Module-2 Initiating Projects

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2.1 How to get a project started: -

Project Identification

The initiating phase of the project life cycle starts with recognizing a need, problem, or opportunity for which a project or projects are identified to address the need. Projects are identified in various ways: during an organization's strategic planning, as part of its normal business operations, in response to unexpected events, or as a result of a group of individuals deciding to organize a project to address a particular need. Business strategies can be driven by the market opportunities, competition, and/or technology. For example, there may be an emerging market opportunity for a project to develop a new educational product for preschool-age children. Or a company that is losing market share to a competitor may need a project to redesign its product in order to incorporate the latest technology and more customer-friendly features. Another business may see a rapidly growing market for its products in Asia, and thus it identifies a project to build a factory in India to meet the demand for its products. Not-for-profit organizations or associations can also define strategies to advance their mission. Based on a survey of its members, a national association may need a project to develop a new website to better serve its members. A philanthropic foundation may want to address a critical health care need in a particular country and therefore identifies a project to build a clinic. Projects can also be identified as part of a company's normal operational or maintenance needs. As an example, a business needs to reduce its indirect costs and identifies a project to consolidate its office space from several locations into one. In order to reduce the risk of noncompliance with new government regulations, a company identifies a project to install a new wastewater treatment system. There are circumstances when projects are identified as a result of unexpected events, such as an earthquake that caused the collapse of a bridge, that create the need for a project to be undertaken—in this case, to build a new bridge. Another situation would be if a fire destroyed an elementary school, and projects were needed to determine how to continue to provide instruction for the students and to build a new school. In some cases, volunteers may come together and decide they want to do a project for a particular reason. It could be to raise funds for a local food bank or to organize a festival to celebrate the anniversary of the town's founding. Projects are

identified in various ways by different organizations. It is important to clearly define the need. This may require gathering data about the need or opportunity to help determine if it is worth pursuing. For example, if a company needs to change the layout of its manufacturing facility to make room for new production equipment that has to be incorporated into the production flow, the manufacturing manager may simply ask one of the supervisors to put together a proposal for "what it's going to take to reconfigure the production line." Or if a business wants to pursue a new market for one of its products, it may first conduct a market assessment or survey. It is important to try to quantify the need to help evaluate whether the expected benefits from implementing a project outweigh the costs or consequences of conducting the project. Once the magnitude of the expected benefit or improvement has been estimated, the organization needs to estimate the cost for a project to implement the improvement. For example, if a business estimates that it could save Rs100,000 a year by reducing its scrap rate from 5 percent to 1 percent, it might be willing to make an investment of Rs200,000 for new automated production equipment, thus breaking even after two years of operation. However, the business may not be willing to spend Rs500,000 for a solution. Businesses have a limited amount of funds available and, therefore, usually want to spend those funds on projects that will provide the greatest return on investment or overall benefit. Sometimes organizations identify several or many needs but have limited funds and people available to pursue potential projects to address all of those needs. In such cases, the company must go through a decision-making process to prioritize and select those projects that will result in the greatest overall benefit.

Project Selection

Project selection involves evaluating potential projects, and then deciding which of these should move forward to be implemented. The benefits and consequences, advantages and disadvantages, plusses and minuses of each project need to be considered and evaluated. They can be quantitative and qualitative, tangible and intangible. Quantitative benefits could be financial, such as an increase in sales or a reduction in costs. There also may be intangible benefits associated with a project, such as improving the company's public image or associated with each project, such as the cost required to implement the project or disruption to work throughput while the project is being implemented. Some consequences may be less tangible, such as legal barriers or reaction from a particular advocacy group.

The steps in the project selection process include:

1. Develop a set of criteria against which the project will be evaluated. These criteria will be used to evaluate potential projects and support project selection and probably include both quantitative and qualitative factors. For example, if a pharmaceutical company has identified several potential projects to develop new products, it might evaluate each potential project against the following criteria:

- Alignment with company goals
- Anticipated sales volume
- Increase in market share
- Establishment of new markets
- Anticipated retail price
- Investment required

- Estimated manufacturing cost per unit
- Technology development required
- Return on investment
- Human resources impact
- Public reaction
- Competitors' reaction
- Expected time frame
- Regulatory approval
- Risks

Sometimes the potential projects may not all be similar, such as several alternative new products. They could be very different and all compete for a company's limited funds. One project may be to put a new roof on the factory, another to implement a new information system, and a third to develop a new product to replace one that is outdated and for which sales are rapidly declining.

2. List assumptions that will be used as the basis for each project. For example, if one project is to build an on-site day care center for children and elderly relatives of company employees, one assumption might be that the company would be able to obtain a bank loan to build such a center.

3. Gather data and information for each project to help ensure an intelligent decision regarding project selection. For example, it may be necessary to gather some preliminary financial estimates associated with each project, such as estimated revenue projections and implementation and operating costs. These data may then be analyzed using certain mathematically based financial models so that the projects can be compared on an equal basis. Such financial or economic models can include methodologies used to calculate simple payback, discounted cash flow, net present value, internal rate of return, return on investment, or life cycle costs associated with each project being considered.
In addition to gathering quantitative data, it may also be necessary to obtain other information regarding each potential project. This could include getting information from various stakeholders who would be affected by the project. These stakeholders could be employees, consumers, or community residents, depending on the specific project. Methods of gathering this information could include surveys, focus groups, interviews, or analysis of available reports. For example, if the projects being considered have to do with introducing several alternative food preparation products into the market, it may be valuable to conduct some focus groups with consumers to determine their needs and preferences. In the case of building an on-site day care center, it may be worthwhile to survey employees to determine how many employees would use the day care center for children or elderly relatives, and how often (all day, second shift, before or after school), ages of children, the health care needs of elderly relatives, and so forth.

4. Evaluate each project against the criteria. Once all the data and information have been collected, analyzed, and summarized for each potential project, they should be given to all the individuals who are responsible for performing the evaluation. It is beneficial to have several individuals involved in the evaluation and selection process in order to get various viewpoints. Each person on the evaluation and selection team or committee should have a different background and experiences to bring to the decision-making process. There may be someone from marketing who knows consumer preferences; someone from finance who knows costs and

the company's financial condition; someone from production who understands what process and equipment changes may be needed; someone from research and development who can provide expertise on how much additional technology development may be required; and someone from human resources to represent any impact on the workforce or the community. Although it may take longer and be more stressful to gain group consensus on project priorities and selection, it will most likely be a better quality decision than if the decision is made by just one individual. Acceptance of the decision will also be greater. One approach to the evaluation and selection process would be to have the evaluation and selection committee meet to develop a set of evaluation criteria. They may also develop some type of rating system (such as High-Medium-Low, 1–5, 1–10) against which to rate each potential project against each criterion. Then each committee member should be provided with any data and information that have been collected, analyzed, and summarized. Before the entire committee meets, each member can individually assess the benefits and consequences of each project against the evaluation criteria. This will give each member sufficient time for thoughtful preparation prior to a meeting of the entire committee. It is advisable to develop a project evaluation form listing the criteria with space for comments and a rating box for each criterion. Each evaluation and selection committee member could then complete a form for each project prior to coming to a meeting of the entire committee. Figure 2.1 is an example of a project evaluation and selection form that is suitable for comparing and selecting among projects that are similar, such as if a company is deciding to select one of three potential product development projects for three of its house-ware appliance product lines. Which one of the three potential product development projects in Figure 2.1 would you select? When the potential projects are not similar, such a form may not be useful since the evaluation criteria may be different for each project, and it may be difficult to identify a set of criteria that is appropriate for all potential projects being evaluated. An example would be trying to identify common criteria for evaluating and comparing dissimilar projects such as a marketing campaign, a production control system, refurbishing the company's offices, a website, building a new warehouse, and development of a new pharmaceutical product. In most cases, the project selection will be based on a combination of quantitative evaluation and what each person feels in her or his "gut" based on experience. Although the final decision may be the responsibility of the company owner, president, or department head, having a well-understood evaluation and selection process and a well-rounded committee will increase the chances of making the best decision that will result in the greatest overall benefit. Once the project selection decision has been made, the next step is for the sponsor to prepare a project charter to authorize moving forward with the project. If it is determined that project work should be outsourced to a contractor or consultant rather than using the organization's own internal resources, then an RFP will also need to be prepared to solicit proposals from potential contractors.

2.2 Selecting project strategically: -

The Need For Strategic Project Selection

All organizations operate under limitations. In an ideal situation, organizational leadership could initiate an unlimited number of projects in order to create a multitude of outcome benefits. Unfortunately, resources are limited. Time, financing, human resources, material, and skills are just a few of the top items on a long list of constrained organizational resources. The

constraints of the organization force choices in all areas of operation, including project selection. There simply isn't enough of what is needed to go around and undertake every potential project.

Because of these limitations, project selection needs to be approached in a structured, strategic way. The goal should be to select projects with the most benefit to the organization; the greatest efficiency for the resources used. Exactly what that means will be different for every organization. It may even change depending on a given situation. By having a number of different selection tools and techniques at our disposal, we will be in a better position to select the best projects to undertake.

7 Project Selection Methods

1. Financial Analysis
2. Strategic Alignment
3. Solving Problems
4. Opportunities
5. Fulfilling Requirements
6. Time Frame
7. Weighted Scoring Model

Seven Techniques For Structured Project Selection

There are lots of ways to decide on which projects to select. Here are seven basic techniques for picking projects to undertake. All of the methods listed here can be used alone, or in combination with other techniques.

1. Financial Analysis

Sometimes, the decision on which project to select comes down to only one thing – money. When this is the case, projects should be selected based on which option creates the most financial benefit for the organization.

Fortunately, there are several various financial analysis tools that can be used to determine which project provides the most benefit. Two of the most common are Return on Investment (ROI) and Payback Period. ROI is a direct measure of the return of capital produced by a project relative to the amount of capital spent on or invested in a project. ROI is calculated with the following equation:

ROI = (Gain from Investment – Investment Cost) / Investment Cost

The higher the return on investment, the more desirable the project.

The payback period of a project examines how long a project will take in order to recover the amount of capital invested. It asks the question; how long will it take for a project to generate enough income to pay for itself? The simplest calculation for payback period is to divide the

amount of capital invested in the project by the amount generated (or saved) by the project per period of time (months, years, etc.). Using payback period, the project with the shortest time to recover invested capital should be selected.

Additional examinations covering a wide range of complexities can be used to select among multiple project options. In the majority of cases, project selection comes down to the idea that projects selected have an opportunity cost. The capital invested in a project could also be invested in other projects. Deciding which opportunity to select, based on financial analysis alone, should provide the best possible outcome based on the specific financial needs and objectives of the organization.

2. Strategic Alignment

Projects can be a powerful tool for achieving the strategic objectives of an organization. When an organization has clearly defined strategic objectives, projects should be selected to help further, or deepen, that strategy.

In doing so, projects should be selected based on their ability to support organizational strategy. For example, if an organization has stated their mission is to provide superior customer service, projects that enhance customer service should be designed and selected. If an organization is focused on innovation as a source of competitive advantage, research and development projects might be the best options to pick.

3. Problem Solving

There are instances in organizations where conditions can be improved or situations resolved through the implementation of particular projects. This is the concept of using projects to solve organizational problems. When this is the case, projects are selected to remove hindrance and impediments to smooth, efficient, organizational operations.

4. Taking Advantage Of Opportunities

Smart managers are always on the lookout for new opportunities to take advantage of. Opportunities can be identified to further a number of different organizational goals, from increasing profits to entering new markets or developing new products and services. But identified opportunities rarely take advantage of themselves. In many cases, projects can be designed, selected, and implemented specifically to take advantage of opportunities identified by organizational leadership.

5. Fulfilling Requirements

In a dynamic business environment, the one constant is change. Industry, regulatory, and market conditions often create changing requirements. When this is the case, new organizational projects are sometimes the best way to go about fulfilling new requirements.

A recent example was the implementation of the European data protection laws (GDPR) that went into effect in 2018. In order to achieve compliance, organizations had to undertake projects of all types, such as enacting data security procedures and planning employee training sessions.

6. Time Frame

If deciding 'what' is a question of 'when', then the time frame for a project should be the main point of consideration in selection. This can be considered in two ways; time of implementation and total project life cycle time.

Time of implementation looks at when significant portions of the project are to be implemented. For example, are the organizational resources required for a project available when the project is planned for. Feasibility is another consideration; a local sports organization in Austria would be better off implementing a project to plan a triathlon to take place in summer, rather than in winter.

Total project life cycle time considers the total time of the project from selection and initiation to final closing and shut-down. This type of time frame is considered if there is a limited period of time available for the undertaking of a project.

7. Weighted Scoring Model (Decision Matrix)

Weighted scoring models are useful when the decision on project selection comes down to not one, but several factors. In this case, a weighted scoring model (AKA Decision Matrix) can be the best tool to examine, rate, and select among multiple options.

A weighted scoring model is developed by determining which factors are important to an organization in project selection. Those factors are then assigned a relative level of importance or value (weight). Then, the factors are examined and rated for each available project option under consideration, with the rating multiplied by the relative weight of the factor. The project with the highest total score is the one selected. The illustration below provides an example.

As project managers, it's not always the case that we are able to select our own projects to work on. But when we can, either in the capacity of project managers or business leaders, the strategic selection of projects can be an important tool to further the success of all types of organizations. This is especially true as the trend continues in the direction of projectized models of organizational operations.

Weighting Criteria		Scores (0-100)		
Criteria	Weight	Project 1	Project 2	Project 3
Cost	60%	90	88	65
Location	25%	75	72	100
Time	15%	74	95	77

Weighted Scoring Model			
	Project 1	Project 2	Project 3
Cost	54	52,8	39
Location	18,75	18	25
Time	11,1	14,25	11,55
TOTAL	83,85	85,05	75,55

Highest Total Score = Project 2 (85,05)

No list of selection methods can be complete or all-inclusive; not even a single best method exists. Still, the seven methods listed here provide a good start. Even when conditions and demands are different for various organizations, project selection should be done with the same level of consideration that goes into managing them.

2.3 Project selection models (Numeric /Scoring Models and Non-numeric models): -

Project selection is the process of evaluating proposed projects or groups of projects, and then choosing to implement some set of them so that the strategic objectives of the organization will be achieved. Each project will have different costs, benefits, and risks. Rarely are these known with certainty. In the face of such differences, the selection of one (or more) project out of a set is a difficult task. Choosing a number of different projects, a *portfolio*, is even more complex. Only rarely will a project manager be involved in the process by which projects are selected for inclusion in the set of projects the parent organization adopts for investment. It is, however, critically important to the success of the PM that he or she fully understands the parent organization's objectives in undertaking a project that the PM is expected to lead. As we will see, most of the decisions that the PM is forced to make will have an impact on the degree to which the project contributes to those objectives the parent organization expected from the project. Indeed, effectively executing the PM's primary role of managing trade-offs requires that the PM make trade-offs in a way that best supports the organization's overall strategy. Several techniques that can be used to help senior managers to select projects. The proper choice of investment projects is crucial to the long-run survival of every firm. There are two basic types of project selection models, *numeric* and *nonnumeric*. Both are widely used. Many organizations use both at the same time, or they use models that are combinations of the two. Nonnumeric models, as the name implies, do not use numbers as inputs. Numeric models do, but the criteria being measured may be either objective or subjective. It is important to remember that the *qualities* of a project may be represented by numbers and that *subjective* measures are not necessarily less useful or reliable than *objective* measures.

Managers often use *decision-aiding models* to extract the relevant issues of a problem from the details in which the problem is embedded.
Models represent the problem's structure and can be useful in selecting and evaluating projects.
Models do not give any decision, it partially represent the reality.

Criteria of Project Selection Models:-

- Realism - reality of manager's decision
- Capability- able to simulate different scenarios and optimize the decision
- Flexibility - provide valid results within the range of conditions
- Ease of Use - reasonably convenient, easy execution, and easily understood
- Cost - Data gathering and modeling costs should be low relative to the cost of the project.
- Easy Computerization - must be easy and convenient to gather, store and manipulate

Project Feasibility Study data:-

Market Analysis	Potential Market
	Market Share
Technical Analysis	Technical Viability
	Sensible Choice
Financial Analysis	Tasks
	Returns
Economic Analysis	Benefits and costs in shadow price
	Social and other Impacts
Ecological Analysis	Environmental damages
	Restoration Measures

Project Selection Models:

Nonnumeric Models-

- ***Sacred Cow*** - project is suggested by a senior and powerful official in the organization
- ***Operating Necessity*** - the project is required to keep the system running
- ***Competitive Necessity*** - project is necessary to sustain a competitive position
- ***Product Line Extension*** - projects are judged on how they fit with current product line, fill a gap, strengthen a weak link, or extend the line in a new desirable way.
- ***Comparative Benefit Model*** - several projects are considered and the one with the most benefit to the firm is selected

The Sacred Cow In this case the project is suggested by a senior and powerful official in the organization. Often the project is initiated with a simple comment such as, "If you have a chance, why don't you look into…," and there follows an undeveloped idea for a new product, for the development of a new market, for the design and adoption of a global data base and information system, or for some other project requiring an investment of the firm's resources. The immediate result of this bland statement is the creation of a "project" to investigate whatever the boss has suggested. The project is "sacred" in the sense that it will be maintained until successfully concluded, or until the boss, personally, recognizes the idea as a failure and terminates it.

The Operating Necessity If a flood is threatening the plant, a project to build a protective dike does not require much formal evaluation. XYZ Steel Corporation has used this criterion (and the following criterion also) in evaluating potential projects. If the project is required in order to keep the system operating, the primary question becomes: Is the system worth saving at the estimated cost of the project? If the answer is yes, project costs will be examined to make sure they are kept as low as is consistent with project success, but the project will be funded.

The Competitive Necessity Using this criterion, XYZ Steel undertook a major plant rebuilding project in its steel bar manufacturing facilities near Chicago. It had become apparent to XYZ's management that the company's bar mill needed modernization if the firm was to maintain its competitive position in the Chicago market area. Although the planning process for the project was quite sophisticated, the decision to undertake the project was based on a desire to maintain the company's competitive position in that market. In a similar manner, many business schools

are restructuring their undergraduate and MBA programs to stay competitive with the more forward-looking schools. In large part, this action is driven by declining numbers of tuition-paying students and the need to develop stronger programs to attract them. Investment in an *operating necessity* project takes precedence over a *competitive necessity* project, but both types of projects may bypass the more careful selection analysis used for projects deemed to be less urgent or less important to the survival of the firm.

The Product Line Extension In this case, a project to develop and distribute new products would be judged on the degree to which it fits the firm's existing product line, fills a gap, strengthens a weak link, or extends the line in a new, desirable direction. Sometimes careful calculations of profitability are not required. Decision makers typically act on their beliefs about what will be the likely impact on the total system performance if the new product is added to the line.

Comparative Benefit Model In this situation, an organization has many projects to consider, perhaps several dozen. Senior management would like to select a subset of the projects that would most benefit the firm, but the projects do not seem to be easily comparable. For example, some projects concern potential new products, some concern changes in production methods, and still others propose to create a daycare center for employees with small children. The organization may have no formal method of selecting projects, but members of the Selection Committee think that some projects will benefit the firm more than others, even if they have no precise way to define or measure "benefit."

The concept of comparative benefits, if not a formal model, is widely adopted for selection decisions on all sorts of projects. Of the several techniques for ordering projects, the Q-Sort is one of the most straightforward. First, the projects are divided into three groups—*good*, *fair*, and *poor*—according to their relative merits. If any group has more than eight members, it is subdivided into two categories, such as *fair-plus* and *fair-minus*. When all categories have eight or fewer members, the projects within each category are ordered from best to worst. Again, the order is determined on the basis of relative merit. The rater may use specific criteria to rank each project, or may simply use general overall judgment (see Figure 2.2 for an example of a Q-sort). The process described may be carried out by one person who is responsible for evaluation and selection, or it may be performed by a committee charged with the responsibility. If a committee handles the task, the individual rankings can be developed anonymously, and the set of anonymous rankings can be examined by the committee itself for consensus. It is common for such rankings to differ somewhat from rater to rater, but they do not often vary strikingly because the individuals chosen for such committees rarely differ widely on what they feel to be appropriate for the parent organization. Projects can then be selected in the order of preference, though they are usually evaluated financially before final selection.

Although it is easy to dismiss nonnumeric models as unscientific, they should not be discounted casually.

These models are clearly goal-oriented and directly reflect the primary concerns of the organization. The sacred cow model, in particular, has an added feature; sacred cow projects are visibly supported by "the powers that be." Full support by top management is certainly an important contributor to project success. Without such support, the probability of project success is sharply lowered.

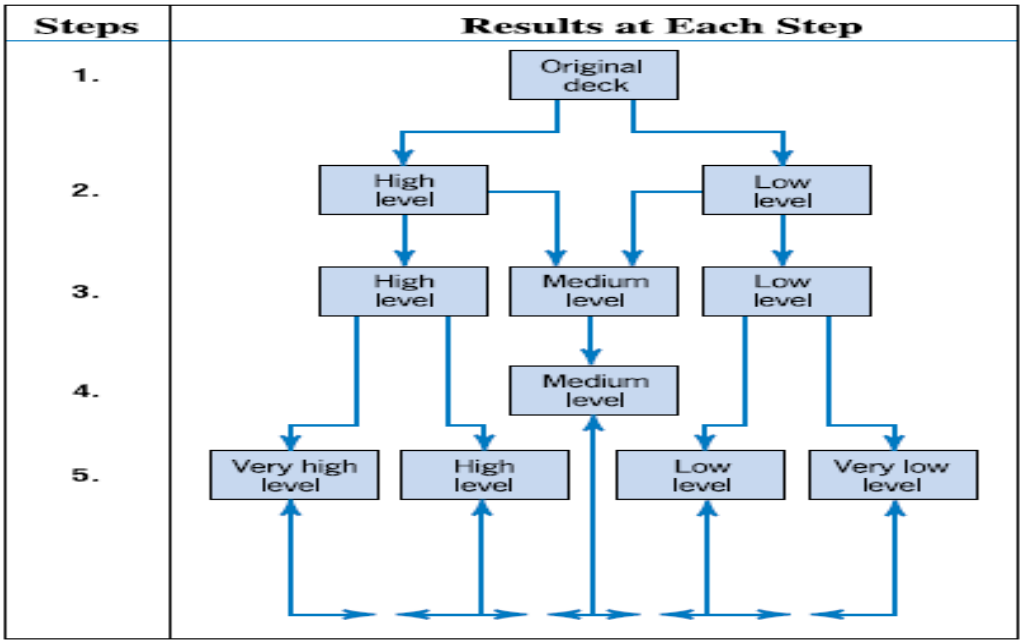

Fig. 2.1 Q-sort method

Sustainability

More and more organizations are building sustainability into the set of criteria that must be met for proposed projects to be selected for funding. Jewelry companies avoid the use of "blood diamonds," and manufacturing firms avoid purchasing inputs from suppliers that use child labor. The sale of a pharmaceutical of questionable purity or serious side-effects is commonly far more costly in the long run than the cost of better quality control or the research needed for better drug design. In other words, sustainability focuses on long-run profitability rather than short-run payoff. To integrate sustainability into the organization's decision-making requires the appointment of a senior manager with responsibility for the task. Metrics must be developed to measure the results of policy changes to increase sustainability, and this often requires developing the "soft" measures.

