

*International Good Practice Guidance*

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## Project Appraisal Using Discounted Cash Flow



International Federation  
of Accountants

The Professional Accountants in Business Committee of the International Federation of Accountants (IFAC) approved this International Good Practice Guidance, *Project Appraisal Using Discounted Cash Flow (DCF)*, at its meeting from March 31 to April 2, 2008.

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**IFAC PAIB COMMITTEE  
INTERNATIONALGOOD PRACTICE GUIDANCE  
PROJECT APPRAISAL USING DISCOUNTED CASH FLOW**

**TABLE OF CONTENTS**

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	Page
1. General Overview of Why the Topic is Important .....	4
The Role of the Professional Accountant in Business .....	5
2. Key Principles That are Widely Accepted Features of Good Practice. ....	6
Scope of this IGPG .....	6
The Key Principles in Project Appraisal Using DCF .....	7
3. Application Guidance on Implementing the Principles .....	8
Appendix A: Resources .....	21
Appendix B: Definitions .....	23

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## Project Appraisal Using Discounted Cash Flow

### 1. General Overview of Why the Topic is Important

- 1.1 In the interest of stronger economies and economic growth, decisions on resource allocation in organizations require a systematic, analytical, and thorough approach, as well as sound judgment. Investment (project) appraisals and capital budgeting, which involve assessing the financial feasibility of a project, should use Discounted Cash Flow (DCF) analysis as a supporting technique to (a) compare costs and benefits in different time periods, and (b) calculate net present value (NPV). NPV utilizes DCF to frame decisions, to focus on those that create the most value.
- 1.2 This International Good Practice Guidance (IGPG) covers DCF analysis, and supports professional accountants in business who evaluate investments to support decision-making. In advocating fundamental principles and providing guidance on how to use DCF analysis, this IGPG establishes a benchmark that can help professional accountants to deal with the complexities of practice. Investments include major capital spending and strategic investments such as product development, and acquisitions and divestitures that shape the future of an organization (see paragraph 2.1).
- 1.3 Companies with good records in value creation tend to have better access to capital and a more motivated and productive workforce. This IGPG supports and encourages professional accountants in business to promote (a) disciplined financial management in organizations, and (b) generation of long-term value. This allows organizations to focus on decisions that maximize expected value, rather than their short-term impact on reported earnings.
- 1.4 Delivering public and not-for-profit services requires a focus on (a) ensuring that public funds are spent in the most efficient and effective way, and (b) activities that provide the desired benefits to society.
- 1.5 This IGPG encourages professional accountants in business to promote the use of DCF analysis and NPV to evaluate investments. Adoption and prioritization of these techniques will vary depending on jurisdiction, size of organization and organization type. For example, organizations with explicit value creating strategies may emphasize DCF and NPV, and downplay the role of other criteria such as payback and EPS growth. Conversely, a restructuring organization experiencing poor performance may emphasize short-term financial performance and criteria such as EPS growth. However, research shows that a significant number of organizations do not prioritize DCF and internal rate of return (IRR) when perhaps they should, especially in assessing strategic investment decisions and taking a long-term view. In smaller organizations, use of DCF and IRR is particularly variable, as many rely on relatively simple approaches such as payback criteria and informal rules of thumb.

## **The Role of the Professional Accountant in Business**

- 1.6 The importance of the role of professional accountants in business in supporting communication of information within organizations and to its outside stakeholders is highlighted in the IFAC Code of Ethics for Professional Accountants. Paragraph 300.2 states that investors, creditors, employers, and other sectors of the business community, as well as governments and the public at large, may all rely on the work of professional accountants in business. Professional accountants in business may be solely or jointly responsible for preparing and reporting on financial and other information on which both their employing organizations and third parties may rely. To this end, professional accountants in business should (a) apply high standards of DCF and NPV analysis, (b) establish safeguards to compensate for risks to the integrity of information flows, and (c) provide objectivity where conflicts of interest could influence a decision. In this context, professional accountants in business both challenge and contribute to decision-making.
- 1.7 DCF analysis and estimating the NPV of cash flows incorporate fundamental principles of finance that support disciplined financial management in organizations. Professional accountants in business have a role in promoting and explaining the importance of these principles in their organizations, particularly where the connections between the application of financial principles and related financial theory are not easily understood or accepted. A key challenge in using DCF arises from the confusion that often occurs in understanding its theoretical basis and practical application.
- 1.8 Professional accountants in business can promote the use of both DCF and NPV in investment appraisal and advise on the appropriateness of other techniques for specific contexts. They can also directly (a) conduct DCF analysis, and (b) ensure the quality of information flows, to support analysis and appraisal of the investment.
- 1.9 Professional accountants in business who work in a finance and accounting function of an organization may participate in interdisciplinary teams, whether at a marketing, research and development, or other functional interface, that assess the effectiveness of investments. For example, marketing expenditures with longer-term effects, such as product launch advertising and promotions, could be evaluated using DCF to analyze expenditures and earnings. Some organizations with significant brand investments have used professional accountants in business to develop DCF-based and other tools to provide insights into the effectiveness of these investments. A typical role in this context is helping to (a) frame the decision(s) and the purpose of the analysis, and (b) select the most appropriate approach and tools, given the context of the decision and the end user's information requirements.
- 1.10 In investment appraisal and capital budgeting, professional accountants in business could participate in (a) recognizing the investment opportunity, (b) determining the alternatives, (c) ensuring that information is used in a way that leads to the selection of the best alternative, and (d) subsequent checking to establish whether anticipated benefits have been realized. Many organizations require consideration of at least three alternative investment options in making decisions.

