PROJECT REPORT

ON

"THE STUDY OF BUDGETARY CONTROL"

A Project Submitted to

University of Mumbai for Partial Completion of the Degree of

Master in Commerce

Under the Faculty of Commerce

BY:

Mr. PRIYA TANAJI JADHAV

ROLL NO: 20096

UNDER THE GUIDANCE OF

PROF. Dr. DIPIKA VALECHA

SHRI SIDH THAKURNATH COLLEGE OF ARTS & COMMERCE
ULHASNAGAR - 421 004.

UNIVERSITY OF MUMBAI

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(embossing page)

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COLLEGE CERTIFICATE

This is to certify that the project report entitled, as "**A STUDY OF BUDGETARY CONTROL"**. Submitted in partial fulfillment of requirement for the award of the degree of **MASTER OF COMMERCE** from **UNIVERSITY OF MUMBAI**. carried out by **Ms. PRIYA TANAJI JADHAV** D/o **Mr. TANAJI TUKARAM JADHAV** under **Roll No. 200963** has been carried out the successful completion of the 03RD semester, under my supervision and guidance.

The data reported in it the best of my knowledge data reported is original the assistance and help receive during the course of this project has duly acknowledged.

Date : ……..

Place: ……..

Signature

Dr. DIPIKA VALECHA

Project Guide

DECLARATION

I the undersigned Ms. PRIYA TANAJI JADHAV here by, declare that the work embodied in this project work titled **" THE STUDY OF BUDGETARY CONTROL "** forms my own contribution to the research work carried out under the guidance of **Prof. DIPIKA VALECHA** is a result of my own research work and has not been previously submitted to any other University for any other Degree / Diploma to this or any other University.

Wherever reference has been made to previous works of others, it has been clearly indicated as such and included in the bibliography.

_____

(**PRIYA T. JADHAV**)

ACKNOWLEDGEMENT

To list who all have helped me is difficult because they are so numerous and the depth is so enormous.

I would like to acknowledge the following as being idealistic channels and fresh dimensions in the completion of this project.

I take this opportunity to thank the University of Mumbai for giving me chance to do this project.

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I take this opportunity to thank our **Co-ordinator** – **Ms. Varsha Sawlani** for her moral support and guidance.

I would also like to express my sincere gratitude towards my **Project Guide Prof. DIPIKA VALECHA** whose guidance and care made the project successful.

I would like to thank my **College Library,** for having provided various reference books and magazines related to my project.

Lastly, I would like to thank each and every person who directly or indirectly helped me in the completion of the project especially **my Parents and Peers** who supported me throughout my project.

OBJECTIVES

1. To present estimates of receipts and expenditure of the university in respect of a financial year before the commencement of that year;
2. To specify the objects for the limits up to which expenditure may be legally incurred during the course of financial year;
3. To use budget as a means of exercising financial control over approved items of income and expenditure;
4. To classify transaction in a manner, so far as possible, to make them in conformity with the system of classifications as it obtains in the government.
5. To regroup the heads and sub-heads of income and expenditures as to present at one place all receipts and expenditure of identical nature.
6. To facilitate proper reconciliation and control over cash balances by maintaining the cash books for the different parts of the budget separately.
7. To exercise proper and effective control over receipts and expenditure and to facilitate quick preparation of Appropriation Account.
8. To ensure ready availability of facts and figures for statistical use.
9. To facilitate in collecting, linking and correlating figures;
10. To eliminate avoidable and unnecessary details; and
11. To simplify the forms of Annual Accounts to be prepared and presented by the universities.

EXECUTIVE SUMMARY

Budgets are detailed plans for the operations of the unit. In firms with long range plans, they are the instruments that enable such plans to be achieved. Budgets begin by identifying limiting factors and are drawn up to ensure that those factors display maximum productivity. The budget should be reviewed and revised whenever significant changes occur in the economy, the extent of competition, production methods or the cost of meterials/labour. In the budgeting exercise the futuristic view of the organization is to be followed and sufficient provision made for unforeseen contingencies.

The Positive outlook of the employees towards the organization and its prosperity should go hand in hand and is to be balanced. Participative budget utilizes the benefit of improved communication, coordination and motivation. This requires at all levels to become involved with the budget preparation. Budget proposals are to be made first at the lowest level of management and then integrated into the proposals for the next level and so on, until the proposals reach the top level of management when the budget is completed

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INTRODUCTION

Most firms will need to do capital budgeting at some stage or another. Capital budgeting is the process with which new projects or even projects to simply renew or replace old assets are considered, evaluated and eventually implemented. Bearing in mind that firms do not have unlimited funds and the main goal is to maximize firm value the most suitable project needs to be found and eventually implemented through the capital budgeting process. This paper will lead through the various stages of the capital budgeting process as described by Mukherjee and Henderson (1987).

- Identification Process
- Development process
- Selection Process
- Control Process

In the Identification process firms are on the constant look out for potential new projects. Once these potential projects are identified they are moved on to the development process where this paper will focus on the screening, budget allocation and cash flow estimation. The development process filters out unsuitable projects so that an in-depth analysis is only done on the best projects. The projects that made it through the screening process are then moved on to the actual selection process where capital budgeting techniques are used to estimate returns. This paper will explain the theory as well as look at how the capital budgeting techniques are used in practice. Capital rationing as well as assessing the risk of projects are also important in the selection process and will thus be looked at in some detail. Lastly the projects estimated risks and returns need to be compared to the company's cost of capital. Here the paper will focus on the WACC, CAPM and surveys on recent trends on estimating cost of capital. Once a suitable project has made it through the rigorous selection process it will be implemented. Now it moves into the control section where its performance will be continually monitored. This will be the concluding section of the paper where the focus will be on managers' performance measures and incentives as well as the audit process.

IDENTIFICATION AND DEVELOPMENT PROCESS

Identification Process

Firms should always be on the lookout for opportunities to grow and expand their business. During the identification process firms need to assess what their current needs are and how best they can answer these needs. Istvan (1961) identifies two distinct categories of projects a firm may need to choose between. Firstly, there are the necessary projects for the company to remain a going concern. The firm has little or no choice but to accept these projects. Deyananda et al (2002) also note that certain projects may be mandatory due to health and safety regulations. The second category of projects as noted by Istvan (1961) either increase firm value or reduce costs. These projects are more difficult to choose between as many factors play a role in which projects are best suited to the firm's current and future needs. The identification process needs much creativity, as the possible ways to answer the firm's needs could be endless. Istvan (1961) found that the identification of projects is usually made by lower management or operating personnel as these people are closer to the firms operations and thus have a better understanding of what projects would add value and are essential to the firm. Once possible project ideas have been identified these are submitted so that they can be screened and evaluated further.

DEVELOPMENT PROCESS OF CAPITAL BUDGETING

SCREENING PROCESS

The identified projects that answer to the firm's specific needs must be screened for their suitability and value adding potential to the firm. The screening takes place, as it would be too costly to do an in-depth analysis on all available projects when they could have been excluded prior due to unsuitability.

The potential financial gain from projects to the company needs to be assessed. These are the incremental cash flows to be expected from undertaking the project compared to its costs. Cash inflows can either come in the form of increased revenue or reducing the firm's operating costs. To evaluate the added value that the projects add to the firm, all factors need to be taken into account. These include acquisition costs, lost opportunity costs for not undertaking other projects, salvage value at the end of the project and the riskiness of the project. Another factor which is not of financial but of ethical nature is that many firms opt for projects that are in line with the firm's core values and image. Thus, projects may be rejected even though they may be highly profitable if they do not meet this requirement.

All projects are then formulated as a proposal so that management can ascertain each project's suitability to the firms needs and then choose the most profitable ones according to the capital available. Projects are usually ranked and chosen according to a few factors such as necessity or postponability and the hurdle rates set by the firms. The projects that make it through the screening process are then analysed in more depth to get a better estimate of cash flows and expected returns so that the most profitable ones can be chosen.

BUDGETING FOR CAPITAL PROJECTS

Capital projects usually require large investments by the relevant firms. Top management is usually in charge of allocating funds within the various firms. After a project has made it through the screening process the person in charge of it will apply for funds to undertake the project. There are, however, various concerns when funds are to be allocated. Harris and Raviv (1996) assume a decentralized model of management where divisional managers answer to headquarters. The divisional managers have more inside knowledge into the specific projects available and the value of them. The capital however needs to be allocated to the specific divisions from the headquarters but the headquarters do not have in-depth knowledge of the quality of the projects (Bernardo, Cai & Luo, 2001). This may create agency problems as the division managers will want as large a budget possible to undertake projects but the headquarters need

to allocate the funds so as to maximize the firm's value (Harris & Raviv, 1996). Therefore Harris and Raviv (1996) show that the optimal capital allocation strategy is to impose a spending limit on the divisions. If extra funds are needed these can be applied for at the headquarters discretion. The headquarters can then audit the project in more detail to ascertain whether the extra funds are needed and used in the firm's best interest.

CASH FLOW ESTIMATION

When evaluating potential capital projects two main things are needed: the estimated cash flows from and into the project as well as the appropriate discount rate to discount the cash flows back at to get a current value for the project (Pohlman et al, 1988). Cash flow estimation is the most important part in the capital budgeting process but also the most difficult (Hall & Millard, 2010). The cash flows are needed so as to apply the capital budgeting techniques and through them decide if the project should be accepted or rejected. If cash flows are incorrectly estimated it will not matter which technique is used as the results will be flawed by the information going into the model; this could have a detrimental effect to the firm. Also the time value of money needs to be taken into account, however, Istvan (1961) found that many managers incorrectly prefer projects that payback sooner and estimate cash flows without taking the time value of money into consideration. When estimating cash flows the following points need to be remembered:

Relevant cash flows - Only the incremental cash flows must be included. These are the cash flows stemming directly from adoption of the project as well as the indirect effects that the project has on the firms other lines of business. Sunk costs as well as research and design expenditure must be ignored from the cash flow estimation as these were incurred regardless if the project is accepted or rejected (Ogier, Rugman & Spicer, 2004). Conservative or Optimistic Cash flows - In practice the cash flows by managers are not the same as those suggested by the theory. Real cash flows are often too conservative or too optimistic. This may be due managerial incentives or overconfidence in the projects cash flows by managers. When cash flows are either conservative or

optimistic the discount rates used need to be adjusted up or down accordingly (Ogier, Rugman & Spicer, 2004).

Examples of some of the cash flows to be considered are:

- Initial cost
- Sales, Revenue to be received from undertaking the project
- Expenses relating to the project
- Cost of sales
- Taxes
- Depreciation
- Working capital
- The effect of inflation on cash flowsOpportunity cost of forgone projects

In a survey done by Pohlman, Santiago and Markel (1985) it was found that large firms estimate cash flows 60% of the time for their capital expenditures. Also 67% of the firms had a specific person overseeing the cash flow estimation process. When asked how they forecast cash flows, subjective estimates were used 90% of the time; sensitivity analysis was used 69%, experts' opinions (67%) and computer simulations (52%). These results can be compared to a South African study where 46.3% used subjective estimates, 33.3% used quantitative methods and 14.8% used experts' opinions (Hall & Millard, 2010). This is quite remarkable that human estimates are used more widely than more sophisticated quantitative methods. It shows that experience is more valuable and accurate than most financial models.

Factors that were found to be important in cash flow estimation were:

- Financial factors such as: working capital, tax acquisition of funds and project risk
- Marketing factors: sales forecasts, competitive advantages and disadvantages
- Production factors: Operating expenses, Overheads and expenses and Material costs

Managers required detailed cash flow estimates for the above categories so as to make informed decisions regarding adopting or rejecting certain projects. When asked about the accuracy of their estimates the managers showed 90% accuracy, however, operating cash flows were the most difficult to predict with accuracy, as only 43% of managers managed to get them on target.

METHODS USED FOR CAPITAL BUDGETING

3.1. Accounting Rate of Return

Theoretical Background

The accounting rate of return (ARR), or alternatively the book rate of return, is a popular "rule of thumb" capital budgeting technique used by managers of firms to evaluate real investment projects. The ARR is essentially a simple financial accounting ratio, which provides an estimate of project's worth over its useful life.

A number of different variations of the basic ARR formula exist. The ARR is similar to the financial accounting ratios of the return on investment (ROI) or the return on assets (ROA) (Brealey, Myers & Allen, 2008). However, the main formula is generally defined as the average accounting profit earned on an investment divided by the average amount of capital invested (Hillier, Grinblatt & Titman, 2008):

Accounting Rate of Return = Average Accounting Profit / Average Investment

The ARR is expressed as a percentage. This rate of return is then compared to the required rate of return/target hurdle rate. If the ARR is higher than the required rate, then the proposed project will be accepted. In contrast, if the accounting rate of return is less than the required rate, the project will be rejected (Hillier, Grinblatt & Titman, 2008). Thus, when comparing investments, the higher the ARR, the more attractive the investment is.