Numeric Models: Profit/Profitability

Basic questions

 Is the project worthwhile financially (that is whether it will generate sufficient cash flows to repay debt and produce a satisfactory rate of return on investment)?

How to select the "best" project from a list of projects?

Most common measures: -Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period, Return on Investment (ROI), Discounted Cash Flow.

As noted earlier, a large majority of all firms using project evaluation and selection models use profitability as the sole measure of acceptability.

Payback Period The payback period for a project is the initial fixed investment in the project divided by the estimated annual net cash inflows from the project. The ratio of these quantities is the number of years required for the project to repay its initial fixed investment. For example, assume a project costs Rs100,000 to implement and has annual net cash inflows of Rs25,000.

Then Payback periodRs100,000/Rs25,000 4 years This method assumes that the cash inflows will persist at least long enough to pay back the investment, and it ignores any cash inflows beyond the payback period. For some managers, this method also serves as a proxy for risk (discussed later in this section). The faster the investment is recovered, the less the risk to which the firm is exposed.

Discounted Cash Flow Also referred to as the net present value (NPV) method, the discounted cash flow method determines the NPV of all cash flows by discounting them by the required rate of return (also known as the *hurdle rate, cutoff rate,* and similar terms) as follows:

$$\text{NPV (project)} = A_0 + \sum_{t=1}^{n} \frac{F_t}{(1+k+p_t)^t}$$

Where
Ft = the net cash flow in period *t*,
k = the required rate of return, and
pt = the predicted rate of inflation (or deflation) during period *t*.
Early in the life of a project, net cash flow is likely to be negative, the major outflow being the initial investment in the project, *A*0. If the project is successful, however, cash flows will become positive. The project is *acceptable* if the sum of the NPVs of all estimated cash flows over the life of the project is positive. A simple example will suffice.

Net Present Value (NPV)

- Calculate the present value of all future cash flows with the discounting factor (MARR)
- Add all the present values of cash in-flows (cash revenues) and subtract all the present values of cash out-flows (cash expenses)
- What we obtain is the Net Present Value or NPV
- Positive NPV means attractive financial return, and larger NPV means more attractive project alternative.

$$\text{NPV (project)} = A_0 + \sum_{t=1}^{n} \frac{F_t}{(1+k)^t} \quad \text{(Without Inflation)}$$

$$\text{NPV (project)} = A_0 + \sum_{t=1}^{n} \frac{F_t}{(1+k+p_t)^t} \quad \text{(With Inflation)}$$

Using our Rs100,000 investment with a net cash inflow of Rs25,000 per year for a period of 8 years, a required rate of return of 15 percent, and an inflation rate of 3 percent per year, we have

$$\begin{aligned}\text{NPV (project)} &= -\$100,000 + \sum_{t=1}^{8} \frac{\$25,000}{(1+0.15+0.03)^t} \\ &= \$1,939\end{aligned}$$

Because the present value of the inflows is greater than the present value of the outflow— that is, the NPV is positive—the project is deemed acceptable. Several comments are in order about all the profit-profitability numeric models. The commonly seen phrase "return on investment," or ROI, does not denote any specific method of calculation but usually involves some form of NPV calculation. There are a number of advantages of numeric profitability models: they are simple to use and understand, the accounting data is usually available (though possibly inaccurate), and they can often be adjusted to account for project risk. But there are many disadvantages as well: they ignore all nonmonetary factors (which are often the most important), models that do not use discounting ignore the time value of money, but models that do discount are strongly biased toward short-term solutions, and all of the models are highly sensitive to data errors in the early years of a project.

Numeric Models: Real Options

A more recent approach to project selection employs financial analysis that recognizes the value of positioning the organization to capitalize on future opportunities. It is based on the financial options approach to valuing prospective capital investment opportunities. Through a financial option an organization or individual acquires the right to do something but is not required to exercise that right. To illustrate the analogy of financial options to project selection, consider a young biotech firm that is ready to begin clinical trials to test a new pharmaceutical product in humans. A key issue the company has to address is how to produce the drug both now in the low volumes needed for the clinical trials and in the mass quantities that will be needed in the future should the new drug succeed in the clinical trial phase. Its options for producing the drug in low volumes for the clinical trials are to invest in an in-house pilot plant or to immediately license the drug to another company. If it invests in an in-house pilot plan, it then has two future options for mass producing the drug: (1) invest in a commercial scale plant or (2) license the manufacturing rights. In effect then, investing now in the pilot plant provides the pharmaceutical company with the option of building a possibly highly profitable commercial scale plant in the future, an option it would not have if it chose to license the drug right from the start.

In addition to considering the value of future opportunities a project may provide, the cost of *not* doing a project, and thus foregoing a potential future opportunity, should also be considered. This approach to project selection is based on the well-known economic concept of "opportunity cost." Consider the problem of making an investment in one of only two projects. An investment in Project A will force us to forgo investing in Project B, and vice versa. If the return on A is 12 percent, making an investment in B will have an opportunity cost of 12 percent, the cost of the opportunity forgone. If the return on B is greater than 12 percent, it may be preferred over selecting Project A.

Occasionally, organizations will approve projects that are forecast to lose money when fully costed and sometimes even when only direct costed. Such decisions by upper management are not necessarily foolish because there may be other, more important reasons for proceeding with a project, such as to:

- Acquire knowledge concerning a specific or new technology
- Get the organization's "foot in the door"
- Obtain the parts, service, or maintenance portion of the work

- Allow them to bid on a lucrative, follow-on contract
- Improve their competitive position
- Broaden a product line or line of business

Of course, such decisions are expected to lose money in the short term only. Over the longer term they are expected to bring extra profits to the organization. It should be understood that "lowball" or "buy-in" bids (bidding low with the intent of cutting corners on work and material, or forcing subsequent contract changes) are unethical practices, violate the PMI Code of Ethics for Project Managers, and are clearly dishonest.

Numeric Models: Scoring

In an attempt to overcome some of the disadvantages of profitability models, particularly their focus on a single decision criterion, a number of evaluation/selection models that use multiple criteria to evaluate a project have been developed. Such models vary widely in their complexity and information requirements. If the models include both monetary and qualitative factors, they are generally known as cost–benefit analyses. If the element of risk is added to this mix, we believe these models come closest to how managers actually evaluate investments. The following example illustrates one type of numeric scoring model.

Weighted Factor Scoring Model When numeric weights reflecting the relative importance of each individual criterion (or factor) are added, we have a weighted factor scoring model. In general, it takes the form

$$S_i = \sum_{j=1}^{n} s_{ij} w_j$$

Where

S_i = the total score of the ith project,
s_{ij} = the score of the ith project on the jth criterion, and
w_j = the weight of the jth criterion.

The weights, *wj*, may be generated by any technique that is acceptable to the organization's policy makers. There are several techniques available to generate such numbers, but the most effective and most widely used is the classic Delphi method. The Delphi method (Dalkey, 1969) is a technique for developing numeric values that are equivalent to subjective, verbal measures of relative value. The use of experts to develop weightings is nicely demonstrated by Jolly (2003) who applies the technique to the development of weights to a technology portfolio. When numeric weights have been generated, it is helpful (but not necessary) to scale the weights so that

$$0 \le w_j \le 1 \quad j = 1, 2, 3, \ldots, n$$

$$\sum_{j=1}^{n} w_j = 1$$

The weight of each criterion can be interpreted as the "percent of the total weight accorded to that particular criterion." A special caveat is in order. It is quite possible with this type of model to include a large number of criteria. It is not particularly difficult to develop scoring scales and weights, and the ease of gathering and processing the required information makes it tempting to include marginally relevant criteria along with the obviously important items. Resist this

temptation! After the important factors have been weighted, there usually is little residual weight to be distributed among the remaining elements. The result is that the evaluation is simply insensitive to major differences in the scores on trivial criteria. A good rule of thumb is to keep the number of factors to eight or less because the higher weights, say 20 percent or more, tend to force the smaller weights to be insignificant with weights less than 2 percent or 3 percent. (If elements are discarded, and if you wish *wj* 1, the weights must be rescaled to 1.0.) It is not particularly difficult to computerize a weighted scoring model by creating a template on Excel® or one of the other standard computer spreadsheets. An example of a weighted factor scoring model to select a project is illustrated next. As was the case with profitability models, scoring models have their own characteristic advantages and disadvantages.

The advantages are:

1. These models allow multiple criteria to be used for evaluation and decision making, including profit/profitability models and both tangible and intangible criteria. Furthermore, the models allow the inclusion of both objective and subjective criteria.

2. They are structurally simple and therefore easy to understand and use.

3. They are intuitive and reflect the way we think about making choices: what are our options, what are the important criteria, what is the most important criterion, and how do the options compare on the criteria.

4. They are a direct reflection of managerial policy.

5. They are easily altered to accommodate changes in the environment or managerial policy.

6. Weighted scoring models allow for the fact that some criteria are more important than others.

7. These models allow easy sensitivity analysis. The trade-offs among the several criteria are readily observable.

The disadvantages are the following:

1. The output of a scoring model is strictly a relative measure. Project scores do not represent the value or "utility" associated with a project and thus do not directly indicate whether or not the project should be supported.

2. In general, scoring models are linear in form and the elements of such models are assumed to be independent.

3. The ease of use of these models is conducive to the inclusion of a large number of criteria, most of which have such small weights that they have little impact on the total project score.

4. To the extent that profit/profitability is included as an element in the scoring model, this element has the advantages and disadvantages noted earlier for the profitability models themselves.

Numeric Models: Window-of-Opportunity Analysis

In the early stages of new product development, one may know little more than the fact that the potential product seems technically feasible. Just because one can develop and/ or install a new technology does not necessarily imply that the new technology is worth implementing, or will be economically profitable. Fundamentally, the decision to invest in the development of a new process or product depends on an estimate of cash flows and other benefits expected to result if the innovation is successful—a difficult problem at best. Given some idea for a new product or process, we can attempt to determine the cost, timing, and performance specifications that *must* be met by this new technology *before* any R&D is undertaken. (This is called the *window of opportunity* for the innovation.) The method for conducting such an analysis is as follows. Given

a potential production process innovation, for example, the current production process is analyzed in detail and baseline data on the current process are collected (e.g., its cycle time, its cost). Following this, the level of improvement needed from the process improvement project is determined. Finally, if estimates of the benefits from the process improvement project meet the required level of improvement in a resource effective way, the process improvement project is approved.

Numeric Models: Discovery-Driven Planning

Like the window-of-opportunity analysis, discovery-driven planning also reverses the expensive and risky traditional approach of trying out the technology to determine its benefits. This approach funds enough of the project to determine if the initial assumptions concerning costs, benefits, etc. were accurate. When the funds are gone, the assumptions are reevaluated to determine what to do next. The idea isn't to implement the project but rather to *learn* about the project. The assumptions about the project are written down and analyzed carefully to determine two aspects about them: (1) which are the critical assumptions that will make or break the desirability of the project, and (2) how much will it cost to test each of the assumptions. The high-priority, deal-killer assumptions that will cost the least then are ranked at the top, with the lesser and more expensive assumptions following. If a critical assumption proves to be invalid, management must rethink its strategy and the project. This process is not just a one-time exercise, however; the process continues as the stages of the project are executed so that at any point in the project, management can step in and terminate it if conditions change and the project looks less promising. And conditions are always changing: the economy gets worse, the market moves toward or away from the promise of the project, a key team member of the project leaves the company, the strategy of the organization changes with a new executive, a new government regulation impacts the project, and so on. Project failure is more often management's failure to consider an important problem or question than it is a technical failure within the project.

Choosing a Project Selection Model

Selecting the type of model to aid the evaluation/selection process depends on the philosophy and wishes of management. Weighted scoring models are strongly favored for three fundamental reasons. First, they allow the multiple objectives of all organizations to be reflected in the important decision about which projects will be supported and which will be rejected. Second, scoring models are easily adapted to changes in managerial philosophy or changes in the environment. Third, they do not suffer from the bias toward the short run that is inherent in profitability models that discount future cash flows. This is not a prejudice against discounting and most certainly does not argue against the inclusion of profits/profitability as an important factor in selection, but rather *it is an argument against the exclusion of nonfinancial factors* that may require a longer-run view of the costs and benefits of a project. Finally, they support performing detailed sensitivity analyses of the criteria and scores, which in turn provides further insights into the decision-making situation. Nonetheless, the actual use of scoring models is not as easy as it might seem. Decision makers are forced to make difficult choices and they are not always comfortable doing so. They are forced to reduce often vague feelings to quite specific words or numbers. Multiattribute, multiperson decision making is not simple. The use of any project selection model assumes that the decision-making procedure takes place in a reasonably

rational organizational environment. Such is not always the case. In some organizations, project selection seems to be the result of a political process, and sometimes involves questionable ethics, complete with winners and losers . In others, the organization is so rigid in its approach to decision making that it attempts to reduce all decisions to an algorithmic process in which predetermined programs make choices so that humans have minimal involvement—and responsibility. Whether managers are familiar with accounting systems or not, it is useful to reflect on the methods and assumptions used in the preparation of accounting data. Among the most crucial are the following:

1. Accountants live in a linear world. With few exceptions, cost and revenue data are assumed to vary linearly with associated changes in inputs and outputs.

2. The accounting system often provides cost–revenue information that is derived from standard cost analyses and equally standardized assumptions regarding revenues. These standards may or may not accurately represent the cost–revenue structure of the physical system they purport to represent.

3. The data furnished by the accounting system may or may not include overhead costs. In most cases, the decision maker is concerned solely with cost–revenue elements that will be changed as a result of the project under consideration. Incremental analysis is called for, and great care should be exercised when using pro forma data in decision problems. Remember that the assignment of overhead cost is always arbitrary. The accounting system is the richest source of information in the organization, and it should be used—but with great care and understanding.

4. Warning! A great many organizations utilize project cost data as the primary, *and the only* routine measure of project performance. We emphasize that projects should be measured on three dimensions, time, cost, and scope. Without including information on the schedule and the physical completion of work, cost measurements have no useful meaning. We will repeat this warning throughout this book. Finally, no matter what method is used for project selection, as time goes by the selection model's inputs must be constantly updated. The world does not stand still—things change! What was a promising project yesterday may be a loser today—and yesterday's loser may be today's winner.

Risk Considerations in Project Selection

In our previous discussion of factors to consider when selecting projects, we emphasized costs and benefits, with only a side reference to the inherent uncertainty associated with both of these, though benefits are usually more uncertain than costs. However, both are uncertain, and can be greater or less than expected. In the case of being worse than expected, the organization is exposed to some, perhaps substantial, level of risk. There are many more ways of dealing with project risk besides using a shorter payback period. PMI (2011) reports that risk management is used significantly more by high-performing project organizations than low-performing organizations.

Risk has been interpreted as being unsure about project task durations and/or costs, but uncertainty plagues all aspects of the work on projects and is present in all stages of project life cycles. The impact of imperfect knowledge on the way a project is organized and on its budget and schedule will be discussed in the chapters devoted to those subjects. In the real world of project management, it has been common to deal with estimates of task durations, costs, etc. as if the information were known with certainty. In fact, a great majority of all decisions made in the course of managing a project are actually made under conditions of uncertainty. However, we

can still make some estimates about the *probabilities* of various outcomes. If we use appropriate methods for doing this, we can apply what knowledge we have to solving project decision problems. We will not always be correct, but we will be doing the best we can. Such estimates are called "subjective probabilities" and are dealt with in most elementary courses on probability and statistics. While such probabilities are no more than guesses, they can be processed just as empirically determined probabilities are. In the world of project management, a best guess is always better than no information at all. Then it is possible to examine some of the effects of uncertainty on project selection. At times, an organization may wish to evaluate a project about which there is little information. R&D projects sometimes fall into this general class. But even in the comparative mysteries of R&D activities, the level of uncertainty about the outcomes of R&D is not beyond analysis. As we noted earlier, there is actually not much uncertainty about whether a product, process, or service can be developed, but there can be considerable uncertainty about *when* it will be developed, at *what* cost, and *whether* it will be viable. As they are with R&D projects, time and cost are also often uncertain in other types of projects. When the organization undertakes projects in which it has little or no recent experience— for example, investment in an unfamiliar business, engaging in international trade, and myriad other projects common enough to organizations, in general, but uncommon to any single organization—there are three distinct areas of uncertainty. First, there is uncertainty about the timing of the project and the cash flows it is expected to generate. Second, though not as common as generally believed, there may be uncertainty about the direct outcomes of the project—that is, what it will accomplish. Third, there is uncertainty about the side effects of the project—its unforeseen consequences. Typically, we try to reduce such uncertainty by the preparation of *pro forma* documents. *Pro forma* profit and loss statements and break-even charts are examples of such documents. The results, however, are not very satisfactory unless the amount of uncertainty is reflected in the data that go into the documents. When relationships between inputs and outputs in the projects are complex, Monte Carlo simulation (Meredith et al., 2002) can handle such uncertainty by exposing the many possible consequences of embarking on a project. With the great availability of microcomputers and user-friendly software (e.g., Crystal Ball®), simulation for assessing risk is becoming very common.

2.4 Project portfolio process: -

Although up to now we have primarily talked about the selection of a project in competition with other projects, in reality organizations typically maintain a *portfolio* of projects, and trying to keep a proper balance among this portfolio is the real task of upper management. With limited resources, management must choose between long-term and short-term projects, safe and risky projects, manufacturing and marketing projects, and so on. To help choose between the myriad project proposals, in competition with ongoing projects as well as each other, management needs some overarching measures to evaluate each of the projects, and those measures are commonly related to the organization's mission, goals, and strategy.

We will assume here that the organization has already identified its mission, goals, and strategy and that these are well known throughout the organization. If this is not the case, then any attempt to tie the organization's projects to its goals is folly and PPM will have little value. In an attempt to identify the characteristics of "great" projects, four criteria has been used to select potential projects for further analysis: (1) a major undertaking of strategic importance to the organization; (2) the outcome contributed substantially and over a long duration to the

performance of the organization and well-being of its clients; (3) highly innovative from a scientific, technological, design, or operational perspective; and (4) the outcome had a major impact on its industry and stimulated others to follow. Based on this, they then analyzed 15 great projects and identified 7 common characteristics of *highly* successful strategic projects:

1. It creates a unique competitive advantage and/or exceptional value for its stakeholders.

2. It requires a long period of project definition dedicated to defining a powerful vision, a clear need, and a successful execution approach.

3. It creates a revolutionary project culture.

4. It needs a highly qualified project leader who is unconditionally supported by top management.

5. It maximizes the use of existing knowledge, often in cooperation with outside organizations.

6. It uses integrated development teams with fast problem-solving capability and the ability to adapt to business, market, and technology changes.

7. Its project team has a strong sense of partnership and pride.

In contrast to these seven characteristics, some author found that only 30 percent of surveyed organizations insisted on knowing the value a project would add to the organization's strategy before granting approval. Deloitte also identified the following eight symptoms of a misaligned portfolio:

- Many more projects than management expected
- Inconsistent determination of benefits, including double-counting
- Competing projects; no cross-comparison of projects
- "Interesting" projects that don't contribute to the strategy
- Projects whose costs exceed their benefits
- Projects with much higher risks than others in the portfolio; no risk analysis of projects
- Lack of tracking against the plan, at least quarterly
- No identified "client" for many projects

If the goals and strategies have been well articulated, however, then PPM can serve many purposes:

- ❖ To identify proposed projects that are not really projects and should be handled through other processes
- ❖ To prioritize the list of available projects
- ❖ To intentionally limit the number of overall projects being managed so the important projects get the resources and attention they need
- ❖ To identify the real options that each project offers
- ❖ To identify projects that best fit the organization's goals and strategy
- ❖ To identify projects that support multiple organizational goals and cross-reinforce other important projects
- ❖ To identify codependent projects
- ❖ To eliminate projects that incurs excessive risk and/or cost
- ❖ To eliminate projects that bypassed a formal selection process and may not provide benefits corresponding to their risks and/or costs
- ❖ To keep from overloading the organization's resource availability
- ❖ To balance the resources with the needs
- ❖ To balance short-, medium-, and long-term returns

PPM attempts to link the organization's projects directly to the goals and strategy of the organization. This occurs not only in the project's initiation and planning phases but also throughout the life cycle of the projects as they are managed and eventually brought to completion.

