

Pricing and Estimating

Approaches to pricing and estimating –
costs, labour, overhead, and materials



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Project management

Outline of the lecture



- Types of estimates
 - Labour Distributions
 - Support Costs
 - Economic Project Selection Criteria – Capital Budgeting
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- Estimates are not blind luck. They are well-thought-out decisions based on either the best available information, some type of cost estimating relationship, or some type of cost model. Cost estimating relationships (CERs) are generally the output of cost models. Typical CERs might be:
 - Mathematical equations based on regression analysis
 - Cost–quantity relationships such as learning curves
 - Cost–cost relationships
 - Cost–noncost relationships based on physical characteristics, technical parameters, or performance characteristics
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- Specific pricing strategies must be developed for each individual situation. Frequently, however, one of two situations prevails when one is pursuing project acquisitions competitively.
 - First, the new business opportunity may be a one-of-a-kind program with little or no follow-on potential, a situation classified as type I acquisition.
 - Second, the new business opportunity may be an entry point to a larger follow-on or repeat business, or may represent a planned penetration into a new market.
 - The objective for type I acquisition is to win the program and execute it profitably and satisfactorily According to contractual agreements. The type II objective is often to win the program and perform well, thereby gaining a foothold in a new market segment or a new customer community in place of making a profit. Accordingly, each acquisition type has its own, unique pricing strategy.
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Two global pricing strategies

- Comparing the two pricing strategies for the two global situations reveals a great deal of similarity for the first five points.
- The fundamental difference is that for a profitable new business acquisition the bid price is determined according to actual cost, whereas in a “must-win” situation the price is determined by the market force

Type I Acquisition: One-of-a-Kind Program with Little or No Follow-On Business

1. Develop cost model and estimating guidelines; design proposed project/program baseline for minimum cost, to minimum customer requirements.
2. Estimate cost realistically for minimum requirements.
3. Scrub the baseline. Squeeze out unnecessary costs.
4. Determine realistic minimum cost. Obtain commitment from performing organizations.
5. Adjust cost estimate for risks.
6. Add desired margins. Determine the price.
7. Compare price to customer budget and competitive cost information.
8. Bid only if price is within competitive range.

Type II Acquisition: New Program with Potential for Large Follow-On Business or Representing a Desired Penetration into New Markets

1. Design proposed project/program baseline compliant with customer requirements, with innovative features but minimum risks.
2. Estimate cost realistically.
3. Scrub baseline. Squeeze out unnecessary costs.
4. Determine realistic minimum cost. Obtain commitment from performing organizations.
5. Determine “should-cost” including risk adjustments.
6. Compare your final cost estimate to customer budget and the “most likely” winning price.
7. Determine the gross profit margin necessary for your winning proposal. This margin could be negative!
8. Decide whether the gross margin is acceptable according to the must-win desire.
9. Depending on the strength of your desire to win, bid the “most likely” winning price or lower.
10. If the bid price is below cost, it is often necessary to provide a detailed explanation to the customer of where the additional funding is coming from. The source could be company profits or sharing of related activities. In any case, a clear resource picture should be given to the customer to ensure cost credibility.

Types of estimates

- Projects can range from a feasibility study, through modification of existing facilities, to complete design, procurement, and construction of a large complex.
- Many companies try to standardize their estimating procedures by developing an estimating manual.
- Estimating manuals, as the name implies, provide estimates. The question, of course, is “How good are the estimates?” Most estimating manuals provide accuracy limitations by defining the type of estimates.