- 1.11 In addition to using DCF analysis to help an organization improve decision-making, professional accountants in business could encourage a wider assessment of the strategic impact and economic rationale of a potential investment. Organizations should place investment appraisal in a wider strategic context. For example, determining whether acquisition or internal growth is most effective in reaching an organization's strategic objectives requires an understanding of the business environment and an organization's specific situation. A wider strategic analysis might include an assessment of (a) market economics, (b) economic profitability across markets, products, and customers, (c) determinants of sustainable profitable growth and competitive position, and (d) alternative options. In this context, where appropriate, professional accountants in business could encourage consideration of a range of stakeholders in assessing potential investments. That range could include employees, managers, communities, customers, suppliers, the industry, and the general public.
- 1.12 Professional accountants in business could advise on the alignment of investment appraisal with assessments of subsequent managerial performance. For example, management incentives based on accounting profit could encourage actions that do not support long-term value generation to shareholders. For example, a potentially good (based on NPV criteria) project, supported by a wider assessment of its strategic importance, could result in poor accounting returns in its early years.

## **2. Key Principles That are Widely Accepted Features of Good Practice**

### **Scope of this IGPG**

- 2.1 Investment (project) appraisal refers to evaluations of decisions made by organizations on allocating resources to investments of a significant size. Typical capital spending and investment decisions include:
- Make or buy decisions, and outsourcing certain organizational functions
  - Acquisition and disposal of subsidiary organizations
  - Entry into new markets
  - The purchase (or sale) of plant and equipment
  - Developing new products or services (or discontinuing them), or decisions on related research and development programs
  - The acquisition (or disposal) of new premises or property by purchase, lease, or rental
  - Marketing programs to enhance brand recognition and to promote products or services
  - Restructuring of supply chain
  - Replacing existing assets.
- 2.2 Definitions of terms used in this IGPG are at appendix B. The purpose of this IGPG is to support decisions in organizations for managerial purposes. Where DCF and NPV is used

in connection with financial reporting, professional accountants in business should refer to International Financial Reporting Standards or local GAAP requirements.

- 2.3 A commonly recognized feature of Islamic Finance is the prohibition of interest. While this may affect the use of corporate finance tools and the approach to investment project appraisals, it may not necessarily preclude its use under Sharia Law provided conditions of Sharia are met. For example, the estimation of the timings of future cash flow and estimating the value of a proposed project can be used as a reference or benchmark to support decisions undertaken in Islamic finance.

### **The Key Principles in Project Appraisal Using DCF**

- 2.4 The key principles underlying widely accepted good practice are:
- A. When appraising multi-period investments, where expected benefits and costs and related cash inflows and outflows arise over time, the time value of money should be taken into account.**
  - B. The time value of money should be represented by the opportunity cost of capital.**
  - C. The discount rate used to calculate the NPV in the DCF analysis should properly reflect the systematic risk of cash flows attributable to the project being appraised, and not the systematic risk of the organization undertaking the project.**
  - D. A good decision relies on an understanding of the business and an appropriate DCF methodology. DCF analysis should be considered and interpreted in relation to an organization's strategy, and its economic and competitive position.**
  - E. Cash flows should be estimated incrementally, so that a DCF analysis should only consider expected cash flows that could change if the proposed investment is implemented. The value of an investment depends on all the additional and relevant cash inflows and outflows that follow from accepting an investment.**
  - F. At any decision-making point, past events and expenditures should be considered irreversible outflows (and not incremental costs) that should be ignored, even if they had been included in an earlier cash flow analysis.**
  - G. All assumptions used in undertaking DCF analysis, and in evaluating proposed investment projects, should be supported by reasoned judgment, particularly where factors are difficult to predict and estimate. Using techniques such as sensitivity analysis to identify key variables and risks helps to reflect worst, most likely, and best case scenarios, and therefore can support a reasoned judgment.**
  - H. A post-completion review or audit of an investment decision should include an assessment of the decision-making process, and the results, benefits, and outcomes of the decision.**

### 3. Application Guidance on Implementing the Principles

**PRINCIPLE A**

**When appraising multi-period investments, where expected benefits and costs and related cash inflows and outflows arise over time, the time value of money should be taken into account.**

- A.1 DCF analysis considers the time value of money, based on the premise that (a) people prefer to receive goods and services now rather than later, and (b) investors prefer to receive money today, rather than the same amount in the future, i.e., one dollar (or other currency) today is worth more than one dollar tomorrow. An investor demands a rate of return even for a risk-less investment, as a reward for delayed repayment. Even the risk-free rate of interest is normally positive, because people attach a higher value to money available now rather than in the future.
- A.2 DCF analysis is appropriate for multi-period investments, i.e., where the expected benefit and costs arise over more than one period. For such investments, DCF supports decision-making better than evaluating an investment using payback period or accounting (book) rate of return. DCF recognizes that an investment has cash flows throughout its expected life, and that cash flows in the early periods of an investment are more significant than later cash flows. Many organizations use several methods for evaluating capital investments, an acceptable practice so long as they only supplement a DCF approach.
- A.3 The major limitation of using payback period as an investment criterion is that it may cause an organization to emphasize short payback periods too much, thereby ignoring the need to invest in long-term projects that could enhance its competitive position. The payback method (unless cash flows are discounted using the opportunity cost of capital) ignores both the time value of money and cash flows after the payback period. If the payback periods for two projects are the same, the payback period technique considers them equal as investments, even if one project generates most of its net cash inflows in its early years, while the other project generates most of its net cash inflows in the later years.
- A.4 The accounting rate of return criterion also ignores the time value of money. Furthermore, this technique uses accounting numbers that depend on the organization's choice of accounting procedures. This method uses net income rather than cash flows. Although net income is a useful measure of profitability, the net cash flow is a better measure of an investment's performance.
- A.5 Both the NPV and IRR methods discount cash flow, although NPV is theoretically preferable. IRR indicates a potential project's annual average return on investment in percentage terms. For this reason, it can be useful in (a) communicating an analysis of investment choices to entrepreneurs and employees without financial expertise, and (b) facilitating decisions where the discount rate is uncertain. However, it can provide misleading results in certain contexts. Calculating the IRR requires identifying the