There are several advantages to using the ARR as a capital budgeting technique. As Bester (nd) notes, the main ARR is that it is relatively simple and easy to understand and calculate, thus allowing managers to use the measure as a quick estimate with which to compare investments.

However, despite the above advantages, the ARR has numerous disadvantages. An important weakness of the technique is that it makes use of accounting profit (book values), which may be very different to the cash flows generated by a project or investment. Thus the accuracy of the method may be affected by different accounting practices used by firms (Brealey, Myers & Allen, 2008). Another disadvantage, as noted by Bester (nd), is that the ARR fails to consider the time value of money. Thus, there are several shortfalls to using the ARR method and this is supported by MacIntyre and Icerman (1985), who state that the numerous weaknesses of the ARR often cause "its use in capital budgeting analysis to be misleading and can result in non-optimal investment decisions". Therefore the ARR will more likely be a useful capital budgeting tool when used with full recognition and understanding of its limitations (Brown, 1961).

Empirical Evidence

Numerous international studies conducted on capital budgeting techniques employed by firms, generally have indicated that the ARR is not a preferred method used by the majority of firms. In a study conducted by Graham and Harvey (2001), it was found that 20.29% of U.S. firms "always or almost always" use the ARR as a capital budgeting technique. This is a relatively low percentage when compared to the usage of discounted cash flow techniques such as the NPV and IRR methods. A study by Ryan and Ryan (2002) showed that 15% of U.S. firms preferred to use ARR. The unpopularity of the ARR is further illustrated in a capital budgeting survey of European firms conducted by Brounen, de Jong and Koedijk (2004). This study found that in the U.K., Netherlands, Germany and France, 38.10%, 25.00%, 32.17% and 16.07% respectively, of firms use the ARR. Thus from the above studies, it is evident that the ARR is not a primary technique used by firms when analyzing capital investment projects.

The results of empirical studies conducted in South Africa are generally similar to the results concluded in international studies about the use of the ARR. A study by Du Toit and Pienaar (2005) showed that firms used the ARR as a "primary capital budgeting method" only 11.3% of the time. When asked to identity "all capital budgeting methods used", the ARR was used by 35.9% of

firms. In contrast Correia and Cramer, in their 2008 survey, determined a much lower preference of firms using the ARR - only 14% of firms "almost or always almost" employ it as a capital budgeting tool. Furthermore, Correia, Flynn, Uliana and Wormald (2007) show in their study from 1972-1995, that there has been a decline in the use of the ARR in favour of an increase in the use of NPV and IRR (Correia & Cramer, 2008).

Thus from the above empirical evidence found in both international and South African studies, it can be concluded that the ARR is not a primary method used by firms when evaluating capital investment decisions, rather it is used as a supplementary method to other more popular techniques. The evidence shows that there has been a significant decline in the use the ARR and the main reason for this, as stated by Correia and Cramer (2008), is that there may be a lack of understanding of how the ARR is defined.

3.2. Profitability Index

Theoretical Background

The profitability index (PI) is a capital budgeting technique that attempts to identify the relationship between the costs and benefits of a proposed project and, hence is also referred to as the "benefit-cost ratio" (Brealey, Myers & Allen, 2008).

The formula is defined as:

Profitability Index = Present Value of Future Cash Flows / Initial Investment

The profitability index is seen as an "extension" of the net present value rule and is primarily used as a tool for ranking and selecting projects or investments when a firm has limited capital or resources (Mukherjee & Vineeta (1999). As the profitability index is ratio of cash flows to initial investment, a ratio of 1 is logically the lowest acceptable measure on the index. If the profitability index is greater than 1 (PI>1) then the investment will be accepted. Therefore, the attractiveness of the proposed project increases as the value of the profitability ratio increases (Hillier, Grinblatt & Titman, 2008).

Several advantages exist for using the profitability index. Bester (nd) notes that the profitability index is useful in that it shows whether an investment increases firm value, accounts for the time value of money, considers all cash flows of the project and accounts for the risk associated with future cash flows. Furthermore, as stated above, the profitability index is a particularly useful tool to select and rank projects when a firm is operating under capital rationing constraints (Hillier, Grinblatt & Titman, 2008). Lastly, the profitability index generally leads to the same decision as the NPV technique – that is, if a project has a positive profitability index, the NPV will also be positive (Brealey, Myers & Allen, 2008). In contrast, the profitability index may have several shortfalls. The main disadvantage as stated by (Brealey, Myers & Allen, 2008), is that the profitability index may be misleading when comparing mutually exclusive projects. Furthermore, the profitability index requires an estimate of the cost of capital to be calculated, which can be a lengthy procedure (Bester, nd).

Empirical Evidence

The empirical literature on the use of capital budgeting techniques has found that in international countries, the use of the profitability index is limited. The U.S. survey by Graham and Harvey (2001) found that only 11.87% of firms "almost or always use" this capital budgeting method, making it the second most unpopular method used. A similar result is found in the study by Brounen, de Jong and Koedijk (2004) which determined that in the U.K., Netherlands, Germany and France, 15.87%, 8.16%, 16.07% and 37.74% respectively, of firms use the profitability index. In comparison to other more popular techniques such as NPV and IRR, the use of the profitability index is significantly infrequent. A study by Ryan and Ryan (2002) further supports this notion as it found only 21% of U.S. firms used the profitability index, once again highlighting its limited use as a capital budgeting tool. The empirical evidence concluded in South African studies is generally in line with those results found in international capital budgeting studies. Du Toit and Pienaar (2005) found that when asked what "primary capital budgeting method" firms use, the profitability index was not used at all (0%). When asked to identify "all capital budgeting methods used", the profitability index was used 11% of the

time when evaluating investments. Correia and Cramer (2008) concluded that only 7.1% firms "almost or almost always" use the profitability index and was thus classified as the least favourable method used. Correia and Cramer (2008) concluded that a "lack of understanding" may lead firms to prefer other methods over the profitability index. Lastly, in a recent study by Hall and Millard (2010) it was found that only 4.8% of the firms in the study use the profitability index as a capital budgeting method. From the above evidence, it can be concluded that the profitability index is not a preferred or primary capital budgeting method used to evaluate proposed projects. Its limited use is found to occur in both international and South African studies. Although it does not appear to play a significant role in the capital budgeting decision-making process, the profitability index still remains a useful tool for evaluating investments when a firm faces capital constraints.

Payback period

Theoretical Background

The payback method is applied to evaluate a project based on the number of years needed to recover the initial capital outlay (Hillier, Grinblatt & Titman, 2008). For example, if an investment costs $1, 000,000 and gets a return of $250 000 each year. This project will then have a payback of 4 years. The formula used to calculate the payback period is:

Payback period= (Cost of Project) /(Annual Cash inflows)

Bhandara (1986) explains the advantages of the payback period:

- This method is simple for one to understand.
- The payback period method is easy to calculate.
- It is regarded as a measure of safety.
- This method emphasizes the liquidity aspect of an investment decision.

The payback method seems to be designed to meet a firm's assessment of its future cash position, particularly in the case where firms are short of funds (Merrett & Sykes, 1973). Brounen Jong & Koedijk, (2004) point out that some researchers argue that the payback approach is rational for severely capital

constrained firms. As with these firms, if the investment project doesn't pay positive cash flows early on, the firms will close the operation and therefore cannot receive positive cash flows that occur in the distant future.

The main disadvantage of the payback period method is that by concentrating on a projects net cash flow only up to the point where they equal the initial outlay, this method completely ignores overall profitability (Merrett, &Sykes,1973). There seems to be no valid reason to ignore cash flows after the payback period except that this method offers a simple rule of thumb, which allows managers to make swift decisions on minor projects (Hillier, Grinblatt & Titman, 2008). Another disadvantage is that this method ignores the timing of the returns; and gives equal weight to all cash flows before the cutoff; this will be addressed when discussing the Discounted Payback method (Lefley, 1996).

Empirical Evidence

Internationally Graham, Campell and Harvey (1992) reported that 56.7% of US firms used the payback period method, but yet it was only the 3rd most popular capital budgeting tool. US firms that use the payback method were found to be older; have longer tenure CEOs, who didn't have a MBA (Graham et al., 1992).

Graham et al (1992) also found that the payback method was more popular for smaller firms than it was for bigger firms, suggesting that the lack of sophistication is a compelling factor behind the popularity of the payback method. Brounen et al., (2004) agreed with Graham et al (1992), and found that the payback method is more popular with the smaller firms than the larger firms (except for in the UK). Bhanari (1986) gives a potential reason for this popularity in smaller firms by explaining that smaller firms have limited access to capital market and pay higher interest on borrowing, they are therefore more concerned with quick recovery of invested capital then larger firms are. The payback method is also found to be more popular among private companies than public (Brounen et al., 2004).

Interestingly enough most European respondent select the payback method as their most frequently used capital budgeting technique (Brounen, Jong &

Koedijk, 2004). Brounen et al., (2004) demonstrated that 69.2% in the UK, 64.7% in Netherlands, 50% in Germany and 50.9% in France choose the payback period method as their favourite capital budgeting tool. Brounen et al., (2004) concludes that this is a very surprising result as the payback method ignores cash flows beyond the cut-off date and also ignores the time value of money.

In South Africa, Du Toit and Pienaar (2005), found that the payback method was used by 41% of companies, and was the 3rd most favourite tool to be used. Correia and Cramer (2008) concluded that 53,6% of CFO's always and almost always used the payback method. Therefore it can be concluded that the South African Evidence is mostly in line with the studies done internationally.

Despite the disadvantages, it is obvious that the payback period has a robust ability to survive, as it still remains a popular method today interanationally and locally. The popularity stems from the advantages mentioned, the ease of computation and ease on understanding. The problem with this method is not in the concept itself, rather that this method is used to be the decisive factor when contemplating a project (Lumby, 1985). This method should rather be used to give information and just be a factor in the decision process.

Discounted Payback Period

Theoretical Background

Many variations of the payback method have been developed to eliminate the disadvantages found when using this method (Lefley, 1996). The discounted payback period method is similar to the payback period, however it doesn't ignore the time value of money as it is based on discounted cash flows. Essentially what is meant by the "time value of money " is that a given sum of money has a different value depending upon when it occurs in time (Lumby1985).

Lumby (1985) explains that this idea is concerned with the fact that money can be invested to earn interest. The discounted cash flow (DCF) payback period method asks, how many years will the project have to last in order for it to make sense in terms of net present value (Brealey , Myers, & Allen, 2008)?

An example of a discounted payback period method :

Discounted Cash Flows						
Project	**C_0**	**C_1**	**C_2**	**C_3**	**Discounted Payback Period**	**NPV**
A	-2000	$\frac{500}{1.10} = 455$	$\frac{500}{1.10^2} = 413$	$\frac{5000}{1.10^2} = 3757$	3	2,624
B	-2000	$\frac{1800}{1.10} = 1636$	$\frac{500}{1.10^2} = 413$	-	2	50
C	-2000	$\frac{500}{1.10} = 455$	$\frac{1800}{1.10^2} = 1488$	-	-	-58

This method will never accept a negative NPV project (Brealey et al., 2008). The general rule with the DCF payback rule, states that if an investment proposals payback, adjusted for the timing of the net cash flows, is less than or equal to the present value annuity factor at the firms cost of capital for the life of the proposal, the investment should be accepted (Longmore ,1989).

Empirical Evidence

Internationally, Bandari, B., Shyam (1986) found that the discounted cash flow techniques are becoming more popular and are displacing the payback method in large firms, but in small firms payback method is still the major technique used. It appears that in practice the discounted payback method uses discounted figures in its calculation, but yet allows managers to determine the payback hurdle rate, which is based on subjective judgment (Lefley, 1996).

Graham and Harvey (2001) showed that the discounted payback method was the 7th most popular tool to use, with just under 30% of CEOs who almost

always or always use this method. A survey done in 1998 in the Czech Republic, UK and US of medium to large firms, shows that the discounted payback method and conventional payback method were the most used technique (Lefley, Wharton, Hajek, Hynek& Janecek, 2004).

In South Africa, 25% of CFO's reported to always or almost always use the Discounted Payback method (Correia and Cramer,2008). In a survey by Du Toit and Pienaar(2005), their results on the discounted payback method was almost identical to study by Correia and Cramer (2008). This is in line with international evidence on the use of the discounted payback period.

The Discounted payback period, like the payback period ignores cash flows after the payback period, so therefore it isn't the full solution to the problems of the original payback period. Yet this measure is an improved measure of liquidity and project time risk over the conventional Payback method (Lefley, 1996). This method seems to be gaining in popularity internationally and locally.

