The financial appraisal of the business plan is a step ahead in the project management by making the choice of financial decisions with the constraints of time and costs.

**IS THE PROJECT FEASIBLE?**

Managers frequently have to make decisions on whether or not to authorize investment in a project, or they might be asked to decide between two or more different project options. Depending on the type of project under consideration, their final decision will depend on many factors, including answers to questions like the following:

- Is the project feasible technically?
- Are we confident that the claims of the engineers, designers, consultants or architects are valid?
- What are the environmental implications?
- What are the implications, if any, for our staff?
- For a new consumer product development, can we produce it, will people like it, how many can we sell and at what price?
- Is the project likely to be finished on time?
- How much will it all cost?
- For machinery or process plant, what are the expected operating costs?
- Will the proposed new plant produce as much output as the experts claim?
- What is the expected operational life of the new machinery?
- Is there no better project strategy than the one proposed?
- What are the technical risks?
- What are the commercial risks?
- Is the return on our investment going to be adequate?
- How can we raise the investment money?

It is sometimes necessary to commission one or more feasibility studies from independent experts to answer many of these questions. A feasibility study might examine more than one possible project strategy in depth.

For example, a project to develop a copper mine in an undeveloped region can be approached from a number of strategic standpoints. Many geological, environmental, political and economic factors must be considered for each of a number of different case options. Should the ore be mined, given some treatment to concentrate the copper, and then be shipped a great distance to an existing smelter and refinery? Or should a smelter and refinery be built at the new mine location? A feasibility study for any new project could, therefore, examine several different strategic options in considerable depth.

Experts' reports can be open to doubt or give rise to further questions but a feasibility report will usually be required as part of the business case to be considered by the potential owner or fund provider for a very large project. Whatever the circumstances, a careful appraisal of the expected financial outcome is likely to have great influence on most project authorization decisions.

**DIFFERENT VIEWING PLATFORMS FOR THE PROJECT INVESTOR AND THE PROJECT CONTRACTOR**

Most projects involve at least two different principal organizations, each on one side of a contract. On the one hand there is the organization that perceives a need for the project and then finds the motivation and the money that allows it to happen. On the other side of the contract is the organization hired to undertake the work (the contractor). These two principal participants can be found in almost every project, although their identities are often shrouded in organizational complexities. For example, in IT and management...
change projects the customer and main contractor often reside within the same company or group of
companies. Also, many projects have several small contractors rather than one main contractor.
This article, therefore, examines the comparisons of expenditure and resulting benefits as they might be
viewed by the customer and the contractor. The relationships between the timing of payments and the
resulting revenues or benefits are quite different for these two parties.
In a typical project the project owner must find all the funds and cannot usually expect any benefits until
after the project has been completed. The project contractor, on the other hand, can expect to receive
interim payments (known as progress payments or stage payments) from the project owner, in accordance
with the amount of work that can be certified as being successfully completed. Thus, the project contractor
does not usually have to fund the whole cost of the project up to completion and handover. The following
case example illustrates these points.

Relevance of project financial appraisal to the potential investor
Most projects requiring considerable financial investment will involve more uncertainty and risk than the
luxury service apartments project just described. In many such projects, some or all of the capital invested
might be lost in the event of project failure. This increased project risk must often be compensated for in
higher expected benefits, and most projects will need an in-depth financial appraisal before they can be
authorized.

Management change and IT systems projects are particularly prone to failure and the costs of such
failures can be considerable. There are many examples of high-profile public projects that have, to say the
least, not provided their expected benefits on time and within budget. Statistics show that past management
change and (especially) public sector IT projects have included more failures than successes. Think what a
project of this kind (involving high capital expenditure in IT systems and in massive staff reorganization and
retraining) would mean for the project investor if it failed. Here are some points to ponder:
• None of the money invested in the failed IT software and systems design will be recoverable.
• IT hardware is not best known as an investment proposition, and depreciates so rapidly that it
becomes obsolete and worthless in a matter of a year or two, if not worse.
• Staff who have been affected by the failed project, some of whom might have resisted the proposed
changes, will be demotivated, demoralized.
• Far from achieving the expected benefits, the failed project will have damaged the organization’s
performance, prestige and prospects.
• Customers will suffer reduced or interrupted service.

Competent financial appraisal can go a long way towards preventing project failure. Several methods
are available to the prospective project investor and case examples follow to demonstrate some of these
financial appraisal methods. These will be viewed through the eyes of the project investor, but the viewpoint
of the project contractor will be revisited in the last sections of this chapter.