discount rate that results in a zero NPV of cash flows. Comparing the IRR with the target rate of return on an investment can be useful in deciding whether to proceed, but it does not reflect the increase in a company's monetary value flowing from accepting an investment. Furthermore, the NPV approach can incorporate different discount rates for different periods, and cash flow streams of different systematic risks. This allows a proper reflection of changing macroeconomic conditions (inflation and interest rates) and the systematic risk of all projected cash flows. In certain circumstances, such as in multi-period projects where net negative cash flows are followed by net positive cash flows, and then again by net negative cash flows, there may be more than one IRR for which NPV will be equal to zero. Therefore, using the criterion of  $NPV > 0$  as a decision-making tool is better than using the criterion of  $IRR > \text{cost of capital}$ .

- A.6 For a listed company, using NPV as an aid to making decisions is typically consistent with the creation or maximization of shareholder value (or the market price of shares). Maximizing shareholder value implies that projects should be undertaken when the present value of the expected cash inflows exceeds the present value of the expected cash outflows. Any investment that demonstrates a positive expected NPV could contribute to shareholder value, because the risk- and time-adjusted expected cash inflows outweigh the expected cash outflows.
- A.7 As with all decisions in an organization, investment appraisal decisions and DCF analysis rely on good quality information. The characteristics of good information include: accuracy, relevance, reliability, consistency, completeness, and timeliness. All of these can be important in DCF analysis, but usually not all can be included in decision-making. Therefore, professional accountants in business are often faced with deciding which of these characteristics could be the most important, given a specific context, and judging the trade-offs between characteristics. One of the more difficult issues to deal with is bias (typically optimism bias) affecting information flows. Bias that is inherent in information that parts of the organization feed into a DCF analysis can influence decisions. It is important first to recognize bias, then to consider necessary adjustments in a DCF analysis to remove it where possible. Possible bias in forecasts is better addressed by adjusting cash flow estimates rather than the discount rate.

#### *Public and not-for-profit sector application*

- A.8 Governments in some jurisdictions provide guidance to its public sector bodies and authorities on how to appraise proposals before committing significant funds. For example, the United Kingdom, United States, Australian, and New Zealand governments provide guidance (see resources at appendix A) on the issues and techniques that should be considered when assessing new regulatory, revenue or capital policies, programs, and projects. Such guidance advises public sector departments and authorities how to undertake conventional DCF-based analysis to calculate NPV (and usually states that most assessments of potential investments require an NPV calculation). As in a commercial setting, the appropriate monetary yardstick for accepting an investment is normally based on a positive NPV, and/or an expected NPV that is higher than or equal to the expected NPV of mutually acceptable alternatives. However, such guidance can offer

advice on a broader cost-benefit analysis that can be more valuable to the public interest, and in which NPV is only one tool.

- A.9 Cost-benefit analysis is broader than financial analysis, because it considers the potential benefits that flow outside the implementing organization or agency. As well as considering the strategic, financial, and economic case for a proposed investment, a cost benefit analysis could include a number of assessments that consider the potential impact on various stakeholder groups, such as society, the environment, consumers, and employees. This helps to establish the total welfare gain over the whole life of an investment. Non-monetary qualitatively based information can help to outweigh a negative NPV in a project assessment, allowing a proposal to proceed.
- A.10 Investments to improve welfare usually generate benefits that (a) do not have a market price, and (b) are not easily measurable in monetary terms. Therefore, cost-effectiveness measures can be non-monetary units, supported by the use of ratios to link a financial appraisal to the non-monetary benefits arising from an investment. For example, in investing in vaccination programs to support the development of countries, non-monetary measures can include tests of efficiency and effectiveness, such as the number of people immunized, the number of people immunized per dollar (or other unit of currency) invested, and the cost per immunization.

#### **PRINCIPLE B**

**The time value of money should be represented by the opportunity cost of capital.**

- B.1 The opportunity cost of capital is fundamental to investment decisions, and is a significant input to a DCF analysis. Small changes in the discount rate may have a big impact on the NPV (and IRR) of a project. If the selected discount rate is too high, potentially good investment projects appear bad, and if too low, bad investments look attractive. For example, a project with an initial investment of \$800,000, and with annual cash flows of \$500,000 over a 6-year period and a discount rate of 15 per cent will have an NPV of over \$52,000 lower than if the project was considered with a discount rate of 14 per cent.
- B.2 Discounting cash flows reflects the time value of money, which assumes that (a) generally, people prefer to receive goods and services now rather than later (even in the absence of inflation), and (b) the promise of money in the future carries risk for which an issuer of security will require compensation. To calculate present value, estimated future cash inflows and outflows should be discounted by a rate of return (commonly referred to as the discount rate) offered by comparable investment alternatives. In applying the cost of capital, professional accountants in business should consider the most appropriate method for determining present value. For risky cash flows, it is typical to discount expected value using a risk-adjusted discount rate (i.e., adjusted for time and risk). However, an alternative approach is to use a certainty equivalent method that makes separate adjustments for risk and time. Such an approach adjusts for the time value of money by using the risk-free rate to discount future cash flows, after converting uncertain

cash flows into their certainty equivalents. Although not widely used in practice, this approach can be useful when risk varies over time, as it allows each period's cash flows to be adjusted for their specific risks. However, it is important to recognize that, as this method does not involve a market-derived risk element, there will be subjectivity encountered by the decision maker in estimating the appropriate certainty equivalent.

