TECHNICAL INVESTMENT APPRAISAL

Characteristics & Method Data Sheets

Group 13
Alhourani, Sami
Hinrichs, Phil-Johann-Luc
Jose, Royce-Anton
Sidana, Amrinder-Singh

Contents

Technical Investment Appraisal: characteristics and classification

From many perspectives, investments can be taken into account. In line with the cash flow-oriented approach, a cash flow commencing with an initial investment expenditure may characterize an investment project. The fundamental job of making investment decisions will then be to determine if the initial spending will be beneficial for the future benefit of the investment.

Investment Appraisal is an input to an investment decision taken by the sponsor and management board justifying investment in the project, program or portfolio. It is the basis for the expenditure of limited resources and depends on a strong investment assessment.

The analysis done to examine the profitability of an investment over the life of an asset, as well as concerns of affordability and strategic fit, is the underlying reference principle in investment appraisal.

Investment Appraisal can serve three different purposes:

1. Predict profitability of a single investment project

2. Compare different investment options (selection decision)

3. Decide on optimal period of use/ replacement point in time

There are several types of investment projects which may be classified. Because their features are significantly varied, investment projects may demand different techniques for assessing the effect, value and profitability of their investment projects.

Identifying the role of Investment Appraisal in the Capital Investment Decision-Making Process

To analyse profitability of capital investment prospects the analytical tools described further in this report are utilized. However, numerous more decision-making stages are needed before such analytical tools may be implemented. Further measures are necessary to achieve a good conclusion for an investment project once a financial analysis has been performed. In light of every stage required, investment decision-making may be described, as illustrated in Figure 1.3, as an ordered procedure.

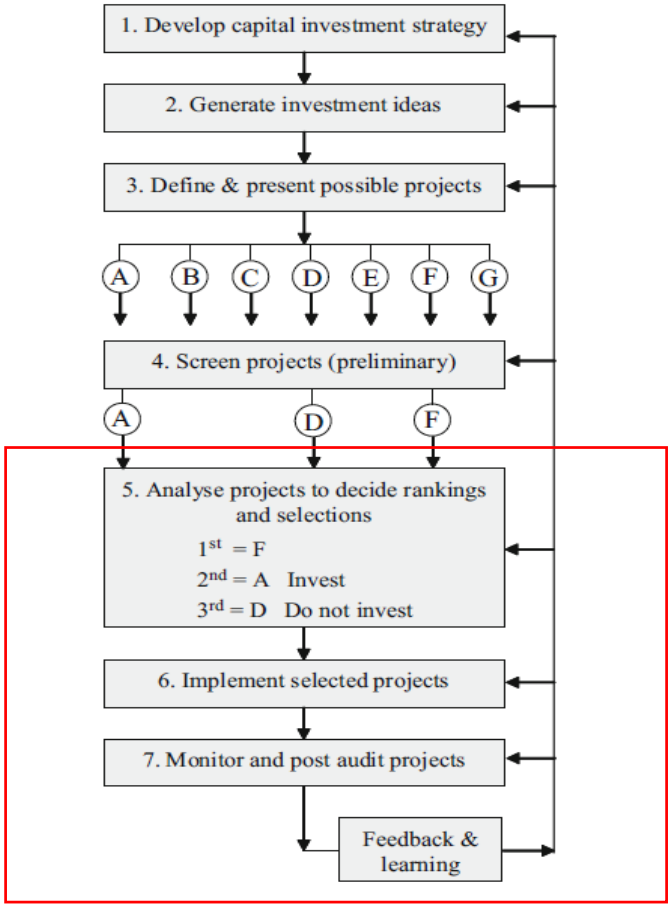


Fig. 1.1: The capital investment decision-making process

Source: Investment Appraisal: Methods and Models, Uwe Götze • Deryl Northcott • Peter Schuster