INTRODUCTION TO PROJECT FINANCIAL APPRAISAL METHODS
There are two common approaches to financial appraisal. One is the simple payback method and the other
uses one of a range of techniques based on discounting the forecast cash flows. Whichever of these
methods is chosen, the appraiser needs to have a good estimate of the amount and timing of each
significant item of expenditure (the cash outflows) and of the revenue or savings expected (the cash
inflows).
The main cash outflow elements of a project can include items such as the following:
• the initial acquisition cost of software, plant or equipment needed for the project (this might be
a single purchase payment, a series of phased payments, or payments scheduled against a
leasing or rental plan; the differences between these options are important not only for the
timing of payments, but also for the tax implications);
• interest payable on financing loans;
• if the project is for new machinery or plant, the costs of operating and maintenance;
• commissioning, debugging and other implementation costs;
• staff or operator training costs;
• all other expenses and fees payable as a result of the new project.

Against these items of expenditure must be balanced all the savings and revenues (the project
benefits) that the new project is expected to generate. The following items are just a few of the many
possibilities:
• savings in operating and maintenance costs achieved by replacing old methods with the new project
• revenue from the sale of products or services made possible by the new project;
• proceeds from the sale of assets no longer required as a result of the new project;

Fiscal measures can have a significant effect on the outcome. Many cash inflows will attract taxes, while some expenditure might be offset by allowances against taxation. Some capital investment projects might generate cash inflows in the form of government grants or special tax incentives and allowances. These circumstances vary considerably from place to place and from one country to another. They can complicate financial appraisal calculations considerably and are best handled by experts.

SIMPLE PAYBACK METHOD

Simple payback is the appraisal method familiar to most managers. It seeks to answer the blunt question ‘How long would this project take to pay for itself?’ The method compares the predicted cash outflows and inflows relating to a new investment option against those of an alternative option (which in many cases means comparing the relative merits of proceeding with a project against the option of doing nothing). Costs and income or savings are analyzed over consecutive periods (typically years) until a point is reached where the forecast cumulative costs of the new project are balanced (paid back) by the cash inflows that the project is expected to generate.

Computation of payback period: The payback period can be calculated in two different situations:

(a) When annual inflows are equal:

When the cash inflows being generated by a proposal are equal per time period i.e. the cash inflows are in the form of an annuity, the payback period can be computed by diving the cash outflow by the amount of annuity. For example, a proposal requires a cash outflow of Rs 1,00,000/- and is expected to generate cash inflows of Rs 20,000/- p.a. for 6 years. In this case, the payback period is 5 years i.e. Rs. 1,00,000 / Rs 20,000. The initial cash outflow of Rs 1,00,000/- will be fully recovered within a period of 5 years and the cash inflows occurring thereafter (i.e., in the 6th year) are ignored. In the above case, if the annual cash inflows are Rs 30,000 then the payback period lies between 3 years and 4 years and is 3.33 years i.e. Rs 1,00,000 / Rs 30,000.

(b) When the annual cash inflows are unequal:

In case the cash inflows from the proposal are not in annuity form then the cumulative cash inflows are used to compute the payback period. For example, a proposal requires a cash outflow of Rs 20,000/- and is expected to generate cash inflows of Rs. 8,000/-, Rs 6,000/-, Rs 4,000/-, Rs 2,000/- and Rs 2,000/- over next 5 years respectively. The payback period is 4 years because the sum of cash inflows of first 4 years is Rs 20,000/- (i.e. Rs 8,000 + Rs 6,000/- + Rs 4,000 + Rs 2,000). A measurement problem may occur when the cumulative cash inflows do not exactly equality to proposal’s cash outflow. In the same case if the cash outflow is only Rs. 18,500 then the payback period may be calculated as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual CF</th>
<th>Cumulative CF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rs 8,000</td>
<td>Rs 8,000</td>
</tr>
<tr>
<td>2</td>
<td>Rs 6,000</td>
<td>Rs 14,000</td>
</tr>
<tr>
<td>3</td>
<td>Rs 4,000</td>
<td>Rs 18,000</td>
</tr>
<tr>
<td>4</td>
<td>Rs 2,000</td>
<td>Rs 20,000</td>
</tr>
</tbody>
</table>

Now the required cumulative cash inflows are Rs 18,500/-. At the end of 3rd year, the cumulative cash inflows are Rs 18,000/-. For the 4th year, the annual cash inflow is Rs 2,000/-. Therefore, cash inflow of Rs 500 only during the 4th year will be sufficient to make the total cumulative cash inflows to be Rs 18,500/-. The precise method required to earn a cash inflow of Rs 500 during 4th year can be calculated (on the assumption that the cash inflows occur evenly throughout the year) by linear interpolation i.e. the payback period is 3 years + (Rs 500 / Rs 2,000) = 3.25 years or 3 years and 3 months. However, it may be noted that the cash inflows occur at the end of the year only. Therefore, the payback period of 3.25 years may be increased to next full year i.e. 4 years.
Decision Rule for payback method: The payback period calculated for a proposal to be compared with some predetermined target period. If the payback period is more than the target period, then the proposal should be rejected, otherwise it may be accepted. If different proposals are to be ranked in order of priority, then the proposal with the shortest payback period will be first in the priority list.

