

**CAPITAL BUDGETING TECHNIQUES
PRINCIPLE VERSUS PRACTICE IN SOUTH AFRICA**

By

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1 Chapter One – Capital budgeting defined

1.1 Introduction

Capital budgeting was defined by Richard Pike, arguably the most published academic on the topic of capital budgeting, as :

“the art of finding assets that are worth more than they cost. Nothing is easier in concept or harder in practical implementation. This definition brings together the complementary notion of the ‘art’ of finding assets and the ‘science’ of developing models to evaluate their worth (Pike 1983: 201).”

In the past the techniques used to evaluate the capital budgeting decision have enjoyed the majority of academics’ attention with little emphasis placed on the ‘art’ that underlies the identification and implementation of profitable capital projects. It is these capital budgeting techniques and the implementation thereof that are the focus of this dissertation.

1.2 The importance of capital budgeting

The capital budgeting decision is amongst the most important decisions to be taken by the management of any firm. By definition, capital budgeting involves the commitment of company resources for a considerable period of time and by virtue of the size of many capital investments, has the potential to significantly affect the future profitability of the firm (Hammer, Carter & Usry 1993: 655). Capital expenditures also often define the strategic direction of the company through the commitment to a certain technology, market or operating structure (Smith 1994: 20). An example of this would be that of the South African Broadcasting Corporation’s (SABC) decision to commit to providing satellite television using analogue transmitters and receivers rather than using the more current digital format. This decision was taken in 1996 amid much public questioning and criticism – the SABC is now negotiating to convert their analogue equipment to digital at great cost to themselves. This demonstrates the importance of capital expenditure in renewing, in an intelligent fashion, the nature of a company and the manner in which the company does business (Bishton 1979: 13).

Given the importance of the capital investment decision, it is worthwhile to ask whether the theoretical techniques propounded by academic institutions adequately serve the needs of

those in commerce. It is wise to examine whether the capital budgeting tools developed in academia are utilised in practice, and whether the development of ever more sophisticated techniques is justified by the level of practical implementation of such techniques.

1.3 Implementation of capital budgeting techniques

The use of financial analysis techniques should not be seen as a goal in itself, but as a vehicle for making better decisions (Moore & Reichart 1983: 623). The academic community has assisted in developing a range of analytical tools for performing financial analysis. Moore *et al* contend that the “ascent of university trained corporate managers into positions with significant decision-making authority has created the opportunity to fuse ‘classroom theory’ and ‘boardroom reality’ (1983: 623)”. Gitman and Mercurio (1982: 21) stated their belief that academics have a responsibility to students and financial managers to help bridge the gap between financial theory and practice.

Pinches (1982: 6) voices his concerns relating to the state of modern capital budgeting, both academic and practical, when he states that “the emphasis [of capital budgeting] is overly narrow, misplaced, and doesn’t focus on the important strategic decision at hand - that is, the enhancement of our ability to make decisions in line with the long run maximisation of the value of the firm”. Pinches holds that the main shortcoming of academics and business is the over-emphasis on the solving of situation-specific investment problems, with insufficient attention directed to critical overall considerations such as strategic direction and the practical process of allocation of scarce resources (1982: 6).

There is no doubt that commerce requires tools that are cost-effective and of relevance in real-world situations. As an American executive remarked, “a theoretical model so elegant that no-one understands it can’t be used (Weaver, Peters, Cason & Daleiden 1988: 15).”

The purpose of this dissertation is to examine the degree of implementation of capital budgeting techniques in practice in order to evaluate the success of academics in devising and disseminating capital budgeting techniques which are relevant and cost-effective.

1.4 The capital budgeting process

Although the main focus of this dissertation is the analytical techniques which have been developed to mathematically determine the viability of projects at hand, it is important to view these techniques within the framework within which they are to be implemented (Mukherjee 1987: 37). The implementation framework to be adopted in this regard is that which was derived by Dean (as quoted by Bishton (1979: 40)) and supplemented by the author using the work of Neale (1994: 286) and is composed of the following stages:

1. Search
2. Initiation
3. Analysis
4. Budget
5. Budget approval
6. Control
7. Implementation
8. Post-implementation audit

The key features relating to these stages of the capital budgeting process are to be examined in Chapter 4 below.

2 Chapter Two - Objective

2.1 Objectives of the study

The objective of this dissertation is to address the following issues :

1. To examine the capital budgeting techniques which have been developed, and form a part of the current mainstream of academic theory, highlighting the conceptual and practical strengths and weaknesses of each.
2. To examine the progression of the degree of application of capital budgeting techniques as revealed in a number of key primary research projects reviewed. The purpose of this is to gauge the development of the practical sophistication of applied capital budgeting techniques over time, and to investigate whether a material gap exists between theory and practice.

This dissertation was chosen with the intention of testing the practical applicability of the academic material propagated by academic institutions, as well as the nature of the relationship between educational syllabi and business practice.

3. To conduct empirical research into the degree of implementation of current capital budgeting theory in South Africa at present.

The examination of currently employed capital budgeting techniques includes a study of the increase in the use of such techniques.

4. To attempt to predict the future direction of capital budgeting practice in South Africa, and the likely usefulness of the further developments in this field of academia.

3 Chapter Three - Research Methodology

The research method employed is a combination of primary and secondary research.

3.1 Primary Research

This research involved the collection of research data relating to the current capital budgeting practices of South African businesses.

The majority of the primary research was sought by means of a questionnaire-based survey of the Financial Mail's Top 100 Companies (measured by market capitalisation) as well as the Financial Mail's Top 100 Companies (measured by capital budget) per the 1997 survey results.

Two company representatives were also interviewed telephonically in an attempt to gain a more comprehensive understanding of the views expressed by respondents in their questionnaires. These discussions also served to investigate the possibility of response bias in the firms which responded to the questionnaires distributed. Response bias (Scapens & Sale 1981: 403) in the context of this dissertation would refer to the possibility that respondents to the questionnaire would exhibit higher than average levels of capital budgeting sophistication as it is those companies who implement best practice measures who are most motivated to respond. As detailed in the chapter on the primary research, no evidence of such bias was indicated. It was also found that such discussions were invaluable in uncovering those issues considered integral to the decision-making structures of business.

The primary research was conducted during the latter half of 1997, with the final receipt of questionnaires taking place in January and February of 1998. The statistical analysis of such data was conducted in December 1999 during the final drafting of the dissertation.

3.2 Secondary Research

The majority of secondary research conducted took the form of an extensive literature review.

This review concentrated on the following distinct areas of financial management theory:

1. Capital budgeting techniques, their development as well as their perceived theoretical and practical advantages and disadvantages.
2. Comparable research studies conducted which compare the theory and application of capital budgeting techniques or which gauge the increase of practical sophistication of practitioners over time.

The secondary research was conducted using the following research depositories :

1. The Cecil Renaud Library - University of Natal (Pietermaritzburg).
2. Inter-library loan facilities - Used to access library material from across South Africa.
3. The Internet; with particular use made of the databases of the CSD (STAR completed dissertation and SABINET periodical databases).
4. The KPMG library maintained by the Johannesburg office of the firm.

The secondary research was largely completed to the two years ended April 1999 with the final editing and selection of pertinent research material taking place between June and December 1999.

Great effort was made to obtain all relevant published materials relating to the topic at hand. All pertinent articles and studies found referenced to research published both in South Africa and abroad were either inspected at the Cecil Renaud Library or requested through the Inter-library loan facility operated by the University of Natal (Pietermaritzburg).

4 Chapter Four – The capital budgeting process

4.1 Introduction

In examining the capital budgeting techniques devised by academics and implemented in practice the process within which these tools are used must be examined. The framework within which this examination will take place is taken from Bishton (1979: 40) and supplemented by the work of Neale (1994: 286). This framework divides the capital budgeting process into the following distinct functions:

1. Search
2. Initiation
3. Analysis
4. Budget
5. Budget approval
6. Control
7. Implementation
8. Post-implementation audit

While different frameworks have been posited by different academics describing the capital budgeting process (see Neale (1994: 286), Fremgen (1973: 25), Bishton (1979: 40) and Shillinglaw (1977: 488)) a broad consensus emerges that the overall process (in whatever form it is described) needs to be recognised and managed in order to effectively implement capital budgeting strategies. It is also recognised that entities that over-structure and excessively formalise the process may limit initiative and thereby reduce the probability of accepting truly promising projects (Neale 1994: 287). In addition, the design of these systems, both from an information gathering, summarising and reporting perspective, and from a control and review perspective can greatly affect the degree to which executives learn from their experiences (Brown & Solomon 1994: 85).

4.2 Formalising the process – Capital budgeting manuals

While bearing Neale's warning in mind – that to over-structure is to suffocate – it is common practice to formalise the capital budgeting process by devising rules and procedures for initiating, analysing and implementing capital projects. These rules and procedures are usually committed to a capital budgeting manual. Research by Nolan and Banda (1971: 13) found that 72% of firms surveyed prescribed policies and procedures for making capital investment decisions and that 71% of these reduced these policies to written form. In addition to this, they found that there was a discernible positive relationship between the size of the firm and the likelihood that a capital budgeting manual was maintained.

Mukherjee (1988: 29) emphasises the need for a capital budgeting manual that is complete and up-to-date, mentioning specifically the need to constantly review changeable variables such as investment hurdle rates and internal and external phenomena such as inflation and interest rates and tax allowances. It is clear from his piece that the manual is expected to form a complete guide as to how the capital budgeting process is to be completed within the parameters of company regulations.

Pike (1983: 201) stresses the need to recognise that there is no one appropriate investment process. Pike believes that the degree to which investment procedures should be formalised is contingent upon the nature of the firm (taking into account size, capital intensity and organisational structure of the business), the characteristics of the firm's environment and the complexity of the proposed investments. Firms with fairly uniform and repetitive capital investment needs, such as retailers (who will periodically evaluate the decision to open another branch or extend shop space) may benefit from a fairly formalised capital budgeting process which dictates in a fair amount of detail the procedures to be followed in evaluating a capital investment.

The importance of carefully designing and implementing the capital budgeting process has been established. A closer examination of the component parts of the process is now undertaken.

4.3 Search

Considerable importance must be attached to the process by which the company identifies capital investment opportunities. Mukherjee (1988: 29) emphasises the need for “an information-gathering system to monitor market opportunities” without defining how such a system may be formed. The author would argue that the following characteristics would be desirable in such a system:

1. Sufficiently formal as to ensure that the required information reaches management with the authority to initiate a capital budgeting proposal whilst sufficiently informal as to ensure that all levels of employees are motivated to contribute.
2. Documented and communicated such that all members of the organisation are aware of the channels through which to submit ideas and proposals.
3. Reinforced through a reward programme designed to encourage participation and through the regular and clear feedback of information on the stage of evaluation or implementation of each project to those responsible for the initiation thereof.

It is important that staff be informed that projects of all descriptions will be evaluated on a cost : benefit basis and not merely on their profitworthiness. Bishton (1979: 40) splits the types of projects that may be considered into three categories, namely:

1. Those pursued for the profit motive – those projects which are perceived to hold the potential for a profit in their implementation.
2. Those pursued for the capacity motive – these projects are implemented to provide greater capacity to meet increased demand.
3. Those pursued for the trade motive – these projects are pursued in order to retain or increase market share e.g. the setting up of a branch in a new town by a retailer in order to pre-empt the arrival of a competitor and to extend market share into a new region.

The formalisation and encouragement of the search process is highlighted by research conducted by Pike (1983: 203) which found that in 1975, 76% of respondents had specific search and screening of alternatives procedures. When the survey was re-performed in 1980 (using the same population and questionnaire), this percentage had increased to 83%. The

caveat to be borne in mind when examining this finding is that it is probable that a large proportion of the respondents were replying regarding the 'screening of alternatives procedures' rather than the 'search' procedures part of the process. Research quoted by Mukherjee (1987: 39) performed by Istvan in 1959 is perhaps more revealing as regards the formalisation of project search and identification procedures. Istvan found that some 47 of 48 firms did not make special efforts to generate ideas for capital expenditure and that, where implemented, this process was typically bottom-up in nature.

4.4 Initiation

Once a possible capital investment has been identified through the 'search' stage of the process, the initiation phase is entered wherein the projects concerned are motivated to the appropriate members of the organisation to be considered for implementation (Bishton 1979: 40). An important facet of this phase of the capital budgeting process is the fact that some kind of screening takes place at this level – whether the evaluation is formal or informal in nature. This fact was evident from the research results of Oblak and Helm (1980: 37) who found that the rate of acceptance of projects which were subjected to detailed analysis (refer to section 4.4 below) was too high to represent a random spread of projects – the projects subjected to detailed formal analysis had to have been first vetted for their appropriateness at some previous part of the process. Oblak *et al* found that 35% of respondents had an acceptance rate of 90% or more with 85% of respondents exhibiting acceptance rates of at least 75% (1980: 38). The existence of this initial screening process is supported by Mukherjee (1987: 39), who quotes the research of Petty, Scott and Bird (1975: 159 – 172) who found that capital expenditure proposals are typically screened at a divisional or plant level before in-depth proposals are compiled for analysis.

How this screening process takes place varies from entity to entity. It is certain that all entities perform at least a heuristic-based or 'gut-feel' examination of a project's merits before subjecting it to detailed analysis (Hammer, Carter & Usry 1993: 655). It is human nature to attempt to avoid the expending of unnecessary effort – each proposal will therefore be examined on a superficial level for profitability and strategic fit before detailed analysis is performed.

4.5 Analysis

The analysis phase is defined by Mukherjee (1987: 43) as the process of deciding “which projects are profitable, which of mutually exclusive projects is superior, and which combination of investments is best in the face of capital rationing”.

The close examination of the analysis phase of the capital budgeting process forms the greater part of this dissertation. This phase is concerned with the following decisions:

1. Project suitability
2. Project viability
3. Individual project profitability
4. Project acceptance

4.5.1 *Project suitability*

An examination should be led to ensure that the project to be reviewed suits the strategic objectives of the entity (Hammer *et al* (1993: 655) and Bishton (1979: 116)). The strategic imperative raised by Hammer *et al* is echoed by Correia, Flynn, Uliana & Wormald (1993: 341) who state that “capital budgeting analysis should take place within the context of a firm’s strategic plan”. To invest in a project without first considering whether the project involves an area of business that the company is not interested in entering is poor management and should be avoided.

4.5.2 *Project viability*

An examination must be lead as to whether the entity has the resources to effectively implement the proposal in the manner envisaged such that a positive impact on current company operations will be enjoyed (Hammer *et al* 1993: 655). Issues such as the availability of suitably experienced staff, factory space and other resources are examined in this part of the process.

4.5.3 *Individual project profitability*

Will the project, if successfully implemented, add value to the budgeting entity? This phase of the analysis process involves the estimation of the cash flows relating to the project and the use of the analytical tools examined in Chapter 5 to evaluate the individual profitability of the project.

It is this phase which is considered the most difficult by practitioners (refer to section 4.12 below) and which is largely beyond the scope of popular academic material. The main reason for this is because the estimation of cash flows is a soft-skills process which cannot easily be taught, but which comes from experience and a thorough knowledge of the industry or project-type concerned.

It is important also that the above decision framework support the evaluation of projects or investments that will not directly yield a profit e.g. the decision to build a canteen for factory employees can usually not be considered as profit-making investment. Procedures must be put in place to evaluate these types of investments – Bishton (1979: 32) found that some 51.4% of his respondents had to invest in some instances up to 25% of their capital budgets on such non-productive investments.

Hammer *et al* state that it is important within this phase of the analysis process to bear in mind that multiple evaluations of the same project may be necessary because circumstances change during the time-span of the project, or because certain important assumptions may require adjustment (e.g. the future exchange rates applicable to a company or a project require constant adjustment in times of currency volatility) (Hammer *et al* 1993: 658).

4.5.4 *Project acceptance*

The analysis phase will culminate in the recommendation whether to accept or reject a particular proposal. Most business are faced with a situation of capital rationing which prevents the acceptance of all seemingly profitable projects. Analysis will, under these circumstances, include the decision as to which of the seemingly profitable projects to accept.

Bearing in mind the various analytical tools available to facilitate the 'Analysis' phase Bishton believes it is important to avoid the 'inevitable drift towards a routine and bureaucratic-

orientated control which overcomes objections and supports recommendations through the use of sophisticated analytical techniques often applied out of context (1979: 36)".

It is also important in this phase of the analysis process to remember that there are many different goals, which are sometimes conflicting, which the company can choose to pursue. Grinyer (1986: 319) argues that the maximisation of shareholder wealth is not the only goal for management to pursue, but rather an "alternative objective function" which aims to "maximise the wealth created within the firm but which is sufficiently flexible to permit a variety of objectives". The analysis phase should therefore also include an evaluation of other indicators of project acceptability, other than profit forecasts. It may, for example, benefit a company to sponsor a medical clinic in a rural area through non-financial benefits received – these benefits would not be highlighted by a purely financial analysis. In this regard, research conducted by Petty, Scott, & Bird (1975: 165) found that the most significant non-financial factors taken into account in the capital budgeting process were the following:

1. Company image
2. Employee morale
3. Legal considerations

Research by Dunn & Hoskins (1974: 50) indicated that 74% of firms periodically undertake assessments which are purely qualitative in nature – respondents reported that these types of projects are mandatory in nature or which relate to critical non-financial business issues such as those listed above.

