Estimate Costs Tools and Techniques

Here are a few terms you'll need to understand for this process. These aren't really covered in the *PMBOK® Guide*, but you may be asked questions about these on the exam.

Fixed costs are costs that are constant throughout the life of the project. An example of a fixed cost would be monthly rent.

Variable costs are costs that vary depending on the amount of resources used on the project. For example, if you rent a piece of equipment for the project, but you decide you need more.

Direct costs are costs that are billed directly to your project. For example, buying equipment just for the project.

[1]**Indirect costs** are costs that can't be directly traced to a specific project and therefore will be accumulated and allocated equitable over multiple projects. For example, electricity or water for the building.

Life cycle costing looks at the total cost of the project from building it to transferring it to the owner through its life. If a project is creating a new database the cost will include building the database, the cost of maintaining it while it's still in use and then the cost of dismantling it when it retires or is replaced.

Sunk costs are costs that have already been spent during the project. Don't include sunk costs when making future decisions about project costs.

There are several tools that can be used to help in estimating costs. Each is different from the other and depending on the accuracy needed for the estimates, one may be used over another or in combination.

Analogous estimating is also known as top-down estimating and is based on another similar project in the organization. It's important to note that when comparing to another project, it has to be apples to apples for the best estimates.

- This type of estimate is usually quick and easy and is made by management or a subject matter expert familiar with the activity or project.
- It may not be as accurate as other types of estimating, like bottom- up.

[1]**Parametric estimating** is an estimating technique in which an algorithm is used to calculate cost or duration based on historical data and project parameters.

- It's best used for activities that are linear. For example, if a team paves 1 mile of road per hour and it costs $1,000, then it stands to reason 10 miles would be paved in 10 hours and cost $10,000.
- This type of estimating is not good for activities that are unknown or haven't been done previously.

Bottom-up estimating is the most accurate of the estimates and is when an estimate is applied to each activity, starting from the bottom and working its way to the top. The estimates are then aggregated up for a total cost. This process can be time consuming, but it's more accurate.

Three-point estimating is also called program evaluation and review technique (PERT) and is where you use three data points to make an estimate. The three points are as follows:

- Pessimistic: worst-case scenario
- Realistic: most likely
- Optimistic: best-case scenario

There are two ways of calculating three-point estimates. Each depends on the level of accuracy needed:

Beta distribution is more accurate and puts a weight on the realistic value to come up with a more accurate estimate. Let's say a team member gives you the following estimates for the cost of an activity: realistically $50, optimistically 20, and pessimistically $80.

You then apply this formula to calculate the estimate: P+(4)R+O/6.

- 80+(4)50+20/6 = 80+200+20/6 = 300/6 = $50 is the estimate for this activity.

Triangular distribution uses the same three points and the formula is much easier to use, but it's not as accurate: P+R+O/3.

- 80+50+20/3 = 150/3 = $50 is the estimate for this activity.

In this particular example the values happen to be the same, but that won't always be the case. Let's look at the following example:

Beta: 15+(4)7+3/6 = $7.67

Triangular: 15+7+3/3 = $8.33

The values are different by less than a dollar. If you have a project where you need more accurate estimates, then you probably want to choose the beta distribution formula.

Another important formula to calculate is standard deviation for PERT analysis. The standard deviation formula is Pessimistic - Optimistic/6.

- $80-$20/6 = $60/6 = $10 standard deviation from the estimate
- For the beta calculation, $50 days +/- $10

Tip: A good way to remember the order of the PERT three-point estimate formula is to think of the word PRO. Just remember the R is multiplied by 4. By the time you finish practicing these formulas you'll be a PRO: Pessimistic, Realistic(4) and Optimistic.

The PMBOK® Guide briefly mentions a range of possible estimates but doesn't go into much detail. There are five ranges of estimates to cover because you may see a question on the exam about them.

Rough order of magnitude: +75% to 100% to -25% to -50%

Conceptual: +50% to -30%

Preliminary: +30% to -20%

Definitive: +20% to -15%

Control: +15% to -10%

As you move down the list, the order of magnitude decreases. The more information you know about your project and project costs, the tighter the estimate.

For example, if you're working on a project that is new to the organization and not much is known, at the beginning of the project the rough order of magnitude estimate of +100% to -50% may be appropriate until you gain more information.

If you are building a single-story house and it's the same for every house on the block, the estimate may be +15% to -10% as you have the costs down pat.

[1]These definitions are taken from the Glossary of Project Management Institute, *A Guide to the Project Management Body of Knowledge, (PMBOK® Guide)* – Sixth Edition, Project Management Institute Inc., 2017.