DISCOUNTED CASH FLOW

The discounted cashflow technique are based upon the fact that cash flows occurring at different point of time are not having same economic worth. In order to make these cashflows equal in economic worth they must be discounted with reference to the time gap between different cash flows and a pre-determined discount rate. This will reflect the true economic trade off and returns.

Based on the discounting procedure there are two basic discounted cash flow techniques to evaluate project proposals. These are Net Present value method and the IRR (Internal Rate of Return) method.

NET PRESENT VALUE METHOD

The net present value of a proposal is the sum of present values of all cash inflows less the sum of present values of all cash outflows. A rate of discount must be specified and applied to both the inflows and outflows to find the present values. This rate of discount should be the rate of return which the investor enjoys from investment of similar nature and risk. It is the opportunity rate of return.

CALCULATION OF NPV:

\[ \text{NPV} = \text{Excess of PV of Inflows over PV of outflows} \]
\[ = \frac{\text{CF1}}{1+k} + \frac{\text{CF2}}{(1+k)^2} + \ldots + \frac{\text{CFn}}{(1+k)^n} - \text{CF0} \]

Where,
\[ \text{CF0} = \text{Cash flows occurring at time 0} \]
\[ k = \text{discount rate} \]
\[ n = \text{life of project in years} \]

Note that the common factor \( \frac{1}{(1+k)^n} \) is in the fact that the PVF for a particular combination of a rate of discount and the ‘n’ is also defined as PVF (r,n) as shown in the table below.

The decision rule under NPV method is:

i. Accept the proposal if the NPV is positive and reject the proposal if NPV is negative. The proposals with negative NPV should be rejected as they decrease the net worth of the stakeholders.

ii. In case of accept the proposal all proposals with negative NPVs are qualified for being accepted.

iii. In case of ranking of mutually exclusive proposals the proposals with highest positive NPV is given the top priority and the proposal with lowest positive NPV is given the lowest priority.

<table>
<thead>
<tr>
<th>CALCULATION OF NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>time</td>
</tr>
<tr>
<td>T0</td>
</tr>
<tr>
<td>T1</td>
</tr>
<tr>
<td>T2</td>
</tr>
<tr>
<td>T3</td>
</tr>
<tr>
<td>T4</td>
</tr>
<tr>
<td>T5</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Since, in the above example the NPV is positive value of Rs 8,435, therefore the firm can accept the project proposal.

PROFITABILITY INDEX

PI is defined as the benefits (in present value terms) per rupee invested in the proposal. This is a variant of the NPV technique only and is also known the benefit- cost ratio or present value index.

\[ \text{PI} = \frac{\text{Total present value of cash inflows}}{\text{Total present value of cash outflows}} \]
Decision rule under PI Technique – Under the PI technique the decision rule is that accept the proposal if the PI is greater than 1 and reject the proposal if PI is less than 1. However, if PI is equal to 1, then firm may be indifferent because the present value of inflows is expected to be just equal to the present values of the outflows.

For e.g.: From the following information about the cash inflows and outflows of a firm the PI can be calculated as:

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash flows (Rs)</th>
<th>PVF (10%, n)</th>
<th>Present values (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-40000</td>
<td>1.000</td>
<td>-40000</td>
</tr>
<tr>
<td>1</td>
<td>20000</td>
<td>.909</td>
<td>18180</td>
</tr>
<tr>
<td>2</td>
<td>40000</td>
<td>.826</td>
<td>33040</td>
</tr>
<tr>
<td>3</td>
<td>-20000</td>
<td>.751</td>
<td>15020</td>
</tr>
<tr>
<td>4</td>
<td>20000</td>
<td>.683</td>
<td>13660</td>
</tr>
</tbody>
</table>

Present values of cash outflows = Rs 40000 + 15020 = 55,020
Present values of cash inflows = Rs 18,080 + 33040 + 13,660 = 64,880
PI = 64,880/55,020 = 1.18
Note that, since PI is greater than 1, therefore this project proposal can be accepted by the firm.