4.6 Budget

The projects which meet the criteria of the business under the evaluation process given above will be placed within a capital budget. This budget represents the entire known profitable investment universe of the company and is compiled to allow management to decide which, if not all, capital investments to make. Bishton (1979: 75) summarises this part of the process in the following stages:

1. Management place the competing projects into a portfolio of possible projects which are evaluated as a group against the planned spend or available finance.

2. A demand schedule is drawn up showing the amount of capital demanded by each proposed investment and the results of the analytical tests applied in evaluating each.
3. The projects are evaluated against one another using the results of the capital budgeting techniques calculated e.g. selecting those investments which promise the most rapid payback period, or the greatest internal rate of return.

4.7 Budget approval

Budget approval should be provided by the correct level of management according to the policy of the company. It is interesting to note that although companies are interested in budgeting for capital budgeting expenditures further out than the current period, research indicates that the horizon for such planning is rarely more distant than two years hence (Pike 1988: 343). Pike contends that this is as a result of firms' lack of confidence in their long-term forecasting abilities. Pike's results also statistically verified the contention that firms with larger capital budgets devote greater attention to the forecasting of investment cash flows (1988: 343).

It is important in the budget approval process to ensure that, although the authority to enter into capital spending contracts is centralised, the persons able to influence the decision to invest are those that are best placed within the organisation to do so. A special case which is worth evaluating is that of the multi-national corporation (the subject of the dissertation by Bishton). In the case of a multi-national corporation it is important to ensure that the parent company has overall control of capital spend, but that the directors of the foreign subsidiaries be given the greatest say in which projects warrant investment – there is a conventional risk - return trade-off between the ideal of centralising control and the benefits of empowering operational management.

In practice, argues Mukherjee (1988: 29), this trade-off situation is solved through having the long-term capital budget set at head-office level with the projects proposed for implementation under that budget initiated, evaluated and approved at operating level.

Further Mukherjee found that the authorisation process usually occupies approximately 75% of the capital budgeting manual. Mukherjee believes that the authorisation process is prescribed in great detail for the following reasons:

1. Provides information to those executives whose responsibility it is to authorise expenditures.
2. The justification process for the acquisition of fixed assets and related items is made in accordance with 'sound economic principles'.
3. A uniform treatment of capital investment transactions is promoted.

4.8 Control

The control phase refers to the process of maintaining control over the implementation of the capital investment. Bishton (1979: 85) describes this as a part of the administrative process of the capital budget in which the responsibility for "controlling actual capital expenditures after the decision to invest has been taken".

In this process, the two types of control may be described as follows:

1. Information controls – The rapid, accurate feedback of all costs and revenues associated with the decision.
2. Budgetary control – The authorised expenditure should be divided into as many distinct areas of cost as are considered necessary (using the cost : benefit decision rule as a guide) and variance analysis conducted sufficiently regularly to ensure that remedial action can be taken timeously should a significant deviation from budget occur.

4.9 Implementation

This phase of the capital budgeting process refers to the physical acquisition and implementation of the capital investment in the entity concerned. This process is not uniform and depends almost entirely on the type of business and the kind of investment concerned.

4.10 Post-implementation audit

4.10.1 *Introduction*

Neale (1989: 309) states that “Many researchers and industrialists ... have commented on the ‘misplaced emphasis’ or ‘myopia’ of those academics who over concentrate on the issues surrounding optimal investment appraisal techniques to the apparent neglect of perhaps more fundamental aspects of overall capital budgeting systems. Such areas include the mechanism whereby new investment proposals are generated, the procedures through which projects are monitored and controlled during their implementation and those whereby completed projects are reviewed and audited (Neale 1989: 309)”.

While some academics argue that the post-implementation review is not a part of the capital decision-making process since it relates to projects which have already been implemented (i.e. the decision whether to invest capital or not has already been taken), Levy & Sarnat as well as Neale, argue that the post-implementation, amongst other benefits, helps to contribute towards the improvement of current decision-making by analysing the patterns of past estimation by department, by staff member, and by type of expenditure. The accumulated information can be extremely valuable in revising current forecasting and evaluation methods (Levy & Sarnat 1986: 25).

One of the comments made most often by practitioners in the critique of the capital budgeting process as taught by academics, is that the real success of capital investments is more related to the implementation process and the control thereof, than is ordinarily admitted (Levy & Sarnat 1986: 25). One of the key areas in the capital budgeting process is the control over the project, once implementation is complete. The performance of this function includes the collection and analysis of information (relating to implementation effectiveness and efficiency, start-up profitability, as well as the continued appropriateness of the investment operation) and the implementation of decisive, appropriate action in the light of such information.

The capital budgeting term for the process which monitors and controls the capital project implementation promoted by Neale, above, is the post-implementation review, post-audit or post-facto performance review. This follow-up process “compares the actual results of a

capital expenditure with the outcome that was expected when the investment project was approved (Hammer *et al* 1993: 672)".

Stated differently, the post-implementation audit is a process of examining the effectiveness of the capital budgeting decision process, performed by comparing the forecast implementation and operation information with the actual results achieved. This function must be differentiated from the activities relating to the evaluation of project performance per se, for the sake of management decision-making and staff evaluation. It is important, quotes Bishton (1979: 90), to ensure that the post-implementation audit does not simply revolve around whether the costs incurred in relation to a project have exceeded those originally authorised – it is critical to evaluate qualitative as well as quantitative outcomes of the project concerned.

4.10.2 *Implementation issues*

Research into the topic of post-implementation reviews has found a number of significant issues that plague the adoption of such processes in practice.

Possible problems relating to the implementation of post-implementation audits include:

1. There may be significant difficulties in measuring those costs or revenues that are attributable to a particular project (Neale 1989: 311). Separating what occurred from what would have occurred had the project not been implemented is particularly difficult as regards the apportionment of joint costs, particularly those relating to overheads. The firm's information system may not be geared to the provision of the data necessary to conduct an effective and efficient post-implementation audit. Research conducted by Baxendale and Levitan (cited by Neale 1989: 311) has suggested that a redesignation of cost centres could eliminate this problem. This would usually involve the creation of a new cost or reporting centre for each significant capital investment to which revenue and costs would be attributed and reported.
2. Neale (1989: 312) submits that there may be limited benefits to be derived from the post-audit of a unique project. However, other academics cite benefits which flow from the post-audit process which do not hinge on the future implementation of similar projects (see for example: Pike (1988: 344)). Research conducted by Brown and Soloman

(1993: 84) into the conditions which foster the most effective learning by staff state that “effective learning requires accurate and immediate feedback about the relation between the situational conditions and the appropriate response”. The post-implementation audit, and the resultant information produced, must be considered to be a component of the feedback which is so valuable to the development of staff.

3. Changes between the project originally motivated for, and the project actually approved and implemented often make it impossible to realistically compare the original forecast cost and income information with actual figures realised. This difficulty, highlighted above in the research reported by Hammer *et al* (1993: 658) show the importance of updating the information supporting the evaluation of the project accept : reject decision.
4. Statman and Tyebjee (1985: 29) have argued that “PIA may contain inherent biases which distort any appraisal of the accuracy of the forecasting procedure decision makers who evaluate the forecasts may incorrectly assume the forecasts are optimistically biased. Such an error may occur if decision-makers misinterpret post-audit results by ignoring the fact that post-audits are performed on accepted projects but not rejected projects”. This means that sample bias may exist in the evaluation of the forecasting accuracy of managers by looking at implemented projects. This is because only the projects which have been accepted are subjected to the post-implementation examination.
5. Research has shown that unless the audit is carefully implemented and staff educated as the benefits to be derived therefrom as well as the motivation for its introduction, the validity of the process may be questioned by staff, resulting in possible ill-will and a lack of co-operation.
6. Research conducted by Matthews quoted by Bishton (1979: 91) found that the majority of respondents set a lower level limit on the size of projects which warranted a post-implementation audit. This may lead to a situation where a large number of projects are not evaluated despite the fact that in aggregate they make up a large proportion of the capital budget for the period under review.

4.10.3 *Benefits of Post-Implementation Audits*

The research conducted into the benefits of a carefully implemented and controlled post-implementation audit provide evidence as to the validity and value of the process as a whole. The benefits found as a result of such research have been grouped below in point form:

1. The follow-up provides the possibility of reinforcing successful projects, salvaging or terminating failing projects and improving future investment proposals and decisions (Bishton 1979: 91; confirmed by Neale's questionnaire survey of management accountants (1989: 319) and later confirmed by Hammer *et al* (1993: 672)).
2. The expectation of a post-implementation audit can encourage managers to make more realistic estimates during the proposal stage (Hammer *et al* 1993: 672; Bishton 1979: 91). Empirical surveys (Bierman 1986; Pruitt and Gitman 1987; Statman & Tyebjee 1985) point to the perceived existence of optimistic bias in capital budgeting forecasting among the majority of surveyed firms. Such biases in capital budgeting estimates can enter either ex ante or ex post (or both). The ex ante estimation bias relates to the optimistic forecast resulting possibly from the competition among managers for internally rationed funds.

The bias can also enter ex post as a result of the prior probability distribution of a project accessible to the firm. Under the competitive market assumption, all firms will earn only 'normal' profits in equilibrium. In other words, the opportunities to earn above-normal profits will be rare in a competitive environment. This basic economic theory has a strong implication in regard to the prior probability distribution of a project accessible to a firm, the implication being that the probability of a project earning an above-normal return is low. This has the effect on the capital budgeting process that the forecast amounts should be considered for downward adjustment, possibly using Bayesian distribution mathematics, to allow for the fact that above-average returns on investment must be considered statistically less probable than normal returns. Mukherjee (1991: 747) counters that the most effective (and mathematically simple) method of counteracting against over-optimistic forecast figures is to upwardly adjust the discount rate utilised in the project analysis procedures in the case of net present value analysis or to increase the hurdle rate where the internal rate of return is used.

This methodology is not affected by the scale of the project and can be flexibly applied to projects of different risk categories. If risk is to be measured by the standard deviation of expected returns, for example, the required rate of return can be increased for projects showing standard deviations over a specified percentage of the expected outcome. This process can be standardised in the capital budgeting manual to ensure a uniform firm-wide approach to risk estimation and measurement.

3. The addition of the post-audit to the reporting structure in place at a company must inevitably provide an additional point at which control may be exercised in the business cycle (Neale 1989: 319).
4. “Post-decision investment control mechanisms can influence both the investment performance (implementation controls) and the quality of future investment decisions (feedback) (Pike 1988: 344)”.
5. The post-implementation audit may be used to manage the autonomy of management in subsidiary companies or different branches of the organisation (Neale 1989: 319).
6. Performance review can focus attention on those individuals or organisations responsible for major or continuing errors or may highlight staff worthy of nurturing and promotion (Bishton 1979: 91).
7. The process of conducting a project performance review is conducive to the building of skills and knowledge in the person responsible for this task – this function may serve to train such individuals for greater project management and approval tasks (Bishton 1979: 91).

4.10.4 *Shortcomings of the post-implementation audit process*

Research conducted into the post-implementation audit process has indicated that, although there are definite benefits to be derived from such reviews, there are certain perceived areas of difficulty or possible negative consequences of the implementation thereof. The seminal research conducted in this regard was conducted by Neale in 1989 (1989: 309-328) and consisted of the circulation of questionnaires to capital budgeting practitioners. One section of the questionnaire related to the perceived negative outcomes related to the implementation of post-implementation audits.

The results of this are represented below and are based on a Likert scale of between 1 = significant shortcoming to 5 = trivial :

No.	Perceived Shortcoming	Likert Rating (1-5)
1.	Too many changed factors to make comparisons worthwhile	2.64
2.	Presence of qualitative factors	2.72
3.	Poor reaction to audit reports	4.03
4.	Encourages excessive caution	4.04
5.	Lack of co-operation with review staff	4.05
6.	Slows down overall decision processes	4.26

As the above responses indicate, the most important perceived potential shortcoming of post-implementation audits in the opinion of the practitioners sampled is the fact that most post-audit procedures do not give adequate weight to changed implementation environments and conditions in evaluating the success of capital investments. The least important perceived weakness relating to the post-implementation audit is that it slows down the decision processes of the organisation. This stands to reason as the audit will be conducted after the implementation of the project is substantially complete – little decision activity is contingent upon the findings of the audit.

A comparable piece of research conducted by Hoskins and Dunn in 1974 found that those respondents *not* performing a post-implementation function as a matter of policy did not do so because of:

1. a lack of time, and
2. the unpopularity of the audit process within the organisation (related to the “Lack of co-operation with review staff” cited by Neale in his research, quoted above).

4.10.5 *Research findings*

The findings of research conducted into the post-implementation audits process are summarised below. In short, what the research reveals is an increasing implementation of the audit process in business, with a bias towards capital intensive businesses, and with greater levels of application in larger firms (Nolan & Banda 1971: 14 and Neale 1989: 317).

4.10.5.1 *Levels of Implementation*

No.	Year & Country of Study	Percentage of Respondents Implementing PIAs	Researchers
1	1971 - US	65%	Nolan & Banda 1971: 13
2	1975 - UK	60%	Pike (1983: 202)
3	1980 - UK	74%	Pike 1983: 201.
4	1982 - US	56%	Gitman & Mercurio 1982: 28
5	1988 - UK	54%	Pike 1988: 344
4	1989 - UK	48%	Neale 1989: 319

The comparison of the research performed does not show an increase in the level of post-implementation audit implementation. It is submitted by the author, however, that the reasons for this are as follows :

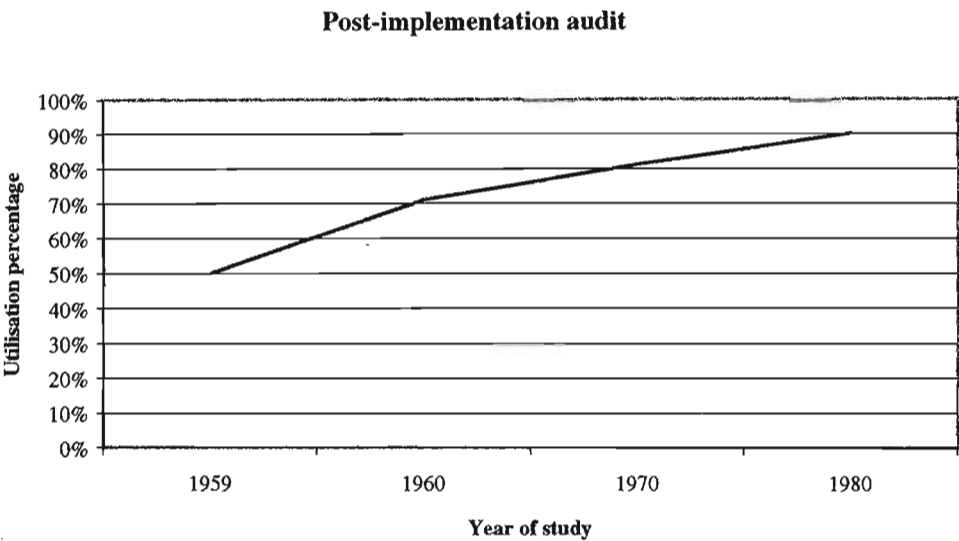
1. **Differences in populations sampled** (studies have shown that these audits are implemented on a greater scale in the United States than in the United Kingdom (Pike 1988: 344)).
2. **Questionnaire bias** (differences in the phrasing of questions, as well as the selection of which companies to circularise) may lead to results that are not directly comparable.

This conclusion was reached after examining the results achieved by the 1975 and 1980 surveys conducted by Pike, using the same sample and the same questionnaire. These survey characteristics ensure that differing populations and questionnaire bias problems are uniform between the two surveys – meaning that the 14% change in the percentage of respondents implementing post-implementation reviews can be interpreted in absolute terms.

This conclusion was reinforced by Mukherjee (1987: 48) who was able to show the following increases in the implementation of post-implementation audit procedures:

No.	Percentage of respondents using post-implementation audits	Year of study
1	50%	1959
2	71%	1960
3	81%	1970
4	90%	1980

The increasing trend in the use of post-implementation audits is most clearly viewed when the above research information is represented in graphical format as follows:



4.10.5.2 *Business sector bias*

The survey conducted by Neale required that respondents select the sector of business to which they belonged. This facet of the survey allowed the examination of whether the post-implementation audit is favoured more in certain areas of business than in others. The results of this examination are as follows :

- Oil & Energy 74%
- Other Manufacturers 63%
- Banking and Finance 27%
- Other Services 11% (Neale 1989: 317).

The above data shows clearly the bias towards the use of the post-implementation audit in capital-intensive industries. It is also interesting to note is that although there are significant differences in the level of post-implementation audit implementation across the various sectors of business, Neale found no evidence of systematic differences in attitudes between firms in different industries towards the benefits of post-implementation audits (1989: 324).

4.11 General research on the capital budgeting process

A broad range of general research has been conducted into the practical implementation of the process of capital budgeting, with particular emphasis being placed on which parts of the process are considered by practitioners to be the most critical, and which parts the most difficult.

Research by Fremgen (1973: 25) found the following in this regard:

Capital budgeting stage	Most critical (%)	Most difficult (%)
Project definition and estimation of cash flows	51	44
Financial analysis and project selection	27	12
Project implementation and review	23	44
No response	2	1

What is interesting to note from the above results is that the phase of capital budgeting which receives the most attention in academic literature (Financial analysis and project selection) is considered by practitioners to be neither the most important nor the most difficult. This may be because if project definition and project implementation are not good, the analytics of the evaluation process are largely irrelevant. The above findings were later confirmed by Gitman and Forrester (1977: 68) who found that 52% of their respondents considered the ‘project definition and cash flow estimation’ as the most critical part of the process and 64.3% of respondents considered this activity to be the most difficult. Pinches (1982: 10) further confirmed these findings stating that the cash flow forecasting phase is often viewed as the most difficult portion of the capital budgeting process and that the successful development of a project will depend on the quality of the information system which underpins it.