3.5. Equivalent Annuity

Theoretical Background

The equivalent annual annuity formula is used in capital budgeting to show the net present value of an investment as a series of equal cash flows for the length of the investment. The equivalent annuity formula is especially helpful when comparing projects with different timespans as it works out the annual cash flows that can be expected from each project under consideration. The general NPV formula has some drawbacks as it calculates the present value of uneven cash flows and also does not take the length of the investment into account. This means that the reinvestment possibility of funds from short-term projects is neglected when compared to the long-term projects that will have funds invested for the whole time span. When applying the equivalent annuity formula:

$$C = \frac{r(NPV)}{1-(1+r)^{-n}}$$

The even annual cash flows over the length of the investment can be found. The project with the higher annual cash flows should be the preferred project even if the NPV of the other might be higher. This can be shown with an example.

Project A: 4 year project, NPV= 100 and r=8%

Project B: 15 year project, NPV= 150 and r=8%

Project A: $C = \frac{0.08(100)}{1-(1+0.08)^{-4}}$

C= 30.192

Project B: $C = \frac{0.08(150)}{1-(1+0.08)^{-15}}$

C=17.524

Through this example it can be seen that NPV would suggest opting for project B but the equivalent annuity shows that in actual fact project A is the better project as it's funds can be re-invested into new projects and earn extra returns for the 11 years which remain on project B and would thus have a higher overall return.

3.6. Internal rate of return

Theoretical Background

The Internal Rate of Return (IRR) is the interest rate that makes the net present value of a project/firm's cash flows are equal to zero. It, like other discounted cash flows, is used to evaluate whether a firm should undertake a project. The benchmark rate it is usually compared to the company's cost of capital, this is the hurdle rate. Managers do not consider capital markets in which the firm operates to calculate the IRR. Thus it becomes the minimum acceptable rate one is willing to accept a project at when comparing capital projects. A company would then calculate the available project IRR's at the time it wishes to invest and compare them to each other and the hurdle rate.

Example

If an investment has the following cash flows.

Year (n) Cash Flow (C_n)

0 −4000

1	1200
2	1410
3	1875
4	1050

Then the IRR is given by

$$NPV = -4000 + \frac{1200}{(1+r)^1} + \frac{1410}{(1+r)^2} + \frac{1875}{(1+r)^3} + \frac{1050}{(1+r)^4} = 0$$

In this case, the answer is 14.3%. This calculation is not easy to carry out manually and requires trial and error to do so. Lowenthal (1983) was one of many that came up with an iterative approach to determine the exact IRR. He concludes that successive iterations based on the equation:

$$R_k = \frac{P}{C} - \frac{(P - SR_{k-1})}{C(1+R_{k-1})^N} \quad k \geqslant 1$$

is a slower method to attain the IRR than Newton's method, although it is more rapid in its convergence to true IRR than the bisection method.

Nowadays all IRR calculations can be computed either my using a financial calculator or by using a spreadsheet program such as Microsoft excel.

Empirical Evidence

The IRR has had a rich usage in the history of capital budgeting internationally. Cooper et al (2002) examined many capital budgeting techniques and found a migration towards the IRR method as a preferred evaluation method. He documented an increase of 10% usage in 1959 to 57% in 1990. His results have resonated throughout the recent century and have been testament to the fact that IRR has been the preferred choice of evaluation technique internationally.

In the U.K. Pike (1996) conducted a survey on 100 large companies and found that the percentage of firms that use the Internal rate of return grew from 45% in 1975 to 81% in 1992. He also found that in 1992 the selected sample of firms did not use the IRR as a single evaluation technique, but rather that it was used mostly in a four method evaluation including NPV, Average accounting rate of return (AARR) and

PB, averaging 36% of firms opting to use a four method evaluation strategy. Schall, Sundem and Geijsbeek (1978) found similar results in their survey of 424 U.S. firms, observing that the majority of firms used a combination of NPV, IRR, AARR and payback, although they found that IRR was the highest used sole method of return evaluation.

In the U.S. Gitman and Forrester (1977) carried out a survey of 600 companies that experienced the highest growth as reported by Forbes and found over the period 1971-76, 53.6% of the firms used the IRR for evaluating projects. Stanley and Block (1983) also survey 339 U.S. firms and find that 65.3% of firms use the IRR as their primary discount technique. Thus we can conclude that the general consensus in the U.S. and U.K. has leaned towards the IRR as their primary evaluation technique.

In Asia Kester et al (1999) surveyed the executives in Hong Kong, Australia, Malaysia, Singapore, Phillippines and Indonesia and found that each country favoured the IRR as their preferred evaluation technique, consistent with international literature and practice. When each executive was asked whether they use single or multiple discount rates their responses were not common with U.K. and U.S. firms finding on average less than 20% of executives use more than one discount rate. With the exception of Australia who used a single discount rate to evaluate projects, the rest of the countries opted to use the specific capital to finance the project to cost the project.

Current theory has proposed that the IRR is a better measure for evaluating projects than the NPV due to the fact that it incorporates as simply stated a project with a higher IRR has a greater return for the firm. However there has been slow acceptance of the IRR in the past. Mao (1970) posits two possible reasons for the reluctance to accept IRR as the preferred measure. Firstly it doesn't consider the effect an investment will have on earnings. And secondly some authors have suggested the payback period is a better indicator of earnings liquidity, something which the IRR cannot account for.

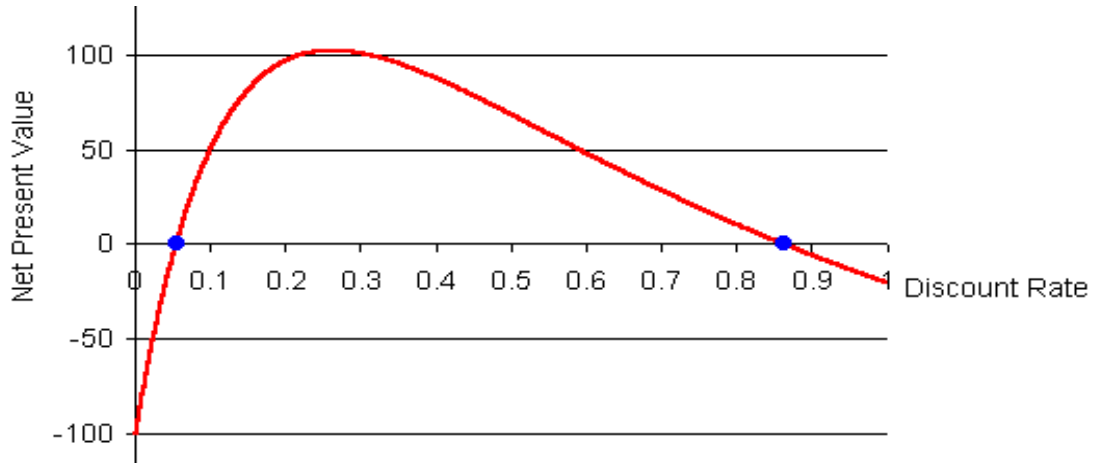
In South Africa a recent study by Du Toit and Pienaar (2005) surveyed 254 firms and found large corporations prefer to use the IRR method for evaluating projects. However a more recent survey of 67 Industrial companies, Hall and Millard (2010)

found that IRR is falling out of favour amongst South African firms, ranking it third behind NPV and Return on investment, being utilized by only 23,7% of the sample surveyed. The authors attribute IRR's preference to the fact that large firms were surveyed thus findings are consistent with international literature.

Problems

Although the IRR has been a popular choice in the past, the likely cause of it being dropped out of favour is due to many of its shortfalls.

Criticism 1: One major problem when calculating the IRR is that if you undertake a project with varying cash flow signs (between positive and negative), your output will be two IRR's which may be misleading and confusing as to which is the more appropriate of the two as one may be negative and the other may be excessively high.



Criticism 2: Another problem of the IRR is that rates fluctuate in reality, whereas the IRR is assumed to be constant, thus reinvestment at that constant rate will be an erroneous calculation.

Criticism3: when mutually exclusive projects are evaluated, you may select a project that has a larger IRR but a lower NPV, which would lead the firm to generating less cash flow as a result; something an executive would want to avoid.

Criticism 4: Sometimes the IRR may be incalculable, therefore leading analysts into a dead end. This however has been somewhat pushed under the rug as an integral criticism as the NPV sometimes experiences a similar shortfall.

The above criticisms are not strong enough to render the IRR insignificant however they may have an impact on the decrease in popularity we have observed over the recent two decades. The criticisms have also led practitioners to formulate an improved version of the IRR, namely the Modified IRR (MIRR).

Is the IRR Useful?

Yes indeed, the IRR is very useful in situations where the timing and the magnitude of the investment is of a critical nature. The IRR is very sensitive to timing and will allow investors fairly accurate holding periods for project. However due to all the shortfalls IRR experiences, it is not a surprise that theory tends to display the IRR being used with many other forms of valuation techniques to increase accuracy of the valuation. One of the major advantages of the IRR method is that it is easy to interpret and due to advanced computing programs it's also easy to compute.

Modified Internal rate of return

Theoretical Background

The IRR has been used and is still being used extensively in capital budgeting around the world. Graham and Harvey (2001) report that over 75% of CFO's always or almost always use the IRR to evaluate capital projects. The IRR method does however have some serious flaws to it; such as assuming an equal re-investment rate for re-invested funds and sometimes providing multiple answers. The modified internal rate of return (MIRR) is similar to the IRR and was first used by Lin (1976) to overcome the deficiencies of the IRR method. The MIRR is the IRR for a project with an identical level of investment and NPV to that being considered but with a single terminal payment. More specifically the MIRR is the average annual rate of return that will be earned on an investment if the cash flows are reinvested at specified rate of return, usually the companies cost of capital. Most practitioners would agree that using the company's cost of capital is a more logical rate to use when reinvesting the projects interim cash flows (Kelleher and McCormack, 2004).

There are two methods in working out the MIRR manually. In the first method the cash flows from every year are compounded by the companies cost of capital and brought together as one amount at the end of the project. In the second all cash flows are brought back to their present value (PV). This is best explained using an example.

For example:

Cash Flows for project, assume 10% cost of capital

0	1	2	3
-1000	400	600	300
	$400(1.1)^2$		484
		600(1.1)	660

Terminal cash flow=1444

This value can then be plugged into the following formula:

$$MIRR = \sqrt[n]{\frac{Terminal\ cash\ flow}{PV\ of\ Outlay}} - 1$$

$$MIRR = \sqrt[3]{\frac{1444}{1000}} - 1$$

$$MIRR = 13.03\%$$

The second method is to calculate the PV of the future cash flows.

0	1	2	3
-1000	400	600	300
363.36	$\frac{400}{1.1}$		
495.86		$\frac{600}{1.1^2}$	
225.39			$\frac{300}{1.1^3}$

1084.90= PV

Then plugging the PV into the following formula:

$$MIRR = \sqrt[n]{\frac{PV}{PV\ of\ Outlay}} \times (1+i) -1$$

$$MIRR = \sqrt[3]{\frac{1084.90}{1000}} \times (1+0.1) -1$$

$$MIRR = 13.03\%$$

The IRR of the project is stated as: 14.92%
Example taken and modified from:
(http://www.accaglobal.com/pubs/students/publications/student_accountant/archive/sa_apr08_ryan2.pdf)

As it can be seen both methods provide the same results and are lower than the calculated IRR this is because the reinvestment rate is taken to be the companies cost of capital rather than assuming to be able to reinvest funds at the IRR. As with the IRR method, projects are chosen in relation to the company's cost of capital. The decision to accept is made when the MIRR is greater than the company's cost of capital and rejected if it is less.

Empirical evidence

Several studies have been done to asses which capital budgeting methods are employed by CFO's. Even though the IRR method has flaws it has been found that 77% and 79% of CFO's still use it in the USA and South Africa respectively. This can be compared to the small number of CFO's that use the substantially better MIRR method, where it was found that only 9% and 7% respectively use it (Ryan and Ryan, 2002). In a later study done by Du Toit and Pienaar (2005) it was found that the number of CFO's using the MIRR had increased to 14%. This is still a very low number but the increased use of the MIRR instead of the flawed IRR is at least a step in the right direction by CFO's in evaluating the expected returns of projects correctly.

NPV

Theoretical Background

The capital budgeting decision is basically based on a cost-to-benefit analysis (Chatfield & Dalbor, 2005). The cost of the project is the net investment and the benefits of the project are the net cash flows. Comparison of these constituents ultimately leads to project acceptance or rejection.

As suggested by Bester (nd.), there are many advantages to using net present value as a capital budgeting evaluation technique. Some being as follows:

- Incorporates the risk involved with a specific project.
- Will depict the potential increase in firm value (i.e. the increase in shareholder wealth).
- The time value of money is taken into account.
- All expected cash flows are taken into account.
- The method is relatively straightforward and simple to calculate.

However this method does come with disadvantages. For example (Bester, nd.):

- Outcomes are depicted in Rand values and not percentages, thus relative comparison may prove difficult.
- NPV requires a predetermined discount rate (cost of capital) which may be difficult to calculate.