A firm that is highly dependent on successful new-product projects found that through their version of PPM they could reduce their portfolio of projects by about two thirds. This resulted in better funding and executing those projects that were most strategically important to the company and thereby substantially improving the chances of project success. Thus, PPM is also a means for monitoring and controlling the organization's strategic projects. On occasion, and particularly during recessions and difficult economic times, this will mean shutting down projects prior to their completion because their risks have become excessive, their costs have escalated out of line with their expected benefits, another (or a new) project does a better job of supporting the goals, or any variety of similar reasons. It should be noted that a significant portion of the administration of this process could be managed by the Project Management Office. As was mentioned earlier, there has been more research on project portfolio management recently, including the application of strategic management theories. Using a system of key performance indicators (KPIs, such as contribution to the strategic objectives and progress toward meeting the triple constraint) to identify interdependencies between projects, risks, and opportunities across projects, and the effect of any given project on overall portfolio performance. Portfolio management was not a straightforward rational process but required intuition, negotiation, and bargaining in a very context- dependent environment. In a later paper, also found that managers typically stressed the commercial value of their strategic projects but obtained more value through organization measures such as knowledge development, knowledge sharing, stakeholder satisfaction, and employee satisfaction. Project managers should be responsible for operational results, but not strategic, project owner or sponsor should be responsible for strategic and business results of the project.

There are eight steps in the PPM process, which generally follow:-

Step 1: Establish a Project Council

The main purpose of the project council is to establish and articulate a strategic direction for those projects spanning internal or external boundaries of the organization, such as cross-departmental or joint venture. Thus, senior managers *must* play a major role in this council. Without the commitment of senior management, the PPM will be incapable of achieving its main objectives. The council will also be responsible for allocating funds to those projects that support the organization's goals and controlling the allocation of resources and skills to the projects.

In addition to senior management, others who should be members of the project council are

- All program managers
- Project owners or sponsors of major projects
- The head of the Project Management Office
- Particularly relevant general managers
- Those who can identify key opportunities and risks facing the organization
- Anyone who can derail the progress of the PPM process later on

Step 2: Identify Project Categories and Criteria

In this step, various project categories are identified so the mix of projects funded by the organization will be spread appropriately across those areas making major contributions to the organization's goals. In addition, within each category, criteria are established to discriminate between very good and even better projects. The criteria are also weighted to reflect their relative importance. Identifying separate categories not only facilitates achievement of multiple organizational goals (e.g., long term, short term, internal, external, tactical, strategic) but also keeps projects from competing with each other on inappropriate categories. The first task in this step is to list the goals of each existing and proposed project: What is the mission, or purpose, of this project? Relating these to the organization's goals and strategies should allow the council to identify a variety of categories that are important to achieving the organization's goals. Some of these were noted above, but another way to position some of the projects (particularly product/service development projects) is in terms of their extent of product and process changes. A matrix has been developed called the *aggregate project plan* illustrating these changes. Based on the extent of product change and process change, they identified four separate categories of projects:

1. Derivative projects These are projects with objectives or deliverables that are only incrementally different in both product and process from existing offerings. They are often meant to replace current offerings or add an extension to current offerings (lower priced version, upscale version).

2. Platform projects The planned outputs of these projects represent major departures from existing offerings in terms of either the product/service itself or the process used to make and deliver it, or both. As such, they become "platforms" for the next generation of organizational offerings, such as a new model of automobile, a tablet computer, or a new type of insurance plan. They thus form the basis for follow-on derivative projects that attempt to extend the platform in various dimensions.

3. Breakthrough projects Breakthrough projects typically involve a newer technology than platform projects. It may be a "disruptive" technology that is known to the industry or something proprietary that the organization has been developing over time. Examples here include the use of fiber-optic cables for data transmission; cash balance pension plans, and hybrid gasoline–electric automobiles.

4. R&D projects These projects are "blue sky," visionary endeavors oriented toward using newly developed technologies or existing technologies in a new manner. They may also be for acquiring new knowledge, or developing new technologies themselves.

The size of the projects plotted on the array indicates the size/resource needs of the project and the shape may indicate another aspect of the project, for example, internal/ external, long/medium/short term, or whatever aspect needs to be shown. The numbers indicate the order, or time frame, in which the projects are to be (or were) implemented, separated by category, if desired.

The aggregate project plan can be used to

1. View the mix of projects within each illustrated aspect (shape)
2. Analyze and adjust the mix of projects within each category or aspect
3. Assess the resource demands on the organization, indicated by the size, timing, and number of projects shown
4. Identify and adjust the gaps in the categories, aspects, sizes, and timing of the projects

5. Identify potential career paths for developing project managers, such as team member of a derivative project, then team member of a platform project, manager of a derivative project, member of a breakthrough project, and so on.

Next, the council should develop separate criteria and cost ranges for each category that determine those projects that will support the organizational strategy and goals. Example criteria might include alignment with the organization's goals/strategy, riskiness of the project, financial return, probability of success, and knowledge acquisition. Scales also need to be determined for each criterion to measure how different projects score on each of them. The scales should also serve as an initial screen, to start the process of winnowing out the weakest projects by including limits on their extremes, maximum probability of technical failure given proposed budget and schedule, or minimum acceptable potential market share. Finally, the council needs to set an importance weighting for the various criteria in each category.
The model we have described above is a "weighted factor scoring model," as described earlier. There are some standard, well-known tools to help develop the weights, scales, and criteria such as the simplified method by Frame (2002), and even software such as *Expert Choice*®. (Frame's method is illustrated in the Reading section at the end of this chapter.) Regardless of the approach used to define the weights, there is considerable value in the process of discussing the weights and ultimately gaining consensus on them.

Step 3: Collect Project Data

For each existing and proposed project, assemble the data appropriate to that category's criteria. Be sure to update the data for ongoing projects and not just use the data from the previous evaluation. Then document any assumptions made so that they can be checked in the future as the project progresses. If the project is new, you may want to fund only enough work on the project to verify the assumptions or determine the window-of-opportunity for the proposed product or process, holding off full funding until later. Similarly, identify any projects that can be deferred to a later time period, those that must precede or follow other projects, those that support other projects or should be done in conjunction with them, those that can be outsourced, and other such special aspects of the projects.
Next, screen out the weaker projects: Have costs on existing projects escalated beyond the project's expected benefits? Has the benefit of a project lessened because the organization's goals have changed? Does a competitor's new entry obviate the advantages of a project? Does a new (or old) project dominate an existing or proposed project in terms of its benefits, furtherance of organizational goals, reduced costs? Also, screen *in* any projects that do not require deliberation, such as projects mandated by regulations or laws, projects that are operating or competitive necessities, projects required for environmental or personnel reasons, and so on. Fewer the projects, that needs to be compared and analyzed, the easier the work of the council.

Step 4: Assess Resource Availability

Next, assess the availability of both internal and external resources, by type, department, and timing. Note that labor availability should be estimated conservatively, leaving time for vacations, personal needs, illness, holidays, and, most important, regular functional (nonproject) work. After allowing for all of these things that limit labor availability, add a bit more, perhaps

10 percent, to allow for the well-known fact that human beings need occasional short breaks to rest or meet other human needs. Timing is particularly important, since project resource needs by type typically vary up to 100 percent over the life cycle of projects. Needing a normally plentiful resource at the same moment it is fully utilized elsewhere may doom an otherwise promising project. Eventually, the council will be trying to balance aggregate project resource needs over future periods with resource availabilities so timing is as important as the amount of maximum demand and availability.

Step 5: Reduce the Project and Criteria Set

In this step, multiple screens are employed to try to narrow down the number of competing projects. As noted earlier, the first screen is each project's support of the organization's goals. Other possible screens might be criteria such as the following:

- Whether the required competence exists in the organization
- Whether there is, or will be, a market for the offering
- How profitable the offering is likely to be
- How risky the project is
- If there is a potential partner to help with the project
- If the right resources are available at the right times
- If the project is a good technological/knowledge fit with the organization
- If the project uses the organization's strengths, or depends on its weaknesses
- If the project is synergistic with other important projects
- If the project is dominated by another existing or proposed project
- If the project has slipped in its desirability since the last evaluation

The result of this step may involve canceling some ongoing projects or replacing them with new, more promising projects. Beware, however, of the tendency to look more favorably upon new, untested concepts than on current projects experiencing the natural problems and hurdles of any promising project.

Step 6: Prioritize the Projects within Categories

Apply the scores and criterion weights to rank the projects within each category. It is acceptable to hold some hard-to-measure criteria out for subjective evaluation, such as riskiness, or development of new knowledge. Subjective evaluations can be translated from verbal to numeric terms easily by the Delphi or other methods and used in the weighted factor scoring model. It should be remembered that criteria such as riskiness are usually composite measures of a set of "risks" in different areas. The same is true for criteria like "development of new knowledge."

It is also possible at this time for the council to summarize the "returns" from the projects to the organization. However, this should be done by category, not for each project individually since different projects are offering different packages of benefits that are not comparable. For example, R&D projects will not have the expected monetary return of derivative projects; yet it would be foolish to eliminate them simply because they do not measure up on this (irrelevant, for this category) criterion.

Step 7: Select the Projects to Be Funded and Held in Reserve

The first task in this step is important: determining the most appropriate mix of projects across the various categories and time periods. Ultimately, the organization's strategy drives the appropriate mix of projects. For example, a company that competes on the basis on being first to market with new products would expect to have a larger percentage of breakthrough projects while a company that competes in mature markets would likely have more derivative projects. Next, be sure to leave some percent (often 10–15 percent) of the organization's resource capacity free for new opportunities, crises in existing projects, errors in estimates, and so on. Then allocate the categorized projects in rank order to the categories according to the mix desired. It is usually a good practice to include some speculative projects in each category to allow future options, knowledge improvement, additional experience in new areas, and such.

Overall, the focus should be on committing to fewer projects but with sufficient funding to allow project completion. Why late projects were delayed and why some, if any, were defunded. One special type of delayed project mentioned earlier is sometimes called an "out-plan" project (in contrast to the selected "in-plan" projects). Out-plan projects are those that appear promising but are awaiting further investigation before a final decision is made about their funding, which could occur in the next PPM cycle or sooner, if they warrant the use of some of the 10–15 percent funding holdout. The result of this step (and most of the project portfolio process) is illustrated in Figure 5 in the Reading section.

Step 8: Implement the Process

The first task in this final step is to make the results of the portfolio analysis widely known, including the documented reasons for project cancellations, deferrals, selections, and nonselections as was mentioned earlier. Top management must now make their commitment to the PPM process totally clear by supporting the process and the results. This may require a PPM champion near the top of the organization. As project proposers come to understand the workings and importance of the PPM process, their proposals will more closely fit the profile of the kinds of projects the organization wishes to fund. As this happens, it is important to note that the council will have to concern itself with the reliability and accuracy of proposals competing for limited funds. Senior management must fully fund the selected projects. It is neither appropriate nor ethical for senior management to undermine PPM and the council as well as strategically important projects by playing a game of arbitrarily cutting *X* percent from project budgets.

The council needs to be wary of interpersonal or interdepartmental competition entering the scene at this point also. In some organizations, individuals with their own particular agenda will ignore committees and processes until implementation time rolls around, and then they attempt to exercise their political power to undermine the results of others' long labors. If this does occur, it is indicative of serious organizational problems and the PPM process will fail until the problems are corrected.

Of course, the process will need to be repeated on a regular basis. The council should determine how often this should be, and, to some extent, it depends on the speed of change in the industry the organization is in. For some industries, quarterly analysis may be best while in slow-moving industries, yearly may be fine. Swanson (2011a) warns, however, that too-frequent reprioritizing

of projects can result in confusion and frustration, particularly if resources suddenly are unavailable.

Finally, the process should be flexible and improved continuously. Instinct may suggest ways that the process may be altered to better match the competitive environment, or to reflect more closely the organization's goals. The process should be changed when it is found appropriate to do so, including categories, criteria, steps, the order of tasks, and so on. Before leaving the subject of project portfolios, it is important to consider the problem of decreasing the size of the organization's investment in projects. The sharp economic downturn of 2008–2009 required a great many firms to do just that, and many were simply not prepared to handle the problem. Senior management, or the project council, should also develop a set of criteria for removing projects from the portfolio. In an interesting short paper, Wheatley (2009) notes that issues such as the size of the expected ROI may be of less importance than the timing of cash in- and outflows. The organization's tolerance for risk is very likely to change during downturns. Some projects are luxuries. Others may be major drivers of future profits and growth. Some may be oriented to cost savings that could have almost immediate benefits. Even projects aimed at meeting legal mandates may have a cost that is significantly higher than the possible legal penalties if the mandates are ignored for a time. Many firms are choosing to pay the penalty instead of implementing costly federal mandates. Some projects can be stopped midway without doing much damage to the project's expected success. Others cannot, and if delayed must start from scratch, or be cancelled. Developing a list of possible criteria for cutting or eliminating the funding for a project is complicated. To be useful, each item in the list should be prioritized. This is a job that demands close attention from senior management.

2.5 Project sponsor and creating charter: -

Develop project charter

Develop Project Charter is the process of developing a document that formally authorizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities. The key benefits of this process are that it provides a direct link between the project and the strategic objectives of the organization, creates a formal record of the project, and shows the organizational commitment to the project. This process is performed once or at predefined points in the project. The inputs, tools and techniques, and outputs of the process are depicted in Figure 2-2.

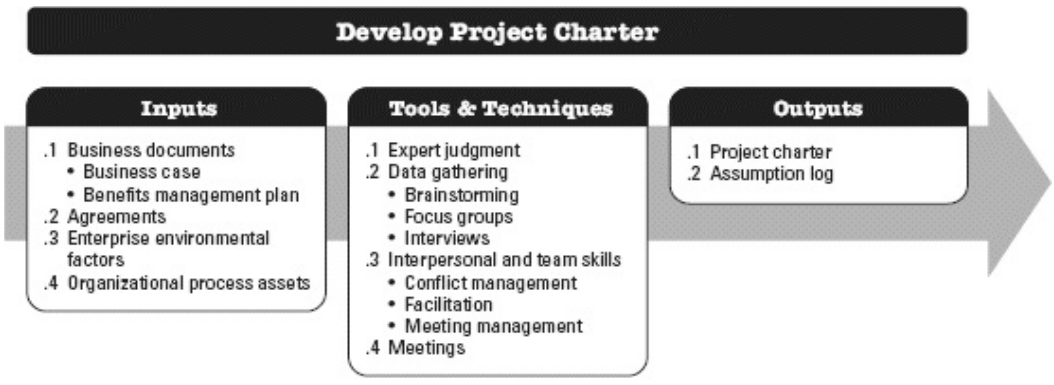

Fig. 2.2 Develop Project Charter: Inputs, tools & Techniques and Outputs

The project charter establishes a partnership between the performing and requesting organizations. In the case of external projects, a formal contract is typically the preferred way to establish an agreement. A project charter may still be used to establish internal agreements within an organization to ensure proper delivery under the contract. The approved project charter formally initiates the project. A project manager is identified and assigned as early in the project as is feasible, preferably while the project charter is being developed and always prior to the start of planning. The project charter can be developed by the sponsor or the project manager in collaboration with the initiating entity. This collaboration allows the project manager to have a better understanding of the project purpose, objectives, and expected benefits. This understanding will better allow for efficient resource allocation to project activities. The project charter provides the project manager with the authority to plan, execute, and control the project.
Projects are initiated by an entity external to the project such as a sponsor, program, or project management office (PMO), or a portfolio governing body chairperson or authorized representative. The project initiator or sponsor should be at a level that is appropriate to procure funding and commit resources to the project. Projects are initiated due to internal business needs or external influences. These needs or influences often trigger the creation of a needs analysis, feasibility study, business case, or description of the situation that the project will address. Chartering a project validates alignment of the project to the strategy and ongoing work of the organization. A project charter is not considered to be a contract because there is no consideration or money promised or exchanged in its creation.

Develop project charter: inputs

1. BUSINESS DOCUMENTS

The business case and the benefits management plan are sources of information about the project´s objectives and how the project will contribute to the business goals. Although the business documents are developed prior to the project, they are reviewed periodically.

A. BUSINESS CASE: - The approved business case, or similar, is the business document most commonly used to create the project charter. The business case describes the necessary information from a business standpoint to determine whether the expected outcomes of the project justify the required investment. It is commonly used for decision making by managers or executives above the project level. Typically, the business need and the cost-benefit analysis are contained in the business case to justify and establish boundaries for the project. The business case is created as a result of one or more of the following:

- *Market demand* (e.g., an automobile manufacturer authorizing a project to build more fuel-efficient cars in response to gasoline shortages),
- *Organizational need* (e.g., due to high overhead costs, a company may combine staff functions and streamline processes to reduce costs),
- *Customer request* (e.g., an electric utility authorizing a project to build a new substation to serve a new industrial park),
- *Technological advance* (e.g., an airline authorizing a new project to develop electronic tickets instead of paper tickets based on technological advances),
- *Legal requirement* (e.g., a paint manufacturer authorizing a project to establish guidelines for handling toxic materials),

- *Ecological impacts* (e.g., a company authorizing a project to lessen its environmental impact), or
- *Social need* (e.g., a nongovernmental organization in a developing country authorizing a project to provide potable water systems, latrines, and sanitation education to communities suffering from high rates of cholera).

The project charter incorporates the appropriate information for the project from the business documents. The project manager does not update or modify the business documents since they are not project documents; however, the project manager may make recommendations.

B. AGREEMENTS

Agreements are used to define initial intentions for a project. Agreements may take the form of contracts, memorandums of understanding (MOUs), service level agreements (SLA), letters of agreement, letters of intent, verbal agreements, email, or other written agreements. Typically, a contract is used when a project is being performed for an external customer.

C. ENTERPRISE ENVIRONMENTAL FACTORS

The enterprise environmental factors that can influence the Develop Project Charter process include but are not limited to: Government or industry standards (e.g., product standards, quality standards, safety standards, and workmanship standards),

Legal and regulatory requirements and/or constraints, Marketplace conditions, Organizational culture and political climate, Organizational governance framework (a structured way to provide control, direction, and coordination through people, policies, and processes to meet organizational strategic and operational goals), and Stakeholders' expectations and risk thresholds.

D. ORGANIZATIONAL PROCESS ASSETS

The organizational process assets that can influence the Develop Project Charter process include but are not limited to:

Organizational standard policies, processes, and procedures; Portfolio, program, and project governance framework (governance functions and processes to provide guidance and decision making); Monitoring and reporting methods; Templates (e.g., project charter template); and Historical information and lessons learned repository (e.g., project records and documents, information about the results of previous project selection decisions, and information about previous project performance).

2. DEVELOP PROJECT CHARTER: TOOLS AND TECHNIQUES

A. EXPERT JUDGMENT

Expert judgment is defined as judgment provided based upon expertise in an application area, Knowledge Area, discipline, industry, etc., as appropriate for the activity being performed. Such expertise may be provided by any group or person with specialized education, knowledge, skill, experience, or training. For this process, expertise should be considered from individuals or groups with specialized knowledge of or training in the following topics: Organizational strategy, Benefits management, Technical knowledge of the industry and focus area of the project, Duration and budget estimation, and Risk identification.

B. DATA GATHERING

Data-gathering techniques that can be used for this process include but are not limited to: Brainstorming. This technique is used to identify a list of ideas in a short period of time. It is conducted in a group environment and is led by a facilitator. Brainstorming comprises two parts:

idea generation and analysis. Brainstorming can be used to gather data and solutions or ideas from stakeholders, subject matter experts, and team members when developing the project charter. Focus groups bring together stakeholders and subject matter experts to learn about the perceived project risk, success criteria, and other topics in a more conversational way than a one-on- one interview. Interviews are used to obtain information on high-level requirements, assumptions or constraints, approval criteria, and other information from stakeholders by talking directly to them.

C. INTERPERSONAL AND TEAM SKILLS

Interpersonal and team skills that can be used for this process include but are not limited to Conflict management:- Conflict management can be used to help bring stakeholders into alignment on the objectives, success criteria, high-level requirements, project description, summary milestones, and other elements of the charter.

Facilitation:- Facilitation is the ability to effectively guide a group event to a successful decision, solution, or conclusion. A facilitator ensures that there is effective participation, that participants achieve a mutual understanding, that all contributions are considered, that conclusions or results have full buy-in according to the decision process established for the project, and that the actions and agreements achieved are appropriately dealt with afterward.

Meeting management:- Meeting management includes preparing the agenda, ensuring that a representative for each key stakeholder group is invited, and preparing and sending the follow-up minutes and actions.

D. MEETINGS

For this process, meetings are held with key stakeholders to identify the project objectives, success criteria, key deliverables, high-level requirements, summary milestones, and other summary information.

3. DEVELOP PROJECT CHARTER: OUTPUTS

A. PROJECT CHARTER

The project charter is the document issued by the project initiator or sponsor that formally authorizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities. It documents the high-level information on the project and on the product, service, or result the project is intended to satisfy, such as:

Project purpose; Measurable project objectives and related success criteria; High-level requirements; High-level project description, boundaries, and key deliverables; Overall project risk; Summary milestone schedule; Preapproved financial resources; Key stakeholder list; Project approval requirements (i.e., what constitutes project success, who decides the project is successful, and who signs off on the project); Project exit criteria (i.e., what are the conditions to be met in order to close or to cancel the project or phase); Assigned project manager, responsibility, and authority level; and Name and authority of the sponsor or other person(s) authorizing the project charter.

At a high level, the project charter ensures a common understanding by the stakeholders of the key deliverables, milestones, and the roles and responsibilities of everyone involved in the project.

B. ASSUMPTION LOG

High-level strategic and operational assumptions and constraints are normally identified in the business case before the project is initiated and will flow into the project charter. Lower-level

activity and task assumptions are generated throughout the project such as defining technical specifications, estimates, the schedule, risks, etc. The assumption log is used to record all assumptions and constraints throughout the project life cycle.

2.6 Project proposal: -

Preparing a Request for Proposal

In some cases, an organization does not have the expertise or staff capacity to plan and perform the project or major portions of the project, and therefore it decides to outsource the work to an external resource (contractor). A request for proposal (RFP) is a document, prepared by the sponsor/customer, which defines the project requirements and is used to solicit proposals from potential contractors to do the project. A proposal is a document that includes a proposed approach, schedule, and budget for meeting the project requirements and accomplishing the project scope.