It is also interesting to see that the most difficult stages of the process are those in which academics has historically offered the least assistance. It is in these difficult to define parts of the process that practical experience counts for the most, and academic knowledge counts the

least. These findings underline the point made by Pike in his definition of capital budgeting (quoted above) as a combination of ‘art’ and science’.

Research conducted by Pike in the United Kingdom in 1975, 1981 and 1986 using the same sample of companies and the same questionnaire attempted to show the change in the implementation of certain “pre-decision” controls. The results of this research were as follows:

Capital Budgeting Control Procedures within 100 large UK firms	1975 %	1981 %	1986 %
Pre-Decision Controls			
Capital Budget looking beyond two years	57	64	64
An up-to-date capital budgeting manual	65	76	84
A formal screening and reviewing body	78	84	83
At least one person fully engaged in capital budgeting	31	33	26
A specific search and screening of alternatives	76	84	98
A regular review of hurdle rates	43	61	71
A formal financial evaluation	93	95	100
A formal analysis of risk	26	38	86

A review of the above results shows a general increase in the application of pre-decision controls – the only significant decline in any of the controls relates to the tasking of capital budgeting proposals to a specific department or member of staff. Pike (1988: 344) concludes that this is due to an increasing perception that capital budgeting, whilst needing to become more sophisticated and accurate, is not as sophisticated as to require dedicated staff in most organisations.

It is informative to list the pre-decision control results reported by Pike in descending order to gain some insight into the perceived key inputs in the capital budgeting process:

- | | |
|--|------|
| 1. A formal financial evaluation | 100% |
| 2. A specific search and screening of alternatives | 98% |
| 3. A formal analysis of risk | 86% |
| 4. An up-to-date capital budgeting manual | 84% |
| 5. A formal screening and reviewing body | 83% |

In a very similar study performed by Klammer (1972: 387 – 397) on a sample of American firms, a strong increase in the application of pre-decision and decision-support measures was found. These results were as follows (Klammer 1972: 387):

Technique	1959 %	1964 %	1970 %
Search for alternative investments	82	87	94
Formal long-range capital budget	43	57	69
Post audits of major projects	50	61	88
Standard forms for expenditure requests	84	90	97
Full time capital budgeting staff	45	51	56

It is clear from the above research that the pre-decision phase of capital budgeting is receiving increasing attention in practical terms and that those in practice are beginning to appreciate the importance of the previously-considered ancillary issues such as risk and inflation to the measurement and evaluation of project suitability.

4.12 Conclusion

The research studied in the course of the examination of the capital budgeting process indicates that there is widespread appreciation in practice that capital budgeting encompasses more than the activity of evaluating certain projects for their suitability and profitability. Respondents report an increasingly complete approach to capital budgeting with greater emphasis being placed on issues such as project risk, inflation adjustment and post-implementation review. This is a most positive development as it shows a greater appreciation by practitioners of the place which capital budgeting has in the operations of the business as a whole as well as the key success factors which have to be addressed and mastered if effective capital investment and maintenance is to take place.

5 Chapter Five - Review of the theory

5.1 Introduction

When attempting to evaluate practical performance or degrees of sophistication it is necessary to have a benchmark of best practice against which to measure such performance or sophistication.

In order to establish such a benchmark, an extensive review was conducted of the current literature available relating to the subject of capital budgeting. Implicit in adopting this approach is the assumption that such best practice will be documented in the academic material. It appears reasonable to the author to assume that this material will include the best analytical tools devised by academics as well as the best implemented practice as discovered by primary research.

This portion of the dissertation therefore represents a summary of the theory pertaining to capital budgeting as revealed in the literature review described above. The review of the literature was divided into the following distinct areas:

1. Section 5.4 : State of the Theory – Unsophisticated Techniques

According to Pike (1988: 346), a sophisticated technique is one which takes into account the time value of money in examining the cash flows associated with a particular investment (e.g. Net Present Value and Internal Rate of Return), whilst a naïve method (e.g. Accounting Rate of Return and Payback) does not.

2. Section 5.5 : State of the Theory – Sophisticated Techniques

3. Chapter 6 : Dealing with Inflation

Although the current rate of inflation in South Africa is low in comparison with other developing economies (the Consumer Price Index falling to 5.0% in April of 1998 and achieving an annual rate of 6.9% for 1998 (South African Reserve Bank 1999: 13)), the impact of inflation on the capital budgeting process should not be discounted. An examination was therefore conducted of the best academic and implemented practice of

incorporating the effects of inflation into the budgeting process and interpreting the results of this process so as to discount distortions introduced by changing prices.

5.2 Structure

In order to clearly show the main aspects of the academic theory as well as facilitate comparisons between methodologies, the review of each capital budgeting technique was divided into the following areas :

1. Description

This section briefly summarises the technique to be examined and introduces the practical application of each technique through a brief worked example.

2. Development

This section provides a history of the technique showing, where applicable, the progression of the theory of the techniques over time. This segment of the study also documents any refinements to the technique which has been introduced. The reasons for the adoption of such improvements are examined to consider how future improvements may develop.

3. Critique

This section provides an in-depth look at the advantages and disadvantages of the techniques examined, both from a practical and theoretical perspective. This part of the dissertation is intended to provide the facts necessary to allow an informed choice to be made as to the best capital budgeting practices available at present.

5.3 Is there a unified academic definition of “best practice”?

Before examining the capital budgeting techniques detailed in the academic literature with the express intention of finding the theoretical ‘best practice’ it is wise to consider whether such a goal is attainable. If academics cannot present a unified theory of the best possible capital budgeting techniques to apply, then the objective of this dissertation cannot be achieved – if best practice cannot be defined, with what shall we compare the results of our research?

Pike (1983: 201) is quoted as saying that “the history of capital budgeting theory, from Irving Fisher (1907) to present times, reveals a heavy concentration on the progressive development and sophistication of appraising investment options”. He further states that although the issue at hand may change over time, the underlying quest for better decision criteria is a central feature of capital budgeting literature.

The search for better decision criteria referred to above reached its peak in the late 1970's with the volume of academic material produced reaching enormous proportions. The vast majority of research produced on the topic of capital budgeting implementation was published during this period. Predictably, a large proportion of this research originated in the United States, with significant contributions to the theory being made by academics in the United Kingdom.

Research material published in the 1980's concentrated largely on the refinement of techniques introduced in the 1960's and 1970's, for example, the allowance for inflation, differential project risk and alternative costs of capital. Research volumes in the 1990's have tapered off, with greater emphasis being placed on other managerial finance topics. One could interpret this as signalling that the end of the search for the most effective capital budgeting techniques has arrived; a closer examination of the literature, however, indicates that this is not the case, but that academics are turning more to management science techniques to help bridge the gap between perfect theory and practical implementation.

It would appear therefore that although the science of capital budgeting is evolving over time there is a significant body of literature which details the development and improvement of the theory from which to devise a definition of best practice. As is shown in the research quoted below, while there are differences of opinion as to the relative strengths and weaknesses of individual analytical tools, a broad consensus may be distinguished as to those tools which are considered superior to the others.

5.4 State of the Theory – Unsophisticated Techniques

The analytical tools developed for the purposes of capital budgeting may broadly be classified as either sophisticated or unsophisticated (Pike 1983: 346) based on whether the technique takes the time value of money into account or not. The unsophisticated techniques to be examined in this section include:

1. Payback period – Section 5.5
2. Accounting rate of return – Section 5.6

5.5 Payback period

5.5.1 Description

The payback method is defined by Fremgen (1973: 19) as “the time required for the cumulative sum of the cash receipts from an investment to just equal the amount of the initial outlay. Colloquially, it is the time it takes for an investment to pay for itself.”

Kee and Bublitz, alternatively define the payback method as “the point at which an asset is expected to break even or earn a zero rate of return (1988: 154)”. Bishton (179: 233) highlights the central feature of the payback measure as a technique which measures the rapidity with which the capital cost of an investment is recouped.

The payback method operates according to the mathematical methodology shown in Illustration 1.

Where uniform cash inflows are forecast for the project, the breakeven payback period can be calculated according to the following equation:

$$\text{Payback period} = \frac{\text{Capital outlay}}{\text{Net annual cashflow}}$$

The application of the formula will return the number of years required for the investment to break even (measured on a cash flow basis).

Where the forecast cash inflows are not expected to be uniform, the payback period calculation is slightly more complex. Illustration 1 demonstrates the calculation of the payback period where the expected cash flows from the asset equal amount to breakeven at the end of a budgeting period (in this case the end of a year; year 3 for project A and year 4 for project B). Where this is not the case, the theory advocates two different approaches:

1. Shorten the planning period in order to more closely approximate the payback characteristics of the project.
2. Assume that the forecast cash flows are received on a straight-line basis during the forecast period and interpolate the payback period to arrive at an approximate breakeven date.

In applying the second approach, the practitioner is required to calculate the cumulative total of project cash flows until such flows are in excess of the cost of the investment. At this point, some assumption must be made as to the relationship between the projected cash flows and the passage of time. Once this assumption has been made, the payback period can be calculated to the nearest day, or month, if necessary. Depending on the appropriateness of this assumption however, the calculation of the payback to the day may create the impression that the result is more accurate than is actually the case.

5.5.2 Development

The payback period technique of evaluating capital budget proposals is amongst the oldest in the theory of capital budgeting. As can be noted from the explanation given above, it is a measure which is simple to compute, easy to understand, and not demanding in terms of numerical inputs.

However, this evaluation tool suffers from a number of fundamental shortcomings (refer to section 5.5.3 below) which significantly detract from the absolute value of the information which can be derived from its use. Research indicates though that the “payback period remains a major supplementary tool in investment analysis ... because this method is easy to understand and compute and because it indicates, to some extent, the risk of a project (Rosenblatt & Jucker 1979: 64)”. This conclusion was reiterated by Mukherjee (1988: 33) and by Gregory (Questionnaire 1997: 1) who stated that “despite condemnation in the academic literature, the payback method continues to be one of the most widely applied quantitative techniques utilised in investment decisions.”

Illustration 1 – Payback period

A company is considering two different investments A & B which both cost R50 000 but which have different cash flow streams. The forecast cash inflows of the projects are as follows:

	<u>Project A</u>	<u>Project B</u>
Year 1	10 000	10 000
Year 2	20 000	10 000
Year 3	20 000	10 000
Year 4	20 000	20 000
Year 5	10 000	30 000
Year 6	-	30 000
Year 7	-	30 000

The payback period of the investment is that point where the *undiscounted* cash inflows equal the cost of the investment.

Given that both projects have a cost of R50 000, the payback may be calculated, thus:

Project A:	Cost	(50 000)	Project B:	Cost	(50 000)
	Year 1 inflow	<u>10 000</u>		Year 1	<u>10 000</u>
	Net value	(40 000)			(40 000)
	Year 2 inflow	<u>20 000</u>		Year 2	<u>10 000</u>
	Net value	(20 000)			(30 000)
	Year 3 inflow	<u>20 000</u>		Year 3	<u>10 000</u>
	Net value	-			(20 000)
	Year 4 inflow	<u>20 000</u>		Year 4	<u>20 000</u>
	Net value	20 000			-

It can be seen that the inflows match the outflows of Project A at the end of year 3 with Project B inflows matching its cost at the end of year 4. Project A therefore has a payback period of 3 years, whilst Project B has a payback of 4 years.

Project A would therefore be selected on the basis of its earlier payback characteristics.

Since the advent of the payback method, more sophisticated investment evaluation tools have been developed – tools which account for differing risk, the time value of money, difficulties in estimating costs of capital and differences in uncertainty in the number of outcomes related to each capital investment decision. Research conducted by Pike (1988: 346) led him to comment that the increase in the use of the sophisticated methods has not come at the expense of the unsophisticated methods. Pike (1988: 346) concluded from his primary research that managers prefer to employ a combination of appraisal methods, with the payback method being employed by 92% of respondents.

Due in part to the popularity of the payback method in practice, academics have devoted considerable effort to improving the efficacy of the payback measure. Such efforts usually concentrate on combining the technique with other capital budgeting tools, or increasing the awareness of practitioners of the shortcomings of the measure (Lohman & Baksh 1993: 23). One product of the efforts of academics in the improvement of the payback measure is the Discounted Payback method, which is examined under Section 5.10 – Sophisticated Techniques.

5.5.3 Critique

The payback method has been the subject of much research relating to its relative advantages and disadvantages, as well as the possible explanations for the technique's widespread use.

For the sake of brevity and ease of reference, the advantages and disadvantages advanced by academics relating to the payback method are provided in list form, with a brief discussion provided where applicable.

Advantages

1. Method is simple to grasp (Fleming & McKinstry (1991: 223) & Chen & Clark (1994: 124)).

The concept of comparing time and return on investment is perceived to be simple to understand. This is particularly important in instances where non-financial personnel are required to interpret capital budgeting measures presented to them by a capital budgeting department or financial control division (Pocock, Correia & Wormald 1991: 38; Chen and Clark 1994: 124).

2. Quick to calculate (Fleming *et al* 1991: 223).

As demonstrated in the illustration above, the payback measure is not demanding in terms of the inputs required in its calculation, and the calculation itself is not complex in its operation. This can be particularly appealing to practitioners with an aversion to the compilation of complex models dependent on a myriad of assumptions.

3. Emphasises liquidity (Fleming *et al* 1991: 223).

The payback method's favouring of projects which break-even soonest, enables firms to choose investments which provide the greatest level of liquidity. This makes the measure more useful for entities operating under conditions of severe capital rationing or in industries which require flexibility in the level of investment.

This apparent benefit of the payback method was contested by Statman who stated that "[it] is not clear at all why a firm cannot obtain capital from capital markets when internally generated funds are not sufficient" (1982: 96). Statman however, appears to be questioning the idea of capital rationing, rather than the usefulness of the payback method in dealing with situations where capital rationing is in place. Clearly, situations arise in practice in which firms are operating under conditions of capital rationing e.g. where levels of investment are limited by management decision or by loan covenant and as such the condition of restricted capital should be accounted for in the capital budgeting decision.

Studies have shown that in practice, the payback method is utilised more extensively in times of capital rationing (Pike (1983: 201) and Pike & Ooi (1988: 165)) - a finding which reinforces the idea that the method provides additional information regarding the most suitable projects to implement in times of capital rationing.

In addition, the presence of increased interest rate volatility (as was witnessed in South Africa in 1998) further motivates businesses to prefer investments in which funds are at risk for as short a period as possible.

4. Provides a measure of the relative risk of the project (Pocock (1991: 38), Pike (1988: 347), Weingartner (1969: 1403) and Correia (1996: 6)).

Blatt (as quoted in Statman (1982: 96)) submits that another possible reason for the use of the payback method is that this method recognises the risk of cash flows expected further into the future. Assuming that it is management's intention to avoid a disaster (defined as "a loss exceeding some critical value" by Pocock, (1991: 38)) and that earlier flows have a lower level of risk than later ones, then the payback method which ignores those flows after payback or breakeven provides a reasonable decision rule.

A survey conducted by Pocock provides evidence which supports the contention that “the value size and its payback period seem to be perceived [by practitioners] as the most significant factors in assessing project risk (1991: 38)”. According to Pocock a factor contributing to widespread use of the payback period is that it is a measure perceived to represent the period for which the funds of the business are at risk.

Statman (1982: 96) however contends that this explanation is flawed in that:

1. The net present value method could compensate for increasing risk of distant cash flows by employing an increasing discount rate - whereas the assumption implicit in the payback method is that the discount rate relating to post-breakeven cash flows is infinite. Statman contends therefore that the payback methodology overstates the risks attaching to cash flows forecast to be received beyond the breakeven date.
2. The disaster mentioned by Blatt is more likely to relate to the unsystematic or firm-specific component of the investment (removed by the diversification of the owner's investment portfolio) than to the passage of time.

As regards this second contention, research by Chen and Clark (1994:121) have shown that in many cases management act in such a way as to maximise those indicators upon which their compensation plans depend, and that they do not always take account of the fact that it is the shareholder's prerogative to diversify his / her investment portfolio.

5. The payback method has a complementary relationship with other investment models (Kee & Bublitz 1988: 153).

Although the payback method has a number of serious shortcomings (detailed below), Kee & Bublitz contend that the use of the payback method together with a “profit-oriented model” facilitate the evaluation of multiple facets of an investment (1988: 154). In evaluating proposed projects, the payback method may be used as a preliminary technique to identify projects with acceptable risk and return attributes. Management may, for example, make it a matter of policy not to further examine projects with a forecast payback period of greater than five years. Given that the inputs required for the payback calculation are simple, this provides a means of eliminating those projects unlikely to prove

profitable, before the detailed evaluation and scrutiny required by other methods are performed. Proposals that meet the requirements of the filter may then be examined more thoroughly with a profit-oriented investment model (Kee & Bublitz 1988: 154). “Identifying these assets and excluding them from further analysis increases the efficiency of the capital budgeting process and permits a manager to focus his analysis on the subset of more desirable investments initially proposed (Kee & Bublitz 1988: 154)”.

Bishton (1979: 13) confirms the complementary relationship that the payback period method enjoys with other more sophisticated methods stating that there appears to be a swing back towards the use of the more traditional methods. He qualifies this finding stating that the increase in the use of the traditional methods takes place at the same time as the more sophisticated methods are utilised. Schall, Sundem and Geijsbeck (1978: 286) recorded similar results – 74% of their respondents used the payback period method, while only 27% used payback as their exclusive evaluation technique.