"Academics have long promoted the use of NPV" (Correia & Cramer, 2008, pg 33). Net Present Value (NPV) is one of the most straight-forward and common valuation methods in capital budgeting. Stated simply, NPV can be defined as a "project's net contribution to wealth" (Brealey, Myers & Allen, 2008, pg 998), and could also be observed as "an estimate of the change in a firm's value caused by an investment in a particular project" (Chatfield & Dalbor, 2005, pg10).

The formula for NPV is as follows:

$$\mathrm{NPV} = \sum_{t=1}^{n} \frac{C_t}{(1+r)^t} - C_0$$

(Hillier, Grinblatt and Titman, 2008).

Stated in words,

NPV = Present Value of cash flows – Investment (Brealey et al, 2008).

NPV incorporates the time value of money into its calculation by discounting future expected cash flows, therefore comparing the value of a Rand today to the value of that same Rand at some point in the future. NPV is the difference between the sum of the present values of the future cash flows, and the present value of the cash outflows, i.e. the initial investment (Brealey et al, 2008).

Subsequently, the basic rule of thumb for the acceptance/rejection decision is as follows:

- A positive cash flow (NPV > 0): the project should be accepted.
- A negative cash flow (NPV < 0): the project should be rejected.

One of the biggest advantages of using NPV, as already mentioned, is that it takes into account the time value of money (this being an attribute of the other popular DCF method, IRR, too). NPV relies heavily on the discount rate when evaluating projects, which in turn relies on the appropriate risk measure for the specific project.

A longitudinal study in the United Kingdom by Pike (1996) examined the use of evaluation procedures and techniques used in capital budgeting over a 17 year period, from 1975 – 1992, and found that the NPV is a discounted cash flow method that was well established among the large firms, with 74% using this specific method. Additionally, the NPV was the method with the most growth over the review period. Specifically, 42% of the survey's sample introduced the NPV method into their decision making (Pike, 1996). It is suggested that the reason for this may be due to more interest and understanding of the importance of the time value of money in capital budgeting techniques (Pike, 1996). There is a popular view that academics prefer the NPV method while practitioners are more inclined to use the IRR method, as well as the fact that both methods appear to be associated with firm size (Pike, 1996).

Empirical Evidence

Graham and Harvey (2001) surveyed 392 companies in the United States about the cost of capital, capital budgeting and capital structure. Among the results, they found that present value techniques in general were more popular with large firms.

Previous studies relating to capital budgeting techniques appear to focus on large firms only and suggested that most prefer the IRR method for evaluation of projects (Graham & Harvey, 2001). This being said, firms do tend to use other discounted cash flow methods, e.g. the NPV method, in their capital budgeting analysis.

For example:

- Gitman and Forrester (1977), examining 103 large firms, found that only 9.8% of firms use the NPV method.
- Moore and Reichert (1983) found that 86% of firms use a type of cash flow method in their study of 298 'Fortune 500' firms.
- Bierman (1983) analysed 74 'Fortune 100' firms and reported that 73 out of the 74 (98.65%) firms use some type of discounted cash flow in their analysis. (Graham and Harvey, 2001).

The authors used scale rating of 0 – 4 on the use of each valuation method; 0 meaning 'never' and 4 meaning 'always'. With regards to NPV, 74.9% of CFOs almost always or always use NPV. The results also showed that large firms and highly levered firms were more inclined to use NPV than the smaller firms or firms with less debt (Graham & Harvey, 2001). Interestingly, firms with CEOs that hold MBAs to their name were more inclined to use the NPV method (Graham & Harvey, 2001). This inclination to prefer NPV applied to the dividend-paying firms and public firms as well (Graham & Harvey, 2001). From this 2001 study, it was observable that the NPV has increased in its popularity and prominence as a capital budgeting evaluation technique. Also noteworthy is the tendency for small firms to use NPV and other discounted cash flow methods (for example the IRR method), possibly due to the lack of sophistication in their evaluation of projects. Brounen, de Jong and Koedijk (2004) replicated Graham and Harvey's 2001 study for four European countries – the United Kingdom, Netherlands, Germany and France. Regarding NPV method, the results showed that the usage rates were 47% for the UK, 70% for the Netherlands, 47.6% for Germany and 35.1% for France (Brounen et al, 2004). Also, except for the UK,

the larger firms and firms managed by CEOs with MBAs used NPV significantly more often, thus offering similar results to those of the Graham and Harvey (2001) study. It is also worthwhile to note that the firms that aimed to maximize shareholder value and wealth were more inclined to use the discounting methods and not the less sophisticated ones, such as the payback criterion (Brounen et al, 2004). Correia and Cramer (2008) conducted a South African survey in which they included the current practices of capital budgeting of a sample of South African companies listed on the JSE. They too found that the use of DCF methods (NPV, IRR) has grown (Correia & Cramer, 2008). More specifically, the percent of CFOs who always or almost always use NPV was 82.1%. Moreover, there is a wide array of South African studies on capital budgeting, for example Andrews and Butler (1982) and Coltman (1995), which have generally indicated a trend toward the increasing use of DCF methods, in particular the use of NPV (Correia & Cramer, 2008). These studies in South Africa are generally consistent with those of Graham and Harvey (2001) and Ryan and Ryan (2002), both occurring in the United States, which depict that NPV is one of the primary methods used. Regarding the European study of Brounen et al (2004), NPV and other discount methods are used more frequently in South Africa. In another South African study, Du Toit and Pienaar (2005) examined how companies listed on the JSE make capital investment decisions. It was found that most companies prefer the NPV and IRR methods to evaluate capital investments, more specifically; IRR was the primary method to be used while NPV was second, with 27.4% of the companies preferring this method (Du Toit & Pienaar, 2005). However, when categorised into industrial sectors, most of the mining sector prefers NPV, with a 71.9% usage. Thus it was stated that, if used correctly, the NPV method is the "simplest and quickest method to use" (Du Toit & Pienaar, 2005, pg26).

Gilbert (2003) declares that "Corporate finance theory clearly prescribes a rule to ensure the optimality of these decisions: all capital investment decisions should be evaluated through the use of the net present value (NPV) rule while project specific risk should be incorporated through the adjustment of the discount rate used in the NPV analysis" (Gilbert, 2003, pg 1). This very strong statement was tested in his paper in a survey of the capital investment evaluation procedures used by South African manufacturing firms. The results show that the majority of the firms do not use NPV in investment evaluation, or if they do make use of NPV, it is more often

than not used in conjunction with another capital investment evaluation procedure (Gilbert, 2003).

Earlier studies on capital budgeting practices appear to be generally consistent with the more recent studies too. Lambrechts (1976) examined the 100 top-quoted companies from the Financial Mail top 100 list in the period 1971 – 1972. As consistent with most of the previously mentioned studies, the larger firms were inclined to apply the net present value in their evaluation of potential investments. However, the net present value method was not applied as widely as originally expected. Nevertheless, when it was used, it was applied more correctly from a theoretical point of view compared to a general discounted cash flow method (Lambrechts, 1976).

Ryan (2002) studied a survey of the Fortune 1000 Chief Financial Officers and found the net present value to be the most preferred method. However, it is interesting to note that NPV has always been behind IRR in terms of preference of managers (Ryan, 2002). But academics give many reasons supporting the use of the NPV method. Firstly, NPV depicts the expected change in shareholder wealth, given the projected cash flows and discount rate; Secondly, NPV assumes intermediate cash flows to be reinvested at the cost of capital, which is more appropriate than assuming reinvestment at the IRR, which is what the IRR method assumes; and Thirdly, NPV is not sensitive to multiple sign changes of cash flows, this not being the case with IRR (Ryan, 2002). In Ryan's (2002) survey, it was seen that 49.8% of respondents utilize NPV in general, while 85.1% of respondents always or most often use NPV. Net present value gained the most positive responses in the survey compared to any of the other capital budgeting techniques (Ryan, 2002). More generally, the NPV method and IRR method were the most preferred, which is exactly in line with theory (Ryan, 2002). "The use of CAPM is dominant in the determination of the cost of equity" (Correia & Cramer, 2008 pg 49). Net Present Value relies on the CAPM framework (or perhaps a similar asset pricing model) in order to determine the cost of equity.

SELECTION PROCESS

4.1 Risk Analysis

Theoretical Background

Risky analysis is incorporated into the capital budgeting process as the primary incentive for investing in a project is the possible creation of profit, but when profit is a possibility there is risk present (Imperial Chemical Industries Limited,1970). The importance of incorporating risk in this process has been preached by academics for several years (Hall and Millard, 2010). Hall and Millard (2010) revealed that recent surveys have shown an increased effort to use sophisticated risk analysis techniques in the capital budgeting process. Sensitivity analysis, scenario analysis, decision tree analysis and options are arguably four of the most popular tools used in risk assessment in capital budgeting.

- *Sensitivity analysis* is a technique that deals with uncertainty by examining the profitability of projects under various circumstances (Imperial Chemical Industries Limited, 1970). Sensitivity analysis per se does not quantify risk, but companies can use it as a relatively simple and cost-effective way to determine the sensitivity of the NPV or IRR to changes in key input variables. This analysis can help determine if the profitability of a project is very sensitive to factors that are outside the control of management, and can then decide that the firm must not proceed with this project (Imperial Chemical Industries Limited, 1970). In comparison to scenario analysis, this method only allows for one variable to be changed at a time, to see the effect (Ryan& Ryan 2002).
- Decision tree analysis is useful as a graphical and analytical tool, which uses a tree-like graph of decisions and their possible consequences. Decision tree approach to analysing the value of information is particularly applicable to investments with high risk and requiring a sequence of related decision to be made (Longmore ,1989).
- *Scenario analysis* allows for the change in more than just one variable at a time, including the probability of such changes, to see whether there is a change in the NPV (Ryan & Ryan, 2002).
- *Option analysis* includes using Black-Scholes or binomial option pricing models (Ryan & Ryan, 2002)

Empirical Evidence

Gitman and Forrester (1977) conducted a survey in the US, and found 71% of their respondents gave explicit consideration to risk. These results were confirmed by a study by Fremgen in 1973. Fremgen (1973) conducted a survey that resulted in 67% of respondents incorporating risk in the evaluation of their capital budgeting projects.

Parry and Firer (1990) reported that a study by Petty et al. in 1975 had 77% of firms using an adjustment of the payback period to adjust for risk. Parry and Firer (1990) also revealed that 42% of respondents in a study by Buler in 1982 used this method (adjustment of payback period) to compensate for risk.

In South African studies, Parry and Firer (1990) found in their survey, that 18% of their respondents had no response to any technique, but that 61% sometimes or often used sensitivity analysis. A study was done by Hall (2001), which concluded that 25% of the larger firms and approximately 40% of smaller firms, who responded to this survey, did not use any formal risk adjustment technique. Sensitivity analysis was also found to be the most popular as it was used by 40 per cent of the larger firms that did respond. However, sensitivity analysis can be considered as a relatively unsophisticated risk adjustment tool, compared to techniques like decision trees, simulations and real option analysis (Hall and Millard, 2010). In a South African study done by Correia and Cramer (2008), scenario analysis and sensitivity analysis were the two most popular method, with the former having 71,4% of CFO's almost always or always choosing it, while the latter got 67,9% of CFO'S electing it as their primary method.

When looking at current practices with respect to incorporating risk into the capital budgeting process, a survey by Hall and Millard done in 2010 in South Africa on industrial firms, seems to be one of the latest surveys conducted in the area of capital budgeting techniques.

Hall and Millard (2010) reported that respondents regard project implementation as the highest risk stage in the capital budgeting process. This contrasted with Hall's early findings, which found project definition and cash flow estimation to be

considerably more risky. Therefore there seems to be a marked increase in the risk consideration during the project implementation stage (Hall and Millard 2010). The reason that financial analysis was considered less risky could be due to the fact that respondents are well educated and highly experienced, as they are at ease with actual financial calculations and analysis of the project (Hall and Millard 2010).

When asked what financial analysis technique would respondents use? Hall and Millard (2010) reported that 7% used no formal technique. This was in contrast to previous studies where up to 40% respondents did not use any formal technique. Therefore more respondents are incorporating risk into their capital budgeting decision. Reasons for this risk incorporation could be that we live in an increasingly uncertain world where more risk factors have been incorporated into financial decision such as the compilation of the specific sample of this study, as well as the fact that we live in an increasingly uncertain world where more risk factors have to be incorporated in any financial decision (Hall and Millard, 2010).

Hall and Millard (2010) show the most popular risk analysis techniques in table 1. It indicates that the most popular method to incorporate risk is sensitivity analysis. Many respondents considered changing the discount rate or the cash flows in order to incorporate risk into the CB process. In this survey a disappointing 4% used option analysis, even though it is regarded as a relatively sophisticated way of dealing with risk. Only 6.9% didn't take risk into account.