Types of estimates



- The first type of estimate is an **order-of-magnitude analysis**, which is made without any detailed engineering data. The order-of-magnitude analysis may have an accuracy of 35 percent within the scope of the project. This type of estimate may use past experience (not necessarily similar), scale factors, parametric curves, or capacity estimates (i.e., \$/# of product or \$/kW electricity).
 - There is the **approximate estimate** (or top-down estimate), which is also made without detailed engineering data, and may be accurate to 15 percent. This type of estimate is prorated from previous projects that are similar in scope and capacity, and may be titled as estimating by analogy, parametric curves, rule of thumb, and indexed cost of similar activities adjusted for capacity and technology. In such a case, the estimator may say that this activity is 50 percent more difficult than a previous (i.e., reference) activity and requires 50 percent more time, man-hours, dollars, materials, and so on.
 - The **definitive estimate**, or grassroots buildup estimate, is prepared from well-defined engineering data including (as a minimum) vendor quotes, fairly complete plans, specifications, unit prices, and estimate to complete. The definitive estimate, also referred to as detailed estimating, has an accuracy of 5 percent.
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Types of estimates



- Learning curves are graphical representations of repetitive functions in which continuous operations will lead to a reduction in time, resources, and money. The theory behind learning curves is usually applied to manufacturing operations.
- During competitive bidding, it is important that the type of estimate be consistent with the customer's requirements. For in-house projects, the type of estimate can vary over the life cycle of a project:
 - Conceptual stage: Venture guidance or feasibility studies for the evaluation of future work. This estimating is often based on minimum-scope information.
 - Planning stage: Estimating for authorization of partial or full funds. These estimates are based on preliminary design and scope.

Classes of estimates

Class	Types	Accuracy
I	Definitive	±5%
II	Capital cost	±10–15%
III	Appropriation (with some capital cost)	±15–20%
IV	Appropriation	±20–25%
V	Feasibility	±25–35%
VI	Order of magnitude	> ± 35%

Source: Kerzner, H. Project Management

Types of estimates

Checklist for work normally required for the various classes (I-VI)

Item	I	II	III	IV	V	VI
1. Inquiry	X	X	X	X	X	X
2. Legibility	X	X	X			
3. Copies	X	X				
4. Schedule	X	X	X	X		
5. Vendor inquiries	X	X	X			
6. Subcontract packages	X	X				
7. Listing	X	X	X	X	X	
8. Site visit	X	X	X	X		
9. Estimate bulks	X	X	X	X	X	
10. Labor rates	X	X	X	X	X	
11. Equipment and subcontract selection	X	X	X	X	X	
12. Taxes, insurance, and royalties	X	X	X	X	X	
13. Home office costs	X	X	X	X	X	
14. Construction indirects	X	X	X	X	X	
15. Basis of estimate	X	X	X	X	X	X
16. Equipment list	X					
17. Summary sheet	X	X	X	X	X	
18. Management review	X	X	X	X	X	X
19. Final cost	X	X	X	X	X	X
20. Management approval	X	X	X	X	X	X
21. Computer estimate	X	X	X	X		

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Source: Kerzner, H. 2017. Project Management



Pricing process

- This activity schedules the development of the work breakdown structure and provides management with two of the three operational tools necessary for the control of a system or project. The development of these two tools is normally the responsibility of the program office with input from the functional units.
 - The integration of the functional unit into the project environment or system occurs through the pricing-out of the work breakdown structure.
 - The total program costs obtained by pricing out the activities over the scheduled period of performance provide management with the third tool necessary to successfully manage the project.
 - During the pricing activities, the functional units have the option of consulting program management about possible changes in the activity schedules and work breakdown structure.
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Pricing proces

- Once the cost data are assembled, they must be analyzed for their potential impact on the company resources of people, money, equipment, and facilities.
 - It is only through a total program cost analysis that resource allocations can be analyzed.
 - The resource allocation analysis is performed at all levels of management, ranging from the section supervisor to the vice president and general manager.
 - For most programs, the chief executive must approve final cost data and the allocation of resources.
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Labour Distributions

- The functional units supply their input to the program office in the form of man-hours.
- The man-hours are submitted for each task, assuming that the task is the lowest pricing element, and are time-phased per month.
- The man-hours per month per task are converted to dollars after multiplication by the appropriate labour rates.



