Software Project Management

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Project Evaluation and Programme Management   cont…

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- **Last two steps of C-B Analysis**
- **Risk evaluation**

Cost-benefit analysis – Detailed Steps

1. Identify the cost and benefits pertaining to the project
2. Categorize the various costs and benefits
3. Select a cost-benefit evaluation technique
4. Interpret the results of the analysis
5. Take appropriate action.

Interpret the results of the analysis

- After the C-B evaluation of the project is complete, the results should be interpreted.
- This requires comparing the actual results against a standard or the result of an alternative investment.
- The interpretation & the decision phases are subjective in nature and require judgment & intuition.
- Based on the level of uncertainty, the project manager may be confronted with a single known value or a range of values for the different measures such as NPV.

Interpret the results of the analysis

- In both the cases (single value or range of values), simpler techniques such as net profit analysis, are easier to implement than other techniques.

- If it can be modified to include the time value of money, the net profit method would be comparable to NPV. But, it is difficult to implement the complex techniques such as NPV.

Take appropriate action

- After interpreting the results, appropriate decision/ action has to be taken, which may be highly subjective.
- This depends on the project manager's or end user's confidence in the estimated costs and benefits and the magnitude of investment.
- The final decision/action is to select the most cost effective and beneficial system for the user.
- Prepare the feasibility study report containing the measure findings and recommendations.

Limitations of C-B analysis

- Valuation problems: Intangible costs and benefits are difficult to quantify.
- Distortion problems: two ways of distorting the results of C-B analysis.
  - International favoritism of an alternative for political reasons.
  - When data are incomplete or missing from analysis.
- Completeness problems: cost related to C-B analysis may be on the high side or not enough costs might be considered to a complete analysis.

Dealing with uncertainty: Risk evaluation

- Every project has some risk.
- Two types of risks are there:
    1. **Project Risk:** related to threats to successful project execution.
    2. **Business Risk:** related to factors threatening the benefits of the delivered project.
- In business case, main focus is on Business Risk.

Risk evaluation methods

- Risk identification and ranking
- Risk and NPV
- C-B Analysis
- Risk profile analysis
- Using decision trees

Risk identification and ranking

- In any project evaluation we should identify the risks and quantify their effects.

- One approach is to construct a project risk matrix utilizing a checklist of possible risks and classifying risks according to their relative importance and likelihood.

- Importance and likelihood need to be separately assessed– we might be less concerned with something that, although serious, is very unlikely to occur than with something less serious that is almost certain.

Risk identification and ranking   cont ...

- For example, project A might appear to give a better return than B, but could be riskier

- Could draw up a project risk matrix for each project to assess risks.

Example of a project risk matrix

Risk	importance	likelihood
Client rejects proposed look and feel of site	H	- -
Competitors undercut prices	H	M
Warehouse unable to deal with increased demand	M	L
Online payment has security problems	M	M
Maintenance costs higher than estimated	L	L
Response times deter purchasers	M	M

- - means unlikely

Risk and net present value

- Where a project is relatively risky, it is a common practice to use a **higher discount rate** to calculate net present value.
- This risk premium might, for example, be an additional 2% for a reasonably safe project or 5% for a fairly risky one.
- Projects may be categorized as high, medium, or low risk using a scoring method and risk premiums designated for each category.
- The premiums, even if arbitrary, provide a consistent method of taking risk into account.

Risk evaluation using C-B analysis

- A more sophisticated approach to the evaluation of risk is to consider each possible outcome and estimate the probability of its occurring and the corresponding value of the outcome.

- Rather than a single cash flow forecast for a project, we will then have a set of cash flow forecasts, each with an associated probability of occurring.

- The value of the project is then obtained by summing the cost or benefit for each possible outcome weighted by its corresponding probability.