Risk Analysis Technique	**%**
Sensitivity analysis	29.2
Adjusting required rate of return	22.2
Scenario analysis	13.9
Adjusting cash flows	12.5
No formal technique in use	6.9
Monte Carlo simulation	4.2
Sophisticated mathematical modeling (Option analysis)	4.2
Decision trees	2.8
Other	4.1

Table 1: Risk analysis techniques used (Hall and Millard, 2010)

It is evident that there has been an increase in the incorporation and consideration given to risk in the capital budgeting process. The more popular risk adjusted techniques used to be applying risk-adjusted discount rates and adjusting the required payback period. Sensitivity analysis was omitted in earlier surveys, but has now gained in popularity (Kim & Farragher, 1981) and could currently be the most common risk analysis technique used in the capital budgeting process (Mukherjee & Henderson, 1987).

Capital Rationing

Theoretical Background

When evaluating capital investments, a firm may often be faced with the possibility that the amount of capital it can devote to new investments is limited. Furthermore, the cash flows of most investment projects are uncertain and as such; the availability of outside capital to fund these risky projects may be constrained (Hillier, Grinblatt & Titman, 2008). These capital constraints often lead to the phenomenon of capital rationing in the capital budgeting process of a firm.

Capital rationing occurs when a firm is unable to invest in profitable projects as restrictions are placed on the amount of new investments to be undertaken by a firm when the supply of capital is limited (Damodaran, 2001). Theoretically, a firm should aim to maximize its value and shareholder wealth by choosing profitable projects. However, as funds are limited under capital rationing, all positive NPV projects may not be selected. Therefore, in efficient capital markets, capital rationing should not exist (Mukherjee & Hingorani, 1999). However many empirical studies based on capital budgeting surveys have shown that capital rationing is prevalent among firms (Mukherjee & Henderson, 1987). It is thus important to understand why capital rationing exists and which capital budgeting tools firms use when making optimal investment decisions in a capital-rationing environment.

Causes of Capital Rationing

There are two different situations in which capital rationing may exist, namely external and internal capital rationing (Bierman and Smidt, 1960). External capital rationing or "hard rationing" implies that a firm may have a shortage of capital due to the firm's inability to raise funds in external equity markets when facing severe capital market imperfections (Brealey, Myers & Allen, 2008). In contrast, internal capital rationing or "soft rationing" occurs through restrictions imposed by the firm's management. This occurs when management decides to voluntarily limit the total amount of funds committed to investments by "fixing" the budget at a predetermined level (Zhang, 1997). This decision to self-impose a budget restriction may be recognized as management's need to exercise financial control over the expenditures of divisions within the firm (Brealey, Myers & Allen, 2008). Another internal restriction imposed by management, as discussed by Bierman and Smidt (1960), occurs when the firm sets a "cut-off rate" for investments that is higher than the firm's cost of capital (using a higher hurdle rate for investments than the cost of capital). Thus the firm is restricted to selecting only those projects which will meet management's expected rate of return.

Project Selection in Capital Rationing

When incorporating the capital rationing constraint into project evaluations, the traditional analysis techniques, such as NPV, may prove to be inadequate as these capital budgeting techniques are based on the assumption that all profitable projects will be accepted (Damodaran, 2001). The two main measures used when evaluating investments under capital rationing constraints are the profitability index and mathematical programming techniques.

The profitability index is the simplest method of including capital rationing in investment analysis. When capital is limited, the profitability index allows a firm to identify and select projects with the highest cumulative NPV from the funds available for capital investment (Damodaran, 2001). However, a limitation to using the profitability index is that the method assumes that the capital rationing constraint only applies to the current period and is only useful when selecting amongst relatively few projects.

In contrast, when capital rationing constraints occur over multiple periods and when there are numerous projects, Baumol and Quandt (1965) suggest that mathematical programming may be used to evaluate investments. The linear programming technique is widely used as the model is specifically designed to search through combinations of projects achieving the highest NPV whilst subject to a budget constraint. However, Brealy et al (2008) note that a main disadvantage to using linear programming may be the models can be highly complex and costly.

Empirical Evidence

Several U.S. surveys examine capital rationing in the overall investigation of the capital budgeting process. The following conclusions have been reached with regards to prevalence of capital rationing, the dominant causes and tools used in capital rationing analysis.

Prevalence of Capital Rationing

Empirical evidence indicates that capital rationing is prevalent amongst firms. It was concluded that between 50 and 75% of firms operate under the capital constraint as found by Fremgen (1975) and Petty, Scott & Bird (1975). Further support for this notion was found by Gitman and Forrester (1977) in their survey of Fortune 500 firms from 1971-1976 in which 52% of respondents indicated the existence of capital rationing. A similar conclusion was found in the 1980 survey conducted by Gitman and Mercurio (1982) which found that 65% of CFOs of firms listed in the Fortune 1000 agreed that they were confronted with capital rationing. Lastly, Mukherjee & Hingorani (1999) in their survey on capital rationing practices of Fortune 500 firms showed that 64% of respondents operate in a capital rationing environment.

Causes of Capital Rationing

Empirical evidence finds that the principal cause of capital rationing is some kind of debt limitation imposed on the firm. Gitman and Forrester (1977) conclude that 70% of respondents agreed that the major cause of capital rationing was a limit placed on borrowing by internal management. Other main causes of capital rationing were the borrowing limitations imposed by outside agreement (10.7%) or external management (3.2%). This is consistent with the findings of the earlier study of Fremgen (1975) who concluded that “the most prevalent cause of capital rationing is a limitation on

borrowing." In a later study, Gitman and Mercurio (1982) confirmed the above results and stated that "most firms operate under a budget constraint as a result of an administered limit on financing".

Project Selection under Capital Rationing

Mukherjee and Vineeta (1999) in their survey of Fortune 500 firms, analysed the how firms select projects under capital rationing. It was concluded that most firms rank their projects in terms of their IRR or Profitability Index when selecting the combination of projects to maximize NPV subject to the given capital constraint. Surprisingly, it was concluded that none of the firms report using linear programming techniques. This is in contrast to earlier studies (Fremgen 1975, Gitman and Mercurio 1982) which documented an increase in the use of linear programming. Mukherjee and Vineeta (1999) conclude that the main reasons why linear programming techniques are not used in practice is due to managers not being familiar with the tools and that data involved is not accurate enough to warrant the use of these methods. Thus from the above analysis, it is evident that most firms operate in a capital rationing environment. Furthermore, empirical evidence concludes that the main cause of capital rationing is the limitations imposed on borrowing mainly by internal management. Lastly, most firms use the more traditional, simple methods of IRR and profitability index over mathematical programming methods when evaluating investments under capital constraints.

COST OF CAPITAL

A firm's capital consists of equity (retained earnings and funds from issuing stock) and debt (borrowed funds). The firm's company cost of capital reflects an opportunity cost: the expected return that is forgone by investing in particular projects instead of the relative financial securities, and is therefore used as the discount rate for a firm's projects (Brealey, Myers & Allen 2008). The lower a firm's cost of capital, the lower its required return on a given investment. Therefore firms firstly estimate their cost of capital in the capital budgeting process because the discount methods (for example the net present value) are partially dependant on it (Madura, 2010). Firms often use the Weighted Average Cost of Capital, commonly known as WACC, to determine the cost of capital in their evaluation calculations. Put simply, a company's assets are financed by either debt or equity, and WACC is simply the average of these costs of financing. It is the economic yield (return) that a company would give up by investing in a particular investment instead of alternative investments of the same risk and characteristics (PWC, 2010). Therefore WACC is often used to determine the economic feasibility of specific opportunities, such as expansion. One could see the cost of capital as "a blend of the cost of debt (the interest rate) and the cost of equity (expected return demanded by shareholders)" (Brealey et al, 2008, pg 241). WACC is calculated by weighting the required return on interest-bearing debt and the required return on equity capital in accordance to their relative proportions of the firm's total capital structure.

The equation is:

$$WACC = \frac{E}{D+E} \cdot r_e + \frac{D}{D+E} \cdot r_d \cdot (1 - t_c)$$

Where:

WACC = Weighted Average Cost of Capital

R_d = before-tax return on debt

R_e= rate of return on capital

T_c = corporate tax rate

D/D+E = debt capital as a percentage of the total invested capital

E/D+E = equity capital as a percentage of the total invested capital

Expanding on the above equation, the cost of capital can be defined as "the weighted cost of the various sources of funding, being typically equity, debt and preference

instruments" (Lilford, 2006, pg 1). As already suggested, it is the required return necessary to make a capital budgeting project (such as building a new factory) worthwhile. One must note that the company cost of capital will not be the correct discount rate to use if the project in question is more, or less, risky than the 'average risk' of the company. Therefore, each project should be evaluated according to its own, more specific, cost of capital (Brealey et al, 2008). Empirically, WACC has been noted as the favoured approach to determine cost of capital. For example, Ryan (2002) stated that WACC is the superior method in determining the cost of capital. In the Fortune 1000 study, the vast majority of respondents (83.2%) chose WACC as their best discount rate.

As the 2009/2010 PWC survey states, there are three steps involved in developing WACC:

- Estimating the opportunity cost of equity financing
- Estimating the opportunity cost of debt (non-equity) financing
- Determining the market-value weights for the capital structure

The cost of debt is relatively easy to measure because the firm incurs interest expense as a result of borrowing. However, the cost of equity is seen to be the most difficult measure of WACC to quantify.

So, how do firms determine their cost of equity?

The PWC 2009/2010 survey states that there are two approaches one can take to determine the cost of equity:

- Deductive models

These models rely on market data to estimate cost of equity, for example the dividend growth model.

- Risk-Return models

The most widely used risk-return model is the Capital Asset Pricing Model (CAPM), which relates expected return to risk (measured by non-diversifiable variance).

Using CAPM, the cost of equity is determined by adding the risk-free rate and a premium for risk, this component being determined by the product of the beta (systematic risk measure) and market risk premium.

CAPM is determined by the following formula:

$R_e = R_f + \beta (R_m - R_f)$

Where:

R_e = Expected return on equity

R_f = Risk free rate of return

$(R_m - R_f)$ = Market risk premium

β = Beta (systematic risk)

From the above equation, one can see that CAPM is thus a linear combination of the risk-free rate, the risk premium and the company's beta (PWC, 2010).

"The use of CAPM is dominant in the determination of the cost of equity" (Correia & Cramer, 2008 pg 49). Relating to South Africa, CAPM appeared to be the only method used in practice by South African firms when determining their cost of equity in the PWC (2005) survey (Correia & Cramer, 2008). More results from this survey depicted that other methods in determining cost of equity – dividend discount, APT, risk free rate plus a risk premium – were not used at all, i.e. CAPM was dominant (Correia & Cramer, 2008). Similarly, Graham and Harvey's (2001) survey reported that CAPM was used 74% of the time. "CAPM is popular, but not perfect" (PWC, 2010, pg25). Despite the CAPM model being the dominant model in the determination of the cost of equity, Correia and Cramer (2008) also point out that its use does not come without criticism of errors and questioning of validity (see Fama & French, 1992), as it fails to capture certain anomalies of equity returns, such as the size effect and value effect. This, together with its several underlying assumptions, may make it difficult to enforce as it ignores many real-world complexities (Bodie, Kane & Marcus, 2008). Nevertheless, the use of CAPM has increases significantly in South Africa over the past 15 years (Correia & Cramer, 2008). However, as briefly mentioned earlier, there are various alternative models to determine the cost of equity, for example the arbitrage pricing theory (APT) and Fama-French Three-Factor Model. The PWC valuation methodology survey (2009/2010) posed a particular question on the methodologies used to in the determination of cost of equity. The results found that CAPM is the most widely-used approach. Although the risk-return models were definitely preferred over the deductive models, firms are increasingly exploring other approaches other than CAPM.

Control Process

Once the entire capital budgeting process has been conducted a firm needs a manner and process in which to monitor the effectiveness of implementing the chosen capital budgeting strategy. Some authors document the fact that due to the level of sophistication of the capital budgeting technique implemented, the control process thereafter may be somewhat similar in terms of sophistication. It was found that larger firms employ more sophisticated capital budgeting techniques than smaller firms (Gitman and Forrester, 1977:68). The limited amount of capital resources available for investment to a company must thus be heavily scrutinized in order to ensure the entire process was indeed a value-creating endeavour.

Postaudit

Gadella (1986) defines the post-completion audit process as: "The term Post Audit (or Post-completion Audit or Ex Post Audit) is meant to signify the in-depth review of a completed capital project, for the purpose of comparing the actual realised benefit with the pre-investment estimates". Many executives have different descriptions to describe the project. Some of the most famous are detailed below.

