ICT Project Management

Chapter 5: Project Planning Phase – Project Cost Management

5.1. Introduction

Project Cost Management includes the processes required to ensure that the project is completed within the approved budget. Project cost management is primarily concerned with the cost of the resources needed to complete project activities. However, project cost management should also consider the effect of project decisions on the cost of using the project product.

- **Cost** is a resource sacrificed or foregone to achieve a specific objective or something given up in exchange
    - Cost is one of 3 Triple constraints of the project. Managing costs of the project is very crucial and hardest part of the project. It spans across all phases of the project right from conception to closure of the project.
    - Costs are usually measured in monetary units like dollars

5.2 Reasons for cost overruns in ICT projects

- Not emphasizing the importance of realistic project cost estimates from the outset
    - Many of the original cost estimates for IT projects are low to begin with and based on very unclear project requirements
- Many IT professionals think preparing cost estimates is a job for accountants when in fact it is a very demanding and important skill that project managers need to acquire
- Many IT projects involve new technology or business processes which involve untested products and inherent risks

5.3. Basic Principles of Project Cost Management

- **Profits** are revenues minus expenditures
- **Profit margin** is the ratio of revenues to profits
    - ✓ $2 profit per $100 revenue → 2% profit margin
- **Life cycle costing** considers the total cost of ownership, or development plus support costs, for a project
    - ✓ A project could take 2 years to build and be in place for 10 years; costs and benefits must be estimated for the entire lifetime of the project
- **Cash flow analysis** determines the estimated annual costs and benefits for a project and the resulting annual cash flow. Too many projects with high cash flow needs in the same year may not be able to be supported which will impact profitability
- **Tangible costs** or **benefits** are those costs or benefits that an organization can easily measure in dollars
    - ✓ A task that was allocated $150,000 but actually costs $100,000 would have a tangible benefit of $50,000 if the assets allocated are used for other projects
- **Intangible costs** or **benefits** are costs or benefits that are difficult to measure in monetary terms
    - ✓ Costs – resources used to research related areas of a project but not billed to the project
    - ✓ Benefits – goodwill, prestige, general statements of improved productivity not easily translated in dollars
- **Direct costs** are costs that can be directly related to producing the products and services of the project
    - ✓ Salaries, cost of hardware and software purchased specifically for the project
- **Indirect costs** are costs that are not directly related to the products or services of the project, but are indirectly related to performing the project
    - ✓ Cost of electricity, paper towels
- **Sunk cost** is money that has been spent in the past; when deciding what projects to invest in or continue, you should *not* include sunk costs
    - ✓ To continue funding a failed project because a great deal of money has already been spent on it is not a valid way to decide on which projects to fund
    - ✓ Sunk costs should be forgotten
- **Learning curve theory** states that when many items are produced (or tasks are performed) repetitively, the unit cost of those items decreases in a regular pattern as more units are produced (or more tasks performed)

- **Reserves** are dollars included in a cost estimate to mitigate cost risk by allowing for future situations that are difficult to predict
    - ✓ **Contingency reserves** allow for future situations that may be partially planned for (sometimes called **known unknowns**) and are included in the project cost baseline
        - Recruiting and training costs for expected personnel turnover during a project
    - ✓ **Management reserves** allow for future situations that are unpredictable (sometimes called **unknown unknowns**) .
        - Extended absence of a manager; supplier goes out of business