6. Serves as a proxy for duration (Pike 1988: 346).

Duration is a measure of how long the capital of a company is at risk and is calculated as the weighted average of the cash flows received weighted by the year in which the funds are received. Payback therefore provides a surrogate measure as to how long the funds of the business are expected to be at risk.

7. Pike argues that payback is useful as a communication device (1988: 346).

Payback is a useful communication device primarily because it is simple to understand and to calculate – those presented with payback statistics are easily able to absorb and interpret the information thus calculated.

8. Correia (1996: 6) suggests that the payback period evaluation method may be suitable for the evaluation of smaller projects which do not justify a detailed or greatly sophisticated analysis.

Disadvantages

- 1. Ignores the forecast investment returns to be received after payback is reached (Fleming *et al* 1991: 223).

As is evident from Illustration 1 above, the payback method does not give an indication as to the extent of cash flows expected to be received after payback date (i.e. after cumulative cash inflows cover the investment cost). Project A, for example, continues to receive income to the extent of R30 000 after breakeven while project B receives an additional R90 000. Had these projects both had calculated payback periods of say, 3 years, we would have been indifferent between the two whilst project B clearly has the more favourable characteristics. This is a fundamental weakness, especially where the investments being evaluated have differing project lengths, or significantly different forecast cash flow profiles.

- 2. Does not take the time value of money into account (Drury 1992: 370).

Consider the following example : A practitioner is considering which of two projects to implement, each with a cost of R200. The following cash flows are forecast:

Year	Forecast cash flows : Project 1	Forecast cash flows : Project 2
Cost of investment	(200)	(200)
Cash inflow Year 1	10	190
Cash inflow Year 2	190	10

For Project 1, he forecasts cash inflows of R10 in year 1 and R190 in year two. For Project 2, he forecasts cash inflows of R190 for year 1 and R10 for year 2. The payback method would prove indifferent between the two projects, as each has a payback period of two years. In reality, however, Project 2 is the more favourable as greater cash inflows are received earlier in the project’s life than is the case with Project 1.

There are two main reasons why the receipt of R10 today is of greater benefit than the receipt of R10 in a year's time, namely that due to inflation the value of these receipts will be different (the R10 received today will, in the presence of inflation, purchase more than the R10 to be received in a year's time will purchase) and the fact that cash flows which are forecast to be received far into the future have a perceived greater degree of risk as the accuracy of forecasting declines as the forecast horizon increases.

It is important to note that research indicates that practitioners are aware of this shortcoming and that this method is not often used to the absolute exclusion of all other techniques for this reason (Kee & Bublitz 1988: 153).

3. Wrong inferences can easily be made (Fleming *et al* 1991: 223).

Given the shortcomings of the payback method listed above, it is possible that the application of this technique to the exclusion of other more sophisticated methods will result in an incorrect investment decision being made.

4. The payback method may be used due to agency conflict or moral hazard (Pike & Ooi 1988: 160).

The potential for moral hazard or agency conflict arises when the owners of a business appoint management to act on their behalf. Agency conflict refers to the situation where management performs in such a manner as to maximise the indicator used to evaluate their performance (usually accounting net profit or return on assets employed) to the possible detriment of the business as a whole (Pike & Ooi 1988:160). The appointed management are remunerated by the owners on some basis or indicator which management are motivated to manipulate or maximise even though such maximisation may not be synonymous with the achievement of the objectives set by the owners of the business.

The following example illustrates the above principle:

Management at a certain company are remunerated on the basis of return on assets employed. In the presence of agency conflict, management would be motivated to apply the payback method of evaluating the investment opportunities presented to them, thereby favouring projects which return a profit soonest, in order to facilitate promotion in the

organisation. Given the shortcomings in the payback method detailed above, it is clear that such conduct would under certain circumstances not be conducive to overall profit maximisation.

Resolving problems relating to moral hazard, and the choice of capital budgeting technique can be addressed according to Chaney (1989: 117) by basing “the manager’s contract ... on the only observable ex-post contract variable, the cash flows. It is also important that the manager’s effort affects the probability of success rather than the cash flow in the success state. If effort choices affect cash flows in success states, information about effort can be noiselessly extracted ex-post from realised cash flows”. Under these circumstances, owners of businesses can evaluate the true level of effort expended by management in the running of the business and remunerate on this basis. Owners of businesses still need to address the future impact of the actions of managers, and not confine their examination of effort-outcomes to current period results. This will assist upper management in assuring that ‘profitable’ managers are not promoted out of a certain area of responsibility at breakeven of a project leaving their successors to manage the potentially unprofitable post-breakeven period. Chaney (1989: 124) contends that as investment uncertainty increases so the potential for moral hazard increases. This should be borne in mind in evaluating the research findings of Sundem (1975: 306), Kee & Bublitz (1988: 154) and Kim & Farragher (1981: 185) who found that payback usage and efficiency increases as project uncertainty or risk increases.

Research conducted by Statman and Sepe (1984: 61) attempted unsuccessfully to show that the use of the payback method was positively related to the form of management compensation plan implemented by the firm. Chen and Clark (1994: 122) contended that the study failed due to a shortcoming in the experiment format adopted by Statman and Sepe. Chen and Clarke redesigned the experiment, using a path model in order to re-examine the possible link between capital budgeting techniques utilised and the management compensation plans in place and were able to show that:

1. There is an inverse relationship between the importance of share price maximisation (as a surrogate for long term payback) and use of the payback period (Chen and Clark 1994: 122).

2. The greater the dependence of compensation on accounting earnings, the greater the use of payback (Chen and Clark 1994: 122).
3. The more important management perceives the earnings objective in capital budgeting, the greater the use of payback, and the less important management perceives the shareholder wealth objective, the greater the use of payback.(Chen and Clark 1994: 129).
4. The more that management earnings are dependent on accounting earnings, the less important to management is the shareholder wealth objective (Chen and Clark 1994: 130).

The study therefore reinforces the contention first made by Statman and Sepe that the payback method can be used by unscrupulous management in order to further career and financial aspirations to the detriment of the wealth maximisation objective of the owners of the business.

5.5.4 *Research findings*

Research has overwhelmingly confirmed the extensive use of the payback period:

1. Gitman and Forrester (1977: 69) found that the payback period method was used more than any other method.
2. Longmore (1989: 185) maintains that the rates of application of the payback period is probably understated by the research undertaken as respondents tend to be the more sophisticated members of the capital budgeting community. In general, research samples are drawn from the Top 100 companies by market capitalisation, or by capital spend, and are not indicative of the average practice seen in the economy.

It is interesting to note that research conducted by Sundem (1975: 306) found that the payback period method performs least well under conditions approximating certainty, but that as the level of uncertainty increased, the payback methods performance relative to that of the theoretically superior net present value method improves such that in “the higher risk environments simulated, payback period outperformed a net present value model”. Although the relevance of simulations may always be criticised on the grounds that the model

constructed is dependent on the assumptions underlying it and that these models are rarely truly representative of the real world, the above findings were implicitly confirmed by the research of Kim and Farragher (1981: 185) which found that as the investment uncertainty of the firms examined increased (measured by the beta of the firms sampled), the application of the sophisticated capital budgeting methods declined. Kee & Bublitz (1988: 153) confirmed these findings in a later study stating that “although the payback periods use is somewhat limited with investments with relatively certain cash flows, it is applicable to a wider range of assets as risk increases”.

5.6 Accounting rate of return

5.6.1 Description

The Accounting Rate of Return method of evaluating capital investment proposals is defined by Fremgen as “the expected average annual net income from an investment divided by the initial outlay for that investment (1973: 19)” and by Drury as being “calculated by dividing the average annual profits from a project into the average investment cost (1992: 371)”.

In algebraic terms, the ARR may be represented as follows :

$$ARR = \frac{\text{Average Net Income}}{\text{Initial Capital Outlay}} \times \frac{100}{1}$$

This formula effectively calculates the forecast annual accounting percentage return that the investment will generate, averaged over the life thereof.

This measure is sometimes referred to as the financial statement method of computing rate of return (Fremgen 1973: 19). The characteristic of this measure that separates it from most of the other capital budgeting techniques is that accounting measures rather than cash flow measures are utilised.

The mathematical operation of this measure is shown in Illustration 2 below.

5.6.2 Development

As a method of evaluating investment alternatives, the accounting rate of return has its roots in the Return on Investment (ROI) ratios frequently employed by managers, analysts and other users of financial statements (Fremgen 1973: 19). The fundamental purpose of these ratios is to calculate a rate of return on a particular asset. Ratios with a similar mathematical basis are calculated to derive the return rendered by a multitude of different assets or investments e.g. Return on Assets, Return on Capital Employed and Return on Equity.

The computational operation of the accounting rate of return is identical to that of the abovementioned ratios. Essentially, the product of the technique is best interpreted as the proportion of the cost of the investment which such investment generates on an annual basis, using accounting income as the measure of the income earned by the investment.

Illustration 2 – Accounting rate of return

A company is considering two different investments A & B which both cost R50 000 but which have different cash flow streams. The forecast cash inflows of the projects are as follows:

	<u>Project A</u>	<u>Project B</u>
Year 1	10 000	10 000
Year 2	20 000	10 000
Year 3	20 000	10 000
Year 4	20 000	20 000
Year 5	10 000	30 000
Year 6	-	30 000
Year 7	-	30 000

The accounting rate of return requires the calculation of the average net profit for the project. If we assume the deductibility of the cost of the investment over five years and a tax rate of 30%, the following profit figures will be applicable to Project A:

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Net cash flow	10 000	20 000	20 000	20 000	10 000
Depreciation	(10 000)	(10 000)	(10 000)	(10 000)	(10 000)
Net income before taxation	-	10 000	10 000	10 000	-
Taxation (30%)	-	(3 000)	(3 000)	(3 000)	-
Net income after tax	-	7 000	7 000	7 000	-

The average net income is calculated as : $(R0 + R7\ 000 + R7\ 000 + R7\ 000 + R0) \div 5 = R4\ 200$.

The cost of investment is R50 000.

The average accounting rate of return is therefore $R4\ 200 \div R50\ 000 \times 100 = 8.4\%$ p.a.

Likewise, the accounting rate of return can be calculated for Project B:

Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 7	Year 8
Net cash flow	10 000	10 000	10 000	20 000	30 000	30 000	30 000
Depreciation	(10 000)	(10 000)	(10 000)	(10 000)	(10 000)	-	-
Net income before taxation	-	-	-	10 000	20 000	30 000	30 000
Taxation (30%)	-	-	-	(3 000)	(6 000)	(9 000)	(9 000)
Net income after tax	-	-	-	7 000	14 000	21 000	21 000

The average net income is calculated as : $(R0 + R0 + R0 + R7\ 000 + R14\ 000 + R21\ 000 + R21\ 000) \div 7 \text{ years} = R9\ 000$

The cost of investment is R50 000.

The average accounting rate of return is therefore $R9\ 000 \div R50\ 000 \times 100 = 18\%$ p.a.

Project B is thus considered more favourable than Project A in terms of the Accounting Rate of Return methodology. Note that this is not the same decision arrived at using the Payback Period method.

5.6.3 Critique

Academics have noted that the following advantages pertain to the use of the accounting rate of return method:

Advantages

1. The method is easily understandable by management (financial and otherwise) (Van Horne (1986: 129) and Fleming & McKinsty (1991: 130)).

In general, management (and economic agents in general) are familiar with percentages as a measure of return from an investment, or as a measure of the cost of borrowing some resource. Examples of conceptually equivalent rates encountered frequently include the prime lending rate, the Repo rate and the rate of interest earned on call deposits. Given that management will frequently encounter similar ratios in practice, it is reasonable to expect that management will, in all likelihood, feel comfortable making decisions on the basis of the accounting rate of return percentage.

2. The calculation is mathematically simple and relatively undemanding in terms of the inputs required (Fleming *et al* 1991: 130).
3. The accounting rate of return method articulates well with the accounting reporting systems used by practitioners (Van Horne 1986: 129).

The accounting rate of return requires two forecasts for its computation, namely the cost of the investment, and its forecast annual net income. The forecast annual net income of any investment is akin to the budgeted income for the year which is prepared by most firms in the course of their annual budget preparation process. Staff, both line and managerial, will have had experience in the calculation and interpretation of forecast net income, be it for a division, department or for the company as a whole. It is to be expected, therefore, that they will be able to use this method with the minimum of training.

4. Post-implementation accounting rates of return are easily calculated from information automatically collected by conventional accounting systems.

In the post-implementation review of the success of a particular investment, it is a simple matter to calculate actual accounting rates of return from the accounting information recorded for reporting purposes. These actual rates of return may then be compared with forecast rates in evaluating both the wisdom of the investment, and the talent of management and staff in the implementation of capital projects.

5. The use of the average net income as a surrogate measure for profitability emphasises accounting income in the decision-making of the entity (Fleming *et al* 1991: 130).

The emphasis on the accounting net income is viewed positively by Fleming *et al* in that it contributes towards an organisational culture of emphasising and relying on the accounting profit or loss for the period. This advantage of the measure must be viewed against the important disadvantages listed below.

Disadvantages

1. The accounting rate of return method ignores the time value of money (Van Horne 1986: 129).

The above is obvious from Illustration 2 which clearly shows that the net income earned in Year 7 by Project B is afforded the same status in the accounting rate of return calculation as the net income forecast to be earned in Year 1. It is this omission of dealing with the time value of money that places this method among the naïve methods (Pike 1983: 346). This is one of the most significant shortcomings of the method which can severely impact on the effectiveness of decisions made as a result of it.

2. The method relies on accounting information, rather than cash flows, in the calculation of the return on the investment.

This has the potential to warp the comparison of the expected rate of return with other measures such as internal rate of return. The greater the deviation between cash flows and accounting net income, the greater will be the difference between the internal rate of return indicator and the accounting rate of return.

Two considerations pertain to the above criticism, namely :

1. Over the life of the investment, cash flows must equal the sum of the accounting entries recorded (Kee and Bublitz 1988: 153). For this reason, the impact of using accounting income in the place of actual cash flows must be assessed by management in the interpretation of this measure.

Where projects have :

- a limited length, or
- the project cash flows coincide reasonably closely with accounting income, or
- where the income expected from the investment is not large, the effect of using accounting income in the place of cash flows will not be significant.

2. Conceptually, there is no reason why cash flows may not be substituted for accounting income in the application of the accounting rate of return technique. In evaluating projects with the characteristics differing significantly from those detailed under 1 above, the management accountant may calculate the accounting rate of return using average net cash inflows instead of average net income in order to arrive at a more accurate indicator of the real return provided by the investment.

3. The accounting rate of return gives no indication of the period over which the average income is to be earned i.e. in evaluating two different investments, each returning 20 % p.a., one with a life of two years, the other with a life of three years, the practitioner would be ambivalent between the two.

The significance of this shortcoming is considered to be limited, given that decision-makers would almost certainly demand to have knowledge of the term of any investment under consideration.

4. The accounting rate of return does not indicate the liquidity of an investment (Fleming *et al* 1991: 130). This disadvantage stems from the fact that the accounting net income is

used to calculate the return enjoyed, rather than the net cash inflow received by the business.

Consider the following example: Two projects are being evaluated, each costing R10 000. They each have a lifespan of five years. Project A and B both result in a total net income of R12 000. This means that each project will show an accounting rate of return of 24%. Project A results in the R12 000 net cash inflow taking place in Year 1, while Project B results in a R12 000 cash inflow in year 5. From a liquidity perspective it is clear that Project A is superior to Project B whilst from an accounting rate of return perspective, it is not possible to tell which of the two investments to choose.

5.7 State of the Theory – Sophisticated Techniques

As detailed above, the analytical tools developed for the purposes of capital budgeting may broadly be classified as either sophisticated or unsophisticated (Pike 1983: 346) based on whether the technique takes the time value of money into account or not. The sophisticated techniques to be examined in this section include:

1. Net present value – Section 5.8
2. Internal rate of return – Section 5.9
3. Discounted payback method – Section 5.10
4. Profitability index – Section 5.11

5.8 Net present value

5.8.1 Description

Woods and Randall (1983: 86) define the net present value evaluation calculation as “the present value of all cash flows (assuming equity financing) discounted at the firm’s weighted cost of capital”. Fremgen describes the net present value as a monetary amount, calculated as the difference between the present value of forecast cash receipts and the present value of forecast cash payments (1973: 19).

The decision rule associated with the net present value technique dictates that proposed investments with a zero or positive net present value should be accepted and implemented as

such projects will increase the shareholder's wealth (Gehr 1981: 14). In practice, however, Stark (1990: 168) has found practitioners who will implement a project only if the present value of forecast cash flows is double the cost of the project – i.e. where the net present value is equal to the cost of the investment. This has the effect of allowing for negative variances in forecast income and expenses as well as excess project risk. The present value of the accepted projects should increase the company market capitalisation by the amount of the net present value as this is the value, determined in today's currency, to be received by the company in the future. As it is generally accepted that the goal of management, acting as custodians of shareholder wealth, should be to maximise shareholders' net worth, it would appear natural that use be made of the net present value technique to evaluate capital projects. Whether this is indeed justifiable, is examined under 'Critique' below.

The operation of the net present value method is summarised in mathematical format below and consists of two distinct operations. The first calculation relates to the computation of the weighted average cost of capital by which the forecast cash flows are discounted. The second calculation applies the cost of capital factor against the forecast cash flows to determine the present value of the cash flow concerned.

$$1. \quad k_a = w_d(1 - T)k_d + w_e k_e$$

Where :

k_d = required return on debt

k_e = the required return on equity

w_d = the percentage of debt in target capital structure measured in market terms

w_e = the percentage of equity in target capital structure ($w_e = 1 - w_d$) T equals the marginal corporate tax rate.