DISCOUNTED PAYBACK PERIOD
This method is a combination of original payback method and the discounted cash flow technique. The cash of the project are discounted to find their present values. The total present values of the cash inflows are then compared with the present values of the outflows, in order to identify the period taken to recover the initial cost or the present values of the outflows. This method, thus takes care of the drawback of the payback period method and allows the consideration of the time value of money of cash flows. In discounted payback method a project is acceptable if the discounted payback is less than the target payback.

INTERNAL RATE OF RETURN
IRR of a project is defined as the discount rate which produces zero NPV i.e., the IRR is the discount rate which will equate the present values of cash inflows with the present values of cash outflows. In the IRR technique the time schedule of the occurrence of cash flows is known but the rate of discount is not known. This rate of discount is ascertained by trial and error procedure.

DECISION RULE FOR IRR – In order to make decision on the basis of IRR technique, the firm has to determine, in the first instance, its own required rate of return, this rate, k, is also known as the cut-off rate or the hurdle rate. A particular project proposal maybe accepted if the IRR, r is more than the minimum rate, otherwise rejected. However, if the minimum rate and required rate are equal the firm may be indifferent in choosing amongst different project proposals.

This decision is based on the rule that the NPV of the project is zero if its cash flows are discounted at the minimum required rate i.e. k. If the project can give a higher rate than this rate then it may contribute to the wealth of the shareholders.

The above discussion was about the different financial techniques that could be used while evaluating or choosing from amongst different projects. However, in reality, the business environment is complex and is uncertain, therefore, the project managers cannot completely rely on cost and time-based estimates. They need to determine the confidence level of certain rate of return in the project. In the next section of this article, we proceed with the discussion of financial techniques in uncertain business environment.

HOW MUCH CONFIDENCE CAN WE PLACE IN THE DATA?
The results of project financial appraisal can be the prime factor in deciding whether or not to commit vast sums of money in launching a new project. Senior managers who are presented with a business case will, if they are good at their jobs, ask searching questions. In particular, they should be asking how much confidence can be placed in the data used in the appraisal. Most estimators and analysts tend to be too optimistic in their predictions and that is why most of the time predictions can go wrong. This is because the environment is uncertain and merely time and cost analysis cannot completely predict the returns from...
a project. The sensitivity and monte-carlo analysis are two methods discussed below to determine the confidence in accepting a project proposal in uncertain and risky environment.

**Sensitivity analysis**

Sensitivity analysis is one way to gain more confidence in the reliability of an appraisal. The process consists of repeating the discounted cash flow calculations with a changed value for one or more of the parameters to test the effect (sensitivity) on the predicted net present value. Still considering the toll bridge project described in the previous section, the estimated cost of maintenance and repairs might be arrived at with some degree of confidence by obtaining an advance quotation for a service contract to carry out this work. The annual costs of managing the operation should be relatively simple to estimate, because the number of staffs needed and the salaries to be paid can be assessed fairly well. Two factors in the toll bridge project cannot be so reliably predicted however. These are as follows:

1. Unforeseen problems during construction that, although not affecting the fixed price agreed, could delay the completion date, thus putting back the start of operations and cash inflows. A few examples from similar projects in the past include exceptionally bad weather, actions by environmental groups, discovery of archaeological remains, disturbance of rare fauna or flora, stoppages through industrial action, unexpected geological conditions and so forth.
2. The forecast for traffic flows and consequent toll revenues might prove to be very inaccurate when the bridge opens, possibly resulting in revenues well below the target levels.

Using sensitivity analysis, each or both of these factors could be changed, either independently or in combination. The changes might, for argument’s sake, be made in steps of ±5 per cent. After each change, net present value must be recalculated to assess the impact of the changed parameter. The sensitivity of net present value to these changes will help to indicate the reliability of the financial appraisal.

**Monte Carlo analysis**

Monte Carlo analysis is a statistical method, associated with some very impressive (but to most of us not very helpful) mathematics. Fortunately, the process is made simple for project managers and financial analysts by the number of off-the-shelf software applications now available. Development of this software in the project management context was originally focused on attempts to predict the probability of finishing a project on time. However, the same principles and a very similar process can be used to predict the probability of cost estimates being under- or overspent.

Monte Carlo analysis of time and cost estimates are both relevant to uncertainty in financial project appraisal because time and costs are greatly interdependent. The illustration discussed below is for a Monte Carlo analysis of a project’s cost estimates.

An example of Monte Carlo analysis of cost estimates

In Monte Carlo cost analysis, the estimator or some independent authority must first review each cost estimate and from it produce two further estimates. Thus, for every original cost item estimated, three new estimates must be tabled. These are as follows:

1. the original estimate, which should be the most likely cost expected for the cost item;
2. a higher estimate, set at the highest possible or most pessimistic estimate for the item;
3. a lower value, which is the lowest possible, or most optimistic estimate for the item.