- B.3 In calculating an organization-wide cost of capital, a rate of return is usually required for each form of capital component, whether it is derived from shareholders (equity) and/or lenders (debt). The cost of capital associated with investment and capital budgeting decisions is typically a weighted average of the various components' costs – typically called the weighted average cost of capital (WACC). Determining the cost of equity capital can be particularly difficult, as the application of techniques such as the Capital Asset Pricing Model (CAPM) can be complex, and subject to a number of variations to reflect particular contexts. It should also be noted that where there is not an open market for securities, CAPM is not usually a useful approach to assess risk because of the difficulties of estimating beta.
- B.4 To provide organizations flexibility in applying and estimating the cost of capital, IAS 36 suggests that an organization could also take into account its incremental borrowing rate and other market borrowing rates. However, professional accountants in business should be aware of the disadvantages associated with these methods, and apply them appropriately given the organizational context. For example, depending on the debt-equity ratio, the cost of debt, the nominal borrowing rate, and the WACC will provide varying values, so that for a highly leveraged organization, the use of the incremental borrowing rate as the cost of capital could lead to an inappropriate estimate for value in use.
- B.5 When using CAPM or alternative techniques to estimate the cost of equity, professional accountants in business should be familiar with the financial theory that underpins them, and their implications for determining the cost of capital. For example, CAPM is based on portfolio theory, which assumes that markets are efficiently priced to reflect greater return for greater risk, and that investors are perfectly diversified. This suggests that investors should only be compensated for systematic risks that affect their whole portfolio of shares. Therefore, although project- and organization-specific risks are important considerations in allocating resources, risks specific to an investment or a project should not be reflected in the discount rate, but rather in an adjustment to the cash flows of the investment or project. For example, diversification by organizations could increase value, but it should not be assumed that diversification will reduce the cost of capital. Reflecting risks in cash flows also enables managers to better assess how specific risks affect value, and therefore how to manage them.
- B.6 Where applying CAPM and its beta coefficient, professional accountants in business should be familiar with the approaches that could be used to enhance their application. They include altering the period over which to measure beta, the frequency of observation, comparator analysis with industry sector betas, and choice of data provider. Comparator analysis, which averages betas across a selection of comparator/peer

companies, can sometimes help estimate betas for organizations not listed on a stock exchange. It could also be necessary to consider how changing capital structures affect expected returns and beta.

### **PRINCIPLE C**

**The discount rate used to calculate the NPV in a DCF analysis should properly reflect the systematic risk of cash flows attributable to the project being appraised, and not the systematic risk of the organization undertaking the project.**

- C.1 The discount rate an organization uses to assess an investment opportunity should be calculated separately, and should not necessarily be the same as the overall cost of capital for the organization. A potential investment with a high systematic risk will always be risky, irrespective of the investor or the organization. An organization with a perceived lower risk should not use its overall cost of capital to appraise an investment that is potentially more risky. Although an organization-wide cost of capital could be the starting point for considering discount rates for project risk, it can only be considered an appropriate discount rate for projects that have the same risk as an organization's existing business.
- C.2 Organizations considering an investment with high specific risks often use a high investment hurdle rate rather than using the discount rate, therefore departing from a lower cost of capital that is calculated using the portfolio approach. There is no theoretical basis for setting a very high hurdle rate to compensate for high specific risk or a risk of failure. It is a matter of judgment, which can be supported by calculating the probability-weighted expected value of cash flows of an investment. This could be achieved by (a) developing several scenarios, and (b) assigning them probabilities of realization (including a probability of a project failure if applicable) – link to principle G. Organizations should be aware of the potential behavioral issues that can arise where an investment hurdle is higher than the cost of capital for a project. In some situations, it could encourage bias in projections and skew investments towards higher risk projects.

### **PRINCIPLE D**

**A good decision relies on an understanding of the business and an appropriate DCF methodology. DCF analysis should be considered and interpreted in relation to an organization's strategy, and its economic and competitive position.**

- D.1 It is important to realize that decisions, especially those taken in a relatively high-risk environment, involve cash flow estimates based on judgment. Hard and fast cash flows do not exist. DCF analysis should probe behind cash flow estimates to understand both the nature of a positive NPV, and the source of value over the opportunity cost of capital.
- D.2 The NPV is only one criterion that supports an evaluation of a potential investment. It should be coupled with a review of (a) the investment's strategic importance, or (b) its alignment with the strategic themes and objectives that have been outlined in a strategic plan and/or in a balanced scorecard-type framework.

- D.3 Discussions and judgments on an organization's competitive environment and competitive position could contribute to (a) an understanding of whether an asset might be more valuable in the hands of another, and (b) highlighting significant forecasting and assumption errors. DCF analysis is most useful in evaluating an organization's strategic position, so that sources of competitive advantage can be better understood. Describing competitive advantage, such as by identifying superior customer value through product attributes and price, can improve the quality and relevance of financial forecasting.

