DEVELOPMENT PANORAMA

Project Selection Models

This article discusses the selection and prioritisation of projects and shows how the financial calculations are done.

The Selection and Prioritisation of Project

The reality of organisations is that resources are finite and as such an organisation cannot undertake all projects that it desires or needs (Burke, 2003; Frigenti and Comninos 1999). Therefore, it is important to realise that execution of a project will tie up organisational resources and, is an opportunity cost (Burke, 2003). The selection of one project may preclude the organisation from undertaking another, perhaps more profitable. Therefore, when potential projects have been identified, they need to be further analysed before being adopted (PHARE, 2004). The analysis may include the following:

- The degree to which projects fit wider objectives
- The immediate appearance of value for money of projects (in other words, projects which do not even claim to have any major benefit relative to the costs should be considered last)
- The appropriateness of the size of the budget relative to the resources available from the company.
- The lessons learned from experiences from within or without the organisation in undertaking such a project or similar project.
- Will the project maximise profits?
- Will the project maximise the utilisation of the workforce?
- Will the project maintain market share, increase market share or consolidate market position?
- Will the project improve the company’s image?
- Will the project satisfy the needs of the stakeholders and their political aspirations?
- Is the project’s risk and uncertainty acceptable?
- Is the project’s scope consistent with company expertise?

Project appraisal (prioritisation and selection process) as such is a process for assessing the relative merits of potential projects and ranking them against predetermined and, sometimes, weighted factors (Frigenti and Comninos, 1999). This process ensures well-informed decisions for the allocation of limited resources.
There are several models that are used to undertake such analysis and these are discussed below.

**Project Selection Models**

There are two predominant types of selection models, i.e., numeric and non-numeric models (Burke, 2003). The non-numeric models consider broader aspects such as market share, political issues, client perception. These are considered a list without any scoring attributed to the categories (Burke, 2003). The numeric models use a scoring system for each category. Some numeric models are usually financially focused and quantify the project in terms of time to repay the investment (pay back) or return on investment (Burke, 2003; Frigenti and Comninos, 1999; Wood and Sangster (1996).

**Check-list model (Non-numeric)**

Burke (2003) has, in general, grouped the kind of information required into the following headings: Production, marketing, financial, personnel, and administration.

Table 1 below shows the considerations that management undertakes for each category.

<table>
<thead>
<tr>
<th>Category</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| **Production** | - Method of implementation  
- Time to be up and running  
- Other applications of the system  
- Extent of outside consultants required  
- Interfacing of equipment required  
- Period of disruption  
- Safety of system |
| **Marketing** | - Number of potential users  
- Market share  
- Impact on current system  
- Ability to control quality of information  
- Customer acceptance  
- Spin-offs  
- Enhanced image of company  
- Extent of possible new markets |
| Financial | • Cost of new system  
  • Impact on company cash flow  
  • Borrowing requirement  
  • Time to break even  
  • Payback period, NPV and IRR  
  • Size of investment required  
  • Cost of implementation  
  • Level of financial risk |
| Personnel | • Skills requirement and availability  
  • Training requirements  
  • Employment requirements  
  • Level of resistance to change from current workforce  
  • Impact on working conditions  
  • Effect on internal communications  
  • Effect on job descriptions  
  • Effect on morale |
| Administration | • Compliance with national and international standards  
  • Reaction from shareholders and other stakeholders  
  • Customer service  
  • Legal considerations |

Adapted from Burke (2003).

The list is not exhaustive. However, the check-list model encourages managers to think broadly about possible problems and benefits. Frigenti and Comninos (1999) refer to the group of categories as appraisal categories. The appraisal categories identified are financial, strategic, organisational/management and technical, and there may be several factors in each category.

**Numeric Models**

The numeric models are subdivided into financial models and scoring models.

**Financial Models**

The commonly cited financial models (Burke, 2003; Wood and Sangster, 1996) are the following:

- Payback period
- Return on investment (IOR)
- Net present value (NPV)
- Internal Rate of Return (IRR)
Payback Period – the payback period is the time taken to gain a financial return equal to the original investment. Payback is one measure of risk; the sooner a project can repay its initial investment the lower the risk (CIMA, 2004a). To calculate the payback period, simply work out how long it will take to recover the initial outlay (Burke, 2003).

Table 2 Payback Calculation Example

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash-Flow Project A</th>
<th>Cash-Flow Project B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>($35,000)</td>
<td>($35,000)</td>
</tr>
<tr>
<td>1</td>
<td>$20,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>2</td>
<td>$15,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>3</td>
<td>$10,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>4</td>
<td>$10,000</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

* A figure in brackets ( ) indicates a negative cash-flow

The initial $35,000 is recovered after two years in project A, and after 3 years in project B. Where projects are ranked by the shortest payback period, project A is selected in preference to project B.