(Woods & Randall 1983: 86)".

2.
$$PV = k_a \times CF_t$$

Where :

k_a = weighted average cost of capital (product of formula 1 above)

CF_t = forecast future cash flow

The application of the net present value methodology is shown in Illustration 3.

5.8.1.1 *Determination of project cash flows*

As the net present value method relies upon the discounting of cash flows (Statman & Tyebjee 1985: 27), it is important to define the method by which such cash flows are determined. The fundamental principles of such calculations are as follows :

1. Only incremental revenues and incremental costs are relevant to the determination of relevant cash flows. Average, fixed, sunk and historic costs, as well as apportioned overheads must be ignored for the purposes of a net present value analysis.
2. Finance charges are not included in the computation of net cash flow. This is due to the fact that finance costs are included in the discounting process – the cost of debt is included in the weighted average cost of capital by which the forecast cash flows are discounted.
3. Working capital which is required for the operation of the proposed project must be treated as an outflow of cash in the period in which such investment occurs, and an inflow of cash in the period in which the project is wound down. In most capital budgeting texts a single investment in working capital is assumed at the beginning of project implementation with a return of such investment in the final period of operation. In reality, it will often be necessary to increase the level of investment in working capital as the project progresses (in retail projects, this will be to allow the granting of trade credit, the placement of cash for float purposes and an investment in inventory) with the working capital being redeemed for cash at the end of the project. This refinement of the forecast process is not difficult to implement and should be borne in mind by the practitioner in the forecasting of cash flows – working capital is often a critical component of the funding of a project which must be forecast and controlled.

4. Non-cash expenses, such as depreciation and accounting provisions, are added back to taxable income in the determination of the net cash flow for the period. The taxation effect of deductible expenses must, however, be accounted for as the deduction of a valid depreciation or wear and tear expense reduces the amount of taxation payable. In general, these deductions are shown as a 'taxation shield' cash inflow in the forecast cash flow schedule. The amount added back is calculated as the amount of the deductible expense multiplied by the rate of taxation which is forecast as being applicable at the time of the deduction.
5. Where a company is forecasting an assessed loss during any accounting period it will not be able to enjoy the benefits of the reduced taxation payable until the assessed loss has been exhausted. It is therefore most correct to recognise the taxation benefits of deductible expenses in the year in which such deductions will reduce the company taxation cash outflows i.e. when a lower amount of tax is paid as a result of the deductions received.
6. Due consideration must be given to the costs relating to deterioration and obsolescence that combine to cause operating costs to increase the longer a firm uses a particular asset (Emery 1982: 17). These costs relate to the decline in serviceability of productive assets as they age, and the possible increase in output that would be possible had the firm acquired and installed a newer version of the productive asset concerned. According to Emery, these costs can be incorporated into the discounted cash flow analysis if the following two assumptions are made:
 - The purchase price and salvage value of current and future generations of equipment are constant.
 - Deterioration and obsolescence increase arithmetically (meaning that the cost of operating any generation of equipment increases by a constant amount (G_d) year). Therefore if the cost of running the equipment is D in year one, the cost of running in year 10 is $D + (10 \times G_d)$. The corollary to this assumption is that the cost of operating the improved piece of equipment would have costs reduced by the constant each year. The opportunity cost, therefore, of not replacing the equipment is then equal to the

number of years the equipment is held multiplied by the calculated constant cost saving foregone.

7. Where possible, the abandonment value of the project concerned should be incorporated in the net present value analysis. The abandonment value is the proceeds which would be receivable should management decide at some date after implementation that the project should be discontinued and the assets realised. Grinyer and Daing (1993: 49) define abandonment values as “options that can in principle be valued, so that their net worth can be included in the values of operating cash flows when calculating the net present values of projects”. The importance of abandonment values is best illustrated by means of an example. Consider a company which is analysing two different projects with identical costs, inflows, net present values and standard deviations of forecast cash flows but with differing abandonment values – the project with the higher abandonment value will clearly be perceived to have a lower risk. Different abandonment values may arise between comparable projects due to guaranteed buy-backs from suppliers of equipment, or differing degrees of specialisation of equipment installed or any number of project-unique factors.

While Grinyer & Daing do not provide guidance on how these abandonment values are to be calculated, their research conducted with British companies in 1989 found the following:

- There is a positive correlation between the implementation of abandonment values and the size and perceived risk of the projects (1993: 53).
- 64% of respondents believed that abandonment values are useful in measuring the downside risk of a project and 71% used these values to determine the bail-out possibilities associated with individual projects (1993: 54).
- More than 50% of respondents utilise abandonment values to measure the future liquidity of the project if the implementation is unsuccessful or if the project has to be shelved after implementation date (1993: 55).
- Most managers believed that an additional 10% in net present value is of less value to the company than a higher abandonment value (1993: 52).

Illustration 3 – Net Present Value

A company is considering two different investments A & B which both cost R50 000 but which have different cash flow streams. The forecast net cash inflows of the projects are as follows:

	<u>Project A</u>	<u>Project B</u>
Year 1	10 000	10 000
Year 2	20 000	10 000
Year 3	20 000	10 000
Year 4	20 000	20 000
Year 5	10 000	30 000
Year 6	-	30 000
Year 7	-	30 000

The NPV is calculated as the sum of the discounted cash flows of the project.

Assuming a cost of capital of 15%, the NPV of Project A is determined as follows:

	<u>Amount</u>	<u>PV Factor</u>	<u>PV Amount</u>
Project A: Cost	(50 000)	1.000	(50 000)
Year 1 inflow	10 000	0.870	8 700
Year 2 inflow	20 000	0.756	15 120
Year 3 inflow	20 000	0.658	13 160
Year 4 inflow	20 000	0.572	11 440
Year 5 inflow	10 000	0.497	4 970
			<u>3 390</u>

Project A thus returns a positive net present value and should therefore be accepted.

Assuming a cost of capital of 15%, the NPV of Project B is calculated thus:

	<u>Amount</u>	<u>PV Factor</u>	<u>PV Amount</u>
Project B: Cost	(50 000)	1.000	(50 000)
Year 1 inflow	10 000	0.870	8 696
Year 2 inflow	10 000	0.756	7 561
Year 3 inflow	10 000	0.658	6 575
Year 4 inflow	20 000	0.572	11 435
Year 5 inflow	30 000	0.497	14 915
Year 6 inflow	30 000	0.432	12 970
Year 7 inflow	30 000	0.376	11 278
			<u>23 430</u>

Project B should therefore be accepted as it returns a positive net present value of R23 430 after paying the contributors of capital their required rates of return.

If the projects are mutually exclusive, Project B should be accepted – if the projects are independent, and capital is not rationed, both projects should be accepted.

5.8.2 *Development*

The literature surrounding the net present value methodology does not indicate any development that took place before the generic technique was first presented and, given the fact that the mathematics and logic of the technique are not onerous, this is perhaps to be expected.

New developments, however, have been seen in the literature relating to the best manner of dealing with two special case difficulties, namely:

1. The value of the decision to wait before investing in a particular investment
2. Determining the optimal investment where mutually exclusive alternatives have different forecast lifespans.

5.8.2.1 *Investment irreversibility & the benefit of the option to defer investment*

The decision rule associated with the traditional net present value technique, i.e. “invest if the present (market) value of the investment is in excess of the direct cost of investing (where direct costs are, essentially, the purchase price of the investment) (Stark 1990: 167)”, is likely to be inappropriate in the presence of investment irreversibility, uncertainty and a choice as to when to invest. This arises due to the fact that a positive net present value is not *de facto* evidence that the current time is the most appropriate to invest in a particular project.

Stark (1990: 167) suggests that the net present value decision rule be altered to “invest if the present (market) value of the investment is in excess of the direct costs of investing plus the value of the option to invest at any other feasible time in the future”. This may be stated algebraically as follows :

A project should be accepted if:

$(\text{The Direct Cost of Investing} + \text{The Option to Wait}) < (\text{The Present Value of Always Producing} + \text{The Option to Shutdown / Abandon})$
--

Stark attempts to show that management should be cognisant of the fact that there may be additional value in deferring investment which he terms the ‘Option to Wait’. By choosing to implement the project at the present time, the entity foregoes the value of the option to wait,

thereby incurring an opportunity cost (Stark 1990: 170). In practice, management will often have to weigh up the benefits of delaying project implementation in order to gain additional information, insight or certainty regarding critical issues (such as accurate market information, implementation cost estimates and market activities of competing producers) and the risk that other economic agents will seize upon the opportunity and reap the benefits thereof to the exclusion of others.

The practical application of this decision rule is problematic in the sense that the pricing of the 'option to invest at any other feasible time in the future' is not easily performed. Research papers published on the topic generally suggest some form of statistical modelling be employed in the valuing of the 'option to wait'. Stark concedes that the sophistication of such models "might well be beyond the abilities of firms even with investment appraisal computer software (1990: 174)". He suggests that the best means of adjusting the net present value calculation to allow for the irreversibility of an investment decision is to adjust the discount rate applied for differences in project uncertainty and irreversibility. Firms could use hurdle rates higher than the cost of capital as a crude method of compensating for greater than average project irreversibility and uncertainty. By this process, firms are able to price into the net present value calculation the irreversibility inherent in a project.

5.8.2.2 *Mutually Exclusive Investment Alternatives*

One of the complicating factors which was encountered in the use of the net present value technique in practice is that when evaluating mutually exclusive investment alternatives with different life-spans the calculated net present values are not always comparable.

It is possible, however, to detail those circumstances under which these net present values are comparable. The differing circumstances which can be encountered in the evaluation of mutually exclusive projects have been categorised by Emery (1982: 15) as follows :

1. **Project life determined by the alternative life.** In this situation (Emery 1982: 15), the length of the project or investment under consideration is effectively determined by the life of the asset to be purchased i.e. an investment in some wasting resource, such as a mine. A company may for example be considering which of two mines to acquire, one with an estimated life of 10 years and another with a forecast productive life of 5 years. Under

these conditions, the net present values of investments with different durations are directly comparable.

2. **Project life independent of and shorter than the lives of the alternatives.** This condition arises when a firm plans to halt a project even though the asset purchased is still serviceable. An example of this would be where a crane is purchased with a life of ten years in order to complete a construction project of two years in duration. Since no future decision is required to be made as regards the future of the project, investment alternatives with differing life-spans are truly comparable. The only difficulty arises in the estimation of salvage values at the termination of the project.
3. **Project life independent of and longer than the lives of the alternatives.** Emery (1982: 15) provides the example of a firm which produces aircraft deciding which of a variety of rivet guns to buy, one with a life of two years, another with a life of three years. "The analyst must therefore evaluate the sequence of decisions associated with each alternative. This evaluation must encompass an interval beyond which future events are not influenced by the current choice (1982: 15)". This means that the choice of one model does not automatically mean that the model will be used throughout the life of the project although this assumption is usually made in the absence of information to the contrary. An evaluation interval set equal to the life of the project obviously provides an evaluation period which is most relevant to the decision at hand. The lowest common multiple of the lives of the alternatives also represents an interval at the conclusion of which the firm has identical options regardless of which choice was made originally.

The interval period to be used under the above circumstances is the lesser of the project life or the lowest common multiple of the investment alternatives equalling or exceeding the project life. Where, for example, the project is shorter than the life of the proposed investments (as in the crane example above), this shorter period may be used. However, where a number of projects may be strung together, the lowest common multiple of the investment alternatives should be used. In the example of the rivet gun provided by Emery above, the lowest common multiple would be a project life of six years. The first gun would need to be acquired three times against the acquisition of two guns of the second type.

4. **Project life independent of and between the lives of the alternatives.** This situation arises for example where a company requires premises for a period of 10 years, which it can either build (assumed to have an unlimited life - i.e. longer than the project life) or may construct a makeshift structure with a life of say 2 years. In order for the second alternative to be workable, the structure would have to be renewed or re-erected 5 times during the term of the project.

In this instance, each of the two alternatives will be evaluated based on the life of the project (a residual value for the building would have to be estimated for the former alternative, an estimate of the cost to erect the structure each time for the latter alternative). The proper evaluation interval for both alternatives is therefore the project life even though this will require a single purchase for one alternative and a series of replacements for the other.

We can therefore see that not all investment problems require the specification of an evaluation interval (not cases 1 & 2 above). What is concerning to note is that the industry-standard solutions to this problem (detailed below) do not always provide the correct evaluation interval.

5.8.3 The Common Life Multiple and Study Period Methods

In dealing with the potential weakness of the net present value method in evaluating mutually exclusive projects with differing life spans, two differing approaches have been developed and implemented in the mainstream, namely :

1. The Common Life Multiple approach, and
2. The Study Period method.

5.8.3.1 Common Life Multiple approach

This methodology requires that the lowest common denominator be chosen between the lives of the proposed investments. This methodology is consistent with the explanation given under case 3 above.

Once the lowest common life multiple has been found, the practitioner will be required to estimate the likely cost of the project implementation in the future and the timing thereof. Each re-tooling or re-investment made necessary through the use of this method will require the estimation of the magnitude and timing of all associated cash flows including the sale of the scrapped asset, the purchase cost of its replacement and any related taxation cash flows.

5.8.3.2 Study period method

The practitioner will specify the time period over which the investment alternatives will be evaluated. The study period method requires that the analysis be restricted to the 'evaluation interval' - usually defined as the life of the shortest-lived investment opportunity. The cash flows for the evaluation interval are then determined (the common life multiple method assumes a like-for-like replacement - i.e. replacement of equipment at the same cost and benefits as are currently available). The alternative cash flows are then discounted and compared as normal.

5.8.3.3 Criticisms of the study period and lowest common multiple period methods

Each of the above methods have their own weaknesses, as highlighted by Emery (1982: 14), which may be summarised as follows :

Study Period Method	Lowest Common Multiple Method
<ol style="list-style-type: none">1. The choice of the evaluation interval is arbitrary.2. Ignores the cash flows occurring after the conclusion of the study period.	<ol style="list-style-type: none">1. The study period is arbitrarily chosen, and may be an arbitrarily long interval which includes cash flows that should have no influence upon the project currently under consideration.2. The assumption of like-for-like replacement of the capital investment is unwarranted because of the likelihood of the change in project cost and the level of technology implemented. Consider a project that will require the acquisition of three mainframe computers at intervals of 3 years – can any practitioner estimate the cost of each mainframe on a like-for-like replacement basis? The technology currently being implemented in the project will in all likelihood not be the same as that acquired in later acquisitions.

5.8.4 Critique

The advantages and disadvantages of the net present value method are examined below.

Advantages

1. Accounts for the time value of money.
2. Can be adapted to effectively deal with projects of differing risk.

The evaluation of projects with differing levels of risk may be achieved by the increase or decrease of the discount rate used in the discounting process. Although the academic literature refers to the weighted average cost of capital as the correct rate to be used, the rate utilised can be adapted to account for differing risk. If, for example, the weighted average cost of capital of a company is 15%, this rate should be applied to those projects which are of the same risk as the average project currently implemented by the firm. Above average risk projects should be discounted using a higher cost of capital to take into account the additional risk accepted in their implementation.

Research conducted by Pindyck (1988: 983) found that managers often utilise costs of capital which “far exceed” those implied by the capital asset pricing model (a model utilised to determine the investor cost of capital for discounting purposes). Management therefore are increasing the cost of capital applied in the discounting process in order to allow for project risk and to provide some degree of comfort regarding the level of profitability of the proposed investment.

3. The net present value method does not suffer from the reinvestment rate problem encountered with the internal rate of return method (refer below).
4. Leads to decisions which maximise the long term wealth of shareholders (in line with the Brigham and Tapley theory documented by Woods and Randall (1989: 91)).

While the mathematics of a correctly-applied net present value measure must lead to the maximisation of shareholder wealth, research conducted by Pike and Ooi (1988: 171) could not confirm that the net present value method of project evaluation is favoured in organisations where the long term financial well-being of shareholders is emphasised (through the use of mission statements and departmental objectives stated in terms of such

results). The assertion that the wealth of shareholders will increase by the amount of the net present value is challenged by Woods and Randall (1989: 85) below.

5. Simpler to compute than certain other sophisticated methods such as the Internal Rate of Return.

Disadvantages

1. When evaluating mutually exclusive investment alternatives, the practitioner must select the correct evaluation alternative and apply one of the adaptations of the net present value method (either the Common Life Multiple or Study Period approach described above). This introduces an additional complication to the evaluation process that other capital budgeting techniques, such as the internal rate of return and accounting rate of return, do not exhibit.
2. The generic application of the net present value method will overstate the likelihood of success of the project under consideration (Pike & Ooi 1988: 1). The reasons for this are as follows:
 - Practitioners often calculate the weighted average net present value of a project based on three equally probable outcomes such as 'best', 'average' and 'worst'.
 - Cognisance is often not taken of the fact that sourcing profitable projects must of necessity be less likely than the sourcing of unprofitable ones (for reasons such as the presence of competing firms, the shortage of important resources in the market and the limited amount of natural resources in the world).
 - Management may be motivated to exaggerate the forecast incomes to be earned from a project. Those tasked with the forecasting of future cash flows may wish to encourage project implementation by overstating forecast income or understating forecast expenses.