Investment in capital should not be vague, but should be linked to the current and planned investment program of the Organization. The long-term strategy of the firm should in turn drive this investment program. Strategy will determine the sort of goods, markets and technology in which the organization wants to invest, and it is thus doubtful that requests to invest in projects be supported and committed or authorized for financing. The rest of the process depends on the development of strong investment ideas after the capital investment strategy is created and Budget procedures implemented (step 2 in Fig. 1.1). Unless properly stated and presented, an investment concept cannot be considered (step 3 in Fig. 1.1). At this stage of the definition of decision-making, the firm must understand what information is needed and the shape the proposal needs to take on a possible investment project. The preliminary screening of investment capital ideas (Step 4 in Fig. 1.1) eliminates plainly unsustainable, excessive research initiatives. The firm would use advanced methodologies, financial and risk analysis and models at the formal analytical stage of the projects (stage 5 at Fig. 1.1). Implementation of the project involves the establishment of efficient information systems to offer feedback on the progress, results and important variables indicated in the proposal for the project. If implementation (step 6 of Fig. 1.1) is poorly managed and implemented, even the finest judgments on capital investment might not be successful. Along with Monitoring and post audit projects (step 7 of Fig 1.1) and steps 5 & 6 of the Capital investment planning process, comprises the Investment Appraisal, which implements the project planning and execution together with Project controlling.

Investment appraisal Methods as investment planning tool:

Any choice that forms part of the investment planning process should be governed by the techniques of investment appraisal. Knowing the various techniques, assumptions, constraints and possible use of investment appraisals will lead to an increase in understanding of investment decision-making and educated choice of approaches. The decision-making in relation to both individual investment projects and investment programs should thus be substantially enhanced.

Depending on the difficulties discovered in analysis and the search for alternatives, crucial questions can be answered utilizing investment assessment techniques.
They are as follows:

1. Should an investment be made or dismissed?
2. Which investment projects should be preferable in the situation of mutually exclusive?
3. How much time should an investment project be used?
4. When is the investment project supposed to begin?
5. Initiation and execution of investment projects when a restricted financial budget reduces the number of investment projects, which may be implemented simultaneously?
6. What investments, what sums, what amounts and what time should be undertaken?
7. In what number and at what time should the investment projects and the product kinds be pursued and produced?

Investment appraisal methods overview:

The basic investment appraisal methods are as shown in Fig 1.2.