There are several advantages for the payback method. The discussion of these is beyond the scope of this paper. The payback period is the mostly widely used project selection calculation, even if this is only an initial filter (Burke, 2003). Its main strength is that it is simple and quick.

Return on Investment – Another popular investment appraisal technique that does look at the whole project is return on investment (ROI). This method first calculates the average annual profit, which is simply the project outlay deducted from the total gains, divided by the number of years the investment will run. The profit is then converted into a percentage of the total outlay using the following equations:

\[
\text{Average Annual Profit} = \frac{(\text{Total gains}) - (\text{Total outlay})}{\text{Number of Years}}
\]

\[
\text{Return on Investment} = \frac{\text{Average Annual Profit} \times 100}{\text{Original Investment} \times 1}
\]

The return on investment method has the advantage of also being a simple technique, but further, it considers the cash flow over the whole project. The total outcome of the investment is expressed as a profit and percentage return on investment, both parameters
readily understood by management. The project with a higher return on investment is selected or ranked better than those with lower returns on investment.

**Discounted Cash Flow (DCF)** – This investment appraisal technique takes account of the time value of money (Burke, 2003; Frigenti and Comninos, 1999; CIMA, 2004b). Money is worth more the earlier it is received. Money received in the future is worth less than money received now (Wood and Sangster, 1996; Drury, 1996; CIMA, 2004b; Burke, 2003). According to CIMA (2004b) future flows of money are worth less to a business than money now because of the following factors:

- The risk of not receiving the money at all
- Future uncertainties
- The impact of inflation over time, which reduces the purchasing power of the money
- If the company had the money now then they could put it an investment or receive interest from the bank.

There are two basic DCF techniques that can model this effect, net present value (NPV) and Internal Rate of Return (IRR). The two techniques enable the project manager to compare two projects with different investment and cash flow profiles. The two major problems with DCF are being dependent on the accurate forecast of the cash flows, and accurate prediction of the interest rates.

**Net Present Value.**

Drury (1996) asserts that the Net Present Value calculation considers both inflows and outflows, and since most projects require an up-front investment of capital at time zero, the net present value calculation is:

\[
NPV = \sum_{t=0}^{n} \frac{CF_t}{(1 + r)^t}
\]

Where \( CF = \) Cash flow; \( t = \) time; \( r = \) discount. When using the net present value decision process, a firm should invest in a project that has a positive NPV and avoid any negative NPV projects. The standard criticisms of the NPV approach are that cash flows are uncertain, there may be different views as to the proper discount
rate and projects are assumed to be independent (D’Arcy, 2004).

For example, if one invests $100 at 20% interest, after one year it earns $120, and after that it earns compounded interest. NPV is the reverse of compound interest (D’Arcy, 2004); discount factor = \(1/(1 + I)^n\) where \(I\) is the forecast interest rate, and \(n\) is the number of years from the start date (D’Arcy, 2004). $120 one year from now and the inflation and interest rate at 20%, working backwards its value in today’s terms would be $100. This is called the present value, and when the cash flow over a number of years is considered in this manner the total figure is called the net present value. Usually, the cash flow timing is expressed in years (Burke, 2003; Drury, 1996). From the start date of the project, the inflation effect is assumed to act at the end of the first year, therefore all cash flow in the first year are at present value. Project cash flow = Income − expenditure; present value = discount factor x cash flow. This is illustrated in tabular form below.

Table 3 Net Present Value Table - Example:

<table>
<thead>
<tr>
<th>Years</th>
<th>Project Cash Flow</th>
<th>Discount Factor</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td></td>
<td>NPV</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The discount factor is usually read from a table (Burke, 2003; Wood and Sangster, 1996). The NPV is a measure of the value or worth added to the company by carrying out the project. When ranking projects, preference should be given to the project with the highest NPV. A positive NPV therefore indicates that an investment should be accepted, while a negative value indicates that it should be rejected. A zero NPV calculation indicates that the firm should be indifferent to whether the project is accepted or rejected (Drury, 1996; Wood and Sangster, 1996).