The importance of the above disadvantage lies in the interpretation of projected net present value figures. High level management must bear the above factors in mind when interpreting the outcome of the net present value calculation. From this perspective, the

net present value measure is less useful than, for example, the internal rate of return or accounting rate of return methods in that it is more difficult to accurately allow for the likely overstatement of figures in the net present value analysis.

One viable alternative to the heuristic downgrading of net present value figures is to increase the cost of capital used to discount the forecast cash flows in much the same manner as is employed when evaluating projects of differing risk. The amount by which the cost of capital should be increased could be determined by considering:

- management's perception of the risk of the project,
- the experience of the staff who will implement the investment,
- the level of competition in the industry, and
- the degree of volatility expected in the income and expense flows associated with the investment.

Textbooks appear to be agreed that the net present value technique is a robust, theoretically accurate means of evaluating capital budgeting proposals. The most significant risk it appears, in the application of the technique, is that practitioners will fail to recognise some of the assumptions which underpin its application.

Most significantly, the following assumptions must be proved valid before the results of the net present value method can be accepted without reservation:

1. The project falls into the same risk class as the average project invested in by the organisation.
2. The project is financed at the firms' target market-value debt-equity ratio (Greenfield, Randall & Woods 1983: 40)..

As can be seen from the above assumptions, the major theoretical pitfalls involved in the net present value technique are related to the cost of capital utilised in its application. Accordingly, it is most important that practitioners afford the necessary attention to the calculation and use of an appropriate cost of capital.

3. The increase in shareholder wealth by the net present value of the project overstates the benefit to the shareholder in certain cases.

This is as a result of the fact that the financial markets will often not capitalise the forecast benefits of a project into the share price until substantive results have been achieved in its implementation (Woods & Randall 1989: 86). In addition, information asymmetry will also nullify the equality of the net present value of a project and the increase in shareholder wealth that results. It is important to the interpretation of these findings that the definition given by Woods *et al* of shareholder wealth is noted – “Shareholder wealth is the aggregate market value of the common shares, which in turn is assumed to be the present value of the cash flows which will accrue to shareholders, discounted at their required return on equity”. This definition makes it clear that unless the value of a particular project can be communicated effectively to the market, shareholder value will remain unchanged upon implementation (this is referred to as the ‘zero credibility condition’ by Woods *et al* (1989: 91). It is also clear that should the shareholder have price-sensitive information which is not known to the market the shareholder wealth measured by the market capitalisation of the company will not equal the actual value of the firm.

5.8.5 *Research*

Mukherjee (1987: 42) reported an increase in the use of discounted cash flow methods quoting a 10% adoption rate in the research conducted by Istvan in 1959, 57% in the Klammer study of 1980 and the ‘vast majority’ of respondents reporting the use of discounted cash flow methods in the Gitman and Mercurio study of the same year. This same trend is highlighted in Chapter 7 in greater detail.

5.9 Internal rate of return

5.9.1 *Description*

The internal rate of return (IRR) method of evaluating investment proposals is defined by Fremgen (19: 1973) as the “interest rate expected to be earned on an investment” or “the discount rate at which the forecast cash inflows will equal the forecast cash outflows”.

The internal rate of return is also referred to as the “yield”, and the “discounted cash flow method” (Fremgen 1973: 19) or the “DCF Rate of Return” (Mukherjee 1988: 31).

In colloquial terms, the internal rate of return is an appraisal method which calculates the mean return forecast to be achieved on the cost of the investment, over the term of the project to be undertaken. As such the internal rate of return calculation provides a percentage measure of the profitability of the investment. This percentage return may then be compared with the weighted average cost of capital of the organisation, or the opportunity costs pertaining to the investment (i.e. returns forecast on alternative projects), or hurdle rates set by management for the evaluation of investments in order to determine whether the investment should be accepted.

The internal rate of return differs from the accounting rate of return method in that it is calculated using forecast cash flows rather than forecast net profit in its calculation and in the fact that the mathematics of its' calculation adjust for the time value of money (thereby eliminating one of the accounting rate of return's most fundamental shortcomings).

The internal rate of return is calculated using a simple step-wise technique, which may be summarised as follows :

1. Forecast the net cash inflows and outflows associated with the investment under consideration. These cash flows should be classified in terms of when they occur, in order to generate a net cash inflow / outflow for a particular period. Depending upon the accuracy required, cash flows can be grouped into annual, bi-annual or monthly categories. The greater the accuracy required, the shorter the evaluation period used to group these cash flows.

2. Discount the forecast net cash flows determined above using a discount rate designed to return as low a positive net present value as possible.
3. Discount the forecast net cash flows again using a discount rate designed to return as small as possible negative net present value.
4. Interpolate between the two discount rates to determine the discount rate at which the net present value of the investment is zero (Shillinglaw 1977: 480).

The practical application of the internal rate of return method is shown in Illustration 4.

5.9.2 *Development*

Research conducted by Mukherjee (1988: 3) found that the use of discounted cash flow methods (principally discounted payback, internal rate of return and net present value) of evaluating investment opportunities was almost universal, and that the internal rate of return was the most popular of such methods. This appraisal method has a number of significant advantages over other techniques, both from an academic and practical point of view. These relative strengths, as well as the weaknesses of the internal rate of return are examined under 'Critique' below.

The internal rate of return arose from a need to create a method of evaluating capital budgeting proposals (and other decisions involving the investment of funds in order to earn some return in the future) which incorporated the following characteristics :

1. Comparatively simple to compute.
2. Applicable to the majority of investment decisions.
3. Provides a measure which is comprehensible to financial and non-financial staff alike.
4. Accounts for the time value of money (a fundamental shortcoming of the earlier naïve methods).

The internal rate of return fulfils the above characteristics and as such provides a measure which is exceptionally useful from a practical perspective and which is theoretically robust.

Illustration 4 – Internal rate of return

A management accountant wishes to calculate the internal rate of return of a project which is currently under consideration. The forecast net cash inflows of the project are as follows:

	<u>Project A</u>
Year 1	10 000
Year 2	20 000
Year 3	20 000
Year 4	20 000
Year 5	10 000
Year 6	-
Year 7	-

The internal rate of return is calculated by interpolation. Interpolation requires that the practitioner find two discount rates, one which results in a positive net present value and the other which renders a negative net present value. Since the IRR is the discount rate which will result in a zero net present value, interpolation is used to determine from the two discount rate what increase is required over the lower rate in order to render a zero NPV. Interpolation provides an approximation of the correct rate the accuracy of which is dependent on using two interest rates which are as close as possible to one another.

Assuming a cost of capital of 15%, the NPV of Project A is determined as follows:

		<u>Amount</u>	<u>PV Factor</u>	<u>PV Amount</u>
Project A:	Cost	(50 000)	1.000	(50 000)
	Year 1 inflow	10 000	0.870	8 700
	Year 2 inflow	20 000	0.756	15 120
	Year 3 inflow	20 000	0.658	13 160
	Year 4 inflow	20 000	0.572	11 440
	Year 5 inflow	10 000	0.497	<u>4 970</u>
				3 390

Project A thus returns a small positive net present value. The discounting process may be repeated using 18% as the discount factor.

		<u>Amount</u>	<u>PV Factor</u>	<u>PV Amount</u>
Project A:	Cost	(50 000)	1.000	(50 000)
	Year 1 inflow	10 000	0.847	8 470
	Year 2 inflow	20 000	0.718	14 360
	Year 3 inflow	20 000	0.609	12 180
	Year 4 inflow	20 000	0.516	10 320
	Year 5 inflow	10 000	0.437	<u>4 370</u>
				(300)

The actual internal rate of return is therefore somewhere between 15% and 18%. This rate can be approximated by interpolation as follows:

$$\text{IRR} = \text{lower rate} + ((\text{positive NPV}) / (\text{sum of two NPV's}) \times (\text{NPV rate 2} - \text{NPV rate 1}))$$

$$\text{IRR} = 15\% + ((3\,390) / (300 + 3\,390) \times (18\% - 15\%))$$

$$\text{IRR} = 15\% + 2.756\%$$

$$\text{IRR} = 17.756\%$$

The internal rate of return of the project is thus approximately 17.756%. This rate will be compared with the hurdle rate used by the company concerned – if this rate of return is higher than the hurdle rate, the project should be accepted.

5.9.3 Critique

Advantages

1. The internal rate of return technique result is cognitively efficient (Evans & Forbes 1993: 89).

Research in the field of ergonomics (the study of the manner in which human cognition interacts with information display methods) indicates that the number of decision errors committed by users of information depends to a degree on the method used to communicate information. Analogue or graphical displays are more easily grasped than digital - and it is the contention of Evans and Forbes (1993: 89) that the net present value result is a digital display (numbers only) and that the internal rate of return result is perceived as an analogue piece of information.

For this reason, Evans *et al* contend that it would be more efficient for academics to emphasise ways of applying the internal rate of return method in a way that overcomes its limitations - or alerting managers as to the situations in which it is safe to use the internal rate of return method rather than to prescribe other methods which are less cognitively efficient (1993: 90).

2. The measure deals effectively with the time value of money.
3. The measure lends itself to dealing with differing levels of project risk.

The decision rule associated with the internal rate of return is as follows: The calculated internal rate of return percentage is compared with the cost of capital or opportunity cost of the firm. If the internal rate of return exceeds such cost, the project will add value to the organisation and should be considered for implementation.

This decision rule is easily adjusted to deal with situations where non-normal levels of risk are present in the project under consideration as follows:

- Where the risk of the investment is lower than that of the average investment held by the company, the hurdle rate applied by the firm is adjusted downwards before the comparison with the internal rate of return is performed. The amount by which the hurdle rate is adjusted is usually determined by management taking into account all

relevant factors such as the firm's cost of capital, the difference between the project risk and the average risk of company project and the magnitude of the investment.

- Where the risk of the investment is higher than that of the average investment held by the company, the cost of capital of the firm is adjusted upwards before the comparison with the internal rate of return is performed (Lohman & Baksh 1993: 22).”
4. The internal rate of return does not require the specification of the cost of capital of the entity. Although the net present value method is theoretically more robust than the internal rate of return method, the principal difficulty in its application is the calculation and specification of a useful cost of capital. Mukherjee (1987: 42) believes that this advantage may be fundamental in the sense that practitioners recognise that the net present value result is only useful provided a meaningful discount rate is used.

Disadvantages

1. Non-normal investment cash flows cause the internal rate of return calculation to return multiple solutions.

Non-normal project cash flows occur when a project has fluctuating periods of net cash inflows and outflows (more than one period of non-consecutive net cash outflows). A practical example of an investment with non-normal cash flows is that of a mine where initial negative cash flows take place as the operation is set up, positive cash flows are received as the mine returns a profit, and further negative cash flows incurred when the mine is de-commissioned .

Research by Fremgen (1973: 21) into the frequency of this internal rate of return shortcoming found that this is a condition which is encountered fairly frequently in practice, to the extent that it is worthy of further academic attention. Fremgen, however, was led to conclude that this shortcoming was not so severe as to totally invalidate the internal rate of return as a capital budgeting evaluation tool.

2. The implicit assumption that cash inflows are reinvested at the internal rate of return.

This so-called “reinvestment problem” is described by Andrews & Butler as follows “the internal rate of return measures the relative profitability of investments by

identifying the return on the declining balance of funds invested. Inherent in the technique is the assumption that immediate cash flows generated in each period are reinvested at the IRR. The use of the IRR will maximise net worth if the actual attainable reinvestment rate is equal to or greater than that rate of discount which equates the present values of project cash flows with the investment outlay (Andrews & Butler 1986: 35).”

Thus, a ‘reinvestment rate problem’ arises because the mathematics behind the internal rate of return assume that the net cash inflows received from the investment will be invested at the calculated internal rate of return. Where the project is a profitable one, it is unlikely that the firm will be able to obtain similar returns on the cash inflows invested.

Research conducted by Andrews *et al* found that only 17 % of respondents stated that they made an explicit assumption regarding the reinvestment rates of return earned by their investments under review (1986: 35). The majority of respondents placed their reinvestment rate at the cost of capital rather than the rate of return implicit in the investment. This further emphasises the fact that the implicit reinvestment rate assumption made by the internal rate of return is considered by practitioners to be unrealistic.

5.9.3.1 *Is the popularity of internal rate of return over net present value justified ?*

Although the net present value method has been shown to be theoretically more robust than the internal rate of return method, the latter has proved more popular in practice (Mukherjee 1988: 33 & Correia 1998: 2). The most useful of the academic research into the reasons for this was conducted by Kim, Crick & Kim (1986: 49) and is summarised as follows:

Factors affecting a choice between NPV and IRR (Kim, Crick & Kim 1986: 49)	
Factor	Percent of Responses
NPV is easier to compute	6
NPV is consistent with the firm's value maximisation goal	13
Reinvestment rate under NPV is more realistic	7
A single project may have more than one IRR	2
A project's IRR remains constant over it's entire life	1
IRR is easier to visualise and to interpret	20
IRR does not require the prior computation of the Cost of Capital	17
Executives are more comfortable with IRR	34
Total Responses	100

From the above results it can be seen that the majority of the popularity of the internal rate of return as reported by the Kim *et al* is due to psychological and intuitive appeal (the last three reasons accounted for 79% of the responses received). The first five reasons were cited by firms who have adopted the net present value technique, the last three by firms that use the internal rate of return. Respondents reported that the internal rate of return is easier to visualise and interpret than the net present value. 34% of respondents cited the intuitive

appeal of the internal rate of return as one of the major reasons for its use in their organisation (Kim *et al* 1986: 52)’’.

The above advantages of the internal rate of return must be weighed against the theoretical strengths of the net present value method (as stated by Kim *et al* 1986: 52), *inter alia*:

1. The net present value is easier to compute.
2. Correctly implemented, the net present value method will lead to the maximisation of wealth of the shareholders of the company.
3. A project will never have more than one calculated net present value, whereas the internal rate of return will return multiple results where the project has non-normal forecast cash flows.
4. The internal rate of return cannot be adapted to account for differing costs of capital over the life of the project, nor for the possible increase in risk that is to be expected as cash flows of the investment are projected further and further into the future.
5. The reinvestment rate implicit in the mathematics of the net present value method (the company cost of capital) is theoretically more correct than that of the internal rate of return method (the return on the individual investment).

In the final analysis, the question as to why practitioners do not apply the most theoretically robust theories available does not depend upon theory alone. Factors such as ease of use, interpretation, business convention and the syllabi of academic institutions all play a role in the choice of capital budgeting technique implemented. For these reasons and others, the rate of implementation of the internal rate of return method in practice exceeds that of the net present value method although theoretically, the NPV comes more highly recommended than the IRR.

5.10 The discounted payback method

5.10.1 *Description*

The discounted payback method is a refinement of the traditional payback method examined above. This method makes an adjustment for the time value of money in the calculation of the payback period of an investment.

As described in the critique of the traditional payback method (refer to section 5.5 above), one of the fundamental shortcomings of the payback period method is that it does not account for the changing value of money over time. The time value of money is that phenomena which results in cash flows expected in the present or short term, having a higher value, *ceteris paribus*, than those expected to be received in the long term. The standard method of adjusting for differing time values is by discounting the cash flows related to the project or investment under consideration. Each of the cash flows is discounted by applying a discount rate that reflects the investor's cost of capital, perception of expected future inflation and an allowance for project risk.

The application of the discounted payback method is demonstrated in Illustration 5 using the figures from Illustration 1 (the illustration of the traditional payback method).

5.10.2 *Development*

The discounted payback method arose as a natural refinement of the standard payback method in order to eliminate one of the shortcomings of the original technique.

The adoption of the discounted payback period technique in practice has not been as widespread as that of the traditional payback technique (Kee and Bublitz 1988: 154). According to Kee *et al* (1988: 154), this is chiefly due to the fact that “payback is employed in conjunction with net present value”. The use of the net present value technique with the payback period renders two results which allow management to capitalise on the strengths of the payback method and evaluate the importance of the time value of money and the post break-even forecast cash flows using the net present value methodology.

This research suggests that the much-publicised shortcoming of the payback method (i.e. that it does not take into account the time value of money) does not have a significant impact on the level of practical implementation of the technique.

Research conducted by Kee *et al* (1988: 149 – 156), as well as Longmore (1989: 185 – 194) indicate that the refinement of the payback method to make adjustment for the time value of money was largely superfluous given the most popular usage of the payback period. They found that the payback method is often utilised in conjunction with the internal rate of return (IRR). Used together, “PB and IRR provide information about an asset’s return at significant points during its economic life (Kee *et al* 1988: 154). The combining of the so-called naïve and sophisticated methods renders a more complete picture of the risk and profitability profile of a proposed investment. The payback method alerts management to potentially problematic cash flows, while the accept : reject decision is made using one of the theoretically superior sophisticated techniques (Kee *et al* 1988: 154).

Another evolutionary adjustment to the traditional payback method proposed by Longmore (1989: 185-194) involves the development of the so-called “Discounted Payback Decision Rule”.

Illustration 5 – Discounted payback period

A company is considering two different investments A & B which both cost \$50 000 but which have different cash flow streams. If the cost of capital of the company is assumed to be 15%, the forecast cash flows and their discounted present values are as follows (for the calculation of the present values, refer to Illustration 3 above):

<u>Project A</u>	<u>Cash flow</u>	<u>Present Value</u>
Project cost	(50 000)	(50 000)
Year 1 inflow	10 000	8 700
Year 2 inflow	20 000	15 120
Year 3 inflow	20 000	13 160
Year 4 inflow	20 000	11 440
Year 5 inflow	10 000	4 970

The discounted payback period of the investment is that point where the *discounted* cash inflows equal the cost of the investment.