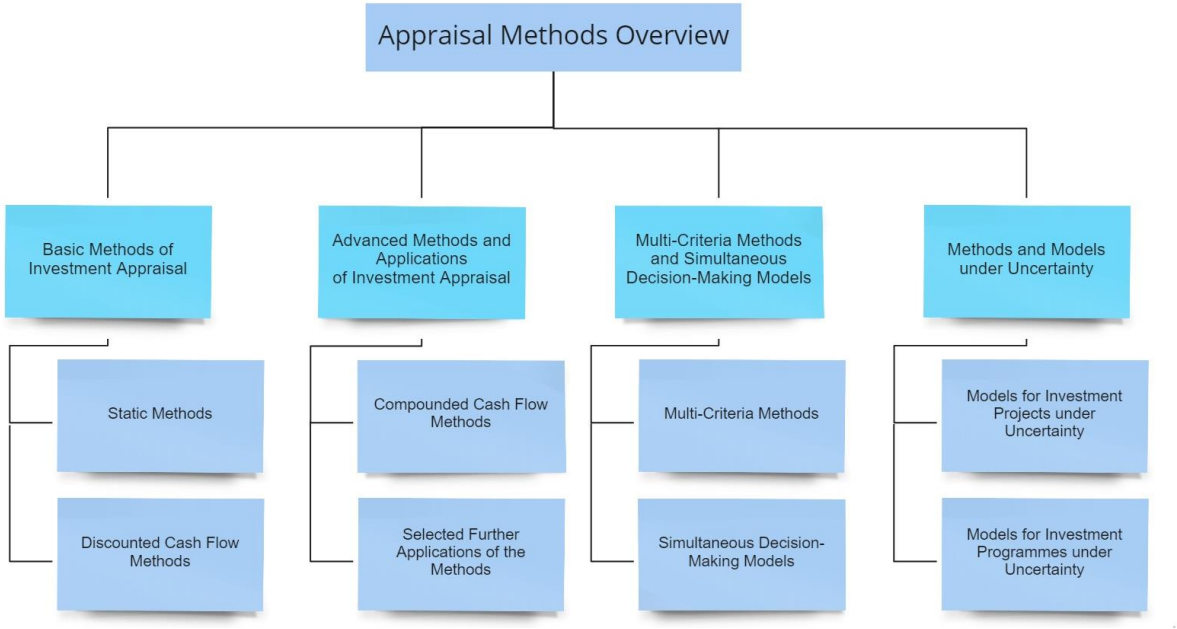


Fig. 1.2: Investment Appraisal Methods Overview

Reference: Investment Appraisal: Methods and Models

Static Methods:

Static techniques of analysis evaluate profitability over a period of one (average) term of an investment. These techniques concentrate on a particular financial metric, therefore ignoring other targets. There is a two-way perspective for the profitability discussed here—in absolute or relative terms.

Absolute profitability: it is better to make an investment than to reject it.

Relative profitability: better investment in project A than investment in project B (A being the more profitable investment: A and B are mutually exclusive).

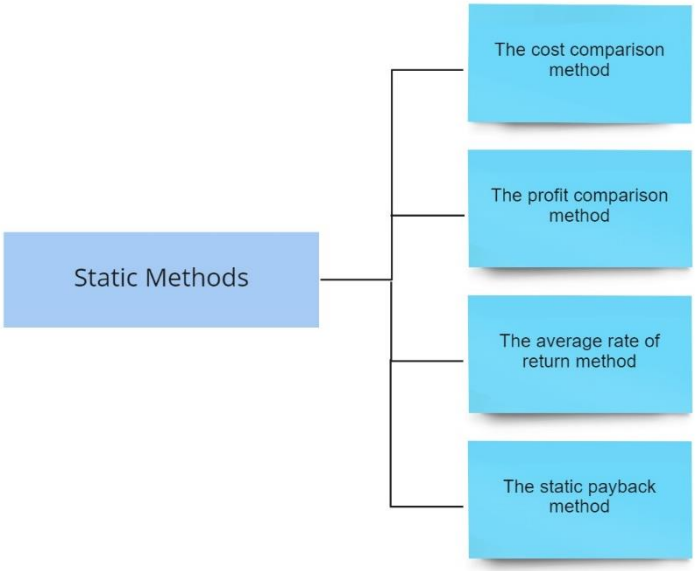


Fig. 1.3: Overview of Statics Methods

Cost Comparison Method: As the name suggests, the target measure for the cost comparison method(s) is the cost(s). For each investment alternative the average cost for the planning period is determined. The costs analysed include: personnel (wages, wages, social spending etc.), raw material expenses, depreciation expenses, interest, duties and charges, and external service costs (such as repair or maintenance)... For any alternative investment the addition of all cost components produces their respective total cost.

Method of comparison:

1. Preselect comparable alternatives
2. Compare total Expenses between the two using the following equation:

$$\frac{Acquisition\ Costs - Residual\ Value}{Number\ of\ observed\ periods} + \left(\frac{Acquisition\ Costs\ +\ Residual\ Value}{2} \times Interest\ rate\right) + Operating\ expenditure$$

Fig. 1.4: Formula: Costs to compare

Profit Comparison Method: As the name suggests, the PCM is different from the cost comparison approach, because the cost and revenue of investing projects are taken into

consideration. The aim is the average profit, computed as the income-cost difference. All other assumptions stated in the CCM remain applicable to PCM, other from that difference.

To assess the absolute and relative profitability of the two investment projects, the projects average revenues and costs must be determined.