#### **PRINCIPLE E**

**Cash flows should be estimated incrementally, so that a DCF analysis should only consider expected cash flows that could change if the proposed investment is implemented. The value of an investment depends on all the additional and relevant cash inflows and outflows that follow from accepting an investment.**

- E.1 Organizational strategy and business planning typically produces a range of investment options, some of which could need consideration and review. Each option can be appraised by establishing a base case that reflects the best estimate of its costs and benefits, and from which incremental cash flows can be estimated. These estimates can be adjusted by considering different scenarios, or the option's sensitivity to changes can be modeled by changing key variables. It is usually helpful to determine which variables lead to a different outcome for a base case and each option, and it could be useful to invest time to quantify these. A focus on incremental cash flows allows an analysis of the effect of a make or buy decision. In deciding whether to make or buy components or replace machinery, for example, the increased costs associated with the purchase and installation of new machinery/technology should be weighed against the savings.
- E.2 DCF analysis models after-tax cash flows arising from the investment. Only cash flow is relevant in DCF analysis, not accounting net income. Forecast profit and loss accounts should be converted into cash flow (earnings are usually reported on an accrual basis according to generally accepted accounting principles). Adjustments to profit to derive cash flow include (a) adding back depreciation, (b) reflecting changes in working capital, and (c) deducting future capital expenditures. Therefore, the cash flow effect of investment in inventories can be measured by considering whether additional cash has been required at the beginning or end of a year. If cash was released by depleting inventory, the resulting cash flow effect is positive. Working capital is a typical cash outflow at the beginning of a project, as more cash is required at the beginning of a new investment project. Liquidating working capital at the end of an investment project usually produces a cash inflow.
- E.3 At any decision-making point, only cash flows that arise in period 0 (period of initial investment) and in subsequent periods should be considered relevant in appraising projects. Incremental cash flow equals cash flow for an organization with the project, less cash flow for the organization without the project. Comparing a potential investment against declining to do it facilitates an understanding of the benefits from making the

investment. DCF analysis is typically based on years, but it can be conducted based on shorter time periods, such as months or quarters.

- E.4 Inflation should be considered in investment appraisal and DCF analysis. It affects cash flows, and could be significant. Inflation reduces the purchasing power of net cash flows over time. Inflation should be properly reflected in the nominal discount rate with a risk-free component of a formula; it should also be reflected in the projected cash flows, because projecting cash flows in real terms will make it impossible to properly state cash outflows related to tax payments. Care should be taken (a) not to use a real discount rate to discount nominal cash flows (and not to use a nominal discount rate with real cash flows), and (b) to ensure that the inflation assumptions in the forecast cash flows are consistent with the inflation assumptions inherent in the discount rate.
- E.5 DCF analysis using nominal prices usually requires an inflation forecast, although forecasting inflation over a long period is not usually reliable. In this case, the impact of different inflation rates on expected cash flows (and on debt service) can be modeled in a sensitivity analysis [link to principle G]. Where the discount rate is used in nominal terms, cash flows should also be expressed in nominal terms. If inflation is not very high and is consistently applied to nominal cash flows and nominal discount rate, the difference between real and projected inflation rates should not materially affect the NPV. Inflation rates for various variables such as rents, labor, materials, and sales could also be different.
- E.6 In practice, there is no universal approach to selecting cash flow projections on real or nominal terms. Using real figures leads to a better meaning, because (a) large sums in nominal terms can mislead (because they represent cumulative inflation), and (b) revenues, costs, and interest are generally forecast in real terms. On the other hand, modeling income statements and balance sheets in real terms leads to complexity, because tax is generally paid on nominal profits, and depreciation is normally calculated on nominal asset book values. Nominal terms should be used where tax, depreciation, and working capital charges can materially affect the analysis. However, modeling using real rather than nominal figures could be necessary in specific contexts, for example in countries with hyper-inflation.
- E.7 Cash flows should be measured after corporate tax. Where a proposed investment changes the tax liabilities of an organization, the tax effects should be included in a DCF analysis, and incorporated into the cash flow at the correct time. Cash received, and cash paid or committed, have an immediate effect on the amount of cash available to the organization; this immediate impact is referred to as the *direct effect*. An event or transaction can change an organization's tax obligations; this impact on an organization's tax payment for the period is referred to as the *tax effect* or *indirect effect*.
- E.8 Non-cash revenues or expenses that have tax effects also affect cash flows. Non-cash revenue such as a credit sale does not initially increase the cash available to an organization, but may increase its taxable income for the period, thereby increasing the cash needed to pay taxes. Therefore, non-cash revenue decreases, not increases, the cash

available to the organization. The amount of the decrease is equal to the increase in taxes resulting from the non-cash revenue.

- E.9 On the other hand, an increase in expenses could decrease taxable income, reducing taxes for the period. A non-cash expense, therefore, could increase cash inflow. In some jurisdictions, depreciation is a non-cash expense that does not require a cash payment in the period in which the expense is recognized. The expense, however, reduces an organization's tax payment for the period. This increases cash available for other uses and results in a cash inflow.
- E.10 Tax incentives offered in particular jurisdictions should be incorporated into the DCF analysis. For example, some jurisdictions offer tax benefits to attract investment from overseas.
- E.11 Terminal (residual) cash flows should be considered where plant, buildings, and other assets deployed during the investment project have a residual value or cost. Assets could have an alternative use within an organization, in a second-hand market, or as scrap. In other cases, their disposal, perhaps relating to environmental legislation, attracts a cost.
- E.12 The additional effects of a proposed investment on the rest of an organization should be considered in DCF analysis. This involves considering the effects on after-tax cash flows elsewhere. For example, a new investment might affect sales of other products. It is usually unlikely that cash flows will be 'normalized' from period 0. Incidental effects should be considered in the context of overall strategy, so that investment decisions support strategic objectives. Set against a scenario of a competitor purchasing a site to establish a store, a retailer could open a second store in a town, which could detract sales at its first store, or invest in internet sales that could decrease earnings at all its stores. This loss elsewhere becomes a relevant cash flow in appraising the new investment. However, although this investment could be out-ranked in terms of potential NPV by another opportunity, the retailer could decide to acquire a second site for strategic and competitive reasons.
- E.13 NPV is not flexible in handling follow-on investments linked to an initial investment. Real options analysis is an emerging and evolving area of practice in valuation and investment appraisal; it can be seen as an extension of DCF analysis. It accommodates real-life scenarios in which cash flows often depend on decisions that will only be made after resolving uncertainties. Real options can enhance DCF analysis by incorporating uncertainty and flexibility – often both important aspects of managerial decision-making. Real options that typically represent adjustments that can be made to projects following a decision to invest include the options to:
- Abandon
  - Expand
  - Scale-back
  - Delay
  - Outsource.