A good RFP allows contractors to understand what the customer expects so that they can prepare a thorough proposal that will satisfy the customer's requirements at a realistic price. For example, an RFP that simply requests contractors to submit a proposal for building a house is not specific enough. Contractors could not even begin to prepare proposals without information about the kind of house that is wanted. An RFP should be comprehensive and provide sufficiently detailed information so that a contractor or project team can prepare an intelligent proposal that is responsive to the customer's needs. Following are some guidelines for drafting a formal RFP to external contractors:

1. The RFP must state the project objective or purpose, including any rational or background information that may be helpful to contractors so that they can prepare thorough and responsive proposals.
2. An RFP must provide a statement of work (SOW) that outlines the major tasks the customer wants the contractor or project team to perform to accomplish the project scope and produce all the deliverables. For example, if the RFP is for a house, the contractor needs to know whether he should design and build the entire house, build it according to the customer's design, or include finishing the basement and installing the carpeting. If a customer needs a marketing brochure, the RFP must state whether the contractor is just to design the brochure or design, print, and mail it.
3. The RFP must include the customer requirements, which define functional, operational, and performance specifications or capabilities that must be met. Requirements cover size, quantity, color, weight, speed, and other physical or operational parameters the contractor's proposed solution must satisfy. For the marketing brochure, the requirements might be for a trifold self-mailer, printed on card stock in two colors, with a print run of 10,000. Requirements for the house might include an overall size of 3,000 square feet with four bedrooms, two baths, a two-car garage, central air-conditioning, and a fireplace. Some requirements address performance. If the RFP is for an automated billing and collection system, performance requirements might include the capacity to process 12,000 transactions a day and provisions for special functions such as consolidated multiple invoices for individual customers and automatic generation of second invoices for payments not received within 30 days of the initial invoice. The requirements may also reference standards and codes that must be used and met.
4. The RFP should state what deliverables the customer expects the contractor to provide. Deliverables are the tangible items that the contractor is to provide during and at the completion of the project. With the brochure example, there might be two deliverables: the concept layout

and the 10,000 copies of the brochure. With the billing and collection system, the contractor may be expected to provide the hardware (computers), software, operator manuals (electronic and hardcopies), and training sessions. Deliverables could also include regular progress reports or a final report that the customer requires the contractor to provide.

5. The RFP should state the acceptance criteria the customer will use to determine if the project deliverables are completed according to the customer's requirements. For example, the project contractor will have to run tests on the automated billing and collection system to validate to the customer that it meets the performance requirements before the customer accepts the system and makes the final payment to the contractor.

6. The RFP should list any customer-supplied items. For example, the RFP might state that the customer will supply a copy of its logo for use on the brochure. If the RFP is for a piece of automated equipment for testing electronic circuit boards, it may state that the customer will provide a certain quantity of the boards for the contractor to use during factory testing of the equipment before it is shipped to the customer.

7. The RFP might state the approvals required by the customer. For example, the housing customer may want to review and approve the plans before construction is started. The brochure customer may want to review and approve the brochure's layout before printing is started.

8. Some RFPs mention the type of contract the customer intends to use. It could be a fixed-price contract, in which case the customer will pay the contractor a fixed amount, regardless of how much the work actually costs the contractor. (The contractor accepts the risk of taking a loss.) Or the contract might be for time and materials. In this case, the customer will pay the contractor whatever the actual costs are.

9. An RFP might state the payment terms the customer intends to use. For example, the brochure customer may intend to make one payment at the end of the project. On the other hand, the customer for the house may specify progress payments, based on a percentage of the total price, that are made as certain milestones are accomplished—25 percent when the foundation is complete, another 25 percent when the framing is complete, and so on, until the entire project is finished.

10. The RFP should state the required schedule for completion of the project and key milestones. It might state simply that the house must be completed within six months, or it might include a more detailed schedule. For example, the billing and collection system must be designed and developed and a design review meeting conducted within four months of the start of the project; then, the system must be installed and tested within four months of the design review; and, finally, the contractor must provide all system documentation and operator training within one month of the system's installation. In addition to the required project completion date, the RFP may also indicate required dates for key milestones during the project.

11. The RFP should provide instructions for the format and content of the contractor proposals. If the customer is going to compare and evaluate proposals from several contractors, it is important that they be consistent in format and content so that a fair evaluation can be made. Instructions might state a required outline or table of contents, the maximum number of pages, specific requirements to provide a detailed breakdown of cost elements, or even the font size and margins for the proposal.

12. The RFP should indicate the due date by which the customer expects potential contractors to submit proposals. Customers want to receive all proposals by a certain date so that they can compare and evaluate them at the same time. For example, a customer may give potential contractors 30 calendar days from the time the RFP is formally issued to submit a proposal.

Customers usually state in the RFP that any proposals submitted after the due date will not be accepted for consideration, because it would be unfair to give some contractors extra time.
13. An RFP may include the evaluation criteria. These are the criteria that the customer will use to evaluate proposals from competing contractors in order to select the one to perform the project. Criteria might include the following:
a. The contractor's experience with similar projects. How recently has the contractor completed similar projects? Were they completed within budget and on schedule? Were the customers satisfied?
b. The technical approach proposed by the contractor. What technology will be used? What type and configuration of computer hardware will be used? What is the design approach for the database? Which software language will be used for developing the management information system?
c. The schedule. Will the contractor be able to meet or beat the required schedule?
d. The costs. If the estimate is based on time and materials, are the costs reasonable?
Have any items been left out? Does it appear that the contractor has submitted a low-cost estimate but will add costs after the project is under way, resulting in final costs that are much higher than the original estimate?
14. In rare cases, an RFP will indicate the funds the customer has available to spend on the project. Usually, the customer expects contractors to submit a proposal that meets the requirements in the RFP at the most reasonable cost. In some situations, however, it may be helpful for the customer to indicate a "ballpark" amount to be spent. For example, stating in the RFP that the cost of building the house should be about Rs300,000 would be helpful. Contractors can then submit proposals that are appropriate to that level of funding, rather than submitting proposals for houses that cost far more than the customer has available. Otherwise, all the contractors might submit proposals with prices much higher than the available funding, and the disappointed customer will have to ask all the contractors to resubmit proposals for a less expensive house. A sample RFP is shown in Figure 2.3. Additional examples of requests for proposals can be found by using a search engine to search the Web for "Request for Proposals."

2.7 Effective project team: -

A project team is more than a group of individuals assigned to work on one project; it is a group of individuals working interdependently and cooperatively to accomplish the project objective. Helping these individuals develop and grow into a cohesive, effective team takes effort on the part of the project manager and each member of the project team. As was noted at the beginning of the chapter, the effectiveness, or lack thereof, of the project team can make the difference between project success and project failure. Although plans and project management techniques are necessary, it is the people—the project manager and project team—who are the key to project success; project success requires an effective project team.

CHARACTERISTICS OF EFFECTIVE TEAMS

The following five characteristics are associated with effective project teams.

- CLEAR UNDERSTANDING OF THE PROJECT OBJECTIVE

The scope, quality requirements, budget, and schedule must be well defined for a project team to be effective. If the project objective is to be accomplished, each team member must have the same vision of the project result and the benefits it will provide.

- CLEAR EXPECTATIONS OF ROLES AND RESPONSIBILITIES

Members of an effective team know how their work must fit together because they participated in developing the project plans. Team members appreciate each other's expertise, skills, and contributions to accomplishing the project objective. Each person accepts responsibility for carrying out her or his part of the project.

- RESULTS ORIENTATION

Each person on an effective project team has a strong commitment to accomplishing the project objective. By setting a good example, the project manager sets the tone for the energy level. Team members are enthusiastic and willing to spend the time and energy necessary to succeed. For example, individuals are willing to work extra hours or weekends or skip lunches when necessary in order to keep the project on track.

- HIGH DEGREE OF COOPERATION AND COLLABORATION

Open, frank, unambiguous, and timely communication is the norm on an effective project team. Members readily share information, ideas, and feelings. They are not shy about asking other members for help. Team members act as resources for each other, beyond just doing their assigned tasks. They want to see other members succeed in their tasks and are willing to help and support them if they are stuck or faltering. They express appreciation when another team member offers or provides help. They give and accept feedback and constructive criticism. Because of this cooperation, the team is creative in Problem solving and timely in decision making.

- HIGH LEVEL OF TRUST

Members of an effective team understand interdependency and accept that everyone on the team is important to project success. Each member can count on the other members to do what they say they will do—and at the expected level of quality. There is a shared sense of trust. Team members care for and about one another. Because differences are accepted, members feel free to be themselves. Differences of opinion are encouraged, freely expressed, and respected. Individuals are able to raise issues that may result in disagreement or conflict without concern about retribution. Effective project teams resolve conflict through constructive and timely feedback and positive confrontation of the issues. Disagreement is not suppressed; rather, it is seen as normal and as an opportunity for growth and learning. Figure 11.4 is a checklist for rating the effectiveness of a project team. It is recommended that team members complete this assessment instrument periodically during the project. After the scores of all team members have been summarized, the team, including the project manager, should discuss how to improve in any areas that were rated low.

BARRIERS TO TEAM EFFECTIVENESS

Although every project team has the potential to be highly effective, there are often barriers that impede a team's achievement of the level of effectiveness of which it is capable. Following are barriers that can hinder project team effectiveness and some suggestions for overcoming them.

- ♣ UNCLEAR VISION AND OBJECTIVE

The project manager needs to articulate the project objective, as well as the project scope, quality requirements, budget, and schedule. She or he needs to create a vision of the project result and the benefits it will provide. This information needs to be communicated at the very first project kickoff meeting. At this meeting, the project manager needs to ask team members if they understand this information and answer any questions they may have. The information should then be provided in written form, along with any clarification given during the meeting, to all members of the project team.

Periodically, the project manager needs to discuss the project objective at project status review meetings. At these meetings, she or he should always ask whether anyone has any questions about what must be accomplished. Telling the team what the project objective is only once, at the beginning of the project, is not sufficient. The project manager must say it, write it, distribute it, and repeat it frequently.

- ♣ UNCLEAR DEFINITION OF ROLES AND RESPONSIBILITIES

Individuals may feel that their roles and responsibilities are ambiguous or that there is overlap in the responsibilities of some individuals. At the beginning of the project, the project manager should meet individually with each member of the project team to explain why he or she was assigned to the project, describe his or her expected role and responsibilities, and discuss how they relate to the other team members' roles and responsibilities. For some projects, job descriptions may be provided that outline team members' roles, areas of responsibility, levels of authority, and performance expectations. Project team members need to feel free to ask the project manager to clarify any areas of ambiguity or overlap whenever they become apparent. As the project team develops the project plan, each member's tasks should be identified using a tool such as a work breakdown structure, a responsibility assignment matrix, or a network diagram or bar chart. Copies of these documents should be given to everyone and be made readily available so that each team member can see not only her or his own assigned tasks but also other members' tasks and how they all fit together.

- ♣ LACK OF PROJECT STRUCTURE

Individuals may feel that everyone is working in a different direction or that there are no established procedures for team operation. This, too, is a reason for the project manager to have the team participate in developing the project plan. A tool such as a network diagram shows how everyone's work fits together to accomplish the project objective. At the beginning of the project, the project manager should establish preliminary operating procedures that address such issues as communication channels, approvals, and documentation requirements. Each procedure, as well as the rationale for establishing it, needs to be explained to the team at a project meeting. The procedures should also be provided in written form to all team members. If some team members do not follow the procedures or circumvent them, the project manager needs to reinforce the importance of everyone consistently following established procedures. However, the project manager needs to be open to suggestions for eliminating or streamlining procedures when they no longer contribute to the effective and efficient performance of the project.

- ♣ LACK OF COMMITMENT

Team members may not appear to be committed to their project work or the project objective. To counter such indifference, the project manager needs to explain to each individual the importance of his or her role on the team and how he or she can contribute to the success of the project. The project manager also needs to ask team members what their personal and professional interests

are and look for ways that the project assignment might help satisfy these interests. She or he should try to determine what motivates each individual and then create a project environment where these motivators are available. The project manager also needs to recognize the accomplishments of each person and support and encourage his or her progress.

- ♣ POOR COMMUNICATION

Poor communication occurs when team members lack knowledge about what is happening on the project and individuals do not share information. It is important for the project manager to have regular project status review meetings with a published agenda. Various project team members should be asked to give a briefing on the status of their work. Participation and questions should be encouraged. All project documents, such as plans, budgets, schedules, and reports, should be kept up to date and distributed in a timely manner to the entire project team. The project manager should encourage team members to get together to share information, collaborate, and solve problems as needed, rather than wait for official project meetings. Also, physically locating all members of the project team in the same office area can enhance project communication.

- ♣ POOR LEADERSHIP

To keep the project team from feeling that the project manager is not providing effective leadership for the team, the manager has to be willing to periodically solicit feedback from team members by asking questions like "How am I doing?" or "How can I improve my leadership?" However, he or she must first establish a project environment in which individuals feel free to provide feedback without fear of retribution. The project manager should state at an early project meeting that feedback will be requested periodically and that others' suggestions for improving his or her leadership skills are welcome. For example, a project manager might show interest in improving his or her leadership skills to enhance his or her own contribution to the success of the project. Of course, the project manager then must be willing to follow up on appropriate suggestions, whether they involve additional training, changing behaviors, or modifying project procedures.

- ♣ TURNOVER OF PROJECT TEAM MEMBERS

When team composition changes often—that is, when new people are continually being assigned to a project and others are leaving—the flow of individuals may be too dynamic for the team to gel. A project team made up of a small number of individuals with long-term assignments will be more efficient than a project team composed of a large number of individuals with short-term assignments. The project manager should acquire individuals for the project team who are sufficiently versatile in expertise and skills that they can contribute to many areas of the project and thus be assigned to a project for a long period of time. Although the project manager should not try to execute the project with a multitude of individuals with narrow expertise who will be assigned to the project for only short intervals, in some cases it may be appropriate for individuals with specific expertise to be assigned to the project for only one task or for a limited time.

- ♣ DYSFUNCTIONAL BEHAVIOR

Sometimes an individual exhibits inappropriate behavior, such as hostility, bullying, excessive clowning around, or making disparaging personal remarks, that is disruptive to the development of an effective team. The project manager needs to meet with this individual, point out the disruptive behavior, and explain that it is unacceptable because of the impact it is having on the rest of the project team.

The individual might be offered coaching, a training seminar, or counseling if appropriate. The project manager must make it clear, however, that if the dysfunctional behavior continues; the person will be released from the project team. Of course, the project manager needs to be prepared to follow through if necessary.

How Effective Is Your Project Team?

	Not at All		Somewhat		Very Much
1. Does your team have a clear understanding of its goal?	1	2	3	4	5
2. Are the project scope, level of quality, budget, and schedule well defined?	1	2	3	4	5
3. Does everyone have clear expectations of his or her own role and responsibilities?	1	2	3	4	5
4. Does everyone have clear expectations of other members' roles and responsibilities?	1	2	3	4	5
5. Does everyone know the expertise and skills that each person brings to the team?	1	2	3	4	5
6. Is your team results oriented?	1	2	3	4	5
7. Does everyone have a strong commitment to accomplishing the project objective?	1	2	3	4	5
8. Does your team have a high level of enthusiasm and energy?	1	2	3	4	5
9. Does your team have a high degree of cooperation and collaboration?	1	2	3	4	5
10. Are open, frank, unambiguous, and timely communications the norm?	1	2	3	4	5
11. Do members readily share information, ideas, and feelings?	1	2	3	4	5
12. Do members feel free to ask other members for help?	1	2	3	4	5
13. Do members willingly help one another?	1	2	3	4	5
14. Do team members give feedback and constructive criticism?	1	2	3	4	5
15. Do team members accept feedback and constructive criticism?	1	2	3	4	5
16. Is there a high level of trust among the project team members?	1	2	3	4	5
17. Do members follow through on what they say they will do?	1	2	3	4	5
18. Is there an openness to differing viewpoints?	1	2	3	4	5
19. Do team members accept one another and their differences?	1	2	3	4	5
20. Does your team constructively resolve conflicts?	1	2	3	4	5

Fig. 2.3 Team Effectiveness Checklist

EFFECTIVE TEAM MEMBERS

Being a member of a project team should be an enriching and satisfying growth experience for each individual. However, growth will not just happen by itself. It requires a sense of responsibility, hard work, open-mindedness, and a desire for further self-development. Although the project manager is ultimately responsible for the success of a project, each member of the project team shares in that responsibility. What people who work on projects have in common is

that they enjoy the challenge of accomplishing something and working as part of a team. Each member of the project team needs to help create and foster a positive and effective project environment. Effective team members plan, control, and feel accountable for their individual work efforts. They have high expectations of themselves and strive to accomplish their assignments under budget and ahead of schedule. They manage their time well. They make things happen; they do not just let them happen. Effective team members do not simply work on a task until they are told to stop; rather they are self-directed and follow through on assignments and action items. They take pride in doing quality work instead of expecting other team members to finish, clean up, or redo any of their sloppy or incomplete work. Each team member can count on all the other team members to perform their respective tasks in a quality and timely manner so as not to delay or impede the work of other team members.

Effective team members participate and communicate. They do not sit back and wait to be asked; they speak up and participate in meetings. They take the initiative, communicating with other team members and the project manager in a clear, timely, and unambiguous manner. They listen to each other and provide constructive feedback to each other. In particular, effective team members feel responsible for identifying problems, or potential problems, as early as possible, without pointing the finger or blaming other individuals, the customer, or the project manager for causing the problems. Effective team members are not only problem identifiers but also problem solvers. When a problem has been identified, they suggest alternative solutions and are ready and willing to collaborate with other team members to solve the problem, even if it is outside of their assigned area of responsibility. Effective team members do not have a "that's not my problem" or "that's not my job" attitude; rather, they are willing to pitch in to help the team accomplish the project objective. They have a "we" attitude and tend to speak in terms of "we, us, and our" rather than "I, me, and my." Effective team members help to create a positive, constructive project environment in which there is no room for gossip, whining, cliques, or divisiveness. They are sensitive to the diverse composition of the project team and show respect for all members of the team. They respect others' viewpoints. They do not let pride, stubbornness, or arrogance get in the way of collaboration, cooperation, and compromise. Effective team members put the success of the project above personal gain. They readily offer congratulations and give credit to their teammates.

It has been said that there is no I in TEAM—there are no individual winners or losers. When a project is successful, everybody wins!

TEAM BUILDING

Legendary baseball manager Casey Stengel once said, "It's easy to get the players. Gettin' 'em to play together, that's the hard part." Teamwork is the cooperative effort by members of a team to accomplish a common goal.

Team building—developing a group of individuals into a team to accomplish the project objective—is an ongoing process. It is the responsibility of both the project manager and the project team. Team building helps to create an atmosphere of openness and trust. Members feel a sense of unity and a strong commitment to accomplishing the project objective. Chapter 10 discussed various things that the project manager can do to foster and support team building. The following discussion provides a few ways that the project team can help the team-building process. Socializing among team members supports team building. The better team members get to know one another, the more team building is enhanced. To ensure that individual members

communicate with one another frequently, situations need to be created that foster socializing among team members. Team members can initiate some of these situations.

The team can request that team members be physically located in one office area for the duration of the project. When team members are located near one another, there is a greater chance that they will go to each other's offices or work areas to talk. Also, they will pass each other more frequently in common areas such as hallways and have a chance to stop and talk. Such spontaneous informal discussions can be very informative and also help to build relationships. Discussions should not always be work related. It is important that team members get to know one another on a personal basis, without being intrusive. A certain number of personal friendships will develop during the project. Having the entire project team located in one area prevents that "us versus them" feeling that can arise when parts of the team are located in different parts of a building or plant. Such a situation can result in a project team that is really a set of several subgroups rather than a true team. Colocation is not possible with virtual teams that are geographically dispersed. Effective electronic communication tools and protocols need to be used to facilitate team building among members of a virtual team. See the section on collaborative communication tools in Chapter 12 for further discussion.

The project team can initiate social events to celebrate project events—for example, reaching a critical milestone, such as a successful design review meeting with the customer or customer acceptance of a major deliverable. The team can also schedule events just for stress relief. An after-work get-together for pizza, a team luncheon, an informal lunch in the conference room, a monthly birthday celebration, a weekend family picnic, a community or charity volunteer event, and a trip to see a sports event or theater production are examples of events the team can organize to foster socializing and team building. It is important that such activities include everyone on the team. Although some individuals may not be able to participate, everyone should at least be invited and encouraged to participate. Team members should use these events to get to know as many other team members (and their families, if they participate) as possible.

A good rule of thumb is to always try to sit next to someone you do not know too well and strike up a conversation—ask questions, listen to what the other person says, and look for areas of common interest. This will help to build relationships. It is important for individuals to avoid forming cliques composed of several people who always hang together at every event. Engaging in social events not only helps to develop a sense of camaraderie but also makes it easier for team members to engage in open and frank communication while working on the project.

In addition to organizing social activities, the team can periodically call team meetings, as opposed to project meetings. The purpose of team meetings is to discuss openly such questions as the following: How are we working as a team? What barriers (such as procedures, resources, priorities, or communications) are impeding teamwork? What can we do to overcome these barriers? What can we do to improve teamwork? If the project manager participates in team meetings, he or she should be treated as an equal—team members should not look to the manager for the answers, and the manager should not pull rank and override the consensus of the team. It is a team meeting, not a project meeting. Only team related issues, not project items, should be discussed.

Team members should foster team building in whatever ways they can. For example, as new people join the team during the project, the project team needs to make a special effort to make them feel welcome and integrate them into the team. For example, team members can organize an informal reception for new team members, or stop by their office to welcome them and

introduce themselves. They should not expect the project manager alone to be responsible for team building.

VALUING TEAM DIVERSITY

Globalization, changes in demographics, and the need for individuals with unique skills are causing changes in the composition or diversity of project teams. Diversity is differences among people. Diversity is about acknowledging, understanding, and valuing differences and creating a work environment that recognizes, respects, and harnesses differences among team members for the benefits of accomplishing a shared goal, such as the project objective. However, differences can create barriers to team performance. Miscommunication and misunderstanding may be more likely to happen between people who are different. If the differences within the project team are not valued as strength, they can lead to low morale, diminished trust, reduced productivity, greater tension, and suspicion and become a serious impediment to team performance. Team members should feel valued and have a sense of belonging. Diversity of the team brings unique ideas and perspectives to projects. Each team member has unique experiences, skills, and values to bring to the team. Such differences can lead to more creative, faster, and higher-quality problem solving and decision making. Chances are that most project teams are diverse in more ways than you think. The following are some dimensions of diversity:

• Age or generation. Many teams have a mix of members of various age groups—younger, older, and in-between. Three or four generations can be represented on a team. Each generation has different experiences that shape values and perspectives and thus responds to different motivational factors.