Thus, every item on the original task list will now have three estimates attached to it, the most likely, the most pessimistic and the most optimistic. Monte Carlo analysis makes use of these different estimates by substituting them at random in many reiterations of the total project cost estimate. At one extreme the computer calculation might contain all the improbably low estimates. At the other extreme all the highest, most pessimistic estimates would be included. Between these least likely calculations, the computer can be made to carry out a great number of project cost calculations in which any of the three possible estimates for each cost item is used at random.

Figure 1 shows the kind of result that Monte Carlo analysis can produce after many hundreds or even thousands of repeat calculations. The height of each vertical bar in the histogram indicates the frequency, which is the statistical term for the number of calculations that produce a particular estimated total project cost. The envelope containing these bars is seen to follow an approximately normal distribution curve about a mean figure of about £3.4 million.

In practice, the curve might be skewed towards a higher or lower probable total project cost but in this case the highest probability is that the project will cost £3.4 million. If the curve is skewed towards the right (that is, towards the higher cost end of the graph) that implies a higher risk of the project overrunning its budgets or even failing.
Uncertainty in project benefit estimates

Just as cost estimates can be subjected to Monte Carlo analysis, the same three-estimate approach can be used to assess the probability of achieving the desired project benefits. Provided there are enough data, Monte Carlo analysis will produce another graph of the same form as that shown in Figure 1, but the distribution curve might have a quite different shape.

At least one company (Isochron Ltd) displays the results of Monte Carlo cost and benefit analyses in a chart which they call the ‘Monte Carlo Box’. Figure 2 shows a similar chart based on that concept. This chart demonstrates how project financial analysts might summarize and compare results from cost and benefit analyses in a business plan, using a format that senior managers can readily understand.

FUNDING OF PROJECTS

Project owner’s viewpoint

Project funding may not be of direct concern to every project manager – unless shortage of funds puts the future of the project (and its manager) in question. However, here is a list of possible sources from which an organization may be able to find the capital needed for investment in a project:
• cash reserves (money held in the bank or in short-term investments, including profits not distributed as dividends to shareholders);
• sale of assets (for example, the owner of a stately home sells a valuable work of art to raise capital for a building restoration project, or a company realizes cash on its real estate in a sale and leaseback deal);
• mortgaging property
• borrowing through a lease purchase agreement;
• renting or leasing (in which case the project will be owned by the financing institution and not by the project user);
• issuing debentures or loan stock;
• raising share capital, either in a private or public company (the company may be specially set up for the project);
• collaborating with other companies to set up a consortium or a joint venture company in which skills, resources and risk are all shared;
• government sources at international, national or local level, through direct grants or fiscal incentives;
• for export projects it might be possible to borrow from a bank against security provided by a government's export credit guarantee scheme.

Project funding from the contractor's viewpoint
Project funding considerations are not the sole concern of the purchaser. Contractors often need to take a serious interest in the financing of projects for several reasons:
• In some cases, the contractor might offer to help or advise the customer to arrange finance. Financing proposals may even feature in the contractor’s project tender.
• The contractor must be assured that the customer is financially viable, and has access to sufficient funds to meet all project costs. Will the customer be able to pay the bills?
• The contractor may need finance to invest in new plant or to expand other facilities in order to be able to carry out the project.
• If the project size is significant compared to the contractor's other work, cash flow will have to be considered. The contractor may have to fund costly work-in-progress until payment is eventually received from the customer. This difficulty can be made worse if invoices are disputed, delaying revenue receipts. Some customers pay late, not just through innocent tardiness but because of a deliberate policy to delay payment of every bill for as long as possible. The experienced contractor will attempt to minimize these effects by insisting on a contract that allows for progress payments, and by efficient invoicing and credit control methods.
• Money due from overseas customers can be particularly difficult to collect, with risk of serious delays or non-payment. It is easy for the inexperienced contractor to cause delay in payment through any failure (however trivial) to observe the complex documentation formalities imposed by some governments. The big banks are excellent sources of advice for those new to exporting.

The contractors could be able to reduce its borrowing requirement if it can improve its cash flow. The following are some of the methods that might be considered:
• reducing inventory (stocks and work-in-progress);
• using trade creditors to advantage, negotiating longest possible credit terms for the payment of suppliers’ and subcontractors’ invoices;
keeping trade debtors to a minimum through prompt and accurate invoicing, asking for progress payments where appropriate, and applying rigorous credit control.

REFERENCES AND FURTHER READING