- The input may be accompanied by labour justification, if required.
 - The labour rates are generally known with certainty over a twelve-month period, but from then on are only estimates. How can a company predict salary structures five years hence?
 - If the company underestimates the salary structure, increased costs and decreased profits will occur.
 - If the salary structure is overestimated, the company may not be competitive; if the project is government funded, then the salary structure becomes an item under contract negotiations.
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Labour Distributions



- The development of the labour rates to be used in the projection is based on historical costs in business base hours and dollars for the most recent month or quarter.
 - Average hourly rates are determined for each labour unit by direct effort within the operations at the department level.
 - The rates are only averages, and include both the highest-paid employees and lowest-paid employees, together with the department manager and the clerical support.
 - These base rates are then escalated as a percentage factor based on past experience, budget as approved by management, and the local outlook and similar industries.
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- Many times management is forced to reduce man-hours either because of insufficient funding or just to remain competitive in the environment.
 - The reduction of man-hours often causes heated discussions between the functional and program managers. Program managers tend to think in terms of the best interests of the program, whereas functional managers lean toward maintaining their present staff.
 - **The most common solution to this conflict rests with the program manager.**
 - If the program manager selects members for the program team who are knowledgeable in man-hour standards for each of the departments, then an atmosphere of trust can develop between the program office and the functional department so that man-hours can be reduced in a manner that represents the best interests of the company
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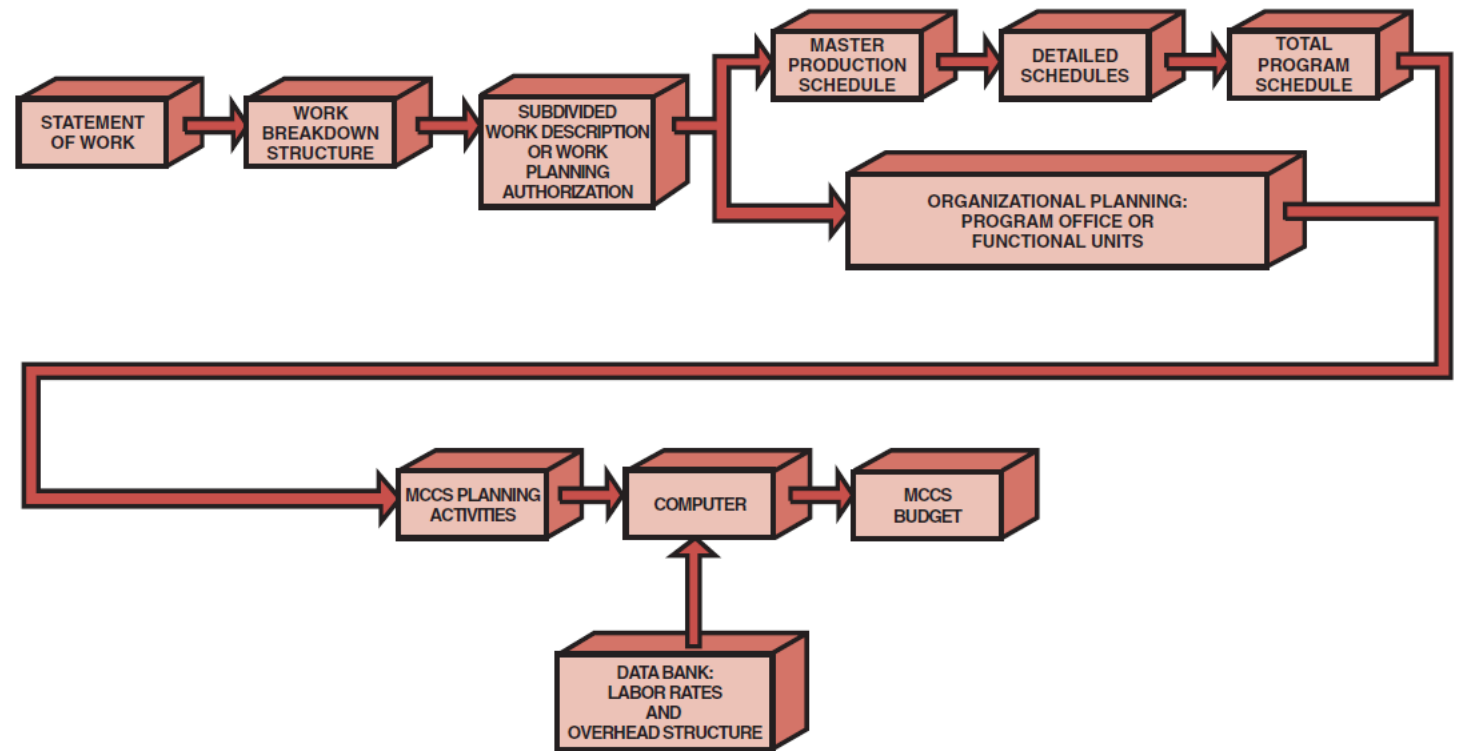
- Each pricing unit was given the work breakdown structure together with the schedule.
 - It should be noted here that, in many companies, labour hours are submitted directly to the pricing department for submittal into the base case computer run. In this case, the program office would “massage” the labour hours only after the base case figures are available.
 - This procedure assumes that sufficient time exists for analysis and modification of the base case. If the program office has sufficient personnel capable of critiquing the labour input prior to submittal to the base case, then valuable time can be saved, especially if two or three days are required to obtain computer output for the base case.
 - During proposal activities, the proposal manager, pricing manager, and program manager must all work together, although the program manager has the final say. The primary responsibility of the proposal manager is to integrate the proposal activities into the operational system so that the proposal will be submitted to the requestor on time.
 - After the planning and pricing charts are approved by program team members and program managers, they are entered into an electronic data processing (EDP) system.
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Labour Distributions