Older team members may value security, a strong work ethic, and adherence to rules and may prefer face-to-face meetings, whereas younger members may value work/life balance and informality, dislike close supervision, and prefer electronic communications with others.

• Appearance. Team members are different in weight, height, facial features, hairstyle, clothing, jewelry, body piercing, and tattoos, just to name a few things. These characteristics can become a barrier to team effectiveness if some team members make assumptions about other members' competence or performance based on their appearance.

• Ethnicity or ancestry. Driven by globalization, projects have team members located around the globe as well as project work packages that may be outsourced to subcontractors on several continents. Moreover, descendants of immigrants are accessing higher education and attaining skilled positions.

Therefore, more project teams include people in or from different countries or with various national ancestries. Team members may have not only different levels of language proficiency but different customs and norms as well. Behaviors and words or phrases that are not considered offensive in one culture may be considered offensive in another culture. Team members may have different concepts of time (punctuality), communication styles (greetings, eye contact, hand gestures, personal space), and perceptions of appropriate protocol (formality, hierarchy), as well as different views on the role of women or elders. Team members need to exhibit patience when another person is struggling with the language or pronunciations.

• Gender. Project teams increasingly include a higher proportion of women, as more women enter and stay in the workforce, particularly in positions that require specific high-demand skills, such as in information and technology fields. Men and women may behave and communicate differently due to disparities in their socialization process. Different communication styles can lead to misinterpretation and misunderstanding.

• Health. Teams are diverse with respect to the health or wellness of their members. This includes physical and mental abilities, as well as behavioral disorders. Some of these differences are visible, such as prostheses or a cane, while other health matters are less visible, such as a heart condition or anxiety disorder. Team members need to accommodate each other with respect to health matters and not "label" people or discount their capabilities and contributions because of health-related limitations.
• Job status. Many project teams include members of different levels of experience and skills, as well as different levels of seniority and job titles. Team members should not make assumptions about the potential contribution of another member based on his or her job title or position. Excluding team members from meetings or problem-solving discussions because they may be considered to hold a lower-level position or do not have the specific expertise can be a missed opportunity for some new and creative ideas.
• Marital and parental status. With respect to conditions such as people getting married at a later age, getting divorced, having been married several times, becoming widowed, blending families, having both spouses working, or being single parents or childless couples or partners, the composition of project teams is more diverse. Team members should not make assumptions about the availability or effectiveness of other members based on their marital or parental status, such as assuming that a single person would have more time to work on a challenging assignment. Members need to accommodate the unique needs of team members, such as finishing a meeting on time so a member can pick up his or her child from child care by a certain time.
• Race. With globalization, migration between countries, and growing numbers of racial minorities who are gaining access to higher education and attaining skilled positions, project teams increasingly have a mix of people of traditionally underrepresented races. Team members should avoid stereotyping others in the team who are from different races. Individuals from various races can bring different and enriching perspectives to project team discussions and processes.
• Religious affiliation. Just as globalization affects the composition of project teams with respect to ethnic and racial diversity, it also impacts teams with respect to religious diversity. There are a variety of religions worldwide, including Buddhism, Christianity, Hinduism, Islam, and Judaism. Each religion has particular practices such as daily prayer times, observance of holy days, dietary restrictions, and so forth. Individuals may have great devotion to their religious beliefs and practices. Team members need to respect other members' religious practices and accommodate them in accomplishing the project schedule.
• Sexual identity and gender expression. As more individuals express their sexual and gender identity and as lesbian, gay, bisexual, or transgender, and there is increased acknowledgement in the workplace, project teams need to demonstrate an open and inclusive environment. Team members should not be unwilling to work with team members just because of their sexual identity or gender expression.
• Other aspects. Other aspects of diversity among the project team can include political affiliation; personal habits, such as smoking; and personal interests, such as hunting, traveling, and so forth. Like the other dimensions of diversity mentioned above, these elements need to be respected, even if there may be personal disagreement, in order to create the environment of trust and support that is necessary for successful team performance.
Stereotyping is categorizing individuals into a group and then conferring on them the characteristics that we believe apply universally to all members of that group. Project team

members should not stereotype or make assumptions about a team member's behavior or performance based on their diversity. Do not attribute a team member's performance to a particular diversity characteristic (gender, age, race, and so forth)—for example, "That activity was very tedious and required attention to detail. Kim did a good job on it because Asians and women are good at those kinds of tasks." Similarly, do not blame team members for something that went wrong and relate it to their diversity (e.g., physical disability, language skills)—for example, "His task did not get done on time because he could not keep up with the rest of the team due to his heart condition," or "We had to do everything over because her directions were not clear because of her poor language skills."

Team members should not exclude or have lower expectations of certain diverse groups, as seen by, for example, assigning them less challenging tasks or assuming that a female team member cannot handle additional responsibilities because of her family obligations. Differences do not imply inferiority or superiority.

Do not discount a team member's comments or contribution just because of diverse characteristics—for example, not asking the opinion of a younger teams member, a clerical worker, or a craftsperson.

Do not identify, label, or refer to team members by drawing attention to their diversity—for example, "He's the one in the wheelchair," or "the old guy," or "the Hispanic," or "the girl with the tattoos," and so forth. Nor should team members make derogatory or insensitive remarks or engage in behavior that demeans the dignity of others—for example, making fun of the spelling or pronunciation of a person's name rather than asking the person for the correct pronunciation; what someone is wearing, such as a turban or nose ring; or a person's religious practice, such as saying a prayer before he or she eats a meal.

It is inappropriate for team members to tell jokes, ridicule, or make fun of a diversity characteristic of a team member or a particular group. Such behavior often reinforces stereotypes. Innuendoes are also made by what is said or written (electronic messages), the words used ("those people," "them"), how it is said (in a disdainful tone), or body language used (smirking, raising eyebrows, shaking head). Even if unintentional, a person may use a phrase or term that confuses or embarrasses another team member. Although one team member may think a comment is funny, another person may consider it offensive or hurtful. Also, there is a chance that a person may be offended because they have an acquaintance or family member who may be in the group (for example, those with a physical disability) that is the brunt of the joke.

Inappropriate behavior regarding diversity includes closed-mindedness, stereotyping, labeling, excluding, ridiculing, insulting, harassing, intimidating, and discriminating. An individual who is offended or a victim of such behavior may not react or speak up. The team member may develop resentment for certain team members, which could affect team cohesion, morale, and performance.

If a team member feels something that was said or done is offensive, he or she should address it with the offender and perhaps take the opportunity to educate the person about why it was offensive. Any diversity issues or conflicts should be addressed immediately so that they can be resolved before they fester and "explode" at a later time. If a team member exhibits unacceptable behavior regarding the various aspects of diversity or sees such behavior from other team members, the concern needs to be discussed with the project manager or the organization's management about how the issues should be addressed—on an individual basis, with the group of individuals involved, or with the entire team. Diversity-related issues that are not addressed can have serious impacts on the project team and work environment, resulting in frequent

conflicts, a hostile climate, strained communication, or poor performance, as well as causing specific team members increased anxiety, nervousness, and stress. It could also lead to a formal complaint by an individual or group and could possibly result in lawsuits against the project contractor and/or specific team members. It could also lead to disciplinary action against individual team members, including dismissal from the team or termination of employment. What can a project organization do to create and sustain a supportive and positive climate for diversity? There are things that can be done by the project organization, project manager, and individual team members in this regard. Two actions the project organization can take are to have a written policy regarding diversity and to provide training about diversity in the workplace. The goals of the policy might be to create a work environment where (1) all team members flourish, (2) differences are respected and valued, (3) the right of all team members to participate and contribute is respected, (4) each team member is valued and respected for his or her unique contributions, and (5) there is zero tolerance for breach of respect or intolerant behavior. Barriers to valuing diversity include lack of awareness and lack of understanding. Therefore, a training session on diversity should raise awareness, create understanding, and help diminish misunderstanding and conflict. Providing a training session on diversity to the project team at the beginning of the project to inform them of the organization's policy, and incorporating case studies and role plays, is a helpful approach. Mandating such training sends a message that the project organization places high importance on valuing diversity. One outcome of the training might be that team members become comfortable asking questions about differences and preferred interactions in the workplace. An example of how additional informal training can take place throughout the project might be to have team lunches where team members of different nationalities bring ethnic food to share and explain some of their customs.

The project manager must promote and foster a respectful and supportive work environment that removes barriers to valuing diversity, values differences, and encourages participation by all team members. She or he must establish and clearly communicate expectations and exemplify the expected behavior. The project manager should discuss the importance of respecting and valuing diversity at a project team meeting at the beginning of the project and periodically throughout the project, as well as discuss those expectations with new members as part of their orientation when they join the team.

Team members can also do things to support valuing diversity and the contributions of all team members. Individual team members can make a personal commitment to understand and value diversity and respect the differences of other team members. Do not make assumptions about other team members' value or potential contributions. Be aware of and acknowledge your own stereotypes of diverse groups. Demonstrate respect by striving to learn from team members who are different from you. Look for occasions for "learning opportunities." Make an effort to enhance your awareness and understanding of the various dimensions of diversity through participation in training, reading, social activities, informal discussions, and so forth. For example, take the time to get to know other team members outside of the work environment in a more relaxed social setting. Be open-minded, exhibit professional behavior, act in a civilized manner, and have a considerate regard for others. Diversity for the project team is about acknowledging, understanding and valuing differences, and creating a work environment that recognizes, respects, and harnesses differences for the benefits of accomplishing a shared goal. It should be seen and valued by the project team as a strength that can enrich communication, foster better relationships, create an enjoyable workplace, and enhance team performance. Diversity of the team brings unique ideas and perspectives to projects. Each team member has

experiences, skills, and values to contribute to the team. Such differences can lead to more creative, faster, and higher-quality problem solving and decision making. Team members need to interact with each other based on each person's unique differences. Having a common goal such as the project objective can bring a diverse group together.
Key points to remember regarding valuing team diversity follow:
• Do not make assumptions or judgments about team members' value-added contributions just because of their diversity characteristics.
• Think before you speak. Once something is said, you cannot take it back, and you may lose the respect of other team members.

2.8 Stages of team development & growth (forming, storming, norming & performing): -

A personal relationship between two people takes time to develop. Initially, you may be curious about each other but apprehensive about letting your guard down and opening yourself up to the other person. As you get to know each other a little more, you may begin to notice differences in your attitudes and values, and disagreements may arise. You may be anxious about whether the relationship will or should continue. As you work through your differences, you may get to know each other better and become friends. As you spend more time together, you may develop a close relationship that helps you to be open with each other, accept each other's differences, and enjoy participating together in activities that are of mutual interest. Likewise, teams evolve through various stages of development. In many projects, people who have never worked together are assigned to the same project team. This group of individuals must develop into an effective team to successfully achieve the project objective. B. W. Tuckman has defined four stages of team development: forming, storming, norming, and performing .

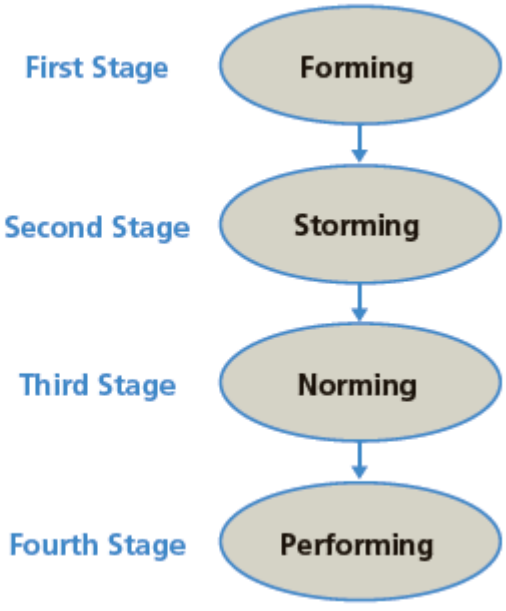

Fig. 2.4 Stages of Team Development

FORMING

Forming is the initial stage of the team development process. It involves the transition from individual to team member. Similar to the early phase of a relationship, it is when individuals on the team begin to get acquainted. During this stage, team members generally have positive expectations and are eager to get started on the work to be accomplished. The group begins to establish an identity and attempts to define and plan the tasks that need to be done. In this phase, however, little actual work is accomplished because of the high level of anxiety that individuals have about the work itself and about their relationships with each other. Team members are unsure of their own roles and the roles of the other members of the project team. In the forming stage, the team needs direction. Members depend on the project manager to provide direction and structure.

Feelings characteristic of this stage include excitement, anticipation, suspicion, anxiety, and hesitancy. Individuals do a lot of questioning in the forming stage: What is our purpose? Who are the other team members? What are they like? Individuals are anxious about whether they will fit in with the other members and be accepted. They may be hesitant to participate because they are unsure how other members will react. Members wonder whether their input will be valued and whether their role in the project aligns with their personal and professional interests.

During the forming stage, the project manager needs to provide direction and structure. In giving orientation to the project team, the project manager must clearly communicate the project objective and create a vision of the successful result of the project and the benefits it will provide. Project constraints regarding the work scope, quality requirements, budget, and schedule must be stated. The project manager also needs to discuss the makeup of the project team: the reasons team members were selected, their complementary skills and expertise, and each person's role in helping to accomplish the project objective. Establishing structure is another task the project manager must perform in this phase. This includes defining initial processes and procedures for team operation and addressing such items as communication channels, approvals, and documentation. These processes and procedures may be improved by the team as it develops through its later stages. To reduce some of the team members' anxiety, the project manager should discuss his or her management style and expectations regarding the work and behavior of the people on the project team. The project manager should have a project kickoff meeting with the project team as early as possible during the forming stage (this is discussed later in this chapter). It is also important to get the team working on some initial tasks. In this stage, the project manager gets the team to participate in developing the project plans.

STORMING

The second stage of team development is known as storming. Like the teenage years, it is usually tough on everyone, but you have to go through it. You cannot get around it or avoid it. The project objective and scope become clearer in this stage. Members start to apply their skills to work on their assigned tasks, and work begins to progress slowly. When reality sets in, though, it may not match individuals' initial expectations. For example, tasks may be more extensive or difficult than anticipated, or cost or schedule constraints may be tighter than expected. As team members begin to perform their tasks, they may feel increasing frustration with dependence on the direction or authority of the project manager. For example, they may have negative reactions to the project manager and to the operating processes and procedures that were established in the forming stage. Team members now begin to test the limits and flexibility of the project manager and the ground rules. During the storming stage, conflict emerges and tension increases. There is

a need for agreement on methods for handling and resolving conflict. Motivation and morale are low in this stage. Members may resist team formation—they want to express their individuality as opposed to team allegiance. The storming stage is characterized by feelings of frustration, anger, and hostility. As individuals begin to perform their tasks, they have more questions about their roles and responsibilities with respect to other team members. As they begin to follow operating procedures, they question the viability and necessity of such procedures. Members wonder how much control and authority they have. In the storming stage, the project manager still needs to be directive, but fewer directives than in the forming stage. She or he needs to provide clarification and better definition of individual responsibilities and of interfacing activities among team members. It is necessary to begin involving the team in problem-solving activities and to start sharing decision making in order to empower the team. The project manager should acknowledge and tolerate any frustration expressed by team members and not become defensive or take it personally. This is the time for the project manager to provide an understanding and supportive environment. It is important to give members an opportunity to express their concerns. The project manager has to provide guidance and foster conflict resolution and not try to suppress any frustration, hoping that it will go away by itself. If the discontent is not addressed, it will build up and could result in dysfunctional behavior later, putting the successful completion of the project at risk.

NORMING

After struggling through the storming stage, the project team moves into the norming stage of development. Relationships among team members and between the team and the project manager become settled in this stage. Interpersonal conflicts are resolved for the most part. In general, the level of conflict is lower than it was in the storming stage. Discontent, too, is reduced, as individuals' expectations align with the reality of the situation—the work to be done, the resources available, the constraints, and the other individuals involved. The project team has accepted its operating environment. Project procedures are improved and streamlined. Control and decision making are transferred from the project manager to the project team. Cohesion begins to develop. There is a sense of team. Individuals feel accepted as part of the team, and they accept others as part of the team. There is an appreciation of each member's contribution to accomplishing the project objective. Trust begins to develop in this stage, as team members start to confide in one another. There is a greater sharing of information, ideas, and feelings; cooperation increases. Team members give and ask for feedback and feel that they can freely and constructively express their emotions and criticisms. A feeling of camaraderie emerges as the team goes through a socialization process. Personal friendships may develop that reach beyond the work environment. During the norming stage, the project manager minimizes defectiveness and takes on a more supportive role. Work performance accelerates, and productivity increases. The project manager should recognize the project team for the progress being made.

PERFORMING

The fourth stage of team development and growth is the performing stage. In this stage, the team is highly committed and eager to accomplish the project objective. The level of work performance is high. The team feels a sense of unity and pride in its accomplishments. Confidence is high. Communication is open, frank, and timely. During this stage, members work individually or in temporary subteams, as needed. There is a great degree of interdependency—members frequently collaborate and willingly help each other with work beyond their own

assigned tasks. The team feels fully empowered. As problems are identified, appropriate team members form subteams to solve the problems and decide how the solution should be implemented. There is a feeling of satisfaction as progress is made and recognized. Individual members realize that they are experiencing professional growth as a result of working on the project.

During the performing stage, the project manager fully delegates responsibility and authority, thereby empowering the project team. She or he focuses on helping the team execute the project plan and on giving recognition to team members for their progress and accomplishments. At this stage, the project manager concentrates on project performance with respect to the scope, budget, and schedule. The project manager's role is to facilitate and support the development and implementation of corrective actions if actual progress falls behind planned progress. It is also at this stage that the project manager acts as a mentor, supporting the professional growth and development of the people working on the project. Figure 2.5 graphically illustrates the levels of work performance and sense of team during the four stages of team development and growth. The amount of time and effort it takes a team to move through each of the stages depends on several factors, including the number of people on the team, whether team members have worked together before, the complexity of the project, and the teamwork skills of the members.

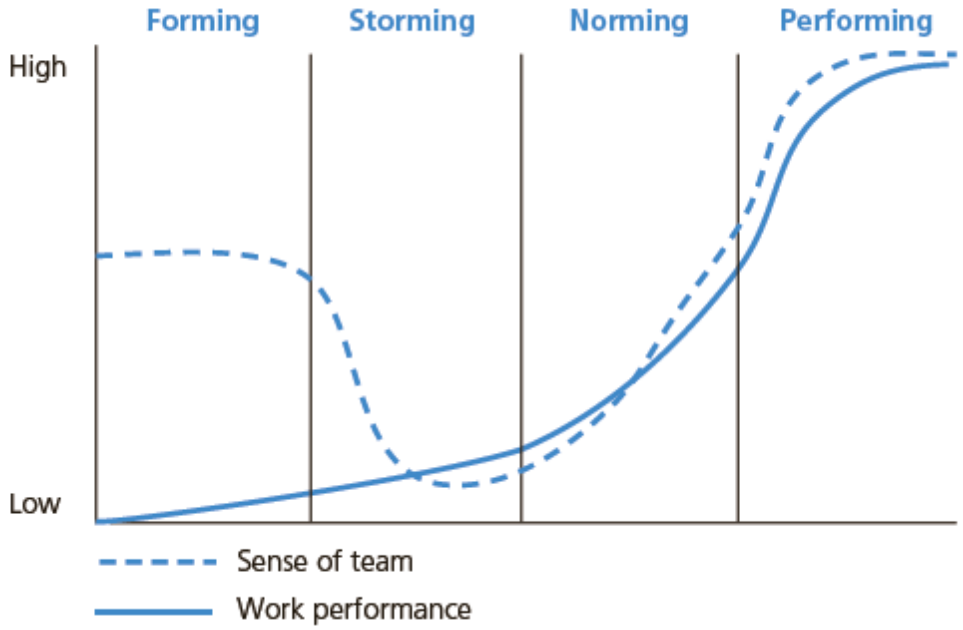

Fig. 2.5 Level of Functioning at Various Stages of Team Development

2.9 Team dynamics: -

Definition Of Team Dynamics

Team dynamics are the unconscious, psychological forces that influence the direction of a team's behavior and performance. They are like undercurrents in the sea, which can carry boats in a different direction to the one they intend to sail.

Team dynamics are created by the nature of the team's work, the personalities within the team, their working relationships with other people, and the environment in which the team works.

Team dynamics can be good - for example, when they improve overall team performance and/or get the best out of individual team members. They can also be bad - for example, when they cause unproductive conflict, demotivation, and prevent the team from achieving its goals.

The Difference Between Team And Group Dynamics

Although team dynamics are very similar to group dynamics, and the terms are often used interchangeably, there is an essential difference.

Groups are a social community, consisting of two or more people who have something in common.

A team is a special instance of a group in which the commonality is a shared goal. This fact, itself, creates a dynamic between team members because they are dependent on each other for success. For example, a sports team wins or loses as a whole.

The word "team" is sometimes used, incorrectly, to refer to a group. For example, many sales "teams" are groups - because the sales people are incentivized individually. A sales person wins commission based on his/her own sales, and is not affected by the performance of other sales people.

Psychological Models Of Team Dynamics

There are many models used to describe team dynamics. Many of them describe the psychological aspects of group dynamics, such as:

- **Group dynamics** which considers how people interact and the common perceptions that arise within a group.
- **Psychoanalysis** which is concerned with the (natural) defensive behaviors of team members.
- **FIRO/Human Elements** which considers the compatibility between people using behaviors of inclusion, control, openness, and how those behaviors relate to inner feelings of significance, competence, and likeability.
- The **Tuckman** model considers four stages of development for a team - forming, storming, norming, and performing.
- **Team Roles** how team performance is related to nine psychological roles taken by different team members.
- **Personality type** theories, consider how the different preferences of team members affect their interactions and team performance.
- **Team Islands** and In/Out groups, showing how sub-teams can form as a result of members having different characteristics or being separated by a geographical boundary.