Organizations that utilize this options-based approach can (without a commitment) up-scale investments if demand warrants; for this reason this approach is more widely used in research- and development-intensive organizations, such as pharmaceuticals, where there is high uncertainty (and most value to gain from using the approach). Real options analysis is usually most beneficial where management has flexibility, and where NPV is low and marginal. It is often applied to significant investments that warrant the additional costs of analysis.

- E.14 When to make investments remains an important decision that in every case requires analysis using DCF as well as real options analysis. The benefits of a potential investment could exceed its costs, but postponing it could change the time profile of benefits and costs, and therefore the investment's or project's NPV. Projects generally have two mutually exclusive alternatives: invest now or later. A decision not to invest could also result from a DCF analysis.

*Public and not-for-profit sector application*

- E.15 In the public and not-for-profit sectors, the DCF analysis is made from the perspective of the implementing organization or agency. It identifies net money flows of an investment to the implementing organization or entity. Organizations in this sector may receive goods and services free of charge (through donations, or volunteer labor, such as parents performing services for schools). This is a genuine advantage to the local entity, but donated resources still represent a true cost to society. They should therefore be included (valuing them at market price where possible) when evaluating proposed investments for policy-making from society's perspective. In most local decision-making, however, viewed from within an organizational unit, only cash costs should be included. However, there may be an opportunity cost in using volunteers because all resources are limited.

**PRINCIPLE F**

**At any decision-making point, past events and expenditures should be considered irreversible outflows (and not incremental costs) that should be ignored, even if they had been included in an earlier cash flow analysis.**

- F.1 Past events and expenditures (often referred to as costs of goods and services already incurred, or sunk costs) should not affect a decision whether to pursue a potential investment, and therefore should generally be ignored in decision-making. Investments do not necessarily need to be completed solely because of significant past expenditures.
- F.2 Sunk costs are always fixed costs, but not all fixed costs are sunk. Examples of sunk costs are investments in equipment that can only produce a specific product, advertising expenditures, or R&D expenditures.
- F.3 Opportunity costs should be considered in DCF analysis. The opportunity cost reflects the best alternative uses to which goods and services could be put. Typically, opportunity costs are difficult to estimate, especially when they arise internally in an organization.

When a resource is freely traded, its opportunity cost is equal to its market price. Therefore, the amount an organization pays for process input or receives for a process output is based on actual prices.

- F.4 Exploring opportunity costs should improve decision outcomes. Proposed investments could divert resources from other projects, and the loss of cash flows from these other projects are opportunity costs that should be considered in decision-making. Costs should be expressed in terms of relevant opportunity costs. An example is making investment choices in the provision of transport, where there is a (a) choice between method of transport or different routes for road and rail links, (b) engineering choice, for example between tunnels and bridges, (c) choice between approaches to improving transport, such as infrastructure investment versus improved maintenance options, and (d) choice between public and private provision, or a mixture of both.

*Public and not-for-profit sector application*

- F.5 The public nature of a product or service sometimes creates market distortions. For example, the value to society of clean water is greater than the price people pay. In economies characterized by price distortions, market prices can poorly reflect opportunity costs. Price distortions can be compensated for by using shadow prices that more accurately reflect the opportunity costs and benefits of a potential investment; this can be a common approach in assessing an investment project's contribution to society's welfare. In considering whether to set shadow prices, the cost of their calculation should be weighed against the benefit to the investment appraisal. For investments by donor agencies, for example, typical adjustments are made to the prices of tradeable goods, the exchange rate, and the wage rate.

**PRINCIPLE G**

**All assumptions used in undertaking DCF analysis, and in evaluating proposed investment projects, should be supported by reasoned judgment, particularly where factors are difficult to predict and estimate. Using techniques such as sensitivity analysis to identify key variables and risks helps to reflect worst, most likely, and best case scenarios, and therefore can support a reasoned judgment.**

- G.1 The quality of a DCF analysis is better judged on (a) the reasonableness of the assumptions and judgments made at the time of the analysis, and the degree of discussion and support it received in the organization, rather than on (b) whether a financial forecast was realized.
- G.2 Assessing uncertainty involves understanding how future risks and uncertainties can affect cash flows, and therefore the choice between potential investment options. The most common way of assessing uncertainty is *sensitivity analysis*, which tests the vulnerability of options to potential events. It assesses risks by identifying the variables that most influence a potential investment's cash inflows and outflows, and by quantifying the extent of their influence. It is one of the best methods to (a) gain consensus on the underlying variables most critical to success, (b) help determine what

further information could be useful in the investment analysis, and (c) help expose inappropriate projections. The usefulness of sensitivity analysis depends as much on how it is presented as on how it is conducted. It can help facilitate discussion between key stakeholders and improve communication between managers involved in the decision. A frequent monitoring and review of key assumptions and variables can also help to respond to changes in the wider competitive business environment.