5.4. Project management process

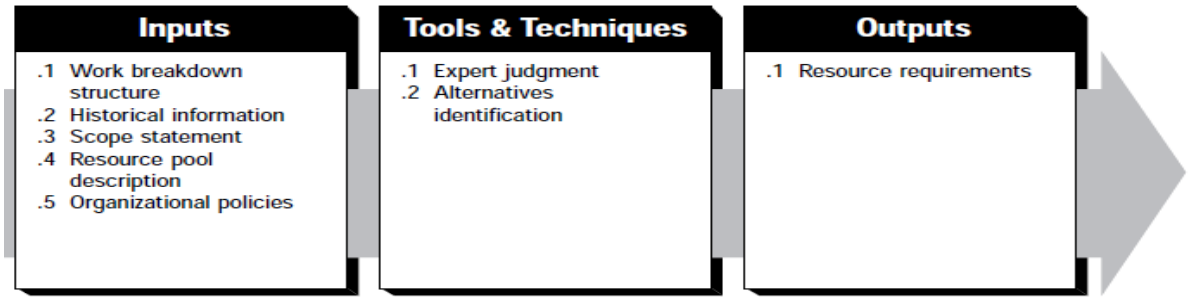
There are three project cost management processes:

- **Resource Planning**—determining what resources (people, equipment, materials) and what quantities of each should be used to perform project activities.
- **Cost Estimating**—developing an approximation (estimate) of the costs of the resources needed to complete project activities.
- **Cost Budgeting**—allocating the overall cost estimate to individual work items to establish a baseline for measuring performance
- **Cost Control**—controlling changes to the project budget.

These processes interact with each other and with the processes in the other knowledge areas as well. Each process may involve effort from one or more individuals or groups of individuals based on the needs of the project. Each process generally occurs at least once in every project phase.

5.5 Resource Planning

Resource planning involves determining what physical resources (people, equipment, materials) and what quantities of each should be used to perform project activities. It must be closely coordinated with cost estimating



5.5.1. Inputs to Resource Planning

1. **Work breakdown structure.** The work breakdown structure (WBS) identifies the project elements that will need resources and thus is the primary input to resource planning.
2. **Historical information.** Historical information regarding what types of resources were required for similar work on previous projects should be used if available.
3. **Scope statement.** The scope statement contains the project justification and the project objectives, both of which should be considered explicitly during resource planning.
4. **Resource pool description.** Knowledge of what resources (people, equipment, material) are potentially available is necessary for resource planning
5. **Organizational policies.** The policies of the performing organization regarding staffing and the rental or purchase of supplies and equipment must be considered during resource planning.

5.5.2. Tools and Techniques for Resource Planning

Expert judgment. Expert judgment will often be required to assess the inputs to this process. Such expertise may be provided by any group or individual with specialized knowledge or training and is available from many sources including:

- Other units within the performing organization.
- Consultants.

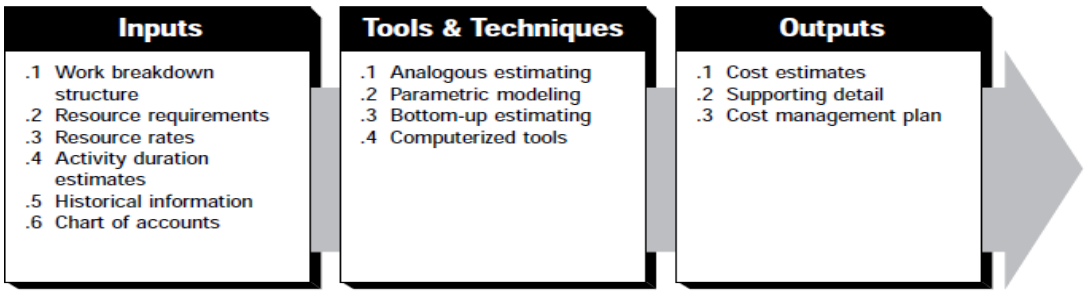
- Professional and technical associations.
- Industry groups.

5.5.3. Outputs from Resource Planning

Resource requirements. The output of the resource planning process is a description of what types of resources are required and in what quantities for each element of the work breakdown structure. These resources will be obtained either through staff acquisition or procurement.

5.6. Cost Estimating

Developing an approximation (estimate) of the costs of the resources needed to complete project activities. Cost estimating includes identifying and considering various costing alternatives. The cost estimating process must consider whether the cost of the additional design work will offset the expected savings.