- The time plan is normally a monthly mechanical printout of all planned effort by work package and organizational element over the life of the contract, and serves as the data bank for preparing the status completion reports.
- Initially, the estimate-at-completion report is identical to the budget report, but it changes throughout the life of a program to reflect degradation or improvement in performance or any other events that will change the program cost or schedule.

Labour planning flowchart



Support Costs

- The salary structure, overhead structure, and labour hours fulfil three of four major pricing input requirements.
- The **fourth** major input is the cost for materials and support.
- **Six subtopics** are included under materials/support: materials, purchased parts, subcontracts, freight, travel, and other.
- Freight and travel can be handled in one of two ways, both normally dependent on the size of the program.

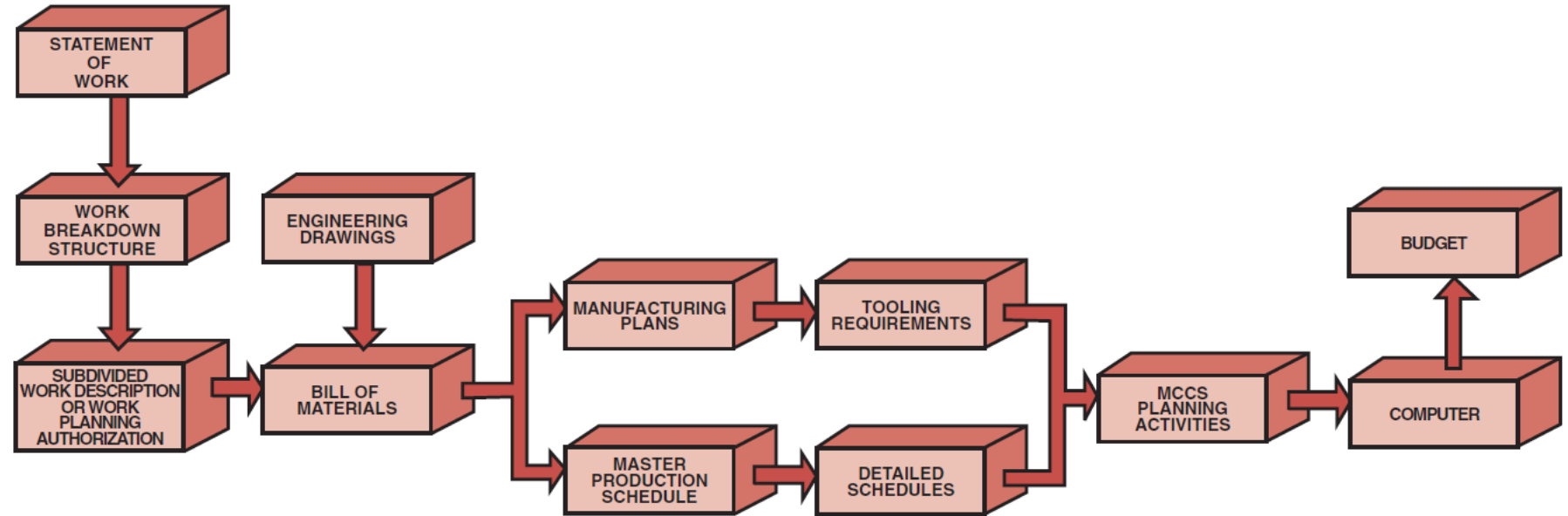


Support Costs



- Determination of the material costs is very **time-consuming**, more so than cost determination for labour hours.
- **Material costs** are submitted via a bill of materials that includes all vendors from whom purchases will be made, projected costs throughout the program, scrap factors, and shelf lifetime for those products that may be perishable.

Material planning flowchart



Source: Kerzner, H. 2017. Project Management

Support Costs



- Using logical pricing techniques will help in obtaining detailed estimates.
- The following **thirteen steps** provide a logical sequence to help a company control its limited resources.
- These steps may vary from company to company.

Step 1: Provide a complete definition of the work requirements.

Step 2: Establish a logic network with checkpoints.

Step 3: Develop the work breakdown structure.

Step 4: Price out the work breakdown structure.

Step 5: Review WBS costs with each functional manager.

Step 6: Decide on the basic course of action.

Step 7: Establish reasonable costs for each WBS element.

Step 8: Review the base case costs with upper-level management.

Step 9: Negotiate with functional managers for qualified personnel.

Step 10: Develop the linear responsibility chart.

Step 11: Develop the final detailed and PERT/CPM schedules.

Step 12: Establish pricing cost summary reports.

Step 13: Document the result in a program plan.