- G.3 Distinguishing between fixed, variable, semi-variable, and semi-fixed costs helps to enhance sensitivity analysis. Therefore, thorough cost information and an understanding of the cost dynamics (for example, understanding that a cost that is fixed relative to one factor may change with another) are required to support a DCF analysis and investment appraisal.
- G.4 Risk modeling techniques such as the *Monte Carlo Simulation* allow consideration of multiple combinations of variables. Investment options are typically affected by a range of variables, for example, market share and size, wages, revenues, prices, and assumptions about the transfer of risks. These variables are usually interrelated, so that understanding their interconnectedness can be more useful than isolating the impact of only one variable (as is the case in sensitivity analysis). Often used in simulating research and development investments, the Monte Carlo Simulation models the potential investment, specifying probabilities for forecast errors, and simulating cash flows. The complexity of such tools requires an understanding of the required data, how it is to be used in the model, and how results will be presented and used.
- G.5 *Decision trees* facilitate the analysis of investments involving sequential decisions. They are useful in assessing situations where the probability of occurrence of particular events depend on previous events. This helps managers identify and present (a) links between today's and tomorrow's decisions, and (b) a strategy that could support the highest NPV. Decision trees are also widely used to support real options analysis, as described in paragraph E.13.
- G.6 *Scenarios* help decision-takers to consider a range of future possibilities including prosperity, social or technological change or economic downturn. Scenario planning helps to envisage several possible futures, key uncertainties and trends in the business environment, and to consider their implication for an organization. Modeling variables within scenarios allows for the consideration of the impact on each component of cash flow, such as revenue and expenses. For example, in assessing investments in emerging markets, macroeconomic variables such as inflation and interest rates, foreign-exchange rates, and growth in gross domestic product can be modeled.

#### **PRINCIPLE H**

**A post-completion review or audit of an investment decision should include an assessment of the decision-making process, and the results, benefits, and outcomes of the decision.**

H.1 Post- (investment) completion reviews or audits facilitate organizational learning, and support continuous improvement in the investment and implementation process. They assess, after the fact, the efficiency and effectiveness of an investment appraisal, and management's decision and implementation. Learning is possible from apparently successful investments, as well as those which are already considered not to have met their objectives. Typically post-completion reviews may consider whether:

- a decision to invest was sound in the first place, by comparing assumptions made in the appraisal with actual values experienced;
- the implementation of the decision was well planned, by considering what went well and what badly; and
- the plan was itself well executed in practice, by comparing both process and outcome with what was intended.

Given these different possible purposes of a review, and because the financial impact of an investment decision is typically felt over several years, a post-completion review of an investment decision may also be conducted in phases. These could include a more immediate assessment of the decision-making process itself, and subsequently a review of the results, benefits, and outcomes of the decision, if necessary broken up by meaningful phases of a project. Unless a review specifically considers how well assumptions made during the decision-making process (for example on markets, technology, competition, wage rates, cost of capital,) were matched by reality, it is unlikely to help improve forecasting, assumptions in future investment cases, and the quality of decisions. Judgment is required on the timing of such comparison.

H.2 Post-completion reviews and audits can be expensive both in terms of the cost of information systems that support the review as well as the cost of the review itself. Therefore, professional judgment is required on the choice of projects to be reviewed, and the criteria used to support a cost benefit analysis of a potential review will depend on organizational circumstances, the expected opportunity for learning lessons, and the nature of the project, especially its strategic and financial scope. The larger and more strategic the investment, the more important it is that the investment is shown to be sound and well managed, and the more likely it is that the costs of a post-completion review and will reveal insights that will benefit of the whole organization. Furthermore, investments at an operational level could be subject to alternative control mechanisms such as routine reporting that covers key performance metrics such as capacity utilization of an investment.

H.3 A review of the decision-making process could involve (a) reviewing all the assumptions and the process(es) that led to their formulation, (b) comparing actual resources consumed by the project with forecasts made at the assessment period, and (c) reviewing the procedures used to obtain an effective and efficient project management process. Above all, a post-completion review/audit should provide an overview of the way in which the decision-making process can be improved.

- H.4 A post-completion review monitors and evaluates the progress of capital investment through comparing actual cash flows and other costs and benefits with those originally projected. Where a review cannot measure all cash flows generated by an investment project (for example where it is not possible to separate the impact of a project from the remainder of an organization), relative success should be judged on a wider set of business processes, initiatives or program. In such cases it is good practice to make clear how the evaluation will be conducted at the time the investment is made, i.e. what will define success for the project.
- H.5 A DCF analysis is undertaken on a marginal basis, which assumes that economic activity should be continued as long as the marginal benefit of one more unit of the activity is greater than or equal to the marginal cost. However, a post-completion review or audit should not necessarily ignore sunk costs related to an individual project and should consider all appropriate historic costs and benefits on a full-costing basis, particularly where the post-completion review or audit is undertaken for a stewardship role.

## Appendix A

### Resources

This list of resources is not intended to be exhaustive. Use the IFAC KnowledgeNet at [www.ifacnet.com](http://www.ifacnet.com) to search IFAC and many of its member body websites.

#### Selected reference material

[IAS 36](#) [web link], Impairment of Assets, revised 31<sup>st</sup> March 2004

Carr C, Kolehmainen K and Mitchell F, [The Influence of Context on Strategic Investment Decision Practices: The Role of Strategic Management Accounting, Paper presented to the European Accounting Association 2008 Conference](#) [web link]

Management Accounting – Business Strategy, [The examiner for \(CIMA\) paper P6 explains the commercial value of foresight and outlines some of the key methods available for envisioning the future](#), Financial Management, April 2008 [web link]

Huikku, Jari (2007) Explaining the Non-adoption of Post-Completion Auditing, European Accounting Review, Vol. 16, No. 2, p. 363-398

Guerrero R (Spring 2007), The Case for Real Options Made Simple, The Journal of Applied Corporate Finance, Morgan Stanley

The Institute of Chartered Accountants in England and Wales (2006), [Measurement in Financial Reporting](#) ISBN-13 978-1-84152-456-6 [web link]

Principles of Corporate Finance (2005), Richard A Brealey, Stewart C. Myers and Franklin Allen, McGraw-Hill ISBN-10 007-31308-26

Corporate Financial Management (2005), Glen Arnold, Financial Times/Prentice Hall ISBN-10: 0273687263