5.6.1. Inputs to Cost Estimating

- ***Work breakdown structure.*** The WBS is used to organize the cost estimates and to ensure that all identified work has been estimated.
- ***Resource requirements.***
- ***Resource rates.*** The individual or group preparing the estimates must know the unit rates (e.g., staff cost per hour, bulk material cost per cubic yard) for each resource in order to calculate project costs. If actual rates are not known, the rates themselves may have to be estimated.
- ***Activity duration estimates.*** Activity duration estimates affects cost estimates on any project where the project budget includes an allowance for the cost of financing (i.e., interest charges).
- ***Historical information.*** Information on the cost of many categories of resources is often available from one or more of the following sources:
- ***Chart of accounts.*** A chart of accounts describes the coding structure used by the performing organization to report financial information in its general ledger. Project cost estimates must be assigned to the correct accounting category.

5.6.2. Tools and Techniques for Cost Estimating

1. **Analogous estimating.** Analogous estimating, also called top-down estimating, means using the actual cost of a previous, similar project as the basis for estimating the cost of the current project. It is frequently used to estimate total project costs when there is a limited amount of detailed information about the project (e.g., in the early phases). Analogous estimating is a form of expert judgment

   Analogous estimating is generally less costly than other techniques, but it is also generally less accurate. It is most reliable when (a) the previous projects are similar in fact and not just in appearance, and (b) the individuals or groups preparing the estimates have the needed expertise.

2. **Parametric modeling.** Parametric modeling involves using project characteristics (parameters) in a mathematical model to predict project costs. Models may be simple (residential home construction will cost a certain amount per square foot of living space) or complex (one model of software development costs uses 13 separate adjustment factors each of which has 5–7 points on it).

   Both the cost and accuracy of parametric models varies widely. They are most likely to be reliable when (a) the historical information used to develop the model was accurate, (b) the parameters used in the model are readily quantifiable, and (c) the model is scalable (i.e., it works as well for a very large project as for a very small one).

Example; Constructive Cost Model (COCOMO);
Used to estimate the software development costs based on the parameters such as the source line of code or functional points. Developed by Bary Boehm.
The function point;- a technology independent assessment of the functions involved in developing a system.
Source lines of Code (Sloc) – human written line of code that is not blank or a comment.

3. **Bottom-up estimating.** Also called Activity based costing. This technique involves estimating the cost of individual work items, then summarizing or rolling-up the individual estimates to get a project total. The cost and accuracy of bottom-up estimating is driven by the size of the individual work items: smaller work items increase both cost and accuracy. The project management team must weigh the additional accuracy against the additional cost.

4. **Computerized tools.** Computerized tools such as project management software and spreadsheets are widely used to assist with cost estimating. Such products can simplify the use of the tools described above and thereby facilitate rapid consideration of many costing alternatives.

5.6.3. Typical Problems with IT Cost Estimates

a) Estimates are done too quickly: Many estimates must be done quickly, before clear system requirements have been produced

b) Lack of estimating experience

- The people developing the costs estimates often don't have much experience, especially on large projects
- There is not enough accurate, reliable project data available on which to base estimates

c). Human beings are biased toward underestimation

- Senior team members make estimates based on their skill level but should take into account the junior people on the project

d). Management desires accuracy but wants to spend less in order to win a bid or internal funding

- Top management never forgets the first estimate and rarely, if ever, remembers how approved changes affect the estimate. The PM must keep the communication lines open at all times

5.6.4. Outputs from Cost Estimating

1. ***Cost estimates.*** Cost estimates are quantitative assessments of the likely costs of the resources required to complete project activities. They may be presented in summary or in detail.
   - Costs must be estimated for all resources that will be charged to the project. This includes, but is not limited to, labor, materials, supplies, and special categories such as an inflation allowance or cost reserve. Cost estimates are generally expressed in units of currency (dollars, francs, yen, etc.) in order to facilitate comparisons both within and across projects. Other units such as staff hours or staff days may be used, unless doing so will misstate project costs (e.g., by failing to differentiate among resources with very different costs). In some cases, estimates will have to be provided using multiple units of measure in order to facilitate appropriate management control.
   - Cost estimates may benefit from being refined during the course of the project to reflect the additional detail available. In some application areas, there are guidelines for when such refinements should be made and what degree of accuracy is expected.