The list below shows the typical pricing reports:

- A detailed cost breakdown for each WBS element. If the work is priced out at the task level, then there should be a cost summary sheet for each task, as well as rollup sheets for each project and the total program.
 - A total program manpower curve for each department. These manpower curves show how each department has contracted with the project office to supply Functional Resources.
 - A monthly equivalent manpower cost summary. This table normally shows the fully burdened cost for the average departmental employee carried out over the entire period of project performance.
 - A yearly cost distribution table. This table is broken down by WBS element and shows the yearly (or quarterly) costs that will be required.
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The list below shows the typical pricing reports:

- A functional cost and hour summary. This table provides top management with an overall description of how many hours and dollars will be spent by each major functional unit, such as a division.
 - A monthly labour hour and dollar expenditure forecast. This table can be combined with the yearly cost distribution, except that it is broken down by month, not activity or department.
 - A raw material and expenditure forecast. This shows the cash flow for raw materials based on vendor lead times, payment schedules, commitments, and termination liability.
 - Total program termination liability per month. This table shows the customer the monthly costs for the entire program. This is the customer's cash flow, not the contractor's. The difference is that each monthly cost contains the termination liability for man-hours and dollars, on labor and raw materials.
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Economic Project Selection Criteria – Capital Budgeting

- Project managers are often called upon to be active participants during the benefit-to-cost analysis of project selection.
- It is highly unlikely that companies will approve a project where the costs exceed the benefits. Benefits can be measured in either financial or nonfinancial terms.
- The process of identifying the financial benefits is called capital budgeting, which may be defined as the decision-making process by which organizations evaluate projects that include the purchase of major fixed assets such as buildings, machinery, and equipment.