1. Regular project monitoring during set-up
2. Regular project monitoring during early stages of operation
3. Examination of the initial evaluation of the project in relation to the outcome, after allowing for any problems

Gitman and Mecurio (1982) in a survey of Fortune 1000 companies found that although 90% of firms conduct a post-audit function, 24% conduct it on an annual basis with 24% conducting it less frequently than annually. In the current economic environment postaudits ought to be conducted on a more frequent basis to ensure greater mitigation of loss causing events.

Brealey and Myers (1991) studied Anglo-Saxon post-auditing practices and found the following:

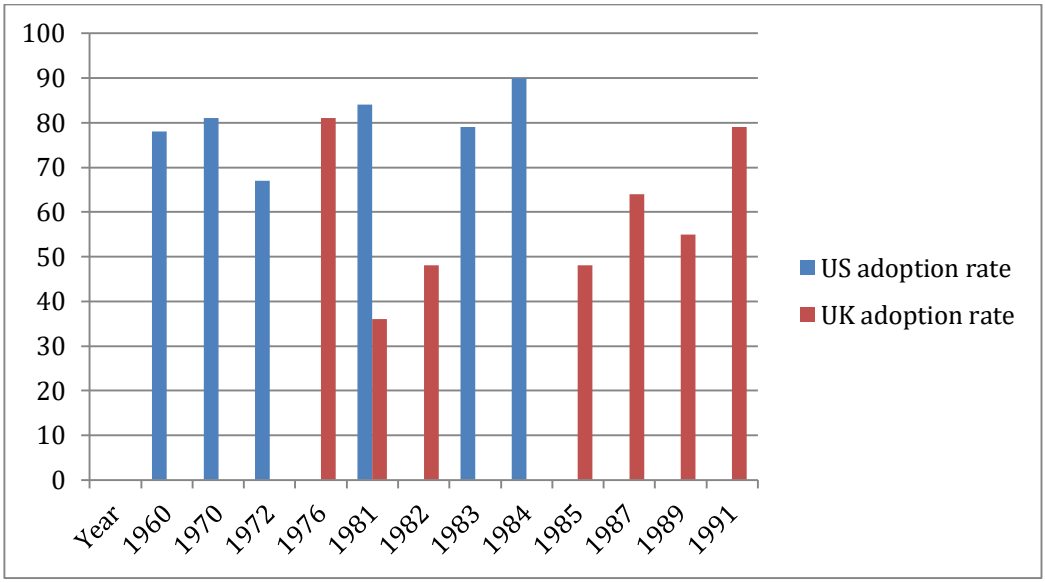


Fig 1.

Figure 1 illustrates that the adoption rate in Britain has steadily increased up until nearly 80% in 1991, whilst the U.S. adoption rate has hovered on average around 75% from 1976-1984. These results show that there has been an increase in the adoption of post-auditing practices, reinforcing the importance companies place on this step in the capital budgeting process.

Pinches (1982) found that companies incorrectly specify the correct procedure for evaluating the performance of the capital budgeting process. He acknowledges that many firms emphasize “accounting” in their PCA process. The post-completion audit process (henceforth PCA) is different from the monitoring process in scope of analysis and thus in degree of completeness. It has been responsible for the evaluation of the success of the capital budgeting process. Its two main functions are:

1. To investigate whether the costs and benefits owing to the project have been thoroughly analysed and check whether any lessons learned can be applied to future investments. This step involves investigating whether the entire capital budgeting system can be improved. This leads us to conclude this step as the PCA being “system control-oriented”.

The objectives of this step are to: a) encourage more realistic assessment of the project; b) ensure improvements in future planning.

Some of the benefits that follow from the system control-oriented step are: i) improved decision making by examining the way projects have been evaluated, implemented and controlled and propose refinements; ii) Identify key variables that will assist in the planning of similar future projects.

2. Assessment of whether the project is on course or whether any adjustment s need to be made or possibly if (in an extreme case) needs to be abandoned. This step can be summarised as an ex post review of the project after rectifying any problems associated during the process. This leads to this step of the PCA process being "project control-oriented"

The objectives of this step are: a) To detect operating difficulties in the process and allow for expeditious correcting of any; b) to assess the project manager's expertise in project appraisal.

The project control-oriented process has benefits to it which are: i) improvements in the internal control mechanisms usually most effectively implemented through constant monitoring; ii) modifying underperforming projects which is a benefit that accrues more from regular monitoring.

The PCA process owes much of its effectiveness to information relay to those who were involved in the planning and evaluation of the project.

In the event the capital budgeting process involved the purchase of an asset the firm must consider the continued use of the asset for future use. The PCA process should address this issue recommending firms to dispose assets with lower future profit generating values. The capital budgeting process generally incorporates an NPV approach to evaluating projects with an NPV equal to zero being the minimum acceptable value if the forecast incorporates all relevant and available information. In the PCA process an actual vs. observed step is required where the company evaluates the forecasted present value of the project undertaken. Should this value be greater than the actual realized value this may suggest that the NPV's may not reflect all relevant information. If this occurs management has two steps available to rectify such an occurrence:

a) Modify the forecasting process and thus include any information that may have resulted in bias or information that may have been excluded.

b) Leave the forecasting process unchanged but rather change the acceptance criteria

The PCA however does have numerous gaps in it which can lead to large financial losses to the project and to firm value. Some of these drawbacks are:

- Staff that have been involved in a project (especially an unsuccessful one) may be reluctant to offer their full co-operation with regards to evaluation
- Project analysts may not react very receptive to PCA reports and may only admit mistakes on their part begrudgingly, thus causing a slowdown in the rectification of such mistakes
- Environmental turbulence has caused problems with regards to evaluating projects before and after completion on an equivalent basis

Unfortunately not much evidence has been compiled with regard to the post-completion audit process in South Africa, however based on the influential effect international practices (especially in developed markets) have filtered into emerging economies, we expect similar practices to be conducted within South Africa.

Performance measures

Pinches (1982) finds that many companies have adopted "accounting" measures such as Earnings per share (EPS) and improvement in Return on assets however these ratios fail to address the fundamental goal of engaging in the capital budgeting process: to create value for shareholders. Klammer (1973) who suggested an operating rate of return to specify the performance, however as is mentioned below using accounting ratios are erroneous. Hall and Westerman (2008) conducted a survey on South African firms and suggested that a more suitable model for evaluating performance may be based on Economic Value added (EVA) to control for Capital expenditure (CAPEX). His suggested formula was:

EVA = ([sales – cost] after taxes + depreciation
tax shield) – (invested capital6cost of capital)

The EVA is a performance measure is developed and coined by Stern Stewart & Co. who proposes it as the best performance measure for evaluating project success. Coupled with the EVA is the market value added (MVA) which is merely the present

value of the future EVA. It measures management performance by establishing whether shareholder wealth has been enhanced or diminished.

This adoption of the EVA help analyze the complete process from strategy down to daily operating activities thus capturing all aspects for a more detailed measure. The main benefit of employing the EVA technique is that managers are evaluated, monitored and compensated using a single measure that is easy to understand across staff functions between employees. This enables a common language to be spoken which enables a greater likelihood of shareholder wealth creation. A great advantage of the EVA lies in its function of removing distortions in the form of accounting for trade-offs between operating costs and capital costs, resulting in a combination of both the abovementioned costs. This enables possible distortions in the form of earnings for example to be weighed against the costs incurred in generating those earnings instead of evaluating them in isolation, thus providing a more accurate measure of performance.

Performance incentives

The issue of adverse selection and managerial hubris has resulted in a necessitated response of managerial incentives in order to align their selection of shareholder wealth creating projects in the capital budgeting process. This now arises due to manager concerns over his/her career. In order for this moral hazard likelihood to be mitigated managers ought to be contracted to a performance measure and incentive to ensure they have an interest in the success of the project (Costa & Holmstrom, 1986).

Bernardo, Cai and Luo (2001) find that managers have a preference to larger capital allocations and thus have an incentive to overstate project quality and perceived benefits. They find that firms will typically under invest in capital relative to the first best situation in which the division manager's information is known to headquarters. They also find that the underinvestment problem is sever in situations where: a) the firm has high R&D costs or where the manager requires highly firm0specific human capital; b) firms have large multi-division or foreign subsidiaries where knowledge of local conditions is critical- this also leads to managers receiving lower performance-based pay. The findings of Bernardo, Cai and Luo (2001)'s paper is critical to discarding the common misconception that increasing performance based incentive

pay will cause shareholder value to increase. They find that in the presence of asymmetric information and moral hazard, managers in charge of high-quality investment earn higher incentive based pay than managers of low-quality projects. Pinches (1982) finds that most incentive systems employed by companies emphasize short run accounting-based returns instead of the long run maximization of firm value. He finds in a survey of 174 companies that many executives are rewarded on a short-term basis, typically in the form of bonuses. Only 42% of companies offered long-term incentive plans. On a survey of the top 250 US companies in his survey he finds only 10-15% of firms reward their executives on a long-term basis. Coupled with this is the issue that those firms linked their reward to accounting based results. Pinches (1982) argues that tying long-term incentive plans to performance helps conflict and thus better align the executives goals with that of the organisation. He finds many companies have adopted plans that are linked to targets and pay bonuses in that form. However Lord and Hanges (1987) suggested that developmental feedback is unlikely and insufficient to alter the behaviour of managers. The long-term incentive plans are usually more sustainable and attainable and they are usually rewarded in the form of cash, company stock or profit shares. The performance incentives are available to both managers and employees. The incentives due to employees are normally based on the manager's recognition and appraisal of employee performance. The performance incentive plans are normally structured such that the employee is given a base salary and afforded a bonus should he/she meet/exceed certain objectives within in a given period. However such incentive plans may lead to employees being discouraged if the objectives set are perceived to be unrealistic or out of reach. Evidence of studies on South African performance incentives have not been conducted according to the author’s knowledge. We presume that developed market legislation and procedures have trickled down into the South African business environment and structure and as a result we presume South African incentive practices are internationally aligned.

CONVENTIONAL TECHNIQUES FOR RISK ANALYSIS

Conventional Techniques for Risk Analysis:

(a) Payback

(b) Risk-adjusted Discount Rate

(c) Certainty Equivalent

(a) Payback Period:

Payback as a method of risk analysis is useful in allowing for a specific types of risk only, i.e., the risk that a project will go exactly as planned for a certain period will then suddenly stop generating returns, the risk that the forecasts of cash flows will go wrong due to lower sales, higher cost etc. This method has been already discussed in detail above so it has not been repeated here.

(b) Risk Adjusted Discount Rate Method:

The economic theorists have assumed that to allow for risk, the businessmen required a premium over and above an alternative which is risk free. It is proposed that risk premium be incorporated into the capital budgeting analysis through the discount rate. i.e. If the time preference for the money is to be recognized by discounting estimated future cash flows, at some risk free rate, to there present value, then, to allow for the riskiness of the future cash flow a risk premium rate may be added to risk free discount rate. Such a composite discount would account for both time preference and risk preference.

RADR = Risk free rate + Risk Premium OR $k = Rf + Rp$

The RADR accounts for risk by varying discount rate depending on the degree of risk of investment projects. The following figure portrays the relationship between amount of risk and the required k.

The following equation can be used:-

$$n \quad NCF$$

$$NPV = \sum_{t=0}^{t} \frac{}{(1+k)^t} - CO$$

Where k is a risk-adjusted rate.

Thus projects are evaluated on the basis of future cash flow projections and an appropriate discount rate.

Decision Rule:

- The risk adjusted approach can be used for both NPV & IRR.
- If NPV method is used for evaluation, the NPV would be calculated using risk adjusted rate. If NPV is positive, the proposal would qualify for acceptance, if it is negative, the proposal would be rejected.
- In case of IRR, the IRR would be compared with the risk adjusted required rate of return. If the 'r' exceeds risk adjusted rate, the proposal would be accepted, otherwise not.

For example, if an investment project has following cash flows, its NPV using RADR will be as follows:

Risk free rate is 6% and Risk adjusted rate is 10%.

Year	**CFAT (Rs.)**	**PV @ 10%**	**PV (Rs.)**
1	50000	0.909	45450
2	40000	0.826	33040
3	45000	0.751	33795
	Less:	$\sum PV$	112285
		Investment	150000
		NPV	(37715)

Merits:

- It is simple to calculate and easy to understand.
- It has a great deal of intuitive appeal for risk-averse businessman.
- It incorporates an attitude towards uncertainty.

Demerits:

- The determination of appropriate discount rates keeping in view the differing degrees of risk is arbitrary and does not give objective results.
- Conceptually this method is incorrect since it adjusts the required rate of return. As a matter fact it is the future cash flows which are subject to risk.
- This method results in compounding of risk over time, thus it assumes that risk necessarily increases with time which may not be correct in all cases.

The method presumes that investors are averse to risk, which is true in most cases. However, there are risk seeker investors and are prepared to pay premium for taking risk and for them discount rate should be reduced rather than increased with increase in risk. Thus, this approach can be best described as a crude method of incorporating risk into capital budgeting.