Average Rate of Return Method: In terms of its target measurement, the average return rate (ARR) approach differs from PCM. The ARR combines a profit measure with a capital measure to focus on the return on the capital invested (represented as an interest rate). The measure of profit and the measurement of capital can be different. Average capital tie-ups can be used to measure capital while average profit and an average interest can be determined to measure profit.

$$\text{Average rate of return} = \frac{\text{Average profit} + \text{Average interests}}{\text{Average capital tie-up}}$$

Fig. 1.5: Formula: Average rate of return

Static Payback Period Method: The target metric utilized here is the Time to recover the capital invested in the project. The calculation might be based on average or total numbers. Here are utilized average numbers. The SPP approach provides a measure of the investment-related risk.
Judging the absolute and relative profitability of the investment projects on the basis of SPP alone is not an appropriate study, since any after-payment cost and income will be totally ignored. The SPP approach is therefore only usable as an additional evaluation method.

$$\text{Payback period} = \frac{\text{Capital tie-up}}{\text{Average cash flow surpluses}}$$

Fig. 1.6: Formula: Payback period

The average net cash flows of a project are the primary measures for the SPP procedure. Cash flow averages are not equal to the average profit. While profit is defined as the income-cost differential, cash flow is the net balance of cash inflows and outflows.

Discounted Cash Flow Methods:

The methods of the discounted cash flows are classed as a dynamic investment assessment approach that explicitly evaluate more than one period and recognize the time worth of money, unlike the static methods discussed earlier.

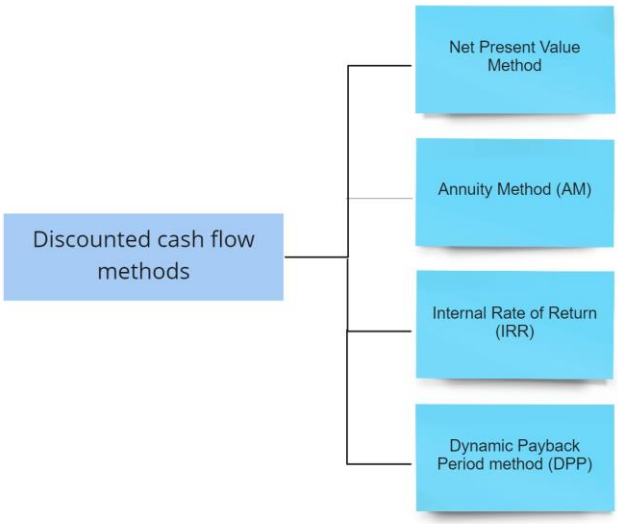


Fig. 1.7: Overview of Discounted Cash Flow Methods

The Net Present Value Method: The net present value is the net monetary gains (or losses) from a project, which is calculated by reducing the present and future cash inflows and outflows of the project.

Absolute profitability: is attained when the NPV of an investment project exceeds zero.

Relative profitability: if there's more NPV than the alternative investment project, an investment project is recommended.

Annuity Method: An annuity is a series of cash flows of equal amounts in each period of the total planning period. The annuity may be considered a sum that an investor may withdraw from the investment project in each period.

Absolute profitability: is reached when the annuity of an investment project exceeds zero.

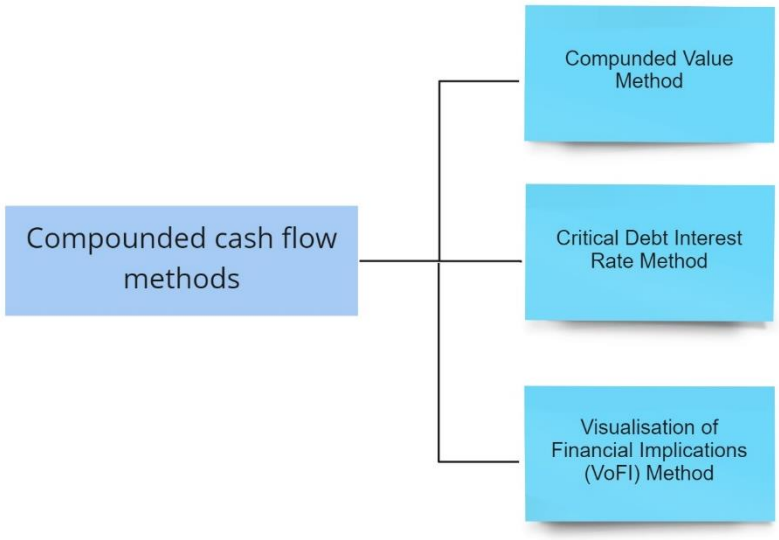
Relative profitability: If the investment project is higher than the alternative investment project, it will be chosen.

