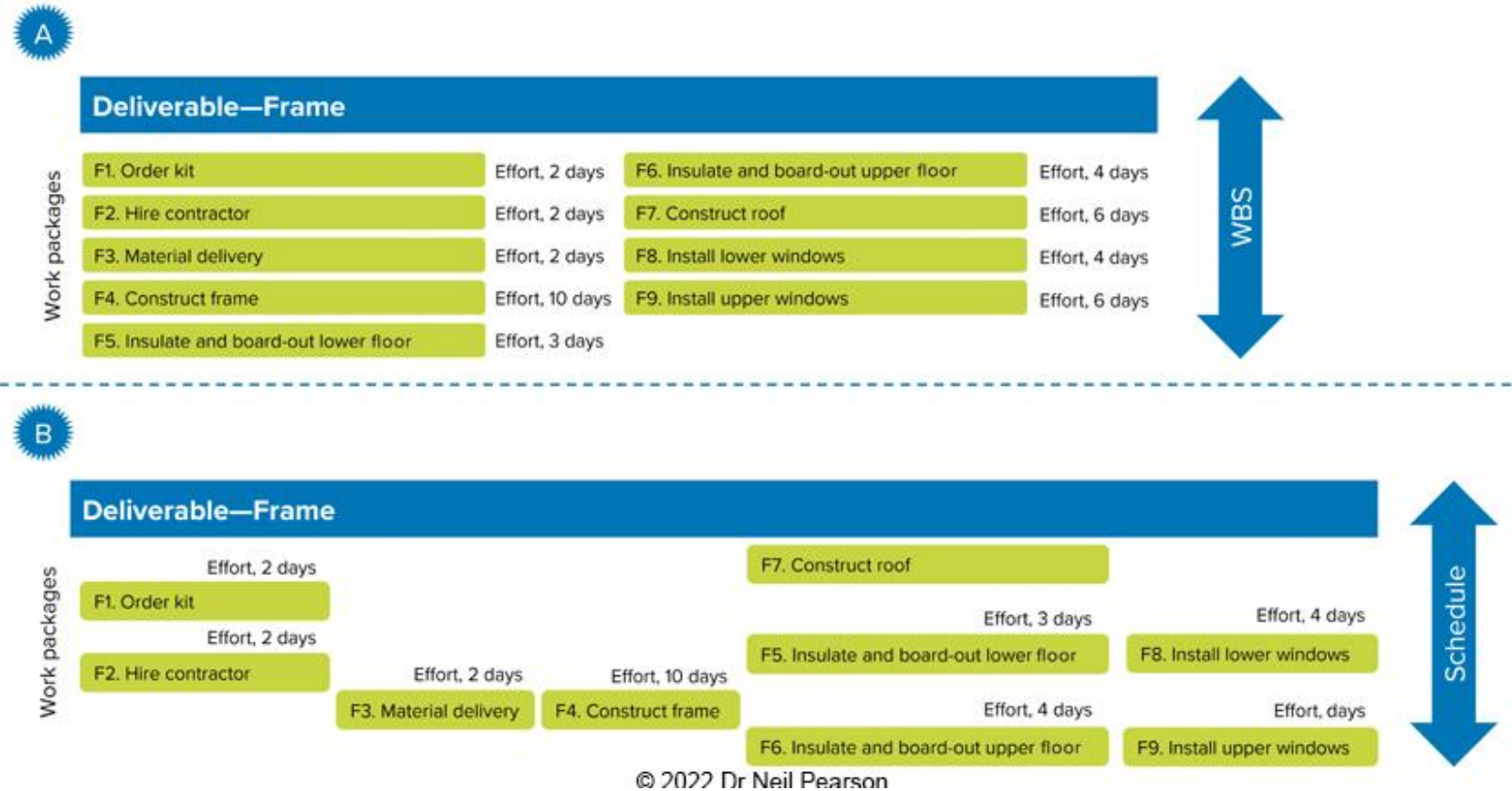**Figure 1:**

Top-down vs. bottom-up

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Terminology—duration vs. effort

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Estimating techniques

Time	Cost	Resources
Expert judgement	Expert judgement	Expert judgement
Analogous estimating	Analogous estimating	Analogous estimating
Parametric estimating	Parametric estimating	Parametric estimating
Three-point estimating	Three-point estimating	–
Bottom-up estimating	Bottom-up estimating	Bottom-up estimating
Data analysis	Data analysis	Data analysis
Decision-making	Decision-making	–
Meetings	–	Meetings
–	Alternatives analysis	–
–	Reserve analysis	–
–	Cost of quality	–
–	Project management information system	Project management information system

Techniques

Analogous means *similar* or *alike in such a way as to permit the drawing of an analogy* (a similarity between the features of two things). When applied to project management, we are usually comparing the estimates of the project (or components of a project) with past similar projects, to inform and formulate our estimate. The analogous estimating method requires that good historical data is available to make comparisons against.

Parametric estimating is a technique where data on various parameters of a previous project are used to make a current estimate of the work to be carried out. The relationship between the historic parameters (such as weight, size, cost, complexity, manpower) are used to estimate the current requirements.