Given that both projects have a cost of R50 000, the payback may be calculated, thus:

Project A:	Cost	(50 000)
	Year 1 inflow	<u>8 700</u>
	Net value	(41 300)
	Year 2 inflow	<u>15 120</u>
	Net value	(26 180)
	Year 3 inflow	<u>13 160</u>
	Net value	(13 020)
	Year 4 inflow	<u>11 440</u>
	Net value	(1 580)
	Year 5 inflow	<u>4 970</u>
	Net value	3 390

It can be seen that Project A reaches payback somewhere in year 5 (as the net NPV is negative at the end of year 4 and positive in year 5). The portion of year 5 required for payback to be reached is calculated as follows:

$$\begin{aligned}
 & \text{Year 4 negative NPV} \div \text{Year 5 forecast inflow} \times 12 \text{ months} \\
 & = 1580 \div 4970 \times 12 \\
 & = 3.8 \text{ months}
 \end{aligned}$$

5.10.2.1 The DCF Payback Decision Rule

In terms of this rule, the following steps are taken to derive a decision rule which equates the annualised project cash flows and the present value factor relevant to the cost of capital and time frame of such flows.

The derivation suggested by Longmore (1989: 185) may be summarised step-wise as follows:

- The net present value decision rule states that the investment proposal should be accepted if the proposal's net present value is greater than or equal to zero. If an investment's annual net cash flows (NCFs) are identical, and C_0 represents the cost of the investment, then the net present value decision rule can be stated as:

$$NCF \sum_{t=1}^n (1+k)^{-t} \geq C_0$$

where :

k is the firm's cost of capital

n is the life of the investment proposal

$\sum_{t=1}^n (1+k)^{-t}$ is the present value annuity factor for n years at k discount rate.

- Dividing each side of the equation by the annuity factor ($\sum_{t=1}^n (1+k)^{-t}$), yields the following:

$$\sum_{t=1}^n (1+k)^{-t} \geq \frac{C_0}{NCF}$$

- The equivalent annual net cash flows (NCF) or uniform annual cash inflows are obtained by determining the present value of the investment proposal's future net cash flows and spreading that present value over the proposal's useful life as an equal amount per year. This is accomplished by dividing the present value of the annual net cash flows by the present value annuity factor as follows:

$$NCF = \frac{\sum_{t=1}^n NCF_t (1+k)^{-t}}{\sum_{t=1}^n (1+k)^{-t}}$$

- From the equation above, the generalised discounted cash flow payback decision rule is derived:

$$\frac{C_o}{NCF} \leq \sum_{t=1}^n (1+k)^{-t}$$

The generalised discounted cash flow payback decision rule is stated in words as follows: If the investment proposal's payback, adjusted for the timing of net cash flows, is less than or equal to the present value annuity factor at the firm's cost of capital for the life of the proposal, the investment should be accepted (Longmore 1989: 189). The generalised discounted cash flow payback decision rule is theoretically consistent with the assumptions of the net present value concept and will therefore always produce the same investment decisions.

The discounted cash flow payback decision rule is applied to investment proposals of average risk by discounting the net cash flows using the weighted average cost of capital. The rule can be adapted to deal with projects with a risk profile which differs from that of the average project by applying a cost of capital which is adjusted for risk i.e. where the project under examination is of above-average risk, the weighted average cost of capital applied is adjusted upwards to allow for excess risk.

5.10.3 *Critique*

5.10.3.1 *Discounted Payback Method*

The discounted payback period methodology has the same advantages as the traditional payback period technique, namely:

1. Method is simple to grasp (Fleming & McKinstry (1991: 223) and Chen & Clark (1994: 124)).
2. Quick to calculate (Fleming *et al* 1991: 223).
3. Emphasises liquidity (Fleming *et al* 1991: 223).

4. Provides a measure of the relative risk of the project (Pocock (1991: 38), Pike (1988: 347), Weingartner (1969: 1403) and Correia (1996: 6)).
5. The payback method has a complementary relationship with other investment models (Kee & Bublitz 1988: 153).
6. Serves as a proxy for duration (Pike 1988: 346).
7. Pike argues that payback is useful as a communication device (1988: 346).
8. Correia (1996: 6) suggests that the payback period evaluation method may be suitable for the evaluation of smaller projects which do not justify a detailed or greatly sophisticated analysis.
9. Addresses the shortcoming of the traditional payback method in that it allows for the adjustment of cash flows for the time value of money.

The discounted payback method still suffers from the other shortcomings of the original payback method, namely :

1. Ignores the position after payback is reached (Fleming & McKinstry 1991: 223).
2. Wrong inferences can easily be made (Fleming & McKinstry 1991: 223).
3. The payback period method is often used due to agency conflict or moral hazard (Pike & Ooi 1988: 160).

As such the discounted payback period measure is one which has some use as a heuristic measure for the preliminary examination of proposed investments, but that remains as unsuitable as the traditional payback period for the final evaluation of investments.

5.10.3.2 *Discounted Cash Flow Payback Decision Rule*

The fundamental shortcoming with the discounted cash flow decision rule is that in order to calculate the actual discounted cash flow payback under the above system we must first calculate the net present value. If one is to understand Longmore correctly, the main motivation for the use of this measure is that it provides an indicator which management can understand. However, the calculation of this measure requires that the net present value is

calculated before proceeding to conclude on the final discounted cash flow payback. Unless a management accountant is present to perform these calculations on behalf of management, it is unlikely that management would be able to calculate the theoretically superior net present value measure, and yet not be in a position to interpret such an indicator. The added value of this technique is thus questionable.

Where these measures are calculated on behalf of management, however, the discounted cash flow payback measure may produce a figure which has more intuitive appeal for managers and which eliminates the theoretical shortcomings of the payback measures (both traditional and discounted).

5.11 Profitability index

5.11.1 Description

The Profitability Index (PI) or Discounted Benefit : Cost ratio was defined by Fremgen as “a ratio, computed by dividing the present value of cash receipts by the present value of cash outlays. The discount rate is the same as that used in determining the net present value (1973: 19).”

This is mathematically presented as:

$$\text{Profitability index} = \frac{\text{PV of cash inflows}}{\text{PV of cash outflows}}$$

The application of the above formula results in the computation of a ratio which may be interpreted according to the following conventions :

1. Where the ratio is less than one, the present value of the forecast inflows represent less than the present value cost of the project - the project should therefore not be accepted.
2. Where the ratio is more than one, the present value of the forecast inflows is greater than the present value of the forecast costs - the project should therefore be accepted.

Illustration 6 details the calculation of the profitability index for two separate projects.

Illustration 6 – Profitability index

The company capital budgeting officer wishes to calculate the profitability index of the two projects evaluated in Illustration 3 – Net Present Value.

The present value of the cash inflows and cash outflows as determined in Illustration 3 were as follows:

	<u>Project A</u>	<u>Project B</u>
Present value of cash outflows	(50 000)	(50 000)
Present value of cash inflows	53 376	73 430

The Profitability index is then determined as the ratio of the cash inflows to cash outflows. This renders a profitability index of 1.068 for Project A and 1.469 for Project B.

The profitability index provides the user with the same decision information as the net present value technique. It is also useful to interpret the PI as a percentage return figure. This can be achieved by subtracting 1 from the index figure and multiplying by 100. Project A therefore returns 6.752% and project B 4.69%. Note that these percentage returns are not annualised and therefore cannot be used for comparison purposes with annual hurdle rates or annual costs of capital.

5.11.2 Development

The profitability index method of evaluating capital investments derives mathematically from the net present value calculation, and a need to be able to compare mutually exclusive projects with differing capital costs. It is clear from the examination of the profitability index calculation above, that the ratio calculated, multiplied by 100, renders the percentage of cash inflows relative to cash outflows. This makes it possible to compare two projects of differing sizes - whereas previously, the practitioner could only compare the calculated net present values of two different projects in order to reach an investment decision. This approach could lead to errors.

Suppose for example, that a practitioner is considering accepting one of two mutually exclusive projects :

Project Cost	Project Net Present Value
R100 000	R20 000
R150 000	R22 000

The practitioner could, for example, be convinced that the second project be selected, as a larger NPV would result (the second project has a forecast NPV of R22 000 while the first has an NPV of R20 000). In percentage return terms, however, it may be more favourable to accept the first project and invest the additional R50 000 in alternative projects. The profitability index measure would support this investment decision as the first project has a forecast profitability index of 1.2 while the second project has a profitability index of 1.18. Note that this type of error will only result in the evaluation of mutually exclusive projects - in the above example, the practitioner would opt to implement both projects for an increase in the value of the business of R44 000 if the projects were not mutually exclusive.

5.11.3 Critique

The advantages and disadvantages of this technique identified by the academic community are detailed below.

Advantages

1. Viewed in isolation, the advantages of the profitability index method of project evaluation mirror those of the net present value technique (i.e. that the time value of money is accounted for and that only cash flows are examined).
2. In addition to the advantages of the net present value method, the profitability index technique incorporates in the decision-making process the scale of the investment required in order to enjoy the forecast cash inflows. As discussed above, this is important in the evaluation of mutually exclusive projects with differing investment costs.

3. Some academics contend that the measure is intuitively appealing in that it is a ratio that is easily explained, understood and interpreted.

Disadvantages

1. According to Mukherjee (1991: 748), the profitability index does not provide any information not already contained in the net present value figure and yet it will sometimes return the incorrect decision in the evaluation of mutually exclusive projects.
2. Mukherjee (1991: 748) further contends that the intuitive appeal of this measure is overstated and that the internal rate of return and net present value hold greater intuitive appeal for the user.
3. Mukherjee (1991: 748) argues that this procedure is easily manipulated by defining part of the capital expenditure as an operating expense, thereby reducing the size of the denominator in the calculation.

Essentially, the calculation of the profitability index hinges on the same mathematical calculations performed in the net present value analysis. It therefore appears inefficient to calculate the net present value and not to use it in the calculation of the profitability index. This is to say that it would be wisest to use the profitability index in conjunction with the net present value technique, rather than in isolation.

5.12 Conclusion

The above methods form the back-bone of the techniques documented in post-graduate capital budgeting studies. Further advances in the science and art of capital budgeting have been concentrated in the areas of dealing with risk differentials and the effect of inflation. It is important to note here, however, that the capital budgeting methods found implemented in practice in the research conducted by the author were, in 88% of the responses received, the methods detailed above.

The author now seeks to examine the treatment of inflation in the capital budgeting process as the impact of inflation on the acceptance or rejection of proposed projects in the South African context is considered to be significant. Thereafter a detailed review is performed of the primary research reported relating to capital budgeting, split between South African and foreign research. The findings of these studies are then compared with the results of the primary research conducted by the author.

6 Chapter Six – Inflation and the Capital Budgeting Process

6.1 Introduction

Inflation is defined as “the rise in the general level of prices for goods and services, which in turn results in a decline in the purchasing power of a unit of money. The anticipated rate of inflation is defined as the expected annual rate of change in this index (Van Horne 1971: 654)”. Although the present reported rate of inflation is comparatively low at 5% (the rate of inflation for April 1999 (South African Reserve Bank 1999: 13)), ignoring inflation can lead to a significant distortion of the perceived profitability of projects under consideration. Certain academics believe that this area of capital budgeting has not received the attention that it deserves (Coulthurst 1986: 41).

It is common cause that cash flows forecast to be received in the future do not have the same value as cash flows received today. This phenomena led to the creation of the discounted cash flow or sophisticated methods of evaluating capital investments. One of the main reasons for the fact that present day cash flows have a higher value than future ones is the impact of inflation. As stated by Cooley, Roenfeldt & Chew (1975: 18), “the increases in the general price level for goods and services necessitate modification of traditional capital budgeting procedures to avoid the inefficient allocation of capital”.

The modification of traditional capital budgeting procedures mentioned above is brought about by a need to ensure that the actions of both the goods market (or real market) and money market (or financial market) are accounted for in the capital budgeting process. This is necessary since any capital investment will involve both of these markets: the financial market will determine the cost of the borrowings or capital used to purchase the underlying asset, whilst the real market will determine the actual cash flows arising on the investment (for example, the cost of the asset and the marketability and price received for the sale of the output thereof). According to Mehta, Curly and Fung (1984: 53), “the speed of adjustment to the inflation expectation change varies in the two markets, whereby the financial market adjusts much more quickly than the goods market. Thus the estimates of cash flows require careful scrutiny with respect to leads and lags in the receipt and disbursement streams”.

This section of the dissertation seeks to identify those tools of capital budgeting which have developed to deal specifically with the effects of inflation. Where another evaluation technique has been modified to allow for inflation or which accounts for changes in the value of money automatically, this was detailed in Chapter Five above.

6.2 Guidelines in Dealing with Inflation

6.2.1 *Two methods of incorporating inflation into the capital budgeting decision*

Dealing with changes in the price level in the economy require the practitioner to distinguish between nominal (sometimes known as money cash flows, nominal cash flows are those which take inflation into account and therefore record cash flows in the currency of day in which such flows are forecast to be received or paid) and real cash flows (real cash flows are forecast in current period money and do not take into account the effects of inflation).

Rappaport and Taggart (1982: 6) state that forecast project cash flows which are measured in nominal currency should be evaluated using a nominal hurdle rate, whilst real cash flows should be evaluated using a real hurdle rate.

Real cash flows may be derived from money or nominal cash flows by dividing by a price index. In general terms, a money flow in period t_2 is adjusted to the real terms of period t_1 by dividing the money flow by the price-index relative formed by the ratio of the index for t_2 to the index of t_1 . If we assume that prices have changed at a constant rate per annum, the conversion is given by the following identity (Bailey and Jensen 1977: 27):

$$RF_{ij} = \frac{MF_{ij}}{(1+p)^t}$$

where : RF = real cash flow

MF = money cash flow

p = period increase in the price level

t = number of compounding periods

Although the simplifying assumption that inflation is the same in all years is often made in the literature, this simplification is not necessary in practice – practitioners may incorporate differing rates of inflation in their forecasts. It is however considered unlikely that this refinement will be implemented to a large degree in practice as it would increase the complexity of an already thorny area of practical implementation (Mehta, Curley & Fung 1984: 48).

In the alternative, nominal cash flows can be discounted using a nominal cost of capital which is derived by the application of the following formula:

$$\text{Nominal Cost of capital} = (1 + p) \times (1 + i)$$

where : p = period increase in the price level (inflation adjustment)

i = real cost of capital (cost of capital adjustment)

In selecting the price level increase to include in the above formulae, Rappaport and Taggart (1982: 6) motivate that the forecast increase in the general price index (such as the consumer price index) should be utilised because “investors hold assets to provide for future consumption” – the actual benefit to be derived by these investors must be determined by taking into account the devaluation of the purchasing power of the currency between the date of investment and the date of consumption. They therefore contend that the conversion of future cash flows to present cash flows should take into account the rate of decline in the value of funds held by the entity making the investment – the decline in the value of funds of a particular investor will obviously be measured in terms of how much that investors’ funds can purchase.

6.2.2 General rules for applying inflation-adjusted capital budgeting techniques

In addition to the individual tools developed for dealing with inflation, academics have also devoted considerable attention to defining and researching the best capital budgeting practices in applying these tools.

The product of this research has been summarised below in point form, including a brief commentary where necessary.

1. A logically consistent treatment of inflation on capital budgeting decisions is critical (Mehta *et al* 1984: 49).

While it is important to recognise the magnitude of the effect that the time value of money can have on the potential profitability of an investment, it is equally important that the approach adopted in dealing with inflation be consistent from project to project and from period to period.

2. In all initiating documents, all assumptions regarding inflation should be stated for the information and assessment of all participating parties.

Given the large impact that inflation can have on the perceived potential profitability of a project, it is important that staff detail any assumptions made regarding the effects of inflation on forecast cash flows. This is especially important where competing potential investment proposals are prepared by different staff members. This suggestion was confirmed by the research of Bishton (1979: 109) who found that senior management devote a comparatively large proportion of their project examination time to the testing and evaluation of the assumptions underlying the analysis conducted rather than reperforming the mechanical aspects of the capital budgeting calculations.

3. Some firms may be able to cope with inflation in capital budgeting by forecasting in current money units, that is, using the assumption that future costs and revenues will all move in step with the general price level.

Simply put, this means that if inflation is to affect revenue cash flows and expense cash flows by the same quantum, the effect of inflation over the life of the project will be zero. However, there are often circumstances when this assumption becomes misleading, for example where items are fixed in money terms (a lease or a long term contract, or a set annual wear and tear taxation allowance), or where items (such as wages) are likely to rise faster than the general price level. Bromwich (1969: 39) contends that it is normally safer and more accurate to use nominal forecast cash flows and to discount these cash flows using a suitable discount factor.

4. Always compare “like with like”.

Where the forecast cash flows are in current money terms, a real cost of capital must be used to discount these flows, whereas if nominal cash flows are utilised in a forecast, a nominal cost of capital should be utilised.

5. Separate escalation or inflation rates should be used for each material part of the forecasting process.

This means, for example, that the practitioner must separately estimate the inflation on the maintenance cost of the equipment, of the selling price of the goods and of the cost of the production inputs (Coulthurst 1986: 38). Note that this separation of the inflation applicable to different cash flows is only considered useful where the differential between the different rates of inflation is significant and where the categories of cash flow concerned are material to that of the project as a whole.

6. All cash flows associated with taxation must be expressed in nominal terms (i.e. using the value of money forecast to be applicable when the taxation is to be paid by the entity) (Coulthurst 1986: 38).