Cost-benefit analysis - Example

A company is planning to develop a payroll application and is currently engaged in C-B analysis. Study of the market shows that if the company can target it efficiently and no competing products become available, it will obtain a high level of sales generating an annual income $800000. It estimates that there is a 1 in 10 chances of this happening. However a competitor might launch, another application before its own launch date., and then sales might generate only $100000 per year. It estimates that there is 30% chance of this happening. The most likely outcome is somewhere in between these 2 extremes- it will gain a market lead by launching before any competing product becomes available, and achieve annual income of $650000. The expected sales income are shown in following table.

Cost-benefit analysis - Example

Sales	Annual sales income (i)	Prob. (p)	Expected value (i*p)
High	800000	0.1	80000
Medium	650000	0.6	390000
Low	100000	0.3	30000
Expected income			500000

Cost-benefit analysis - Example

- Development costs estimated to be $750000
- Sales levels are expected to be constant for at least 4 years
- Annual cost are estimated at $200000

Would you advice going ahead with the project?

Cost-benefit analysis – Example (solution)

- Expected sales of $500000 over 4 years would generate expected income of $1200000 (2000000-200000*4).
- This would provide a good return on investment of $750000
- But if sales are low and there is a 30% chance of this, the company will loose money.
- So it is not advisable to take up this risky project.

Cost-benefit analysis – limitations

- Assigning probabilities of occurrence is a challenge.
- Does not take full account of worst case scenarios.

Risk profile analysis

- An approach which attempts to overcome some problems of C-B analysis method, is by constructing risk profiles using sensitive analysis.
- This involves each of the parameters that affect the project's cost or benefit to ascertain how sensitive the projects profitability is to each factor.
- We might vary one of the original estimates by plus or minus 5% and recalculate the expected costs and benefits for the project.
- By repeating this exercise for each of our estimates in turn, we can evaluate the sensitivity of the project to each factor.

Risk profile analysis   cont …

- By studying the results of sensitive analysis we can identify those factors that are most important to the success of the project.
- We then need to decide whether we can exercise better control over these factors or otherwise mitigate their effects.
- If neither is the case, then we must live with the risk or abandon the project.

Using decision trees to evaluate risks

- The previous approaches assume that the project manages are passive by standards allowing nature to take its own course.
- The project manager can only reject the over risky projects or choose those with risk profile.
- But in some cases it is required to evaluate whether risk is important and, decide a suitable course of action.