(b) Certainty Equivalent Approach:

This approach to incorporate risk in evaluating investment projects, overcomes weaknesses of the RADR approach. Under this approach riskiness of project is taken into consideration by adjusting the expected cash flows and not discount rate. This method eliminates the problem arising out of the inclusion of risk premium in the discounting process. The certainty equivalent coefficient (α_1) can be determined as a relationship between the certain cash flows and the uncertain cash flows. For example, if a company expected a risky cash flow of Rs. 90,000 and a risk free cash flow of Rs. 65,000 then its α_1 will be calculated as follows:

$$\alpha t = \frac{NCF t^*}{NCF_t} = \frac{Risk free cash flow}{Risky cash flow} = \frac{65000}{90000} = 0.7222$$

The certainty equivalent coefficient (α_t) assumes a value between 0 and 1 and varies inversely with risk. The higher the risk, the lower the α_t and the lower the risk, the higher theα_t . The certainty equivalent approach can be expressed in the form of equation as follows:

$$NPV = \sum_{t=0}^{n} \frac{\alpha_t NCF_t}{(1+k_f)^t}$$

where, NCFt = Net cash flow,

α_t	= the certainty equivalent coefficient,
k_f	= Risk free rate

For example, A project is costing Rs. 100000 and it has following estimated cash flows and certainty equivalent coefficients. If the risk free discount rate is 5%, its NPV can be calculated as follows.

Year	**NCF (Rs.)**	**CE Coefficient**	**Adjusted NCF (Rs.)**	**PV @ 5%**	**PV (Rs.)**
1	60,000	0.8	48,000	0.952	45696
2	70,000	0.6	42,000	0.907	38094
3	40,000	0.7	28,000	0.864	24192
				Less: $\sum PV$	107982
				Investment	100000
				NPV	7982

Decision Rule:

- If NPV method is used, the proposal would be accepted if NPV of CE cash flows is positive, otherwise it is rejected.

- If IRR is used, the internal rate of return which equates the present value of CE cash inflows with the present value of the cash outflows, would be compared with risk free discount rate. If IRR is greater than the risk free rate, the investment project would be accepted otherwise it would be rejected.

Merits[29]**:**

- It is simple to calculate.

It is conceptually superior to time-adjusted discount rate approach because it incorporates risk by modifying the cash flows which are subject to risk.

Demerits

- This method explicitly recognizes risk, but the procedure for reducing the forecast of cash flows is implicit and likely to be inconsistent from one investment to another.

- The forecaster expecting reduction that will be made in his forecast, may inflate them in anticipation. This will no longer give forecasts according to "best estimate".

- If forecast have to pass through several layers of management, the effect may be to greatly exaggerate the original forecast or to make it ultra conservative.

- By focusing explicit attention only on the gloomy outcomes, chances are increased for passing by some good investments.

These techniques attempts to incorporate risk but major shortcomings are that

specifying the appropriate degree of risk for an investment project is beset with serious operational problems and they cannot be applied to various projects over time.

2.6.3 Other Techniques:

(a) Sensitivity Analysis
(b) Scenario Analysis
(c) Break Even Analysis
(d) Simulation Analysis
(e) Decision Tree Approach

(a) Sensitivity Analysis:

While evaluating any capital budgeting project, there is a need to forecast cash flows. The forecasting of cash flows depends on sales forecast and costs. The Sales revenue is a function of sales volume and unit selling price. Sales volume will depend on the market size and the firm's market share. The NPV and IRR of a project are determined by analyzing the after-tax cash flows arrived at by combining various variables of project cash flows, project life and discount rate. The behavior of all these variables are very much uncertain. The sensitivity analysis helps in identifying how sensitive are the various estimated variables of the project. It shows how sensitive is a project's NPV or IRR for a given change in particular variables.

The more sensitive the NPV, the more critical is the variables.

Steps[31]:

The following three steps are involved in the use of sensitivity analysis.

1. Identify the variables which can influence the project's NPV or IRR.
2. Define the underlying relationship between the variables.
3. Analyze the impact of the change in each of the variables on the project's NPV or IRR.

The Project's NPV or IRR can be computed under following three assumptions in sensitivity analysis.

1. Pessimistic (i.e. the worst),
2. Expected (i.e. the most likely)
3. Optimistic (i.e. the best)

For example, A company has two mutually exclusive projects for process improvement. The management has developed following estimates of the annual cash flows for each project having a life of fifteen years and 12% discount rate.

Table 2.10

Sensitivity analysis

Project – A

Net Investment (Rs)	90,000				
CFAT estimates:		PVAIF12%, 15 years		PV	NPV
Pessimistic	10,000	6.811		68110	(21890)
Most likely	15,000	6.811		102165	12165
Optimistic	21,000	6.811		143031	53031

Project – B

Net Investment (Rs)	90,000				
CFAT estimates:		PVAIF12%, 15 years		PV	NPV
Pessimistic	13,500	6.811		91948.5	1948.5
Most likely	15,000	6.811		102165	12165
Optimistic	18,000	6.811		122598	32598

The NPV calculations of both the projects suggest that the projects are equally desirable on the basis of the most likely estimates of cash flows. However, the Project

– A is riskier than Project – B because its NPV can be negative to the extent of Rs. 21,890 but there is no possibility of incurring any losses with project B as all the NPVs are positive. As the two projects are mutually exclusive, the actual selection of the projects depends on decision maker's attitude towards the risk. If he is ready to take risk, he will select Project A, because it has the potential of yielding NPV much higher than (Rs. 53031) Project B. But if he is risk averse, he will select project B.

Merits[32]:

- The sensitivity analysis has the following advantages:
- It compels the decision maker to identify the variables affecting the cash flow forecasts which helps in understanding the investment project in totality.
- It identifies the critical variables for which special actions can be taken.
- It guides the decision maker to concentrate on relevant variables for the project.

Demerits

The sensitivity analysis suffers from following limitations:

- The range of values suggested by the technique may not be consistent. The terms 'optimistic' and 'pessimistic' could mean different things to different people.
- It fails to focus on the interrelationship between variables. The study of variability of one factor at a time, keeping other variables constant may not much sense. For example, sales volume may be related to price and cost. One can not study the effect of change in price keeping quantity constant.

(b) Scenario Analysis:

In sensitivity analysis, typically one variable is varied at a time. If variables are inter-related, as they are most likely to be, it is helpful to look at some plausible scenarios, each scenario representing a consistent combination of variables.

Procedure:

The steps involved in scenario analysis are as follows :

1. Select the factor around which scenarios will be built. The factor chosen must be the largest source of uncertainty for the success of the project. It may be the state of the economy or interest rate or technological development or response of the market.

2. Estimate the values of each of the variables in investment analysis (investment outlay, revenues, costs, project life, and so on) for each scenario.

3. Calculate the net present value and/or internal rate of return under each scenario.

Illustration:

A company is evaluating a project for introducing a new product. Depending on the response of the market - the factor which is the largest source of uncertainty for the success of the project - the management of the firm has identified three scenarios :

Scenario 1 : The product will have a moderate appeal to customers across the board at a modest price.

Scenario 2 : The product will strongly appeal to a large segment of the market which is highly price-sensitive.

Scenario 3 : The product will appeal to a small segment of the market which will be willing to pay a high price.

The following table 2.11 shows the net present value calculation for the project for the three scenarios.

Table: 2.11

Scenario analysis

NPV Calculation for Three Scenario

(Rs in million)

	Scenario 1	Scenario 2	Scenario 3
Initial investment	400	400	400
Unit selling price (Rs)	50	30	80
Demand (Units)	40	80	20
Sales Revenue	2000	2400	1600
VC (Rs 12/- pu)	960	1920	480
Fixed costs	100	100	100
Depreciation	40	40	40
Pre-tax profit	900	340	980
Tax @ 35%	315	119	343
PAT	585	221	637
Net cash flow (PAT + Dep)	625	261	677
Project life	20 years	20 years	20 years
NPV @ 20% (Rs)	3043.487	1270.96	3296.70548

Best and Worst case analysis:

In the above illustration, an attempt was made to develop scenarios in which the values of variables were internally consistent. For example, high selling price and low demand typically go hand in hand. Firms often do another kind of scenario analysis are considered: Best case and worst case analysis. In this kind of analysis the following scenarios are considered:

Best scenario : High demand, high selling price, low variable cost, and so on.

Normal scenario : Average demand, average selling price, average variable cost, and so on.

Worst Scenario : Low demand, low selling price, high variable cost, and so on.

The objective of such scenario analysis is to get a feel of what happens under the most favourable or the most adverse configuration of key variables, without bothering much about the internal consistency of such configurations.

Evaluation:

- Scenario analysis may be regarded as an improvement over sensitively analysis because it considers variations in several variables together.
- It is based on the assumption that there are few well-delineated scenarios. This may not be true in many cases. For example, the economy does not necessarily lie in three discrete states, viz., recession, stability, and boom. It can in fact be anywhere on the continuum between the extremes. When a continuum is converted into three discrete states some information is lost.
- Scenario analysis expands the concept of estimating the expected values. Thus in a case where there are 10 inputs the analyst has to estimate 30 expected values (3 x 10) to do the scenario analysis. [34]

(c) Break-even Analysis:

In sensitivity analysis one may ask what will happen to the project if sales decline or costs increase or something else happens. A financial manager will also be interested in knowing how much should be produced and sold at a minimum to ensure that the project does not 'lose money'. Such an exercise is called break even analysis and the minimum quantity at which loss is avoided is called the break-even point. The break-even point may be defined in accounting terms or financial terms.

Accounting Break-even Analysis

Suppose a company is considering setting up a new plant near Mumbai. The capital budgeting committee has given following projections.

Table 2.12 (Accounting break-even analysis)

Cash Flow Forecast for New Project		
	(Rs.'000)	
	Year 0	Year 1-10
Investment	(60,000)	
Sales		54,000
Variable costs (60% of Sales)		32,400
Fixed costs		3,150
Depreciation		5,850
PBT		12,600
Tax @ 35%		4,410
PAT		8,190
Cash Flow from operation		14,040

One can observe from the above table that the ratio of variable costs to sales is 0.6 (32.4/54). This means that every rupee of sales makes a contribution of Rs. 0.4 or if we put it differently, the contribution margin ratio is 0.4, hence the break even level of

$$\frac{\text{Fixed costs + Depreciation}}{\text{Contribution margin ratio}} = \frac{3.15 + 5.85}{0.4} = \text{Rs. } 22.5 \text{ million}$$

sales will be:

We can verify that the break-even level of sales is indeed Rs. 22.5 million.

	Amount (Rs in millions)
Sales	22.5
Variable costs (60%)	13.5
Fixed costs	3.15
Depreciation	5.85
Profit before tax	0
Tax	0
Profit after tax	0

A variant of the accounting break even point is the cash break even point which is defined as that level of sales at which the firm neither makes cash profit nor incurs a cash loss. The cash break even sales is defined as:

$$\frac{\text{Fixed costs}}{\text{Contribution margin ratio}}$$

It is to be noted that depreciation, a non-cash charge, has been excluded from the numerator of the above ratio.

The cash break even level of sales for the project is:

$$\frac{3}{0.40}\frac{.15}{} = Rs.7.875 million$$

A project that breaks even in accounting terms is like a stock that gives you a return of zero percent. In both the cases you get back your original investment but you are not compensated for the time value of money or the risk that you bear. Put differently, you forego the opportunity cost of your capital. Hence a project that merely breaks even in accounting terms will have a negative NPV.

Financial Break-even analysis:

The focus of financial break-even analysis is on NPV and not accounting profit.

At what level of sales will be project have a zero NPV? To illustrate how the financial break-even level of sales is calculated, let us go back to the above project. The annual cash flow of the project depends on sales as follows:

1.	Variable costs	:	60% of sales
2.	Contribution	:	40% of sales
3.	Fixed costs	:	Rs. 3.15 million
4.	Depreciation	:	Rs. 5.85million
5.	Pre-tax profit	:	(0.4 x sales) – Rs. 9 million
6.	Tax (@ 35 %)	:	0.35(0.4 sales - Rs. 9 million)
7.	Profit after tax	:	0.65 (0.4 sales - Rs. 9 million)
8.	Cash flow (4 + 7)	:	Rs. 5.85 million +0.65 (0.4 sales - Rs.9 million)

: = 0.26 Sales

Since the cash flow lasts for 10 years, its present value at a discount rate of 10% is:

PV (cash flows) = 0.325 sales x $PVIFA_{10\ years,\ 10\%}$

= 0.26 Sales x 6.145

= Rs. 1.5977 Sales

The project breaks even in NPV terms when the present value of these cash flows equals the initial investment of Rs. 60 million. Hence, the financial break-even occurs when

PV (cash flows) = Investment

1.5977 Sales = Rs. 60 million

Sales = Rs. 37.55398 million

Thus, the sales for the project must be Rs. 37.6 million per year for the investment to have a zero NPV. Note that this is significantly higher than Rs. 22.5 million which represents the accounting break-even sales. [35]

(d) Simulation analysis:

Sensitivity analysis and Scenario analysis are quite useful to understand the uncertainty of the investment projects. But both the methods do not consider the interactions between variables and also, they do not reflect on the probability of the change in variables.[36] The power of the computer can help to incorporate risk into capital budgeting through a technique called Monte Carlo simulation. The term "Monte Carlo" implies that the approach involves the use of numbers drawn randomly from probability distributions.[37] It is statistically based approach which

makes use of random numbers and preassigned probabilities to simulate a project's outcome or return. It requires a sophisticated computing package to operate effectively. It differs from sensitivity analysis in the sense that instead of estimating a specific value for a key variable, a distribution of possible values for each variable is used.