Non-Psychological Models Relevant To Team Dynamics

In addition, there are many other models that have an important bearing on team dynamics and performance, but are not typically included in definitions of group dynamics. These include:

- Models of organizational **culture**, which considers five cultural factors: power distance, uncertainty avoidance, individualism/collectivism, masculine/feminine, and short-term/long-term focus.
- General leadership and management **processes**, such as performance management, appraisal, reward/recognition, and individual leadership or management practices (e.g. Situational Leadership).
- **Methodologies** for different aspects of team functioning, such as project management (e.g. Prince2), business process reengineering (e.g. LEAN), collective problem solving, running meetings, information sharing, communication, desk instructions, etc.
- Various types of organizational **structure**, including hierarchical, functional, matrix, network, cross-functional teams, working parties, etc.
- **Stakeholder** models, including governance structure, customer forums and feedback, representative groups (e.g. unions), etc.

These are relevant to team dynamics because they can all have a hidden but significant impact on the way a team interacts and performs.

Strategies To Improve Team Dynamics

Team dynamics are complex and multi-layered - being the result of the interaction of many factors (personalities, roles, structure, culture, etc.). To improve team dynamics there needs to be a diagnosis first, to identify the type of intervention that will have the right impact.

In the diagnosis stage the current team dynamics are investigated to identify the primary factors causing any problems or lack of team performance. This typically involves a Team Health Check - individual structured interviews with team members in a private, safe, and confidential environment. Where appropriate, it can also be useful to include people outside the team in the Team Health Check - e.g. senior management, significant customers, or other stakeholders. If you would like us to conduct a Team Health Check for your team, please contact us.

The type of intervention depends on the outcome of the Team Health Check. In some cases, the Team Health Check itself can have a cathartic or therapeutic effect - it gives individuals the opportunity to air their views openly in a consequence-free environment. In most cases, the Team Health Check enables the independent Team Consultant to identify how the team can make progress. There are many types of intervention that can affect team dynamics, some examples being:

- A change of organizational structure, reassignment of personnel, or change of office layout.
- Bespoke team development workshops designed to address specific work or team performance issues.

- Personality workshops that increase awareness of interpersonal dynamics.
- Change workshops, aimed at addressing latent fears and resistance to the work of the team.
- Stakeholder workshops, to give the team a wider perspective or understand others' views of the team's performance.
- A cultural change programme to introduce new types of attitudes and behaviors to the organizational norms.
- New processes, tools, or technology, e.g. to facilitate better communication.

NUMERICALS:-

Among the many methods used for evaluating investment proposals, five are discussed here.
1. **Payback method (or payback period):** Number of years required to return the original investment.
2. **Return on assets (ROA) or return on investment (ROI):** An average rate of return on assets employed.
3. **Net present value (NPV) method:** Present value of expected future cash flows discounted at the appropriate cost of capital, minus the cost of the investment.
4. **Internal rate of return (IRR) method:** Interest rate which equates the present value of future cash flows to the investment outlay.
5. **Profitability Index (PI):** It shows the relative profitability of any project, or the present value of benefits per rupee of costs.

Numerical-1 Table 2.1 gives the cash flows for four mutually exclusive projects. They all have the same life, five years, and they all require the same investment outlay, Rs.1,500. Once accepted, no project can be abandoned without incurring the outflows indicated. For example, Project A has negative cash flows during its fourth and fifth years. Once the project is accepted these expected cash outflows must be incurred. An example of a project of this type is a nuclear power plant. Decommissioning costs at the end of the economic life of the facility can be as large as the initial construction costs and they must be taken into account.

Table 2.1: Cash Flows of Four Mutually Exclusive Projects

	Cash Flows (Rs.)				
YEARS	**A**	**B**	**C**	**D**	**PVIF@10%**
0	-1,500	-1,500	-1,500	-1,500	1.000
1	150	0	150	300	0.909
2	1,350	0	300	450	0.826
3	150	450	450	750	0.751
4	-150	- 1,050	600	750	0.683
5	-600	1,950	-1,875	900	0.621

The last column of Table 5.2 shows the appropriate discount factor for the present value of cash flows, assuming that the appropriate opportunity cost of capital is 10 percent. Since all four

projects are assumed to have the same risk, they can be discounted at the same interest rate. Now we turn our attention to the actual implementation of the five abovementioned capital budgeting techniques (1) the payback method, (2) the return on assets, (3) the net present value,(4) the internal rate of return, (5) Profitability Index. We shall see that only one technique - the net present value method - satisfies all four of the desirable properties for capital budgeting criteria.

1. Payback Method

The payback period is the number of years required to recover the initial capital outlay on a project. The payback periods for the four projects in Table 5.2 are given below.

Project A, 2-year payback
Project B, 4-year payback
Project C, 4-year payback
Project D, 3-year payback.

If management were adhering strictly to the payback method, then Project A would be chosen as the best among the four mutually exclusive alternatives. Even a casual look at the numbers indicates that this would be a bad decision. The difficulty with the payback method is that it does not consider all cash flows and it fails to discount them. Failure to consider all cash flows results in ignoring the large negative cash flows which occur in the last two years of Project A. Failure to discount them means that management would be indifferent between the following two cash flow patterns:

	Cash Flows	
Year	**G**	**G***
0	-1,000	-1,000
1	100	900
2	900	100

because they have the same payback period. Yet no one with a positive opportunity cost of funds would choose Project G because Project G* returns cash much faster.
The payback method also violates the value additivity principle. Consider the following example. Projects 1 and 2 are mutually exclusive but Project 3 is independent. Hence, it is possible to undertake Projects 1 and 3 in combination, 2 and 3 in combination, or any of the projects in isolation.
The only arguments in favor of using the payback method is that it is easy to use, but with the advent of pocket calculators and computers, we feel that other more correct capital budgeting techniques are just as easy to use.

2. Return on Assets (ROA)

The return on assets (ROA) which is also sometimes called the return on investment (ROI)is an average rate of return technique. It is computed by averaging the expected cash flows over the life of a project and then dividing the average annual cash flow by the initial investment outlay. For example, the ROA for Project B in Table 5.2 is computed from the following definition:

$$ROA = \left(\sum_{t=0}^{n} \text{cash flow/n} \right) \div Io$$

Where
Io = Initial cash outlay = Rs.1,500
n = Life of the project = 5 years.
Substituting in the correct numbers from Table 5.2, we have

$$ROA = \left\{ \frac{Rs.-1,500 + Rs.\,0 + Rs.\,0 + Rs.\,450 + Rs.1,050 + Rs.1,950}{5} \right\} \div$$

$$= \frac{Rs.1,950}{5} \div Rs.1,500$$

$$= \frac{Rs.390}{Rs.1,500} = 26\%$$

The ROA's for the four projects are
Project A, - 8%
Project B, 26%
Project C, 25%
Project D, 22%

The ROA criterion chooses Project B as best. The major problem with ROA is that it does not take the time value of money into account. We would have obtained exactly the same ROA for Project B, even if the order of cash flows had been reversed with Rs.1,950 received now, Rs.1,050 at the end of Year 1, Rs.450 at the end of Year 2 and -Rs.1,500 at the end Year 5. But no one with a positive opportunity cost of capital would be indifferent between the alternatives. The opposite ordering of cash flows would always be preferred.

3. Present value method

Another method based on discounted cash flow approach employed to evaluate financial viability of investment projects is the present value method, which involves discounting of streams of future cash earnings to present value at required rate of return to the firm (cost of capital). For ranking projects under this method, net present value is computed. Project with highest positive net present value is accorded the highest priority.
The equation for calculating the net present value of a project is :

$$= \sum_{t=1}^{n} \frac{CF_t}{(1+K)^t} - Io$$

Here CF1,CF2, and so forth represent the net cash flows; k is the firm's cost of capital;I0 is the initial cost of the project; and n is the project's expected life. The net present value of Project C

in Table 2.1 is calculated below by multiplying each cash flow by the appropriate discount factor (PVIF), assuming that the cost of capital, k, is 10 per cent.

Year	CashFlow X	PVIF	= PV
0	-1,500	1.000	-1,500.00
1	150	0.909	136.35
2	300	0.826	247.80
3	450	0.751	337.95
4	600	0.683	409.80
5	1,875	0.621	1,164
		NPV =	**796.28**

The net present value of all four projects in Table 2.1 are:

Project A NPV = Rs. –610.95.
Project B NPV = Rs. 766.05.
Project C NPV = Rs. 796.28.
Project D NPV = Rs. 778.80

If these projects were independent instead of mutually exclusive, we would reject A and accept B, C, and D. Why? Since they are mutually exclusive, we select the project with the greatest NPV, Project C. The NPV of the project is exactly the same as the increase in shareholders' wealth. This fact makes it the correct decision rule for capital budgeting purposes. The NPV rule also meets the other three general principles required for an optimal capital budgeting criterion. It takes all cash flows into account. All cash flows are discounted at the appropriate market-determined opportunity cost of capital in order to determine their present values. Also, the NPV rule obeys the value additivity principle.
The net present value of a project is exactly the same as the increase in shareholders' wealth. To see why, start by assuming a project has zero net present value. In this case, the project returns enough cash flow to do three things:
1. To pay off all interest payments to creditors who have lent money to finance the project.
2. To pay all expected returns (dividends and capital gains) to shareholders who have put up equity for the project, and
3. To pay off the original principal, $I0$, which was invested in the project. Thus, a zero net present value project is one which earns a fair return to compensate both debt holders and equity holders, each according to the returns which they expect for the risk they take. A positive NPV project earns more than the required rate of return, and equity holders receive all excess cash flows because debt holders have a fixed claim on the firm. Consequently, equity holders' wealth increases by exactly the NPV of the project. It is this direct link between shareholders' wealth and the NPV definition which makes the net present value criterion so important in decision making.

4. Internal Rate of Return Method

The internal rate of return (IRR) is defined as the interest rate that equates the present value of the expected future cash flows, or receipts, to the initial cost outlay. The equation for calculating the internal rate of return is :

$$\frac{Cf_1}{(1+IRR)^1}+\frac{Cf_2}{(1+IRR)^2}+\ldots+\frac{Cf_n}{(1+IRR)^n}-Io=0$$

$$\sum_{t=1}^{n}\frac{CF_t}{(1+IRR)^t}-Io=0$$

Here we know the value of *Io* and also the values of CF1,CF2,.....CFn, but we do not know the value of IRR. Thus, we have an equation with one unknown, and we can solve for the value of IRR. Some value of IRR will cause the sum of the discounted receipts to equal the initial cost of the project, making the equation equal to zero, and that value of IRR is defined as the internal rate of return.

The internal rate of return may be found by trial and error. First, compute the present value of the cash flows from an investment, using an arbitrarily selected interest rate - for example, 10 percent. Then compare the present value so obtained with the investment's cost. If the present value is higher than the cost figure, try a higher interest rate and go through the procedure again. Conversely, if the present value is lower than the cost, lower the interest rate and repeat the process. Continue until the present value of the flows from the investment is approximately equal to its cost. The interest rate that brings about this equality is defined as the internal rate of return.

Table 2.2 shows computation for the IRR for Project D in Table 2.2 and Figure 2.6 graphs the relationship between the discount rate and the NPV of the project.

Table 2.2: IRR for Project D

Year	**Cash Flow**	**Pv@10%**		**PV@20%**		**PV@25%**		**PV@25.4%**	
0	-1,500	1.000	-1,500	1.000	-1,500	1.000	-1,500	1.000	-1,500
1	300	0.909	272.70	0.833	249.90	0.800	240.00	0.797	239.10
2	450	0.826	371.70	0.694	312.30	0.640	288.00	0.636	286.20
3	750	0.751	563.25	0.579	434.25	0.512	384.00	0.507	380.25
4	750	0.683	512.52	0.482	361.50	0.410	307.50	0.404	303.00
5	900	0.621	558.90	0.402	361.80	0.328	295.20	0.322	289.80
1650		**778.80**		**219.75**		**14.70**		**-1.65**	

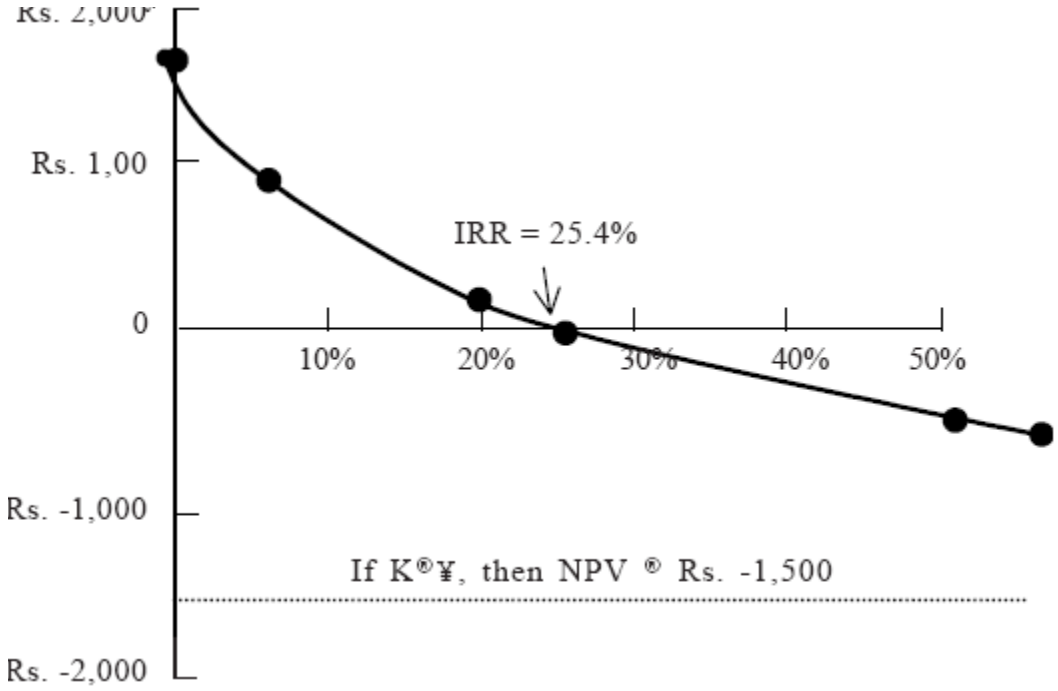

Figure 2.6: NPV of Project D at Different Discount Rate

In Figure 2.7 the NPV of Project D's cash flows decreases as the discount rate is increased. If the discount rate is zero, there is no time value of money and the NPV of a project is simply the sum of its cash flows. For Project D, the NPV equals Rs.1,650 when the discount rate is zero. At the opposite extreme, if the discount rate is infinite, then the future cash flows are valueless and the NPV of Project D is its current cash flow, –Rs.1,500. Somewhere between these two extremes is a discount rate which makes the NPV equal to zero. In Figure 5.1, we see that the IRR for Project D is 25.4 per cent. The IRR's for each of the four projects in Table 1 are given below.

Project A IRR = - 200%
Project B IRR = 20.9%
Project C IRR = 22.8%
Project D IRR = 25.4%

If we use the IRR criterion and the projects are independent, we accept any project which has an IRR greater than the opportunity cost of capital, which is 10 percent. Therefore, we would accept Projects B, C, and D. However, since these projects are mutually exclusive, the IRR rule leads us to accept Project D as best.

5. Profitability Index (PI)

Another method that is used to evaluate projects is the profitability index (PI), or the benefit/cost ratio, as it is sometimes called:
Present value methods had the merit of simplicity in as much as it helps the management in choosing the most profitable proposal. Further, while evaluating and ranking projects it focuses on one of the primary objectives of a firm, i.e., increasing value of the firm.

However, main drawback of this approach is that it does not take into consideration size of investment outlay and net cash benefits together while ranking projects. This may at times lead to faulty decisions.
Profitability Index (PI) method has come to be employed to overcome the above drawback and to ensure rational investment decision by establishing relationship between the present values of the net cash inflows and net investment outlay.
The equation to compute 'PI' of a project is :

$$PI = \frac{\text{PV benefits}}{\text{PV Costs}} = \frac{\sum_{t=0}^{n} \frac{CIF_t}{(I+K)^t}}{\sum_{t=0}^{n} \frac{COF_t}{(I+K)^t}}$$

Here CIF_t represents the expected cash inflows, or benefits, and COF_t represents the expected cash outflows, or costs. The PI shows the relative profitability of any project, or the present value of benefits per rupee costs.
The PI for Project C, based on a 10 percent cost of capital is:

Similarly:
Project A PI = 0.59
Project B PI = 1.51
Project D PI = 1.52

A project is acceptable if its PI is greater than 1.0, and the higher the PI, the higher the project ranking. Mathematically, the NPV, the IRR, and the PI methods must always reach the same accept/reject decisions for independent projects: If a project's NPV is positive, its IRR must exceed k and its PI must be greater than 1.0. However, NPV, IRR, and PI can give different rankings for pairs of projects. This can lead to conflicts between the three methods when mutually exclusive projects are being compared.

Numerical-2

1. Payback Period – Given the cash flows of the four projects, A, B, C, and D, and using the Payback Period decision model, which projects do you accept and which projects do you reject with a three year cut-off period for recapturing the initial cash outflow? Assume that the cash flows are equally distributed over the year for Payback Period calculations.

Projects	***A***	***B***	***C***	***D***
Cost	Rs10,000	Rs25,000	Rs45,000	Rs100,000
Cash Flow Year One	Rs4,000	Rs2,000	Rs10,000	Rs40,000
Cash Flow Year Two	Rs4,000	Rs8,000	Rs15,000	Rs30,000
Cash Flow Year Three	Rs4,000	Rs14,000	Rs20,000	Rs20,000
Cash Flow Year Four	Rs4,000	Rs20,000	Rs20,000	Rs10,000

Cash Flow year Five	Rs4,000	Rs26,000	Rs15,000	Rs0
Cash Flow Year Six	Rs4,000	Rs32,000	Rs10,000	Rs0

Solution

Project A: Year One: -Rs10,000 + Rs4,000 = Rs6,000 left to recover
Year Two: -Rs6,000 + Rs4,000 = Rs2,000 left to recover
Year Three: -Rs2,000 + Rs4,000 = fully recovered
Year Three: Rs2,000 / Rs4,000 = ½ year needed for recovery
Payback Period for Project A: 2 and ½ years, ACCEPT!

Project B: Year One: -Rs25,000 + Rs2,000 = Rs23,000 left to recover
Year Two: -Rs23,000 + Rs8,000 = Rs15,000 left to recover
Year Three: -Rs15,000 + Rs14,000 = Rs1,000 left to recover
Year Four: -Rs1,000 + Rs20,000 = fully recovered
Year Four: Rs1,000 / Rs20,000 = 1/20 year needed for recovery
Payback Period for Project B: 3 and 1/20 years, REJECT!

Project C: Year One: -Rs45,000 + Rs10,000 = Rs35,000 left to recover
Year Two: -Rs35,000 + Rs15,000 = Rs20,000 left to recover
Year Three: -Rs20,000 + Rs20,000 = fully recovered
Year Three: Rs20,000 / Rs20,000 = full year needed
Payback Period for Project B: 3 years, ACCEPT!

Project D: Year One: -Rs100,000 + Rs40,000 = Rs60,000 left to recover
Year Two: -Rs60,000 + Rs30,000 = Rs30,000 left to recover
Year Three: -Rs30,000 + Rs20,000 = Rs10,000 left to recover
Year Four: -Rs10,000 + Rs10,000 = fully recovered
Year Four: Rs10,000 / Rs10,000 = full year needed
Payback Period for Project B: 4 years, REJECT!

2. Payback Period – What are the Payback Periods of Projects E, F, G and H? Assume all cash flows are evenly spread throughout the year. If the cut-off period is three years, which projects do you accept?

Projects	***E***	***F***	***G***	***H***
Cost	Rs40,000	Rs250,000	Rs75,000	Rs100,000
Cash Flow Year One	Rs10,000	Rs40,000	Rs20,000	Rs30,000
Cash Flow Year Two	Rs10,000	Rs120,000	Rs35,000	Rs30,000
Cash Flow Year Three	Rs10,000	Rs200,000	Rs40,000	Rs30,000
Cash Flow Year Four	Rs10,000	Rs200,000	Rs40,000	Rs20,000
Cash Flow year Five	Rs10,000	Rs200,000	Rs35,000	Rs10,000
Cash Flow Year Six	Rs10,000	Rs200,000	Rs20,000	Rs0

Solution

Project E: Year One: -Rs40,000 + Rs10,000 = Rs30,000 left to recover
Year Two: -Rs30,000 + Rs10,000 = Rs20,000 left to recover
Year Three: -Rs20,000 + Rs10,000 = Rs10,000 left to recover
Year Four: -Rs10,000 + Rs10,000 = fully recovered
Year Four: Rs10,000 / Rs10,000 = full year needed
Payback Period for Project A: 4 years

Project F: Year One: -Rs250,000 + Rs40,000 = Rs210,000 left to recover
Year Two: -Rs210,000 + Rs120,000 = Rs90,000 left to recover
Year Three: -Rs90,000 + Rs200,000 = fully recovered
Year Three: Rs90,000 / Rs200,000 = 0.45 year needed
Payback Period for Project B: 2.45 years

Project G: Year One: -Rs75,000 + Rs20,000 = Rs55,000 left to recover
Year Two: -Rs55,000 + Rs35,000 = Rs20,000 left to recover
Year Three: -Rs20,000 + Rs40,000 = fully recovered
Year Three: Rs20,000 / Rs40,000 = 0.5 year needed
Payback Period for Project B: 2.5 years

Project H: Year One: -Rs100,000 + Rs30,000 = Rs70,000 left to recover
Year Two: -Rs70,000 + Rs30,000 = Rs40,000 left to recover
Year Three: -Rs40,000 + Rs30,000 = Rs10,000 left to recover
Year Four: -Rs10,000 + Rs20,000 = fully recovered
Year Four: Rs10,000 / Rs20,000 = 0.5 year needed
Payback Period for Project B: 3.5 years

With a three year cut-off period, ACCEPT F and G, REJECT E and H.