The Chartered Institute of Management Accountants Official Terminology (2005), Elsevier ISBN: 075066827X

CMA Canada, [Management Accounting Practice 3900 – Uncertainty and Capital Budgeting](#) [web link]

[The Real Cost of Capital: A Business Field Guide to Better Financial Decisions](#) (2004), Tim Ogier, John Rugman and Lucinda Spicer, Financial Times Press ISBN-10: 027368874X [web link]

[The Fédération des Experts Comptables Européens guide on Business Valuation: A Guide for Small and Medium Sized Enterprises \(2001\)](#) includes advice on applying the cost of capital for carrying out business valuations. This describes the principles to be applied in the valuation of small and medium sized entities, and this includes the determination of the cost of capital. [web link]

Fundamentals of Investment Appraisal (2000), Steve Lumby and Christopher Jones, Int. Thomson Business Press ISBN-10 186-15260-75

**Selected public sector guidance on cost benefit analysis and DCF analysis**

UK Government, HM Treasury guidance in its [Green Book](#) [web link]

Australian Government (Department of Finance and Administration) [Handbook on Cost-Benefit Analysis](#) [web link]

The US Executive Office of the President [Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs](#) [web link]

New Zealand Government, [The Treasury Primer Cost Benefit Analysis](#) [web link]

## Appendix B

### Definitions

- **Assessment period:** the phase during which information to enable the investment project decision is compiled and the decision is made.
- **Beta:** the factor used in the Capital Asset Pricing Model to reflect the risk associated with a particular equity. Beta is a proxy for the market risk that shareholders bear.
- **Capital Asset Pricing Model (CAPM)<sup>1</sup>:** a tool to estimate the cost of equity capital using several empirical inputs. They include the following: the risk-free rate represents a return an investor can achieve on the least risky asset in a market; equity beta captures the systematic risk of an investment (link to paragraphs 2.2 and 2.15); and an equity market risk premium is the premium that a perfectly diversified equity investor expects to obtain over the risk-free rate. This model predicts that the expected risk premium for an individual stock will be proportional to its beta.
- **Cost benefit analysis:** the comparison between the costs of the resources used (plus any other costs imposed by an activity, such as pollution) and the value of the financial and non-financial benefits.
- **DCF analysis:** a financial modeling tool that uses projected cash flows generated by an investment. DCF analysis calculates value based on all expected cash flows related to (a) the investment or project, (b) the life of the investment, and (c) the opportunity cost of investing in a project of similar risk profile (represented by the discount rate).
- **Discount rate:** a rate that represents the opportunity cost of capital. A discount rate is a desired return that could be represented by (a) the specific return an investor expects for an alternative investment, (b) the interest rate on debt, or (c) another interest rate. The discount rate reflects the time value of money, and uncertainty and risk.
- **Internal Rate of Return:** the average annual percentage return expected for a project, where the sum of the discounted cash inflows over its life is equal to the sum of the discounted cash outflows. The IRR therefore represents the discount rate that results in a zero NPV of cash flows.
- **Nominal cash flows:** the cash flow that an organization generates or is expected to generate during a given period, without adjustment for factors such as inflation or the time value of money i.e. cash flows expressed in real terms represent the purchasing value as of the time of occurrence, nominal cash flows are expressed in currency of purchasing value as of the day of the investment evaluation.
- **NPV:** a single value that represents the difference between the sum of the expected discounted cash inflows and outflows attributable to a capital investment or other project, using a discount rate that properly reflects the relevant risks of those cash flows.

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<sup>1</sup> CAPM is represented by the formula  $R_i = R_f + \beta_i (R_m - R_f)$ , where:  $R_i$  represents expected rate of return on asset  $i$ ;  $R_f$  is rate of return on a risk-free asset;  $R_m$  represents expected rate of return on a market portfolio; and  $\beta_i$  is a beta coefficient of an asset defined as  $\text{Cov}(R_i, R_m) / (\text{Var}_m)$ .

- **Opportunity cost:** the value of the benefit sacrificed when one course of action is chosen over an alternative. The opportunity cost is represented by the foregone potential benefit from the best rejected course of action that has a similar relevant risk profile.
- **Projection:** an estimate of value in a future time period.
- **Real options:** represent the right, but not the obligation, to take different courses of action with respect to real assets (rather than financial instruments). Where DCF is based on a deterministic cash flow projection, with little allowance for management flexibility, real options introduce flexibility to defer, abandon, scale back, or expand investments. They should be considered as part of an evolutionary process to improve the valuation of investments and the allocation of capital.
- **Sunk or irrecoverable cost:** cost that has been irreversibly incurred or committed and cannot be considered relevant to a decision, such as pre-project market research and development costs.
- **Systematic risk:** the risks associated with holding a market portfolio of stocks, for example, interest rate increases, rate of inflation, and oil price changes. Systematic risk represents the variability in a security or stock's total returns that is directly associated with overall movements in the general market or economy. An investor can construct a diversified portfolio to eliminate the specific risks associated with an individual stock. Therefore, a well-diversified investor investing in additional stocks is exposed only to those risks that contribute to the overall riskiness of the portfolio.
- **Terminal value:** the residual value of a business or project at the end of the discrete period for which a detailed cash flow projection is prepared.
- **Value in Use:** the present value of the future cash flows expected to be derived from an asset or cash-generating unit.
- **Weighted Average Cost of Capital (WACC):** the opportunity cost to all capital providers (debt and equity) of investing in an alternative project of similar relevant risk profile, weighted by the project's relative contribution to a company's total capital, and calculated using market values of debt and equity.
- **Working (net) capital:** current assets (cash, accounts receivable, and inventory) less current liabilities. Cash is only included as a working capital item to the extent it is required to operate the business.





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