The Internal Rate of Return: The internal rate of return is the rate leading to an NPV of zero when the uniform discount rate is effective. The internal return rate represents the interest earned by the investment project under examination on the capital utilized at certain times.

The dynamic payback period method (DPP): combines the underlying method of static payback period method with the discounted cash flow of the NPV model. The dynamic payback period is the period after which the investment capital is reimbursed from the reduced net cash flows from the project.

Compounded Cash Flow Methods:

The following methods use differing debt and credit interest rates instead of a uniform discount rate.



The Compound Value Method is a dynamic way to assess investment using the compound value as its aim metric — that is, all cash flows are compounded to the end of investment project. The compound value is the total net monetary profit or loss arising from the investment project, which is linked to the conclusion of its economic life.

The Critical Debt Interest Rate Method: As with the compound value technique, the critical debt interest rate (CDIR) method assumes distinct interest and debt rate. This strategy is

based on the critical debt interest rate metric. The critical debt interest rate is the rate that results in a compound value of zero (with a particular credit interest rate).

An investment project is lucrative when its critical debt interest rate surpasses the indebtedness rate of the market.

Visualisation of Financial Implications (VoFI) Method: The VoFI comprehensive financial plan considers the economic consequences of an investment project, specifically in regard to:

• The amounts and proportions of internal funds and debt capital used.

• The amounts and timing of debt redemption from cash inflows.

• The alternate yield on the long-term financial investment of the initial internal funds (the opportunity interest rate that generates the so-called opportunity income value)—not necessarily identical to the yield on short-term financial investments during the project's economic life.

• The existence of different forms of loans, with differing payback and interest conditions.

Selected Further Applications of the Methods

Income Taxes and Investment Decisions: As taxes may impact on project profitability, they should be included in the analyses of investment projects. This is illustrated by the Net Present Value (NPV) and the Financial Implications Visualisation (VoFI) methodology for assessing investments projects. There are several factors affecting the influence of taxes on profitability of investment projects, including: the form of the tax legislation, the company's juridical form and the approach from which the assessment is made.

The Assessment of Foreign Direct Investments (FDI): Special characteristics and considerations are taken into account for these methods. Furthermore, NPV calculations are utilized to asses FDI.

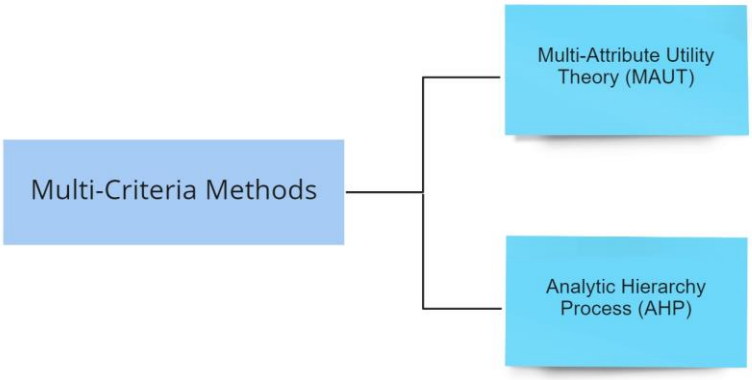
Models for Economic Life and Replacement Time Decisions: In two situations decisions will be taken on the economic life of investment projects. First, before the project's initiation, it is necessary to evaluate the absolute and relative profitability of the project as an ex ante decision or as an economic life decision in a strict sense. Second, following the initiation of the project, decisions on the extension of an existing project are an ex-post decision or a so-called substitution time decision. This is required if the data differ from those used for the original, ex ante decision. In the course of the investment project, the optimal economic life

previously determined should then be re-examined and revised whether this improves financial success.