The simulation model building process begins with the computer calculating a random value simultaneously for each variable identified for the model like market size, market growth rate, sales price, sales volume, variable costs, residual asset values, project life etc. From this set of random values a new series of cash flows is created and a new NPV is calculated. This process is repeated numerous times, perhaps as many as 1000 times or even more for very large projects, allowing a decision-maker to develop a probability distribution of project NPVs. From the distribution model, a mean (expected) NPV will be calculated and its associated standard deviation will be used to guage the project's level of risk. The distribution of possible outcome enables the decision-maker to view a continuum of possible outcomes rather than a single estimate.

Merits:

- An increasingly popular tool of risk analysis, simulation offers certain advantages:
- It facilitates the analysis and appraisal of highly complex, multivariate investment proposals with the help of sophisticated computer packages.
- It can cope up with both independence and dependence amongst variables. It forces decision-makers to examine the relationship between variables.

Demerits:

- Simulation is not always appropriate or feasible for risk evaluation.
- The model requires accurate probability assessments of the key variables. For example, it may be known that there is a correlation between sales price and volume sold, but specifying with mathematical accuracy the nature of the relationship for model purposes may be difficult.

- Constructing simulated financial models can be time-consuming, costly and requires specialized skills, therefore. It is likely to be used to analyze very important, complex, and large-scale projects.
- It focuses on a project's standalone risk. It ignores the impact of diversification, i.e., how a project's stand-alone risk will correlate with that of other projects within the firm and affect the firm's overall corporate risk.

  Simulation is inherently imprecise. It provides a rough approximation of the probability distribution of net present value (or any other criterion of merit). Due to its imprecision, the simulated probability distribution may be misleading when a tail of the distribution is critical.
- A realistic simulation model, likely to be complex, would most probably be constructed by a management scientist, not the decision maker. The decision maker, lacking understanding of the model, may not use it.
- To determine the net present value in a simulation run the risk-free discount rate is used. This is done to avoid prejudging risk which is supposed to be reflected in the dispersion of the distribution of net present value. Thus the measure of net present value takes a meaning, very different from its usual one, which is difficult to interpret.

(e) Decision-tree Approach:

Sometimes cash flow is estimated under different managerial options with the help of decision-tree approach. A decision tree is a graphic presentation of the present decision with future events and decisions. The sequence of events is shown in a format that resembles the branches of a tree.[39]

Steps in constructing decision tree:

The first step in constructing a decision tree is to define a proposal. It may be concerning either a new product or an old product entering a new market. It may also be an abandonment option or a continuation option, expansion option or no-expansion option, etc. Second step is identifying various alternatives. For example, if a firm is launching a new product, it must chalk out the demand possibilities and on that basis it identifies different alternatives-whether to have a large factory or a medium-size or only a small plant. Each of the alternatives will have varying consequences on the cash flow.

The third step is to lay out the decision tree showing the different alternatives through different branches. And finally, the estimates of cash flow with probabilities in each branch are made. The results of the different branches are calculated that show desirability of a particular alternative over the others.

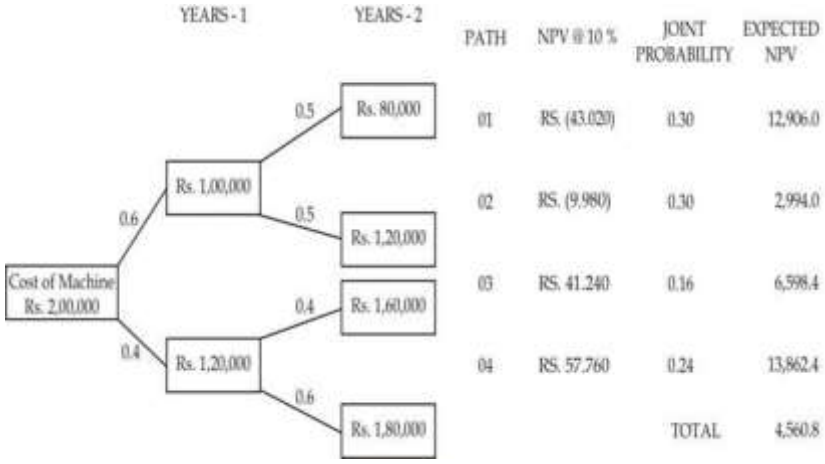


Figure 2.5

For example, a company is considering a new machine having estimated cash flows as follows. The machine is having a life of 2 years. The cost of machine is Rs. 60,000 and a company's required rate of return is 12%. If a company wants to use decision tree approach, recommend whether the machine should be bought or not.

Merits:

- Decision tree analysis gives the clarity of sequential investment decisions.

It gives a decision maker to visualize assumptions and alternatives in graphic form which is easier to understand than the analytical form. It helps in eliminating the unprofitable branches and determines optimum decision at various decision points.

Demerits:

- The decision tree becomes more and more complicated if he includes more and more alternatives. It becomes more complicated if the analysis includes interdependent variables which are dependent on one another.

- It becomes very difficult to construct decision tree if the number of years expected life of the project and the number of possible outcomes for each year are large.

2.7 Some Supplementary Capital Budgeting Techniques:

The following are some other supplementary capital budgeting tools.

(a) Real Options:

Real options capture the value of managerial flexibility to adapt decisions in response to unexpected market developments. Companies create shareholder value by identifying, managing and exercising real options associated with their investment portfolio. The real options method applies financial options theory to quantify the value of management flexibility in a world of uncertainty. If used as a conceptual tool, it allows management to characterize and communicate the strategic value of an investment project. Traditional methods (e.g. net present value) fail to accurately capture the economic value of investments in an environment of widespread uncertainty and rapid change. The real options method represents the new state-of-the-art technique for the valuation and management of strategic investments. The real option method enables corporate decision-makers to leverage uncertainty and limit downside risk. Real option (RO) is a method of evaluating and managing strategic investment decisions in an uncertain business environment. It seeks to quantify numerically each. of the investment options available in a particular situation. A 'real option' represents a "right, to take an action in the future but not an obligation to do so". DCF and RO both assign a present value to risky future cash flows. DCF entails discounting expected future cash flows at the expected return on an asset of comparable risk. RO uses risk-neutral valuation, which means computing expected cash flows based on risk-neutral probabilities and discounting these flows at the risk-

free rate. In cases where project risk and the discount rates are expected to change over time, the risk-neutral RO approach will be easier to implement than DCF (since adjusting cash flow probabilities is more straightforward than adjusting discount rates). The use of formal RO techniques may also encourage managers to think more broadly about the flexibility that is (or can be) built into future business decisions, and thus to choose from a different set of possible investments.

Types of Real Options

The types of real/managerial options available include:

1. Option to expand (or contract) – An important option is one that allows the firm to expand production if conditions become favourable and to contract production if conditions become unfavourable.
2. Options to abandon – If a project has abandonment value, this effectively represents a put options to the project's owner.
3. Option to postpone – For some projects there is the option to wait and therby to obtain new information.

Sometimes these options are treated informally as qualitative factors when judging the worth of a project. The treatment given to these options may consist of no more than the recognition that "if such and such occurs, we will have the opportunity to do this and that." Managerial options are more difficult to value than are financial options.

Valuation Implications

The presence of managerial, or real, options enhances the worth of an investment project. The worth of a project can be viewed as its NPV, calculated in the traditional way, together with the value of any option(s).

Project Worth = NPV + Option(s) value

The greater the number of options and the uncertainty surrounding their use, the greater the second term in the above equation and the greater the project's worth.

Merits

There are several benefits for decision makers if they decide to use real option analysis. Some of the important benefits are:

1. It forces a change in the emphasis of decision makers (and the valuation process) from 'predicting the future outcome perfectly' (the NPV rule) to identifying what can (or rather should) be done about responding to business

uncertainty;

2. It gives decision makers the ability to identify the optimal levels of flexibility; and
3. By focusing management's attention on responding optimally to uncertainty as it evolves, it promotes a sense of discipline in the management of assets that extends over the entire life of the project.

Limitations[45]:

Applying real options to a project is cumbersome and problematic. It has following limitations.

1. Finding an option model that has assumptions that match the project being analyzed i.e. the potential disconnect between financial and real options because strategic options lack the precise meaning and measurements that financial options enjoy.
2. Determining the inputs to the option model correctly is critical to achieving accurate outputs.
3. Being able to mathematically solve the options pricing algorithm. But thanks to more powerful PCs and software, this problem has been made easier. The sophisticated mathematics such as partial differential equations of RO, and the consequent lack of transparency and simplicity are the real concerns.

Thus, RO analysis encourages firm to create various possibilities for the proposed investments. It is possible that traditional capital budgeting tools may not allow firm to adopt emerging new technologies if it does not earn its cost of capital but RO may suggests that it is necessary price to pay for now to earn well in future.

(b) **Economic Value Added**[46] **or EVA®** is an estimate of true economic profit after making corrective adjustments to GAAP accounting, including deducting the opportunity cost of equity capital. It measures managerial effectiveness in a given year or period (Net Operating Profit After Taxes (NOPAT) – After tax cost of capital required to support operations). It is a way to determine the value created, above the required return, for the shareholders of a company.

The basic formula is:

$$EVA = (r - c) \bullet K = NOPAT - c \bullet K$$

Where

$r = \frac{NOPAT}{K}$, called the Return on Invested Capital (ROIC)

NOPAT is the Net Operating Profit After Tax,

c is the Weighted Average Cost of Capital,

K is capital employed

Shareholders of the company will receive a positive value added when the return from the capital employed in the business operations is greater than the cost of that capital.

(b) The firm's **Market Value Added**, or MVA, is the discounted sum of all future expected economic value added:

$$MVA = V - K_0 = \sum_{t=1}^{\infty} \frac{EVA}{(1+c)^t}$$

MVA = NPV of company

(c) **Incremental IRR** is the IRR of the difference in cash flows of two comparison projects; commonly used in replacement decisions.

(d) **PERT/CPM** is the analysis and mapping of the most efficient financial decision.

(e) **Complex mathematical models** a general term inclusive of various option pricing model techniques, complex real options, and firm specific proprietary models and methods.

(f) **Linear programming** identifies a set of projects that maximizes NPV subject to constraints (such as maximum available resources)

Option pricing model include either binomial option pricing model or the Black-Scholes option pricing model, the latter used by firms such as Merck with high R&D expenditures and relatively few, albeit large positive NPV investments.

Conclusion

Capital investment for a company is a vital and significant decision. Companies realise that the decision of which investments to take on will make a considerable difference on their long-term profitability, value maximising, and their ability to outperform competitors (Du Toit & Pienaar, 2005). This report examines the process of capital budgeting and the several steps involved. A simple overview of these steps can be placed into the following: (1) Identification Process - the development of investment proposals; (2) Development Process – the financial evaluation and screening of projects; (3) Selection Process – the implementation of projects, involving risk assessment and capital rationing; and the (4) Control Process – where the project is reviewed and audited.

Moreover, Drury (2004) considers the capital budgeting process to include investment, financing and dividend decisions:

- Determine which projects to accept.
- Determine the total capital expenditure a firm should agree upon.
- Determine how the capital spending should be financed.

Capital budgeting is something that should be carefully examined. Once a project is accepted and taken on, it is not easily reversible and the firm may suffer a great deal of loss in financial terms or growth. There are several formal methods of project evaluation that companies can incorporate into their capital budgeting procedure. By examining the various valuation techniques of capital budgeting, the company can observe which projects will add value to their firm and therefore know which investments to accept and reject. Furthermore, it would be naturally advantageous to make use of several of these methodologies. Although the discounted cash flow methods (i.e. NPV and IRR) are some of the most common and preferred techniques, instead of using any one in isolation and limiting the process, a company should attempt to apply more than one method in the evaluation of a project during the capital budgeting process in order to perform a fully comprehensive analysis. Literature on capital budgeting in South Africa and other developing countries is scarce; thus, given the importance of capital investment and budgeting, it would be highly beneficial to develop and study more on this topic as it will greatly benefit policy makers and companies in their capital budgeting practices.

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