3. Discounted Payback Period – Given the following four projects and their cash flows, calculate the discounted payback period with a 5% discount rate, 10% discount rate, and 20% discount rate. What do you notice about the payback period as the discount rate rises? Explain this relationship.

Projects	***A***	***B***	***C***	***D***
Cost	Rs10,000	Rs25,000	Rs45,000	Rs100,000
Cash Flow Year One	Rs4,000	Rs2,000	Rs10,000	Rs40,000
Cash Flow Year Two	Rs4,000	Rs8,000	Rs15,000	Rs30,000
Cash Flow Year Three	Rs4,000	Rs14,000	Rs20,000	Rs20,000
Cash Flow Year Four	Rs4,000	Rs20,000	Rs20,000	Rs10,000
Cash Flow year Five	Rs4,000	Rs26,000	Rs15,000	Rs10,000
Cash Flow Year Six	Rs4,000	Rs32,000	Rs10,000	Rs0

Solution at 5% discount rate

Project A: PV Cash flow year one -- Rs4,000 / 1.05 = Rs3,809.52
PV Cash flow year two -- Rs4,000 / 1.05^2 = Rs3,628.12
PV Cash flow year three -- Rs4,000 / 1.05^3 = Rs3,455.35
PV Cash flow year four -- Rs4,000 / 1.05^4 = Rs3,290.81
PV Cash flow year five -- Rs4,000 / 1.05^5 = Rs3,134.10
PV Cash flow year six -- Rs4,000 / 1.05^6 = Rs2,984.86

Discounted Payback Period: -Rs10,000 + Rs3,809.52 + Rs3,628.12 + Rs3,455.35 = Rs892.99 and fully recovered

Discounted Payback Period is 3 years.

Project B: PV Cash flow year one -- Rs2,000 / 1.05 = Rs1,904.76
PV Cash flow year two -- Rs8,000 / 1.05^2 = Rs7,256.24
PV Cash flow year three -- Rs14,000 / 1.05^3 = Rs12,093.73
PV Cash flow year four -- Rs20,000 / 1.05^4 = Rs16,454.05
PV Cash flow year five -- Rs26,000 / 1.05^5 = Rs20,371.68
PV Cash flow year six -- Rs32,000 / 1.05^6 = Rs23,878.89

Discounted Payback Period: -Rs25,000 + Rs1,904.76 + Rs7,256.24 + Rs12,093.73 + Rs16,454.05 = Rs12,708.78 and fully recovered

Discounted Payback Period is 4 years.

Project C: PV Cash flow year one -- Rs10,000 / 1.05 = Rs9,523.81
PV Cash flow year two -- Rs15,000 / 1.05^2 = Rs13,605.44
PV Cash flow year three -- Rs20,000 / 1.05^3 = Rs17,276.75
PV Cash flow year four -- Rs20,000 / 1.05^4 = Rs16,454.05
PV Cash flow year five -- Rs15,000 / 1.05^5 = Rs11,752.89
PV Cash flow year six -- Rs10,000 / 1.05^6 = Rs7,462.15

Discounted Payback Period: -Rs45,000 + Rs9,523.81 + Rs13,605.44 + Rs17,276.75 + Rs16,454.05 = Rs11,860.05 and fully recovered

Discounted Payback Period is 4 years.

Project D: PV Cash flow year one -- Rs40,000 / 1.05 = Rs38,095.24
PV Cash flow year two -- Rs35,000 / 1.05^2 = Rs31,746.03
PV Cash flow year three -- Rs20,000 / 1.05^3 = Rs17,276.75
PV Cash flow year four -- Rs10,000 / 1.05^4 = Rs8,227.02
PV Cash flow year five -- Rs10,000 / 1.05^5 = Rs7,835.26
PV Cash flow year six -- Rs0 / 1.05^6 = Rs0

Discounted Payback Period: -Rs100,000 + Rs38,095.24 + Rs31,746.03 + Rs17,276.75 + Rs8,227.02 + Rs7,835.26 = Rs3,180.30 and fully recovered.

Discounted Payback Period is 5 years.

Solution at 10% discount rate

Project A: PV Cash flow year one -- Rs4,000 / 1.10 = Rs3,636.36

PV Cash flow year two -- Rs4,000 / 1.10^2 = Rs3,307.79
PV Cash flow year three -- Rs4,000 / 1.10^3 = Rs3,005.26
PV Cash flow year four -- Rs4,000 / 1.10^4 = Rs2,732.05
PV Cash flow year five -- Rs4,000 / 1.10^5 = Rs2,483.69
PV Cash flow year six -- Rs4,000 / 1.10^6 = Rs2,257.90

Discounted Payback Period: -Rs10,000 + Rs3,636.36 + Rs3,307.79 + Rs3,005.26 + Rs2,732.05 = Rs2,681.46 and fully recovered

Discounted Payback Period is 4 years.

Project B: PV Cash flow year one -- Rs2,000 / 1.10 = Rs1,818.18
PV Cash flow year two -- Rs8,000 / 1.10^2 = Rs6,611.57
PV Cash flow year three -- Rs14,000 / 1.10^3 = Rs10,518.41
PV Cash flow year four -- Rs20,000 / 1.10^4 = Rs13,660.27
PV Cash flow year five -- Rs26,000 / 1.10^5 = Rs16,143.95
PV Cash flow year six -- Rs32,000 / 1.10^6 = Rs18,063.17

Discounted Payback Period: -Rs25,000 + Rs1,818.18 + Rs6,611.57 + Rs10,518.41 + Rs13,660.27 = Rs7,608.43 and fully recovered

Discounted Payback Period is 4 years.

Project C: PV Cash flow year one -- Rs10,000 / 1.10 = Rs9,090.91
PV Cash flow year two -- Rs15,000 / 1.10^2 = Rs12,396.69
PV Cash flow year three -- Rs20,000 / 1.10^3 = Rs15,026.30
PV Cash flow year four -- Rs20,000 / 1.10^4 = Rs13,660.27
PV Cash flow year five -- Rs15,000 / 1.10^5 = Rs9,313.82
PV Cash flow year six -- Rs10,000 / 1.10^6 = Rs5,644.74

Discounted Payback Period: -Rs45,000 + Rs9,090.91 + Rs12,396.69 + Rs15,026.20 + Rs13,660.27 = Rs5174.07 and fully recovered

Discounted Payback Period is 4 years.

Project D: PV Cash flow year one -- Rs40,000 / 1.10 = Rs36,363.64
PV Cash flow year two -- Rs35,000 / 1.10^2 = Rs28,925.62
PV Cash flow year three -- Rs20,000 / 1.10^3 = Rs15,026.30
PV Cash flow year four -- Rs10,000 / 1.10^4 = Rs6,830.13
PV Cash flow year five -- Rs10,000 / 1.10^5 = Rs6,209.21
PV Cash flow year six -- Rs0 / 1.10^6 = Rs0

Discounted Payback Period: -Rs100,000 + Rs36,363.64 + Rs28,925.62 + Rs15,026.30 + Rs6,830.13 + Rs6,209.21 = -Rs6,645.10 and never recovered.

Initial cash outflow is never recovered.

Solution at 20% discount rate

Project A: PV Cash flow year one -- Rs4,000 / 1.20 = Rs3,333.33
PV Cash flow year two -- Rs4,000 / 1.20^2 = Rs2,777.78
PV Cash flow year three -- Rs4,000 / 1.20^3 = Rs2,314.81
PV Cash flow year four -- Rs4,000 / 1.20^4 = Rs1,929.01

PV Cash flow year five -- Rs4,000 / 1.20^5 = Rs1,6075.10

PV Cash flow year six -- Rs4,000 / 1.20^6 = Rs1,339.59

Discounted Payback Period: -Rs10,000 + Rs3,333.33 + Rs2,777.78 + Rs2,314.81+ Rs1,929.01 = Rs354.93 and fully recovered

Discounted Payback Period is 4 years.

Project B: PV Cash flow year one -- Rs2,000 / 1.20 = Rs1,666.67

PV Cash flow year two -- Rs8,000 / 1.20^2 = Rs5,555.56

PV Cash flow year three -- Rs14,000 / 1.20^3 = Rs8,101.85

PV Cash flow year four -- Rs20,000 / 1.20^4 = Rs9,645.06

PV Cash flow year five -- Rs26,000 / 1.20^5 = Rs10,448.82

PV Cash flow year six -- Rs32,000 / 1.20^6 = Rs10,716.74

Discounted Payback Period: -Rs25,000 + Rs1,666.67 + Rs5,555.56 + Rs8,101.85 + Rs9,645.06 + Rs10,448.82 = Rs10,417.96 and fully recovered

Discounted Payback Period is 5 years.

Project C: PV Cash flow year one -- Rs10,000 / 1.20 = Rs8,333.33

PV Cash flow year two -- Rs15,000 / 1.20^2 = Rs10,416.67

PV Cash flow year three -- Rs20,000 / 1.20^3 = Rs11,574.07

PV Cash flow year four -- Rs20,000 / 1.20^4 = Rs9,645.06

PV Cash flow year five -- Rs15,000 / 1.20^5 = Rs6,028.16

PV Cash flow year six -- Rs10,000 / 1.20^6 = Rs3,348.97

Discounted Payback Period: -Rs45,000 + Rs8,333.33 + Rs10,416.67 + Rs11,574.07 + Rs9,645.06 + Rs6,028.16 = Rs997.29 and fully recovered

Discounted Payback Period is 5 years.

Project D: PV Cash flow year one -- Rs40,000 / 1.20 = Rs33,333.33

PV Cash flow year two -- Rs35,000 / 1.20^2 = Rs24,305.56

PV Cash flow year three -- Rs20,000 / 1.20^3 = Rs11,574.07

PV Cash flow year four -- Rs10,000 / 1.20^4 = Rs4,822.53

PV Cash flow year five -- Rs10,000 / 1.20^5 = Rs4,018.78

PV Cash flow year six -- Rs0 / 1.20^6 = Rs0

Discounted Payback Period: -Rs100,000 + Rs33,333.33 + Rs24,305.56 + Rs11,574.07 + Rs4,822.53 + Rs4,018.78 = -Rs21,945.73 and initial cost is never recovered.

Discounted Payback Period is infinity.

As the discount rate increases, the Discounted Payback Period also increases. The reason is that the future dollars are worth less in present value as the discount rate increases requiring more future dollars to recover the present value of the outlay.

4. Discounted Payback Period – Graham Incorporated uses discounted payback period for projects under Rs25,000 and has a cut off period of 4 years for these small value projects. Two projects, R and S are under consideration. The anticipated cash flows for these two projects are listed below. If Graham Incorporated uses an 8% discount rate on these projects are they accepted or rejected? If they use 12% discount rate? If they use a 16% discount rate? Why is it necessary to only look at the first four years of the projects' cash flows?

Cash Flows	*Project R*	*Project S*
Initial Cost	Rs24,000	Rs18,000
Cash flow year one	Rs6,000	Rs9,000
Cash flow year two	Rs8,000	Rs6,000
Cash flow year three	Rs10,000	Rs6,000
Cash flow year four	Rs12,000	Rs3,000

Solution at 8%

Project R: PV Cash flow year one -- Rs6,000 / 1.08 = Rs5,555.56
PV Cash flow year two -- Rs8,000 / 1.08^2 = Rs6,858.71
PV Cash flow year three -- Rs10,000 / 1.08^3 = Rs7,938.32
PV Cash flow year four -- Rs12,000 / 1.08^4 = Rs8,820.36

Discounted Payback Period: -Rs24,000 + Rs5,555.56 + Rs6,858.71 + Rs7,938.32 + Rs8,820.36 = Rs5,172.95 and initial cost is in first four years, project accepted.

Project S: PV Cash flow year one -- Rs9,000 / 1.08 = Rs8,333.33
PV Cash flow year two -- Rs6,000 / 1.08^2 = Rs5,144.03
PV Cash flow year three -- Rs6,000 / 1.08^3 = Rs4,762.99
PV Cash flow year four -- Rs3,000 / 1.08^4 = Rs2,205.09

Discounted Payback Period: -Rs18,000 + Rs8,333.33 + Rs5,144.03 + Rs4,762.99 + Rs2,205.09 = Rs2,445.44 and initial cost is in first four years, project accepted.

Solution at 12%

Project R: PV Cash flow year one -- Rs6,000 / 1.12 = Rs5,357.14
PV Cash flow year two -- Rs8,000 / 1.12^2 = Rs6,377.55
PV Cash flow year three -- Rs10,000 / 1.12^3 = Rs8,541.36
PV Cash flow year four -- Rs12,000 / 1.12^4 = Rs7,626.22

Discounted Payback Period: -Rs24,000 + Rs5,357.14 + Rs6,377.55 + Rs8,541.36 + Rs7,626.22 = Rs3,902.27 and initial cost is in first four years, project accepted.

Project S: PV Cash flow year one -- Rs9,000 / 1.12 = Rs8,035.71
PV Cash flow year two -- Rs6,000 / 1.12^2 = Rs4,783.16
PV Cash flow year three -- Rs6,000 / 1.12^3 = Rs4,270.68
PV Cash flow year four -- Rs3,000 / 1.12^4 = Rs1,906.55

Discounted Payback Period: -Rs18,000 + Rs8,035.71 + Rs4,783.16 + Rs4,270.68 + Rs1,906.55 = Rs996.10 and initial cost is in first four years, project accepted.

Solution at 16%

Project R: PV Cash flow year one -- Rs6,000 / 1.16 = Rs5,172.41
PV Cash flow year two -- Rs8,000 / 1.16^2 = Rs5,945.30
PV Cash flow year three -- Rs10,000 / 1.16^3 = Rs6,406.58
PV Cash flow year four -- Rs12,000 / 1.16^4 = Rs6,627.49

Discounted Payback Period: -Rs24,000 + Rs5,172.41 + Rs5,945.30 + Rs6,406.58 + Rs6,627.49 = Rs151.78 and initial cost is in first four years, project accepted.

Project S: PV Cash flow year one -- Rs9,000 / 1.16 = Rs7,758.62
PV Cash flow year two -- Rs6,000 / 1.16^2 = Rs4,458.98
PV Cash flow year three -- Rs6,000 / 1.16^3 = Rs3,843.95
PV Cash flow year four -- Rs3,000 / 1.16^4 = Rs1,656.87

Discounted Payback Period: -Rs18,000 + Rs7,758.62 + Rs4,458.98 + Rs3,843.95 + Rs1,656.87 = -Rs251.58 and initial cost is not recovered in first four years, project rejected.

Because Graham Incorporated is using a four year cut-off period, only the first four years of cash flow matter. If the first four years of anticipated cash flows are insufficient to cover the initial outlay of cash, the project is rejected regardless of the cash flows in years five and forward.

5. Comparing Payback Period and Discounted Payback Period – Mathew Incorporated is debating using Payback Period versus Discounted Payback Period for small dollar projects. The Information Officer has submitted a new computer project of Rs15,000 cost. The cash flows will be Rs5,000 each year for the next five years. The cut-off period used by Mathew Incorporated is three years. The Information Officer states it doesn't matter what model the company uses for the decision, it is clearly an acceptable project. Demonstrate for the IO that the selection of the model does matter!

Solution

Calculate the Payback Period for the project:

Payback Period = -Rs15,000 + Rs5,000 + Rs5,000 + Rs5,000 = 0 so the payback period is 3 years and the project is a go!

Calculate the Discounted Payback Period for the project at any positive discount rate, say 1%...

Present Value of cash flow year one = Rs5,000 / 1.01 = Rs4,950.50

Present Value of cash flow year two = Rs5,000 / 1.01^2 = Rs4,901.48

Present Value of cash flow year three = Rs5,000 / 1.01^3 = Rs4,852.95

Discounted Payback Period = -Rs15,000 + Rs4,950.50 + Rs4,901.48 + Rs4,852.95 = -Rs295.04 so the payback period is over 3 years and the project is a no-go!

6. Comparing Payback Period and Discounted Payback Period – Neilsen Incorporated is switching from Payback Period to Discounted Payback Period for small dollar projects. The cut-

off period will remain at 3 years. Given the following four projects cash flows and using a 10% discount rate, which projects that would have been accepted under Payback Period will now be rejected under Discounted Payback Period?

Cash Flows	*Project One*	*Project Two*	*Project Three*	*Project Four*
Initial cost	Rs10,000	Rs15,000	Rs8,000	Rs18,000
Year One	Rs4,000	Rs7,000	Rs3,000	Rs10,000
Year Two	Rs4,000	Rs5,500	Rs3,500	Rs11,000
Year Three	Rs4,000	Rs4,000	Rs4,000	Rs0

Solution

Calculate the Discounted Payback Periods of each project at 10% discount rate:

Project One

Present Value of cash flow year one = Rs4,000 / 1.10 = Rs3,636.36

Present Value of cash flow year two = Rs4,000 / 1.10^2 = Rs3,305.78

Present Value of cash flow year three = Rs4,000 / 1.10^3 = Rs3,005.26

Discounted Payback Period = -Rs10,000 + Rs3,636.36 + Rs3,305.78 + Rs3,005.26 = -Rs52.60 so the discount payback period is over 3 years and the project is a no-go!

Project Two

Present Value of cash flow year one = Rs7,000 / 1.10 = Rs6,930.69

Present Value of cash flow year two = Rs5,500 / 1.10^2 = Rs5,391.63

Present Value of cash flow year three = Rs4,000 / 1.10^3 = Rs3,005.26

Discounted Payback Period = -Rs15,000 + Rs6,930.69 + Rs5,391.63 + Rs3,005.26 = Rs327.58 so the discount payback period is 3 years and the project is a go!

Project Three

Present Value of cash flow year one = Rs2,500 / 1.10 = Rs2,272.73

Present Value of cash flow year two = Rs3,000 / 1.10^2 = Rs2,479.34

Present Value of cash flow year three = Rs3,500 / 1.10^3 = Rs2,629.60

Discounted Payback Period = -Rs8,000 + Rs2,272.73+ Rs2,479.34 + Rs2,629.20 = -Rs618.33 so the discount payback period is over 3 years and the project is a no-go!

Project Four

Present Value of cash flow year one = Rs10,000 / 1.10 = Rs9,090.91

Present Value of cash flow year two = Rs11,000 / 1.10^2 = Rs9,090.91

Present Value of cash flow year three = Rs0 / 1.10^3 = Rs0

Discounted Payback Period = -Rs18,000 + Rs9,090.91 + Rs9,090.91 + Rs0 = Rs181.82 so the discount payback period is 3 years and the project is a go!

Projects one and three will now be rejected using discounted payback period with a discount rate of 10%.

7. Net Present Value – Swanson Industries has a project with the following projected cash flows:

Initial Cost, Year 0: Rs240,000

Cash flow year one: Rs25,000

Cash flow year two: Rs75,000

Cash flow year three: Rs150,000

Cash flow year four: Rs150,000

a. Using a 10% discount rate for this project and the NPV model should this project be accepted or rejected?

b. Using a 15% discount rate?

c. Using a 20% discount rate?

Solution

a. NPV = -Rs240,000 + Rs25,000/1.10 + Rs75,000/1.10^2 + Rs150,000/1.10^3 + Rs150,000/1.10^4

NPV = -Rs240,000 + Rs22,727.27 + Rs61,983.47 + Rs112,697.22 + Rs102,452.02

NPV = Rs59,859.98 and accept the project.

b. NPV = -Rs240,000 + Rs25,000/1.15 + Rs75,000/1.15^2 + Rs150,000/1.15^3 + Rs150,000/1.15^4

NPV = -Rs240,000 + Rs21,739.13 + Rs56,710.76 + Rs98,627.43 + Rs85,762.99

NPV = Rs22,840.31 and accept the project.

c. NPV = -Rs240,000 + Rs25,000/1.20 + Rs75,000/1.20^2 + Rs150,000/1.20^3 + Rs150,000/1.20^4

NPV = -Rs240,000 + Rs20,833.33 + Rs52,083.33 + Rs86,805.56 + Rs72,337.96

NPV = -Rs7,939.82 and reject the project.

8. Net Present Value – Campbell Industries has a project with the following projected cash flows:

Initial Cost, Year 0: Rs468,000

Cash flow year one: Rs135,000

Cash flow year two: Rs240,000

Cash flow year three: Rs185,000

Cash flow year four: Rs135,000

a. Using an 8% discount rate for this project and the NPV model should this project be accepted or rejected?

b. Using a 14% discount rate?

c. Using a 20% discount rate?

Solution

a. NPV = -Rs468,000 + Rs135,000/1.08 + Rs240,000/1.08^2 + Rs185,000/1.08^3 + Rs135,000/1.08^4

NPV = -Rs468,000 + Rs125,000.00 + Rs205,761.32 + Rs146,858.96 + Rs99,229.03

NPV = Rs108,849.31 and accept the project.

b. NPV = -Rs468,000 + Rs135,000/1.14 + Rs240,000/1.14^2 + Rs185,000/1.14^3 + Rs135,000/1.14^4

NPV = -Rs468,000 + Rs118,421.05 + Rs184,672.21 + Rs124,869.73 + Rs79,930.84

NPV = Rs39,893.83 and accept the project.

c. NPV = -Rs468,000 + Rs135,000/1.20 + Rs240,000/1.20^2 + Rs185,000/1.20^3 + Rs135,000/1.20^4

NPV = -Rs468,000 + Rs112,500.00 + Rs166,666.67 + Rs107,060.19 + Rs65,104.17

NPV = -Rs16,668.97 and reject the project.

9. Net Present Value – Swanson Industries has four potential projects all with an initial cost of Rs2,000,000. The capital budget for the year will only allow Swanson industries to accept one of the four projects. Given the discount rates and the future cash flows of each project, which project should they accept?

Cash Flows	*Project M*	*Project N*	*Project O*	*Project P*
Year one	Rs500,000	Rs600,000	Rs1,000,000	Rs300,000
Year two	Rs500,000	Rs600,000	Rs800,000	Rs500,000
Year three	Rs500,000	Rs600,000	Rs600,000	Rs700,000
Year four	Rs500,000	Rs600,000	Rs400,000	Rs900,000
Year five	Rs500,000	Rs600,000	Rs200,000	Rs1,100,000
Discount Rate	6%	9%	15%	22%

Solution, find the NPV of each project and compare the NPVs.