Models to Determine Optimum Investment Timing: The most important factors in such decisions, for example as cash flows, are assumed to be economic impacts. They depend on several influences, the most important of which are listed as follows:

- Interdependencies of various investment projects available at the same time.
- Building on early investment advantages
- Pioneering disadvantages in the form of additional costs or cash outflows
- Technological advances over time that could influence investment project results
- Investment projects' specificity—i.e. to what extent an investment is linked to a specific use and thus prospect of alternative usage, adaptability, or loss in value where the incorrect project is being pursued.
- The uncertainty of information available and the risks associated with this information and anticipating improved information for the future which may lead to delays.

Multi-Criteria Methods



When an investor wants to pursue several targets and not just one, using a Multi-Criteria Method Model may be preferable. They are made with the support of many individuals of whom are experts in certain fields which involve the project. These experts and their opinions determine the criteria for the technical appraisal.

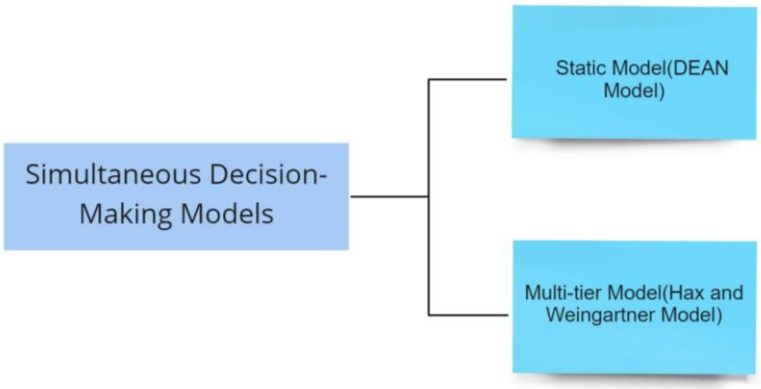
1) Multi-Attribute Utility Theory (MAUT)

This is a method is commonly used to analyse the effects a development project may have on the environment, but it can also be used in other areas such as Economics, finance, and actuarial analysis. This method takes uncertainty into account and can incorporate preferences.

2) Analytic Hierarchy Process (AHP)

This method is seen as easy to use, and the hierarchy structure can easily adjust to fit many sized problems. This method can be applied to performance type problems, resource management, and political strategy.

Simultaneous Decision-Making Methods



Simultaneous Decision-Making processes are used when on wishes to make a simultaneous choice between various investment and finance projects within a single period.

1) Static Model(DEAN Model)

This relatively simplistic since only one period is considered, as such it is very limited when applied in real world investment plans and decision making.

2) Multi-tier Model (Hax and Weingartner Model)

This is a multi-tiered model in which projects are assumed to commence at different times unlike the DEAN model.

Models for Investment Project under uncertainty

In the real world, there are always going to be various factors of risk and unpredictability when working on a project, whether they may be environmental, economic, or even making the wrong decision which may lead to loss of profit. As such, when analysing an investment project, it is important to have models which incorporates all the different factors of risk which may impede progress. Here are the following methods which are chosen based on various criteria:

1) Risk adjusted analysis
2) Sensitivity analysis
3) Risk analysis
4) The decision-tree method
5) Option pricing models

If none of these solve a decision problem, then Decision theory may be used.

Models for Investment Programmes with uncertainty

When investment programmes are planned, there exist many other alternative investments exist which complicate matters. Thus, models which limit the range of uncertainty and alternative investments are needed. Some useful analytical models which clear these goals are:

1) Sensitivity analysis
2) Chance-constrained programming
3) Simulation
4) Fuzzy set models
5) Portfolio selection models
6) Flexible planning

Sources:

1) https://www.researchgate.net/profile/Patrick-Hester/publication/275960103_An_analysis_of_multi-criteria_decision_making_methods/links/55eefed208ae199d47bff202/An-analysis-of-multi-criteria-decision-making-methods.pdf

2) Investment Appraisal Methods and Models https://link-springer-com.ezproxy2.hsrw.eu/book/10.1007%2F978-3-662-45851-8