Using decision trees to evaluate risks

- Such decisions will limit or affect future options and is important to asses how a decision will affect the future profitability of the project.
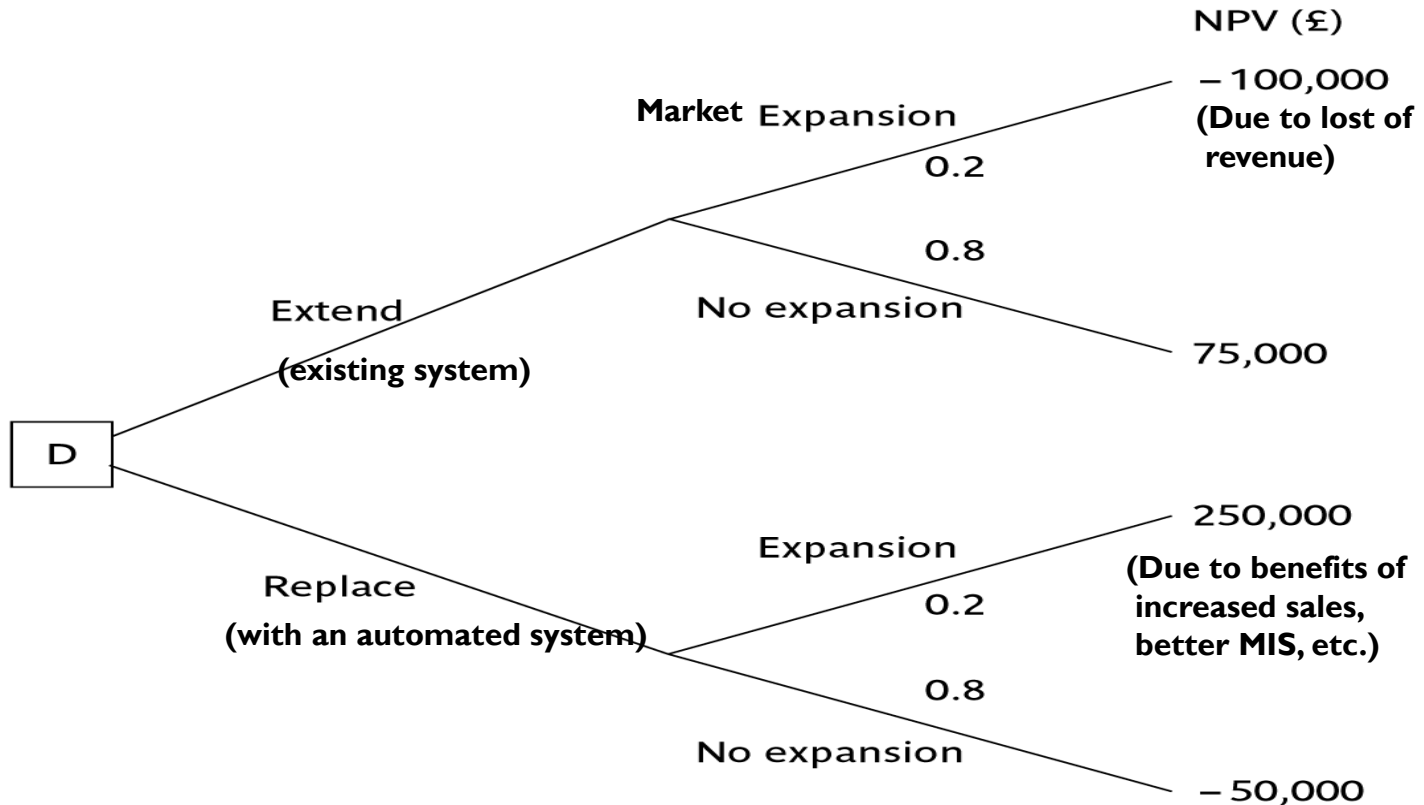- Decision trees comes in a handy in this scenarios.

Example

A company is considering when to replace its sales order processing system. The decision depends on the rate at which its business expands. If its market share increases, then the existing system might need to be replaced within two years. Not replacing the system in time could be an expensive option as it could lead to lost revenue, if it cannot cope with the increased sales. Replacing the system immediately will be very expensive.

Extending the system will have an NPV of $75,000. If the market expands, this will be turned into a loss with an NPV of -$100000 due to lost revenue. If the market expands, replacing the system will have an NPV of $250000, due to the benefits of handling increased sales and other benefits. If sales don't increase, the benefits will be severely reduced and project will suffer with an NPV of -$50000.

Company estimates the likelihood of the market increasing significantly at 20%, and hence he probability that it will not increase is 80%. Construct the decision tree.

Decision tree for the example

NPV (£)

−100,000
(Due to lost of revenue)

Market Expansion

0.2

0.8

No expansion

75,000

Extend
(existing system)

D

250,000
(Due to benefits of increased sales, better MIS, etc.)

Expansion

0.2

Replace
(with an automated system)

0.8

No expansion

−50,000

Analysis of the decision tree

- The analysis consists of evaluating the expected benefit of taking each path from the decision point D.

- The expected value of each path is the sum of the values of each possible outcome multiplied by its probability.

- Expected value of extending the existing system is

    $75,000*0.8 – $1,00,000 *0.2 = $40,000

- Expected value of replacing the system is

    $2,50,000*0.2 – $50,000 *0.8 = $10,000

So, the company should choose the option of extending the existing system.

Summary   cont…

- A project may fail not through poor management but because it should never have been started

- A project may make a profit, but it may be possible to do something else that makes even more profit

- Projects with the highest potential returns are often the most risky

- Discussed the different risk evaluation techniques.

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Thank you