Project M's NPV = -Rs2,000,000 + Rs500,000/1.05 + Rs500,000/1.05^2 + Rs500,000/1.05^3 + Rs500,000/1.05^4 + Rs500,000/1.05^5

Project M's NPV = -Rs2,000,000 + Rs476,190.48 + Rs453,514.74 + Rs431,918.80 + Rs411,351.24 + Rs391,763.08

Project N's NPV = Rs164,738.34

Project N's NPV = -Rs2,000,000 + Rs600,000/1.09 + Rs600,000/1.09^2 + Rs600,000/1.09^3 + Rs600,000/1.09^4 + Rs600,000/1.09^5

Project N's NPV = -Rs2,000,000 + Rs550,458.72 + Rs505,008.00 + Rs463,331.09 + Rs425,055.13 + Rs389,958.83

Project N's NPV = Rs333,790.77

Project O's NPV = -Rs2,000,000 + Rs1,000,000/1.15 + Rs800,000/1.15^2 + Rs600,000/1.15^3 + Rs400,000/1.15^4 + Rs200,000/1.15^5

Project O's NPV = -Rs2,000,000 + Rs869,565.22 + Rs604,914.93 + Rs394,509.74 + Rs228,701.30 + Rs99,435.34

Project O's NPV = Rs197,126.53

Project P's NPV = -Rs2,000,000 + Rs300,000/1.22 + Rs500,000/1.22^2 + Rs700,000/1.22^3 + Rs900,000/1.22^4 + Rs1,100,000/1.22^5

Project P's NPV = -Rs2,000,000 + Rs245,901.64 + Rs335,931.20 + Rs385,494.82 + Rs406,259.18 + Rs406,999.18

Project P's NPV =-Rs219,413.98 (would reject project regardless of budget)

And the ranking order based on NPVs is,

Project N – NPV of Rs333,790.77
Project O – NPV of Rs197,126.53
Project M – NPV of Rs164,738.34
Project P – NPV of -Rs219,413.98

Swanson Industries should pick Project N.

10. Net Present Value – Campbell Industries has four potential projects all with an initial cost of Rs1,500,000. The capital budget for the year will only allow Swanson industries to accept one of the four projects. Given the discount rates and the future cash flows of each project, which project should they accept?

Cash Flows	*Project Q*	*Project R*	*Project S*	*Project T*
Year one	Rs350,000	Rs400,000	Rs700,000	Rs200,000
Year two	Rs350,000	Rs400,000	Rs600,000	Rs400,000
Year three	Rs350,000	Rs400,000	Rs500,000	Rs600,000
Year four	Rs350,000	Rs400,000	Rs400,000	Rs800,000
Year five	Rs350,000	Rs400,000	Rs300,000	Rs1,000,000
Discount Rate	4%	8%	13%	18%

Solution, find the NPV of each project and compare the NPVs.

Project Q's NPV = -Rs1,500,000 + Rs350,000/1.04 + Rs350,000/1.04^2 + Rs350,000/1.04^3 + Rs350,000/1.04^4 + Rs350,000/1.04^5

Project Q's NPV = -Rs1,500,000 + Rs336,538.46 + Rs323,594.67 + Rs311,148.73 + Rs299,181.47 + Rs287,674.49

Project Q's NPV = Rs58,137.84

Project R's NPV = -Rs1,500,000 + Rs400,000/1.08 + Rs400,000/1.08^2 + Rs400,000/1.08^3 + Rs400,000/1.08^4 + Rs400,000/1.08^5

Project R's NPV = -Rs2,000,000 + Rs370,370.37 + Rs342,935.53 + Rs317,532.90 + Rs294,011.94 + Rs272,233.28

Project R's NPV = Rs97,084.02

Project S's NPV = -Rs1,500,000 + Rs700,000/1.13 + Rs600,000/1.13^2 + Rs500,000/1.13^3 + Rs400,000/1.13^4 + Rs300,000/1.13^5

Project S's NPV = -Rs1,500,000 + Rs619,469.03 + Rs469,888.01 + Rs346,525.08 + Rs245,327.49 + Rs162,827.98

Project S's NPV = Rs344,037.59

Project T's NPV = -Rs1,500,000 + Rs200,000/1.18 + Rs400,000/1.18^2 + Rs600,000/1.18^3 + Rs800,000/1.18^4 + Rs1,000,000/1.18^5

Project T's NPV = -Rs1,500,000 + Rs169,491.53 + Rs287,273.77 + Rs365,178.52 + Rs412,631.10 + Rs437,109.22

Project T's NPV = Rs171,684.14

And the ranking order based on NPVs is,

Project S – NPV of Rs344,037.59
Project T – NPV of Rs171,684.14
Project R – NPV of Rs97,084.02
Project Q – NPV of Rs58,137.84

Campbell Industries should pick Project S.

11. Internal Rate of Return – What are the IRRs of the four projects for Swanson Industries in problem #9?

Solution, this is an iterative process but can be solved quickly on a calculator or spreadsheet.

Enter the keys noted for each project in the CF of a Texas BA II Plus calculator

Cash Flows	*Project M*	*Project N*	*Project O*	*Project P*
CFO	-Rs2,000,000	-Rs2,000,000	-Rs2,000,000	-Rs2,000,000
CO1, F1	Rs500,000, 1	Rs600,000, 1	Rs1,000,000, 1	Rs300,000, 1
CO2, F2	Rs500,000, 1	Rs600,000, 1	Rs800,000, 1	Rs500,000, 1
Year three	Rs500,000, 1	Rs600,000, 1	Rs600,000, 1	Rs700,000, 1
Year four	Rs500,000, 1	Rs600,000, 1	Rs400,000, 1	Rs900,000, 1
Year five	Rs500,000, 1	Rs600,000, 1	Rs200,000, 1	Rs1,100,000, 1
CPT IRR	7.93%	15.24%	20.27%	17.72%

12. Internal Rate of Return -- Internal Rate of Return – What are the IRRs of the four projects for Campbell Industries in problem #10?

Solution, this is an iterative process but can be solved quickly on a calculator or spreadsheet.

Enter the keys noted for each project in the CF of a Texas BA II Plus calculator

Cash Flows	*Project Q*	*Project R*	*Project S*	*Project T*
CFO	-Rs1,500,000	-Rs1,500,000	-Rs1,500,000	-Rs1,500,000
CO1, F1	Rs350,000, 1	Rs400,000, 1	Rs700,000, 1	Rs200,000, 1
CO2, F2	Rs350,000, 1	Rs400,000, 1	Rs600,000, 1	Rs400,000, 1
Year three	Rs350,000, 1	Rs400,000, 1	Rs500,000,1	Rs600,000, 1
Year four	Rs350,000, 1	Rs400,000, 1	Rs400,000, 1	Rs800,000, 1
Year five	Rs350,000, 1	Rs400,000, 1	Rs300,000, 1	Rs1,000,000, 1
CPT IRR	5.37%	10.42%	23.57%	21.86%

13. Comparing NPV and IRR – Chandler and Joey were having a discussion about which financial model to use for their new business. Chandler supports NPV and Joey supports IRR. The discussion starts to get heated when Ross steps in and states, “gentlemen, it doesn’t matter which method we choose, they give the same answer on all projects.” Is Ross right? Under what conditions will IRR and NPV be consistent when accepting or rejecting projects?

Solution: Ross is partially right as NPV and IRR both reject or both accept the same projects under the following conditions:

- The projects have standard cash flows
- The hurdle rate for IRR is the same as the discount rate for NPV
- All projects are available for acceptance regardless of the decision made on another project (projects are not mutually exclusive)

14. Comparing NPR and IRR – Monica and Rachel are having a discussion about IRR and NPV as a decision model for Monica's new restaurant. Monica wants to use IRR because it gives a very simple and intuitive answer. Rachel states that there can be errors made with IRR that are not made with NPV. Is Rachel right? Show one type of error can be made with IRR and not with NPV?

Solution: The most typical example here is with two mutually exclusive projects where the IRR of one project is higher than the IRR of the other project but the NPV of the second project is higher than the NPV of the first project. When comparing two projects using only IRR this method fails to account for the level of risk of the project cash flows. When the discount rate is below the cross-over rate one project is better under NPV while the other project is better if the discount rate is above the cross-over rate and still below the IRR.

15. Profitability Index -- Given the discount rates and the future cash flows of each project, which projects should they accept using profitability index?

Cash Flows	*Project U*	*Project V*	*Project W*	*Project X*
Year zero	-Rs2,000,000	-Rs2,500,000	-Rs2,400,000	-Rs1,750,000
Year one	Rs500,000	Rs600,000	Rs1,000,000	Rs300,000
Year two	Rs500,000	Rs600,000	Rs800,000	Rs500,000
Year three	Rs500,000	Rs600,000	Rs600,000	Rs700,000
Year four	Rs500,000	Rs600,000	Rs400,000	Rs900,000
Year five	Rs500,000	Rs600,000	Rs200,000	Rs1,100,000
Discount Rate	6%	9%	15%	22%

Solution, find the present value of benefits and divide by the present value of the costs for each project.

Project U's PV Benefits = Rs500,000/1.05 + Rs500,000/1.05^2 + Rs500,000/1.05^3 + Rs500,000/1.05^4 + Rs500,000/1.05^5

Project U's PV Benefits = Rs476,190.48 + Rs453,514.74 + Rs431,918.80 + Rs411,351.24 + Rs391,763.08 = Rs2,164,738.34

Project U's PV Costs = Rs2,000,000

Project U's PI = Rs2,164,738.34 / Rs2,000,000 = Rs1.0824 accept project.

Project V's PV Benefits = Rs600,000/1.09 + Rs600,000/1.09^2 + Rs600,000/1.09^3 + Rs600,000/1.09^4 + Rs600,000/1.09^5

Project V's PV Benefits = -Rs2,000,000 + Rs550,458.72 + Rs505,008.00 + Rs463,331.09 + Rs425,055.13 + Rs389,958.83 = Rs2,333,790.77

Project V's PV Costs = Rs2,500,000

Project V's PI = Rs2,333,790.77 / Rs 2,500,000 = 0.9335 and reject project.

Project W's PV Benefits = Rs1,000,000/1.15 + Rs800,000/1.15^2 + Rs600,000/1.15^3 + Rs400,000/1.15^4 + Rs200,000/1.15^5

Project W's PV Benefits = Rs869,565.22 + Rs604,914.93 + Rs394,509.74 + Rs228,701.30 + Rs99,435.34 = Rs2,197,126.53

Project W's PV Costs = Rs2,400,000

Project W's PI = Rs2,197,126.53 / Rs2,400,000 = 0.9155 and reject project.

Project X's PV Benefits= -Rs2,000,000 + Rs300,000/1.22 + Rs500,000/1.22^2 + Rs700,000/1.22^3 + Rs900,000/1.22^4 + Rs1,100,000/1.22^5

Project X's PV Benefits= -Rs2,000,000 + Rs245,901.64 + Rs335,931.20 + Rs385,494.82 + Rs406,259.18 + Rs406,999.18 = Rs1,780,586.02

Project X's PV Cost = Rs1,750,000

Project X's PI = Rs1,780,586.02 / Rs1,750,000 = 1.0175 and accept project.

16. Profitability Index -- Given the discount rates and the future cash flows of each project, which projects should they accept using profitability index?

Cash Flows	*Project A*	*Project B*	*Project C*	*Project D*
Year zero	-Rs1,500,000	-Rs1,500,000	-Rs2,000,000	-Rs2,000,000
Year one	Rs350,000	Rs400,000	Rs700,000	Rs200,000
Year two	Rs350,000	Rs400,000	Rs600,000	Rs400,000
Year three	Rs350,000	Rs400,000	Rs500,000	Rs600,000
Year four	Rs350,000	Rs400,000	Rs400,000	Rs800,000
Year five	Rs350,000	Rs400,000	Rs300,000	Rs1,000,000
Discount Rate	4%	8%	13%	18%

Solution, find the present value of benefits and divide by the present value of the costs for each project.

Project A's PV Benefits = Rs350,000/1.04 + Rs350,000/1.04^2 + Rs350,000/1.04^3 + Rs350,000/1.04^4 + Rs350,000/1.04^5

Project A's PV Benefits = Rs336,538.46 + Rs323,594.67 + Rs311,148.73 + Rs299,181.47 + Rs287,674.49 = Rs1,558,137.84

Project A's PV Costs = Rs1,500,000

Project A's PI = Rs1,558,137.84 / Rs1,500,000 = 1.0388 and accept project.

Project B's PV Benefits = Rs400,000/1.08 + Rs400,000/1.08^2 + Rs400,000/1.08^3 + Rs400,000/1.08^4 + Rs400,000/1.08^5

Project B's NPV = -Rs2,000,000 + Rs370,370.37 + Rs342,935.53 + Rs317,532.90 + Rs294,011.94 + Rs272,233.28 = Rs1,597,084.02

Project B's PV Costs = Rs1,500,000

Project B's PI = Rs1,597,084.02 / Rs1,500,000 = 1.0647 and accept project.

Project C's PV Benefits = Rs700,000/1.13 + Rs600,000/1.13^2 + Rs500,000/1.13^3 + Rs400,000/1.13^4 + Rs300,000/1.13^5

Project C's PV Benefits = Rs619,469.03 + Rs469,888.01 + Rs346,525.08 + Rs245,327.49 + Rs162,827.98 = Rs1,844,037.59

Project C's PV Costs = Rs2,000,000

Project C's PI = Rs1,844,037.59 / Rs2,000,000 = 0.9220 and reject project.

Project D's PV Benefits = Rs200,000/1.18 + Rs400,000/1.18^2 + Rs600,000/1.18^3 + Rs800,000/1.18^4 + Rs1,000,000/1.18^5

Project D's PV Benefits = Rs169,491.53 + Rs287,273.77 + Rs365,178.52 + Rs412,631.10 + Rs437,109.22 = Rs1,671,684.14

Project D's PV Costs = Rs2,000,000

Project D's PI = Rs1,671,684.14 / Rs2,000,000 = 0.8358 and reject project.

17. Comparing All Methods -- Given the following After Tax Cash Flows for Tyler's Tinkering Toys on a new toy find the Payback Period, NPV, and Profitability Index of this project. The appropriate discount rate for the project is 12%. If the cut-off period is six years for major projects, determine if the project is accepted or rejected under the four different decision models.

Year 0 cash outflow: Rs10,400,000

Years 1 to 4 cash inflow: Rs2,600,000 each year

Year 5 cash outflow: Rs1,200,000

Years 6 – 8 cash inflow: Rs750,000 each year

Solution:

Payback Period: -Rs10,400,000 + Rs2,600,000 + Rs2,600,000 + Rs2,600,000 + Rs2,600,000 = Rs0 (Four years but year five is also an outflow so we need to continue) - Rs1,200,000 + Rs7,500,000 + Rs7,500,000 = Rs300,000 so we only need part of year seven, Rs4,500,000 / Rs7,500,000 = 0.6 so total Payback is 7.6 years and project is rejected with six year cut-off.

Net Present Value: -Rs10,400,000 + Rs2,600,000/1.12 + Rs2,600,000/1.12^2 + Rs2,600,000/1.12^3 + Rs2,600,000/1.12^4 - Rs1,200,000/1.12^5 + Rs7,500,000/1.12^6 + Rs7,500,000/1.12^7 + Rs750,000/1.12^8

NPV = -Rs10,400,000 + Rs2,321,428.57 + Rs2,072,704.08 + Rs1,850,628.64 + Rs1,652,347.00 - Rs680,912.23 + Rs379,973.34 + Rs339,261.91 + Rs302,912.42

NPV = -Rs2,161,656.25 and reject project under NPV rules.

Present Value of Benefits = Rs2,600,000/1.12 + Rs2,600,000/1.12^2 + Rs2,600,000/1.12^3 + Rs2,600,000/1.12^4 - + Rs7,500,000/1.12^6 + Rs7,500,000/1.12^7 + Rs750,000/1.12^8 =

Rs2,321,428.57 + Rs2,072,704.08 + Rs1,850,628.64 + Rs1,652,347.00 + Rs379,973.34 + Rs339,261.91 + Rs302,912.42 = Rs8,919,255.73

Present Value of Costs: Rs10,400,000 + Rs1,200,000/1.12^5 = Rs10,400,000 + Rs680,912.23 = Rs11,080,912.23

Profitability Index = Rs 8,919,255.73 / Rs11,080,912.23 = 0.8049 and reject.

18. Comparing All Methods -- Tom's Risky Business is looking at a project with the estimated cash flows as follows:

Initial Investment at start of project: Rs 3,600,000

Cash Flow at end of Year 1: Rs 500,000

Cash Flow at end of Years 2 through 6: Rs 625,000 each year

Cash Flow at end of Year 7 through 9: Rs 530,000 each year

Cash Flow at end of Year 10: Rs 385,000

Risky Business wants to know the Payback Period, NPV, and Profitability Index of this project. The appropriate discount rate for the project is 14%. If the cut-off period is six years for major projects, determine if the project is accepted or rejected under the four different decision models.

Solution:

Payback Period = -Rs3,600,000 + Rs500,000 + Rs625,000 + Rs625,000 + Rs625,000 + Rs625,000 + Rs625,000 = Rs 25,000 and we only need part of year 6 so,

Rs600,000 / Rs625,000 = 0.96 and Payback Period is 5.96 years and project is accepted.

NPV = -Rs3,600,000 + Rs500,000 / 1.14 + Rs625,000/1.14^2 + Rs625,000/1.14^3 + Rs625,000/1.14^4 + Rs625,000/1.14^5 + Rs625,000/1.14^6 + Rs530,000/1.14^7 + Rs530,000 /1.14^8 + Rs530,000/1.14^9 + Rs385,000/1.14^{10}

NPV = -Rs 3,600,000 + Rs 438,596.49 + Rs 480,917.21 + Rs421,857.20 + Rs370,050.17 + Rs 324,605.42 + Rs 284,741.59 + Rs 211,807.78 + Rs 185,796.30 + Rs162,979.21 + Rs103,851.37 = -Rs614,797.27 and project is rejected using NPV rules.

Present Value of Benefits = Rs 500,000 / 1.14 + Rs625,000/1.14^2 + Rs625,000/1.14^3 + Rs625,000/1.14^4 + Rs625,000/1.14^5 + Rs625,000/1.14^6 + Rs530,000/1.14^7 + Rs530,000 /1.14^8 + Rs530,000/1.14^9 + Rs385,000/1.14^{10}

Present Value of Benefits = Rs438,596.49 + Rs480,917.21 + Rs421,857.20 + Rs370,050.17 + Rs324,605.42 + Rs284,741.59 + Rs211,807.78 + Rs185,796.30 + Rs162,979.21+ Rs103,851.37 = Rs2,985,202.73

Present Value of Costs: Rs3,600,000

Profitability Index = Rs2,985,202.73 / Rs3,600,000 = 0.8292 and reject.

19**.** A project requires an initial investment of Rs.3,25,000 and is expected to generate the following net cash inflows:

year	1	2	3	4
Cash inflow after tax	Rs.1,95,000	Rs.1,80,000	Rs.1,60,000	Rs.1,55,000

Compute net present value (NPV) of the project if the minimum desired rate of return is 15%.

Sol. The cash inflow generated by the project is uneven. Therefore, the present value would be computed for each year separately:
Present value (PV) factor for year 1= $1/(1+0.15)=0.86956$
Present value (PV) factor for year 2= $1/(1+0.15)^2=0.75614$
Present value (PV) factor for year 3= $1/(1+0.15)^3=0.657516$
Present value (PV) factor for year 4= $1/(1+0.15)^4=0.57175$

Year	**Present Value Factor for years**	**Net Cash Inflow**	**Present Value of Cash Inflow**
1	0.86956	1,95,000	1,69,564.2
2	0.75614	1,80,000	1,36,105.2
3	0.657516	1,60,000	1,05,202.56
4	0.57175	1,55,000	88,621.25
Total			**4,99,493.21**
Initial Investment required			**3,25,000**
Net Present Value of Project		(499493.21-325000 = **Rs. 1,74,493.21**)	

Question 10:-Assume there are two projects that a company is reviewing and investing Rs.7000 is not a problem to the company provided its gets the required return. Management must decide whether to move forward with one, none or both of the projects. The cash flow (Rs.) patterns for each project are as follows:
Using internal rate of return (IRR) determine which project the company should accept if the cost of capital of company is 10%.
Sol.

	Cash Flows after tax	
Years	**Project A**	**Project B**
Initial cost of project	5000	2000
CF 1	1700	400
CF 2	1900	700
CF 3	1600	500
CF 4	1500	400
CF 5	700	300

The IRR for each project must be calculated. This is through an iterative process, solving for IRR in the following equation:
You can use the following formula to calculate IRR:

$0 = P_0 + P_1/(1+IRR)^1 + P_2/(1+IRR)^2 + P_3/(1+IRR)^3 + \ldots + P_n/(1+IRR)^n$

where $P_0, P_1, \ldots P_n$ equals the cash flows in periods 1, 2, . . . n, respectively; and
IRR equals the project's internal rate of return.

For **Project A**:-
$1700/(1+i)^1 + 1900/(1+i)^2 + 1600/(1+i)^3 + 1500/(1+i)^4 + 700/(1+i)^5 - 5000 = 0$
On solving we get,
Internal rate of return (IRR) ,i = 16.61%

For **Project B**:-
$400/(1+i)^1 + 700/(1+i)^2 + 500/(1+i)^3 + 400/(1+i)^4 + 300/(1+i)^5 - 2000 = 0$
On solving we get,
Internal rate of return (IRR) ,i = 5.23%

If the company's cost of capital is 10%, management should proceed with Project A and reject Project B.

Module-2 Initiating Projects **(Question Bank)**

1. What are the contents of a Project Charter? Who prepares and authorizes the Project Charter?
2. What are the numeric and non numeric models of project selection?
3. Explain aggregate project plan used in project portfolio process.
4. Why project manager's role is more of a facilitator rather than a supervisor?
