Chapter 5
Estimating Duration, Resource Requirements, and Cost
Estimating Duration

- **Duration** is the elapsed time in business working days, not including weekends, holidays, or other nonworking days.

- **Work effort** is labor required to complete an activity
  - Can be consecutive or nonconsecutive hours
Several causes of variation in the actual activity duration:

- Varying skill levels
  - Will be both a help and a hindrance to PM
- Unexpected events
  - Example: incorrect shipments of materials
- Efficiency of work time
- Mistakes and misunderstandings
- Common cause variation
Elapsed time versus work time

Labor

Duration

L = D

L = 0.75D

33% unplanned interruptions
Methods for Estimating Task Duration

There are six techniques for initial planning estimates

1. Similarity to other activities
   - Extrapolate based on recollections of similar activities

2. Historical data
   - Based on project notebook records of estimated and actual duration
   - Can be sophisticated database search with regression

3. Expert advice
   - Vendors may prove good source

4. Delphi technique

5. Three-point technique

6. Wide-band Delphi technique
Methods for Estimating Task Duration

cont.

Delphi technique

- Can produce good estimates in the absence of expert advice
- Extracts and summarizes the knowledge of the group to arrive at an estimate.
- Each individual in the group is asked to make his or her best guess of the activity duration.
- Results are tabulated and presented in a histogram labeled First Pass.
- Those whose estimates fall in the outer quartiles are asked to share the reason for their guess.
- Group is asked to guess again.
- Repeat for Second and Third Passes.
- Average of the third guess is used as the group’s estimate.
Delphi technique cont.
Three-point technique

Need three estimates of activity duration:

- Optimistic
  - The shortest duration one might expect to experience given that everything happens as expected

- Pessimistic
  - The duration that would be experienced if everything that could go wrong did go wrong, yet the activity was completed

- Most likely
  - The time usually experienced
Methods for Estimating Task Duration cont.

Three-point technique

\[ E = \frac{O + 4M + P}{6} \]

O: Optimistic
P: Pessimistic
M: Most Likely
Wide-band Delphi technique

- Combines Delphi and Three-Point methods
- In place of a single estimate, the panel members are asked, at each iteration, to give their O, P, and M estimates for the duration of the chosen task.
- The results are compiled, and any extreme estimates are removed.
- Averages are computed for each of the three estimates
Determine Resource Requirements

Types of resources:

People
In most cases the resources you will have to schedule are human resources. This is also the most difficult type of resource to schedule.

Facilities
Project work takes place in locations. Planning rooms, conference rooms, presentation rooms. The exact specifications as well as the precise time at which they are needed are some of the variables that must be taken into account.

Equipment
What is needed and when drive the task schedule based on availability.

Money
Project expenses typically include travel, rooms and meals, and supplies

Materials
Parts to be used in the fabrication of products and other physical deliverables are often part of the project work, too. For example, the materials needed to build a bicycle might include nuts, bolts, washers, and spacers.
People as Resources

- **People** are the most difficult type of resource to schedule because you plan the project by specifying the types of skills you need, when you need them, and in what amounts. Note that you do not specify the resource by name.

- There are a tool you can use to help you schedule people. 
  - **Skills Matrices**
Skills Matrices

This process involves gathering inventory data for two inventories:

- An inventory of the **demand for skills** needed to perform the tasks associated with specific activities. This is represented as a matrix whose rows are the activities and whose columns are the skills. These include both current and long-term needs.
- An inventory of the **current skills** among the professional staff. This is represented as a matrix whose rows identify the staff and whose columns represent the skills.

![Diagram showing the relationship between activities, staff skills inventories, and staff assignments](image-url)
Skills Matrix Sample

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<th>POSITIONS</th>
<th>SERVICE AREAS</th>
<th>TECHNICAL SPECIALTIES</th>
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<td>Cross Cutting Support</td>
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C-TiP’s WORKFORCE SKILLS MATRIX
The Resource Breakdown Structure is used to assist in not only resource estimation but also cost estimation.
There are three ways to assign a resource to an activity:

- **Assign at a Constant Rate.**
  - 40 hour/Week = 8 hours/day
- **Assign as a Total Amount.**
  - Assign the worker to the activity until the work is completed
- **Assign as a profile**
  - Useful when not flat-loaded at constant rate
Anytime you are forecasting the future, as you are when you plan a project, you are dealing with some amount of uncertainty.

Projects are so often over budget because the budget is an estimate, not an exact mathematical calculation.

Three types of estimates are common in project management:

**Order of magnitude estimate:**
This type means that the number given for the estimate is somewhere between **25 percent above and 75 percent below** the number. Order of magnitude estimates are often used at the very beginning of the estimation process when very little detail is known about the project work and a rough estimate is all that management calls for. It is understood that this estimate will be improved over time.
Estimating Cost cont.

Budget estimate:
This type has a range of 10 percent over and 25 percent below the stated estimate. These estimates are generated during project planning time and are based on knowing some detail about the project activities.

Definitive estimate:
This type is generally the one that is used for the rest of the project. It has a range of 5 percent over and 10 percent below the stated estimate. These estimates are most useful during project execution when new information helps further improve the estimates generated during project planning time.
Cost Budgeting

- After estimate, you go into the cost budgeting phase.
  - When you assign costs to tasks on the WBS, very formulaic -
    You take the needed resources and multiply the costs times
    the number of hours they are to be used.

- Gives the sponsor a final check on the costs of the project.

- Remember that no matter what, you are still doing an estimate.
  - Different than estimating in that it is more detailed but is still
    just a best effort at expressing the cost of the project.
How often do you need to get reports of the costs?

- Would be good if you could account for everything in real time
  - Generally way too expensive and time-intensive
  - More likely, you’ll get figures once a week:
    - Gives you a good snapshot of the costs that are occurring.
    - If you wait longer, you may find that the project has spun out of control.

How do you look at the numbers you’re receiving?

- If you’ve done a cost baseline, then what you’re looking for is a variance from the original costs.
- Your job is to look at the two and determine if management action must be taken.
Using a JPP to Determine Resource Requirements

- The planning team includes resource managers or their representatives.
- At the time the planning team is defining the WBS and estimating activity duration, estimates of resource requirements will be made.
- To determine resource requirements the following practice is effective:
  - First, create a list of all the resources required for the project.
  - For people resources, list only position title or skill level, not the specific people
  - Envision a person with the typical skill set and loading on the project activity
- Second, when the WBS is presented, resource requirements can be reported, too
The team should have access to a standard costing table.
   - Will list all resources, unit of measure, and cost per unit.

Then just a simple exercise in calculating the cost per resource based on the number of units required and the cost per unit:

- Many organizations will have a spreadsheet template that will facilitate the exercise.
- These calculated figures can be transferred to the WBS and aggregated up the WBS hierarchy to give a total cost for each activity level in the WBS.