Type of Estimate	When Done	Why Done	How Accurate
Rough Order of Magnitude (ROM)	Very early in the project life cycle, often 3–5 years before project completion	Provides estimate of cost for selection decisions	–50% to +100%
Budgetary	Early, 1–2 years out	Puts dollars in the budget plans	–10% to +25%
Definitive	Later in the project, less than 1 year out	Provides details for purchases, estimates actual costs	–5% to +10%

a) **Rough Order of magnitude** (ROM) estimate provides an estimate of what a project will cost. Also referred to as a ballpark estimate, a guesstimate, a swag, or a broad gauge.
- Done very early in a project, often three or more years prior to project completion, or even before a project is officially started
- Used to assist in project selection decision making.
- Accuracy is typically -50 percent to +100 percent, meaning the project's actual costs could be 50 percent below the ROM estimate or 100 percent above.

b). **Budgetary estimate** is used to allocate money into an organization's budget.
- Many organizations develop budgets at least two years into the future.
- Budgetary estimates are made one to two years prior to project completion.
- The accuracy of budgetary estimates is typically -10% to +25%
- A budgetary estimate that actually costs $100,000 would range between $90,000 to $125,000.

c). **Definitive estimate** provides an accurate estimate of project costs (most accurate of the three types).
- Definitive estimates are used for making many purchasing decisions for which accurate estimates are required and for estimating final project costs.
- For example, if a project involves purchasing 1000 personal computers from an outside supplier in the next three months, a definitive estimate would be required to aid in evaluating supplier proposals and allocating the funds to pay the chosen supplier.
- Definitive estimates are made one year or less prior to project completion
- Accuracy range is normally -5% to +10%

The number and types of cost estimates vary by application area. Example in construction project the following cost estimates are required by the Association for the Advancement of Cost Engineering International; ROM, Conceptual estimates, Preliminary estimates, definitive and control.

Cost estimates are done usually at various stages of a project ands should become more accurate as time progresses.

2. ***Supporting detail.*** Supporting detail for the cost estimates should include:
   - A description of the scope of work estimated. This is often provided by a reference to the WBS.
   - Documentation of the basis for the estimate, i.e., how it was developed.
   - Documentation of any assumptions made.
   - An indication of the range of possible results, for example, $10,000 ± $1,000 to indicate that the item is expected to cost between $9,000 and $11,000.

   The amount and type of additional detail varies by application area. Retaining even rough notes may prove valuable by providing a better understanding of how the estimate was developed.

3. ***Cost management plan.*** The cost management plan describes how cost variances will be managed (e.g., different responses to major problems than to minor ones). A cost management plan may be formal or informal, highly detailed or broadly framed based on the needs of the project stakeholders. It is a subsidiary element of the overall project plan

5.7. Cost Budgeting

Cost budgeting involves allocating the overall cost estimates to individual work items based on the WBS. The main goal is to produce a **Cost Baseline** for measuring project performance and project funding requirements.

5.7.1. Inputs to Cost Budgeting

- ***Cost estimates.*** Cost estimates are described in Section 7.2.3.1.
- ***Work breakdown structure.*** The work breakdown structure identifies the project elements that costs will be allocated to.
- ***Project schedule.*** The project schedule includes planned start and expected finish dates for the project elements that costs will be allocated to. This information is needed in order to assign costs to the time period when the cost will be incurred.

5.7.2. Tools and Techniques for Cost Budgeting

Cost estimating tools and techniques. The tools and techniques described in Section for developing project cost estimates are used to develop budgets for work items as well.