Economic Project Selection Criteria – Capital Budgeting



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Sophisticated capital budgeting techniques take into consideration depreciation schedules, tax information, and cash flow.

Since only the principles of capital budgeting will be discussed in this text, we will restrict ourselves to the following topics:

- **Payback Period** - The payback period is the exact length of time needed for a firm to recover its initial investment as calculated from cash inflows.
 - Payback period is the least precise of all capital budgeting methods because the calculations are in dollars and not adjusted for the time value of money.
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Discounted Cash Flow (DCF)

- A dollar today is worth more than a dollar a year from now.
- The reason for this is because of the time value of money. To illustrate the time value of money, let us look at the following equation:

$$FV = PV(1 + k)^n$$

where FV = Future value of an investment

PV = Present value

k = Investment interest rate (or cost of capital)

n = Number of years

Economic Project Selection Criteria – Capital Budgeting

Net Present Value (NPV)

- The net present value (NPV) method is a sophisticated capital budgeting technique that equates the discounted cash flows against the initial investment.
- This indicates that the cash inflows discounted to the present will not recover the initial investment. This, in fact, is a bad investment to consider. Previously, we stated that the cash flow stream yielded a payback period of four years.

The decision-making criteria using NPV are as follows:

- If the NPV is greater than or equal to zero dollars, accept the project.
- If the NPV is less than zero dollars, reject the project.

$$NPV = \sum_{t=1}^n \left[\frac{FV_t}{(1+k)^t} \right] - II$$

A positive value of NPV indicates that the firm will earn a return equal to or greater than its cost of capital.

Internal Rate of Return (IRR)

- The internal rate of return (IRR) is perhaps the most sophisticated capital budgeting technique and also more difficult to calculate than NPV.
- The internal rate of return is the discount rate where the present value of the cash inflows exactly equals the initial investment. IRR is the discount rate when $NPV = 0$.
- Formula:

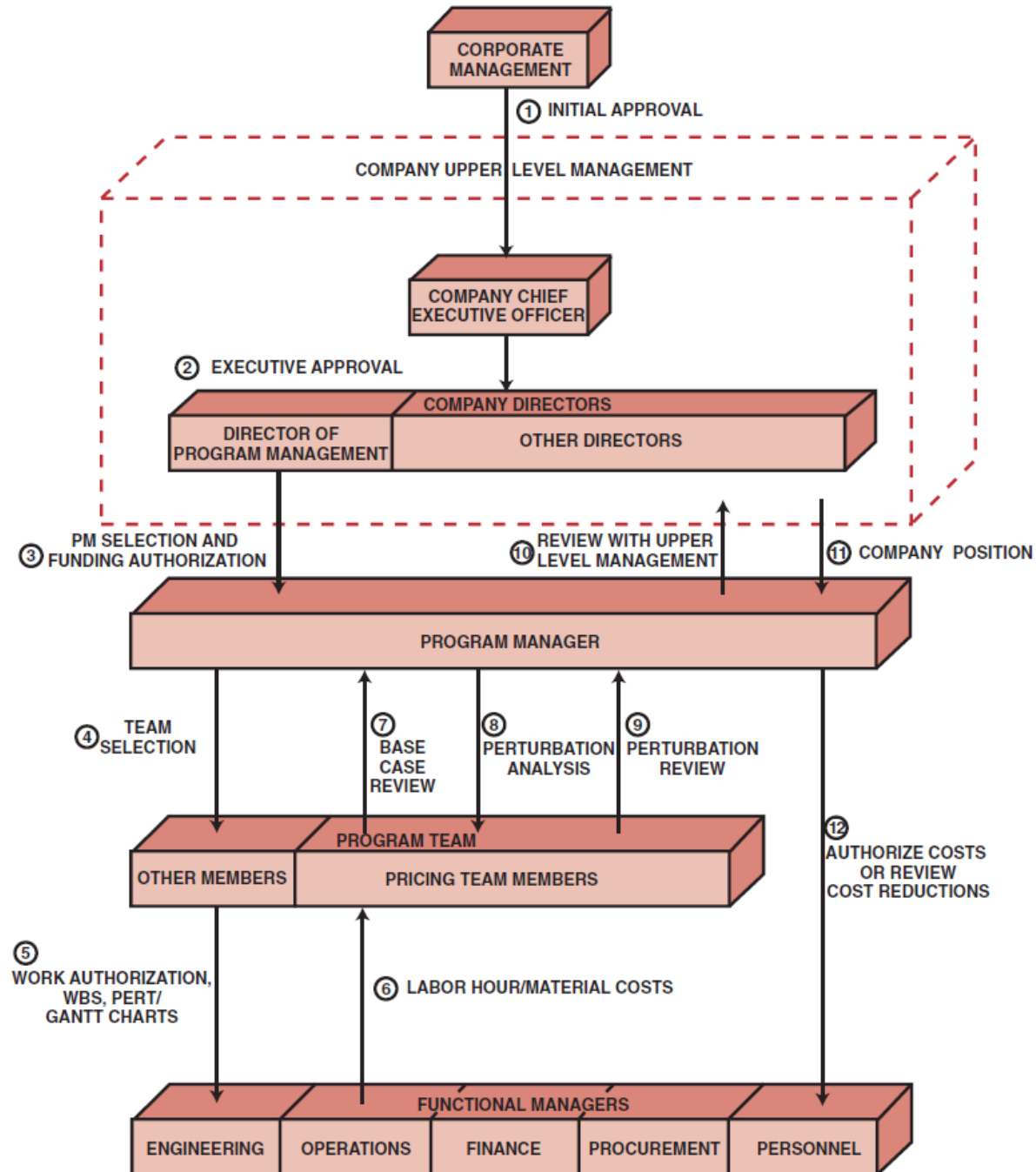
$$\sum_{t=1}^n \left[\frac{FV_t}{(1 + IRR)^t} \right] - II = 0$$



- **The ability to project, analyse, and control problem costs requires coordination of pricing information and cooperation between the functional units and upper-level management. A typical company policy for cost analysis and review.**
 - **Corporate management may be required to initiate or authorize activities, if corporate/company Resources are or may be strained by the program, if capital expenditures are required for new facilities or equipment, or simply if corporate approval is required for all projects in excess of a certain dollar amount.**
 - **The newly appointed program manager then selects this program's team. Team members, who are also members of the program office, may come from other programs, in which case the program manager may have to negotiate with other program managers and upperlevel management to obtain these individuals.**
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RECAP

- The system approach to determining total program costs.
- This procedure normally creates a synergistic environment, provides open channels of communication between all levels of management, and ensures agreement among all individuals as to program costs.



- **For most projects, both IRR and NPV will generate the same accept-reject decision.**
 - **However, there are differences that can exist in the underlying assumptions that can cause the projects to be ranked differently.**
 - **The major problem is the differences in the magnitude and timing of the cash inflows. NPV assumes that the cash inflows are reinvested at the cost of capital, whereas IRR assumes reinvestment at the project's IRR. NPV tends to be a more conservative approach.**
 - **The timing of the cash flows is also important. Early year cash inflows tend to be at a lower cost of capital and are more predictable than later year cash inflows. Because of the downstream uncertainty, companies prefer larger cash inflows in the early years rather than the later years.**
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