**Internal Rate of Return.**
The internal rate of return is also called DCF yield or DCF return on investment (Burke, 2003; Drury, 1996). The IRR is the value of the discount factor when NPV is zero (Burke, 2003; Drury, 1996). The IRR is calculated by either a trial and error method or plotting NPV against IRR. It is assumed that the costs are committed at the end of the year and these are the only costs during the year.
Table 4 Internal Rate of Return Table - Example:

<table>
<thead>
<tr>
<th>Interest rate</th>
<th>NPV Project A</th>
<th>NPV Project B</th>
</tr>
</thead>
<tbody>
<tr>
<td>18%</td>
<td>-</td>
<td>$102</td>
</tr>
<tr>
<td>19%</td>
<td>-</td>
<td>($660)</td>
</tr>
<tr>
<td>20%</td>
<td>$2,692</td>
<td>($1,396)</td>
</tr>
<tr>
<td>21%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>22%</td>
<td>$1,494</td>
<td>-</td>
</tr>
<tr>
<td>23%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>24%</td>
<td>$361</td>
<td>-</td>
</tr>
<tr>
<td>25%</td>
<td>($184)</td>
<td>-</td>
</tr>
</tbody>
</table>

*Figure in brackets ( ) indicate negative cash flow.

The NPV becomes negative between 24% and 25%, therefore the IRR is between 24% and 25% for project A. For project B the NPV is already negative at 20%. The IRR must lie between 18% and 19% for project B. The IRR analysis is a measure of the return on investment, therefore select the project with the highest IRR (Drury, 1996; Wood and Sangster, 1996; Burke, 2003).

The financial models have a common limitation, they only consider the financial element of the project.

**Scoring models**

Factor model – The factor model (Burke, 2003) attempts to broaden the selection criteria by using multiple criteria to evaluate the projects. The factor model simply lists a number of desirable factors on a project selection proforma along with columns for scores on a scale and also a weighted column. The weighted column is added to increase the score of important factors while reducing the scoring of the less important.

For each factor a positive (value) or negative (risk) weighting is determined by upper management and the executive (Frigenti and Comninos, 1999). Frigenti and Comninos (1999) recommend that a maximum of 12 factors be used at any one time in order to keep the prioritisation process manageable. The factors discussed by Frigenti and Comninos (1999) are listed below but not explained in full.

**Appraisal Factors – Value and Risk**

1. **Financial**, overall financial evaluation (value)
   The overall financial evaluation appraises the likely impact of the proposed project on the organisation’s financial performance. The overall financial analysis may be based on cash flow summary, Net Present Value and the benefit
2. Strategic
   The Strategic factors relate to the likely impact of the
   proposed project on the organisation’s strategy. Factors
   considered include: contribution to strategy (value),
   political/public perception gain (value), and contestability
   (value).

3. Organisational/Management
   The organisational/management factors appraise the likely
   impact of the proposed project on the organisation’s
   culture and employee satisfaction. That is organisational
   culture (value), contribution to employee
   satisfaction/support (value), change management (risk),
   pace of change (risk), and execution capability (risk).

4. Technology
   Technology is an important tool in the achievement of
   business improvement projects and the following need to
   be evaluated: compatibility with corporate architecture
   (value), definitional uncertainty (risk), technical
   uncertainty (risk).

Weighting of factors
Executives and upper management award a weighting of between
0 – 10 to each factor after considering current business strategies
and organisation circumstances (Frigenti and Comninos, 1999).
Value factors are assigned a positive weighting, and risk factors a
negative. It is important that the weightings are reviewed
periodically because circumstances change. Weighting must be
carefully considered to reflect the business imperatives over the
short to medium term. For example, if the organisation finds itself
in a difficult financial situation a relatively higher weighting can be
assigned to the financial contribution of a proposal. Each of the
categories value and risk components are scored in the range 0 –
5. These factor scores are then multiplied by the weightings to
establish the score for the component. Finally, the individual
component scores are added to establish the project score.

Burke (2003) lists advantages of using a scoring model as:
   • Encouraging objectivity in decision making
   • Using multiple selection criteria to widen the range of
     evaluation
   • Simple structure, therefore easy to use.
   • Selection factors are structured by senior management.
     This implies that they reflect the company goals and
     objectives.
   • Easy to change factors
   • Weighted scoring reflects the factor’s differential
importance.

- They are not biased towards short run projects favoured by financial models.
- Very low weightings can be removed from the list as they have little to no influence. This will reduce the number of questions.
- The weighted model can also be used as a flag to improve projects by identifying the variance between factor score and the maximum possible score.

And the disadvantages of using a scoring model as:

- If the factors are not weighted they will all assume equal importance
- A simple model can encourage the development of long lists that could introduce trivial factors and therefore waste management time.