5.7.3. Outputs from Cost Budgeting

An important goal is to produce a **cost baseline**

- A time-phased budget that project managers use to measure and monitor cost performance
- Estimating costs for each major project activity over time provides management with a foundation for project cost control
- Cost budgeting also provides information for project funding requirements –at what point(s) in time will the money be needed

5.8. Project Cost Control

Cost control is concerned with

(a) influencing the factors which create changes to the cost baseline to ensure that changes are beneficial,

(b) determining that the cost baseline has changed, and

(c) managing the actual changes when and as they occur.

Cost control includes:

- Monitoring cost performance to detect variances from plan.
- Ensuring that all appropriate changes are recorded accurately in the cost baseline.
- Preventing incorrect, inappropriate, or unauthorized changes from being included in the cost baseline.
- Informing appropriate stakeholders of authorized changes.

5.8.1. Inputs to Cost Control

- **Cost baseline.** The cost baseline is
- **Performance reports.** Performance reports provide information on cost performance such as which budgets have been met and which have not. Performance reports may also alert the project team to issues which may cause problems in the future.
- **Change requests.** Change requests may occur in many forms—oral or written, direct or indirect, externally or internally initiated, and legally mandated or optional. Changes may require increasing the budget or may allow decreasing it.
- **Cost management plan.**

5.8.2. Tools and Techniques for Cost Control

- ***Cost change control system.*** A cost change control system defines the procedures by which the cost baseline may be changed. It includes the paperwork, tracking systems, and approval levels necessary for authorizing changes.
- ***Performance measurement.*** Performance measurement techniques, help to assess the magnitude of any variations which do occur. An important part of cost control is to determine what is causing the variance and to decide if the variance requires corrective action.

- ***Additional planning.*** Few projects run exactly according to plan. Prospective changes may require new or revised cost estimates or analysis of alternative approaches.
- ***Computerized tools.*** Computerized tools such as project management software and spreadsheets are often used to track planned costs vs. actual costs, and to forecast the effects of cost changes.

5.8.3. Outputs from Cost Control

- ***Revised cost estimates.*** Revised cost estimates are modifications to the cost information used to manage the project. Appropriate stakeholders must be notified as needed. Revised cost estimates may or may not require adjustments to other aspects of the overall project plan.
- ***Budget updates.*** Budget updates are a special category of revised cost estimates. Budget updates are changes to an approved cost baseline. These numbers are generally revised only in response to scope changes. In some cases, cost variances may be so severe that "re-base lining" is needed in order to provide a realistic measure of performance.
- ***Corrective action.*** Corrective action is anything done to bring expected future project performance into line with the project plan.
- ***Estimate at completion.*** An estimate at completion (EAC) is a forecast of total project costs based on project performance. The most common forecasting techniques are some variation of:
  - EAC = Actuals to date plus the remaining project budget modified by a performance factor, often the cost performance index. This approach is most often used when current variances are seen as typical of future variances.
  - EAC = Actuals to date plus a new estimate for all remaining work. This approach is most often used when past performance shows that the original estimating assumptions were fundamentally flawed, or that they are no longer relevant due to a change in conditions.
  - EAC = Actuals to date plus remaining budget. This approach is most often used when current variances are seen as atypical and the project management team's expectation is that similar variances will not occur in the future.

  Each of the above approaches may be the correct approach for any given work item.
- ***Lessons learned.*** The causes of variances, the reasoning behind the corrective action chosen, and other types of lessons learned from cost control should be documented so that they become part of the historical database for both this project and other projects of the performing organization.

There are many general accounting approaches for measuring cost performance but **earned value management** is a tool unique to project management

Earned Value Management (EVM)

EVM is a project performance measurement technique that integrates scope, time, and cost data. Given a **baseline** (original plan plus approved changes), project managers and their team can determine how well the project is meeting its scope, time, and cost goals by entering actual information and then comparing it to the baseline

Information entered;

- Was a WBS item completed or approximately how much of the work was completed
- Actual start and end dates
- Actual cost
- More and more organizations around the world are using EVM to help control project costs.