Techniques (cont'd)

The **three-point estimate** (**PERT**) has become a popular way of arriving at a (weighted) average. The PERT formula considers three estimates: a low (optimistic) estimate, an average (most likely) estimate and a high (pessimistic) estimate.

$$\frac{\text{optimistic} + (4 \times \text{most likely}) + \text{pessimistic}}{6}$$

PERT Technique

- <u>P</u>rogram <u>E</u>valuation and <u>R</u>eview <u>T</u>echnique

- Developed in 1956 for the Polaris Missile project

- Activity-on-Node (AON) or Activity-on-Arrow (AOA)

- Duration = optimistic time + 4 x likely time + pessimistic time

Example: (1 workday + 4x2 workdays + 9 workdays) / 6
   = **3 workdays**

Techniques (cont'd)

Range estimating works best when work packages have significant uncertainty associated with the time, cost or resource dimensions involved for completing the work package.

WBS ID	Description	Duration estimate in units of .5 days				
		Low estimate	Average estimate	High estimate	Range	Confidence level
1.2.2.1	Excavate					
WP 1.2.2.1-1	Tree removal	4	5	7	3.0	low
WP 1.2.2.1-2	Rubbish removal	1	1.5	2	1.0	high
WP 1.2.2.1-3	Excavate	2	5	8	6.0	medium
1.2.2.2	Re-bar					
WP 1.2.2.2-1	Lay re-bar	3	4	7	4.0	medium
WP 1.2.2.2-2	Level	0.5	1	2	1.5	high
WP 1.2.2.2-3	Tie	2	2.5	3	1.0	low
WP 1.2.2.2-4	Survey check	0.5	1	2.5	2.0	low
1.2.2.3	Pour					
WP 1.2.2.3-1	Pour	1	1	3	2.0	high
WP 1.2.2.3-2	Hardness test	0.5	0.5	1	0.5	high
WP 1.2.2.3-3	Remove planking	1	3	6	5.0	low

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Where next?

We are going to use the estimates of resources, durations and costs to build further project artefacts…

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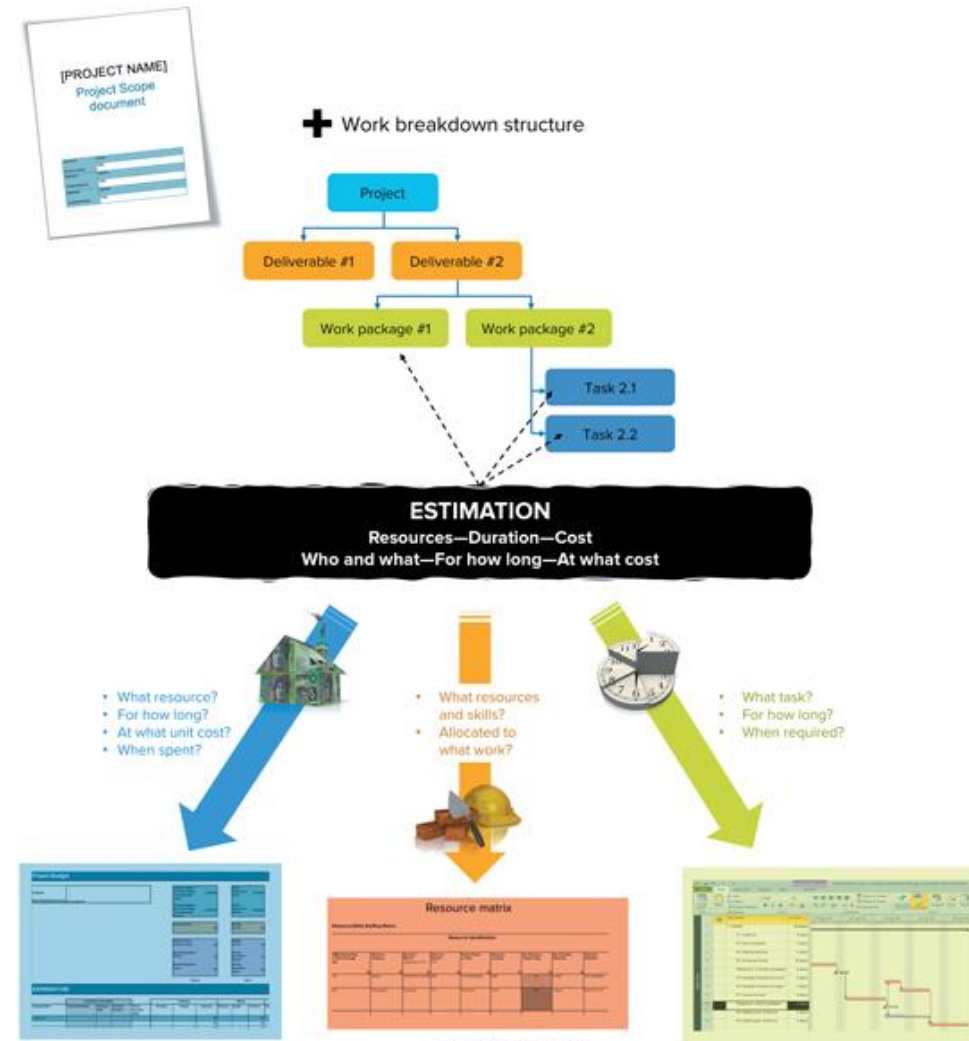
A Few Final Words

- You can't manage what you don't know
- Sequence tasks in parallel where you can
- Estimating is usually done poorly
- Estimates are really <u>management</u> targets
- Collect as much information about previous projects as possible (then apply good judgement)
- Use more than one method of estimating
- Top down OK in early stages but later use bottom up
- Seek a range of opinions
- Document your methods, record your assumptions
- Apply a risk based contingency reserve (e.g. 20%)
- Regularly re-evaluate your estimates