Examples of Calculations:

**Rationale for benefits realisation (financial and non-financial)**

A. Net Present Value & Cost Benefit Ratio

Table 5 Net Present Value Table and Cost Benefit Ratio

<table>
<thead>
<tr>
<th>Period</th>
<th>Cash Flow ($)</th>
<th>10% Discount values</th>
<th>Present Value ($)</th>
<th>Cost Benefit Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-33,000</td>
<td>1</td>
<td>-33,000</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>-32,950</td>
<td>0.9091</td>
<td>-29,954.85</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>137,400</td>
<td>0.8264</td>
<td>113,547.36</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-2,300</td>
<td>0.7513</td>
<td>-1727.99</td>
<td></td>
</tr>
<tr>
<td>Net Cash Flow</td>
<td>Net Present Value</td>
<td>48,864.52</td>
<td>1.76</td>
<td></td>
</tr>
</tbody>
</table>

Key:

Positive Net Present Value = Accept
Negative Net Present Value = Reject
> 1 Cost Benefit Ratio = Accept
< 1 Cost Benefit Ratio = Reject

**Net Value Calculation for X Project**

Table 6 Calculation of NPV

<table>
<thead>
<tr>
<th>Cash Flow for each period</th>
<th>@10% discount rate</th>
<th>Present value</th>
</tr>
</thead>
<tbody>
<tr>
<td>-33000</td>
<td>1</td>
<td>-33000</td>
</tr>
<tr>
<td>-32950</td>
<td>0.9091</td>
<td>-29954.85</td>
</tr>
<tr>
<td>137400</td>
<td>0.8264</td>
<td>113547.36</td>
</tr>
<tr>
<td>-2300</td>
<td>0.7513</td>
<td>-1727.99</td>
</tr>
<tr>
<td><strong>Net Present Value</strong></td>
<td></td>
<td><strong>48,864.52</strong></td>
</tr>
</tbody>
</table>

NPV Method 2 (Discounted Cash Flow Calculator for Financial Math)

The cash flow series developed in this arbitrary groupings of related activities were designated as cash flow 1,2,3, 4. These were then fed into a Discounted Cash Flow Calculator (Wheatworks, 2004).

Table 7 NPV Calculated with Wheatworks.com Financial Calculator

<table>
<thead>
<tr>
<th>Cash Flow Series</th>
<th>Discount rate</th>
<th>NPV</th>
<th>MIRR</th>
<th>Benefit/Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>-33000</td>
<td>10.0000</td>
<td>48871.15</td>
<td>32.69%</td>
<td>1.76%</td>
</tr>
<tr>
<td>-32950</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>137400</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Conclusion**

Frigenti and Comninos (1999) give valuable advice concerning the selection and prioritisation of projects:

1. Having an appraisal system informs the executive of impacts of a single project on the institution. (Executive ownership of the changes brought about by the projects is lacking, as they do not understand the impacts and influences a single project can have on the organisation).

2. Proposal prioritisation, together with an analysis of limited resources required to deliver the portfolio, is essential to avoid over-promising and under-delivering. An organisation-wide view of the resources required to deliver the proposed projects will avoid overloading staff and will improve the quality of services delivered.

3. Approving projects must be done within a framework of clarity rather than pressure. Essentially, all projects will deliver some form of benefits. The important issue is which set of proposed projects will deliver the optimum portfolio of benefits.

4. Sponsors championing their projects will unwittingly ‘sell’ the project at the expense of other proposals. Without a process that assesses which proposals will deliver maximum benefits, organisations will continue in this unfocused manner.

5. One has to invest in projects to obtain the benefits downstream. This can cause a severe drain of an organisation’s human resources. Careful consideration must be given to the amount of project work placed on staff, as well as the level of change visited upon staff at any one time.

6. Approving projects without full understanding affects organisation cash flow. It is not sufficient to view only the cost of undertaking the portfolio of projects. Just as important is the stream of funds returning from the projects. Delays in achieving financial benefits can place the organisation under a cash flow strain. Large organisations running many projects simultaneously can be exposed to serious cash flow problems through delayed returns on project investments.

7. A prioritisation and selection group or committee will ensure an unbiased list of prioritised proposals.

In summary to consider a project proposal in the context of an investment, organisations must predetermine the parameters that
a project proposal must meet. These typically include estimates of impact on personnel, organisation strategy, operating costs and capital costs. If the proposal meets these preset parameters, the proposal can be allowed to proceed through the prioritisation process. However, certain projects may continue through the process even if they do not fit the criteria. These might be essential to implement because of their political impact on the organisation or because of their public or customer importance. The selection and prioritisation process must also be able to evaluate these types of projects.

Sekelani S. Banda, MB ChB, MSc, MMEd, PhD

References