Implicit in this suggestion is that care should be taken to correctly estimate when the benefit of taxation deductions will be enjoyed – if a company has an assessed loss, the benefit of this loss is realised when the company begins making a profit (and would therefore have paid taxation in the absence of the assessed loss) and not when the deduction is allowed by the taxation authorities.

7. The cost of capital must be forecast for the entire period of the investment, taking into account estimated future changes (Coulthurst 1986: 39).

Although the cost of capital is usually treated as static, net present value analysis allows for the use of multiple costs of capital in order to account for changes therein. If one considers the change in the South African prime rate of interest, increasing from 18% in June 1998 to 24% in September 1998 and subsequently declining to a current level of 15.5% (South African Reserve Bank 1999: Table 14), one can easily envisage a situation in which significant changes could occur in the cost of capital of a business.

8. If the impact of inflation is to be accounted for, financial personnel should not rely on the naïve methods of investment appraisal, such as accounting rate of return. Non-discounting methods of investment analysis do not have the capacity to account for inflation (Coulthurst 1986: 39).

6.3 Dealing with Inflation – Research findings

The following results returned by Pike (1983: 203) in a questionnaire survey conducted in 1980 show the primary methods of dealing with inflation in practice, as well as the changes in such methods between 1975 and 1980.

Procedures for Handling Inflation (150 Firms)	1975	1980
	%	%
Inflation ignored	30	11
Specify rates for different costs and revenues	20	30
Specify cash flow in constant prices and apply real rate of return	29	35
Adjust for estimated changes in general level of inflation	29	39
Consider at risk analysis / sensitivity analysis stage	13	18

From the above, it is clear that fewer firms are ignoring inflation as time passes and that the most popular method of dealing with such price changes is to adjust the forecast cash flows in aggregate for inflation. This indicates that practitioners are aware of the importance of accounting for inflation in the capital budgeting process, but that the implementation of the more sophisticated means of adjusting for inflation described above, have yet to achieve prominence.

Mukherjee's (1988: 31) research into the possible reasons for the non-adjustment for inflation (Mukherjee found that "only a handful" of firms require the inclusion of the expected effects of inflation in the consideration of all projects) in the capital budgeting analysis found the following explanations:

1. "The resulting analysis would involve comparing dollars of different purchasing power (1988: 31)". This perception is invalid – the discounting process will convert the future

nominal cash flows into real cash flows which may be compared with the current real cost of investment.

2. There is a wide disparity as to what the future rates of inflation or deflation will be (1988: 31). This is also not a reasonable explanation for the non-adjustment for inflation. If necessary, the group head office should specify a standard rate of inflation to be used in the forecasting process for the next quarter or half year. This rate could be obtained from the company’s merchant bank or from their investment advisors – the difficulty of guessing inflation correctly, is no excuse for ignoring completely its effects on the capital budget process. Van Horne (1971: 654) believes that it is unlikely that optimal capital investment decisions will be reached if anticipated inflation is not incorporated into the analysis.

A South African study performed by Andrews and Butler (1986: 35) found a large proportion of respondents ignoring inflation in their capital budgeting decision-making process in contrast with the high degree of inflation awareness reported in the Pike study above. Their findings are presenting in a tabular form below.

Adjustments made for inflation	
Inflation adjustment method	Percentage of firms using method
No allowances made for inflation	42,4%
All items in cash flow inflated at an agreed rate	48,0%
Inflated at an agreed rate for a certain number of years	4,8%
Some other method	3,2%

6.3.1 *Impact of inflation on investment decisions*

A great deal of research has been conducted on inflation – its causes, its effects, the economic treatment thereof and also the impact that it has on the capital investment decision. The key conclusions that have been reached as regards this element of the economic environment are expressed in what follows:

1. Inflation frequently represents a factor which must be accounted for in the analysis of capital investment decisions. Inflation is a significant factor not only in hyperinflationary

economies but also in the analysis of any project in which a significant investment is made or which has a fairly lengthy duration (Van Horne 1971: 653).

2. The optimal level of capital investment will depend, *ceteris paribus*, on the rate of inflation. The higher the rate of inflation, the lower the optimal level of capital investment (Nelson 1976: 923).
3. The net present value of mutually exclusive projects will depend on the rate of inflation (Nelson 1976: 926). If one understands the net present value calculation methodology, this assertion is self-evident – projects with life-spans of greater than one period are affected by inflation; capital investments that generate wear and tear taxation shields are prejudiced by inflation; it follows that the ranking of such mutually exclusive projects will depend on the period over which the tax shield cash flows are enjoyed.
4. Net present value rankings of mutually exclusive projects which differ in terms of durability will also be dependent on the rate of inflation (Nelson 1976: 928). Investment projects which generate a declining stream of cash flows will generally lead to a replacement decision after some interval. Projects which produce more rapidly declining cash flows will tend to be replaced more often. This time period, referred to as the durability of the project, is a surrogate measure of the pace with which the capital investment can be converted into wear and tear taxation shields. The faster the turnover of capital, the sooner the benefit of these wear and tear flows will be enjoyed. The higher the rate of inflation, therefore, the greater the motivation to invest in projects with shorter durability.

Three main methods have been introduced in the theory to explicitly deal with inflation in the capital budgeting context. These methodologies are examined below.

6.4 The gross profit per unit method

6.4.1 *Description*

Under the gross profit per unit method, the simplifying assumption is made that the gross profit per unit of the product or project (gross profit is defined as “the excess of sales revenue over the cost of those sales” by Anderson & Clancy (1991: 1004)) will remain constant throughout its marketable life (Rappaport & Taggart 1982: 5). The gross profit per unit method is termed the ‘Incremental Real Profit per Unit’ by Mehta, Curley & Fung (1984: 49).

Practically speaking this means that inflation need not be accounted for in the forecasting of the future cash flows of the project, since all inputs into the forecasting process, both revenue and costs, will be similarly affected, and hence need not be manually adjusted for.

There are a number of assumptions inherent in this method which give rise to the major shortcomings therein. These assumptions are as follows :

1. Should inflation occur in the future, such inflation will affect forecast cash flows equally (e.g. all inputs into the production process will increase in cost in the same proportion).
2. Any increases in the cost of producing the product may be passed on to the consumer (i.e. the selling price of the good will increase by the amount of the increase in the cost of manufacture). The effect of this assumption, and the first assumption above, is that inflation is effectively ignored in the gross profit per unit calculations by virtue of the fact that any increases in production costs arising on inflation are assumed to be passed to the consumer, with no residual effect to the firm. The forecast cash flows, prepared on this basis, will therefore be discounted using a real discount rate which does not make adjustment for inflation.
3. The gross profit per unit methodology assumes zero taxation or that taxation-related cash flows are affected by inflation in the same manner as cost or revenue cash flows. Simply put, this treatment implicitly assumes that taxation cash flows are always affected by inflation and may be adequately described by nominal forecast cash flows. This treatment introduces an inaccuracy into the capital budgeting process in a number of circumstances, the most obvious of which is where the taxation authorities allow a constant deduction

against income. The most common example of constant taxation write-offs are those relating to wear and tear allowances. If a piece of capital equipment is purchased for R5 million, and written off over 5 years using the straight line basis, and a taxation rate of 30%, the benefit of the write off is R300 000 per annum, in current day Rands ($R5\,000\,000 \div 5 \text{ years} \times 30\%$). In the presence of inflation, the value of this write-off will decline as the purchasing power of the R300 000 declines. The use of the gross profit per unit method will therefore overstate the benefits of taxation write-offs.

Clearly, all of the assumptions given above are to a lesser or greater degree ordinarily invalid. The materiality of the differences that these assumptions give rise to is what is important in evaluating the accuracy of this evaluation method. Research indicates that projects with shorter life spans, lower levels of capital asset taxation write-offs and a high elasticity of demand for their product, may be most successfully evaluated using this method. This is because projects with shorter life-spans suffer less from the effects of inflation; as do projects with lower levels of fixed taxation write-offs; and products with a high elasticity of demand allow production price increases to be passed on to the consumer with little impact on total demand.

The obvious benefits of adopting this approach in examining capital investments is that it is simple to implement and does not require the specification of future rates of inflation and the impact of inflation on the cost and revenue cash flows of the entity concerned.

Research conducted by Taggart and Rappaport (1982: 5) found that the gross profit per unit method, or some variation thereof, is commonly used in practice”.

6.5 Nominal cash flow approach

6.5.1 Description

Under this approach, future price and cost changes are incorporated into forecasts, using the management's best estimate of the future rates of inflation ((Rappaport and Taggart 1982: 5) refer also to Van Horne (1971: 656)). This means that nominal forecast figures are used in the net present value calculation rather than real figures as required by the gross profit per unit method above.

The proper discount rate to be utilised under the nominal cash flow approach is an inflation adjusted hurdle rate i.e. the cost of capital of the business, adjusted for the forecast annual inflation (Rappaport *et al* 1982: 6)". This rate (as discussed in section 6.2.1 above) may be calculated as follows:

$$\text{Nominal Cost of capital} = (1 + p) \times (1 + i)$$

where : p = period increase in the price level (inflation adjustment)

i = real cost of capital (cost of capital adjustment)

In short, this approach suggests the application of the ordinary net present value technique, using costs and revenues stated in nominal terms and discounted by a nominal discount rate. This involves inflating forecast figures by the inflation rate to reflect the amount expected to be received in future currency. The nominal discount rate (a discount rate calculated to allow for inflation) will then convert the nominal (future) cash flows to real (present day) figures. This discounting process is effected by the application of the following formula:

$$RF_j = \sum_{t=1}^T \frac{MF_{jt}}{((1 + p)(1 + i))^t}$$

where : p = period increase in the price level (inflation adjustment)

i = real cost of capital (cost of capital adjustment)

MF = money / nominal forecast cash flow

(Bailey 1977: 27)

The implementation of this methodology calls for the estimation of the future rates of inflation attaching to significant categories of cash flows. A risk attaches to this process in that managers from different divisions may adopt unrealistic inflation forecasts in order to overstate the profitability of projects they are motivating for (Rappaport *et al* 1982: 12). This risk is best ameliorated (as suggested by Bishton above) by ensuring that all assumptions made by managers in their proposals are clearly and completely documented or by having some central authority dictate the inflation rate and methodology to be used in capital budgeting evaluations.

6.6 Real cash flow approach

6.6.1 Description

The Real Cash Flow approach is a step-wise application of the Nominal Cash Flow approach in that the nominal forecast cash flows are first converted into real cash flows by the application of a price deflator (a discount rate based on expected future inflation) and then discounted by the real cost of capital to determine whether the real forecast cash flows will result in a positive net present value project (Rappaport & Taggart 1982: 5)". For this reason, the Real Cash Flow approach is considered to be additional effort over the nominal cash flow approach with little associated additional benefit (Mehta *et al* 1984: 48).

6.7 Choice of approach

Practitioners are faced with a choice between not only the techniques detailed above, but also with the choice of whether to ignore inflation or to accept the treatment of inflation inherent in some of the other capital budgeting techniques e.g. net present value, internal rate of return, discounted payback period.

If the assumptions listed under the gross profit per unit method above are realistic, each of the three methodologies dealt with in Chapter 6 will render the same results. If, however, the assumption relating to the symmetrical action of inflation on revenue, expenses and taxation is removed, the gross profit per unit approach will render a different result (usually overstating the worth of the project concerned) (Rappaport *et al* 1982: 6). It is important to note that the nominal and real gross profit per unit methods will always produce identical results. The significance of the differences in outcomes between the gross profit per unit method and the other two methods will depend on a number of factors including:

1. rate of inflation
2. differences between revenue-inflation and cost-inflation
3. length of forecast period
4. size and timing of forecast taxation flows

From a theoretical and realistic perspective, therefore, the nominal and real cash flow approaches will provide a superior decision-making outcome for the investing entity (Rappaport *et al* 1982:9).

7 Chapter Seven – Research

7.1 Secondary research

The topic of capital budgeting and the capital budgeting decision has been the subject of a large number of primary research studies. These studies were devised by their authors to investigate various issues relating to the implementation of capital budgeting theory, such as:

1. The extent of the use of sophisticated versus naïve capital budgeting techniques
2. The most popular capital budgeting techniques utilised in practice and changes in their utilisation over time.
3. Differences in capital budgeting techniques relating to industry under review, size of the organisation or size of capital budgeting staff complement.

This area of management accounting seems to have generated a large amount of interest relating to whether the theories being developed by academics and practitioners are finding widespread application in commerce. Indeed, it was the objective of the author to evaluate the level of application and sophistication of the capital budgeting process in a sample of South African companies in order to measure the degree to which industry has adopted the theory available to it.

Before analysing the data arising on the survey performed by the author, it is important to place such information in context by examining research results obtained in other academic studies.

7.2 South African research

Research conducted into the degree of implementation of capital budgeting techniques in South Africa rests primarily on six documented studies performed between 1972 and 1995. The findings of these studies were contrasted and compared by Correia (1998: 1 – 18) in an attempt to define a trend over time of capital budgeting practice in certain definable areas such as the growth in the use of discounted cash flow methodologies, changes in the treatment of risk in capital budgeting, procedures relating to costs of capital definition and calculation, the use of post-implementation audits, treatment of inflation and the choice between mutually

exclusive projects. The research conducted by Correia as well as the original survey results were examined in examining the development of capital budgeting practice in South Africa over the past 27 years.

7.2.1 *The comparison of disparate survey results*

Correia (1996: 1) (refer also Rappaport 1979: 101) cautions at the outset of his piece that the drawing of inferences from different surveys may produce conclusions which are inaccurate. In particular, the following elements of any primary research study will influence the results obtained:

1. differences in sample populations
2. differing response rates for each survey
3. differing sample sizes
4. different survey wordings possibly contributing to different response outcomes
5. different survey objectives – certain of the surveys (e.g. Reeve's study in 1981 relating to the treatment of inflation) cited were conducted with the intention of evaluating one particular aspect of capital budgeting practice (Correia 1996: 1).

7.2.2 Survey comparisons

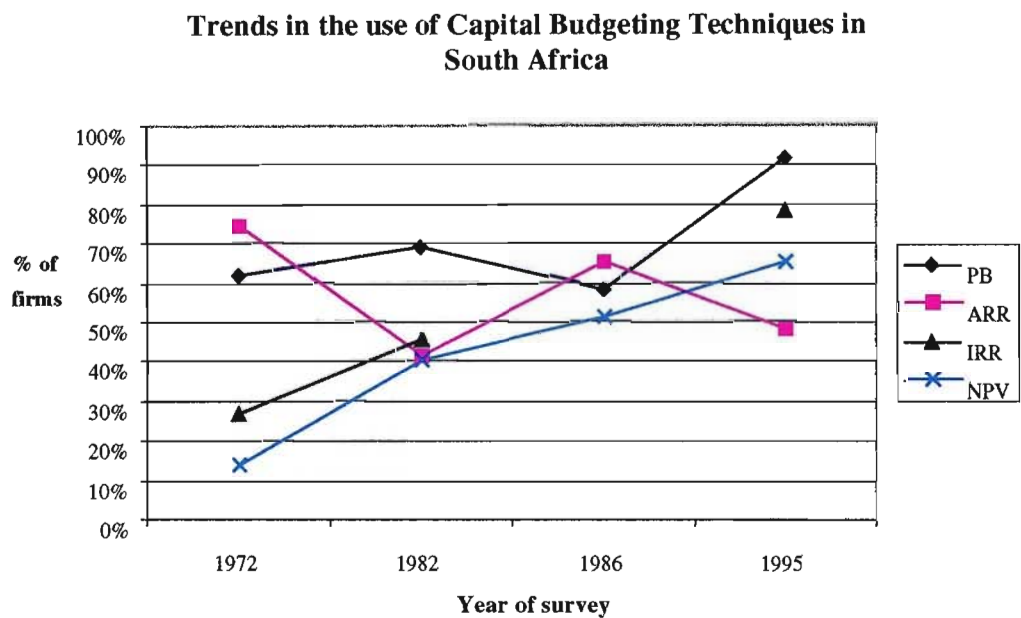
The following South African surveys were examined in the compilation of this dissertation (summarised in a table compiled by Correia 1996: 3):

Year of survey	Year published	Author/s	No. of firms	Response rate	Sample used
1972	1976	Lambrechts, I.J.	48	48%	Largest firms – Financial Mail Top 100
1978	1981	Reeve, R.	50	50%	Largest firms – Financial Mail 100
1982	1986	Andrews, G.S. & Butler, F.	132	26%	Largest firms, 500 firms
1986	1990	Parry, H. & Firer, C.	71	24%	Industrial listed companies on the JSE, 270 firms
1987	1991	Pocock, A., Correia, C. and Wormald, M.	40	32%	Industrial listed companies on the JSE, 126 firms
1995	Unpublished	Coltman, G.	37	43%	Listed firms – industrial holding, clothing, footwear & textiles, and engineering – 85 firms

A close examination of the results of the above surveys, bearing in mind the areas in which such surveys may be inconsistent with one another, brought to light a number of significant trends.

7.2.2.1 Increased use of discounted cash flow methods

Significant growth has been seen in the implementation of discounted cash flow methods (Correia 1996: 3). The survey by Coltman (Correia 1996: 3) (a finding corroborated by the survey results achieved by this author) found the internal rate of return method to be the most popular discounted cash flow method in practice, but a review of the findings of the surveys listed above shows that the increase in the use of discounted cash flow methods is greatest in



respect of the net present value technique. This increase is seen to be greatest in the larger, more capital intensive firms and may be ascribed to the fact that the net present value method is generally accepted to be the most academically correct technique in existence at present.

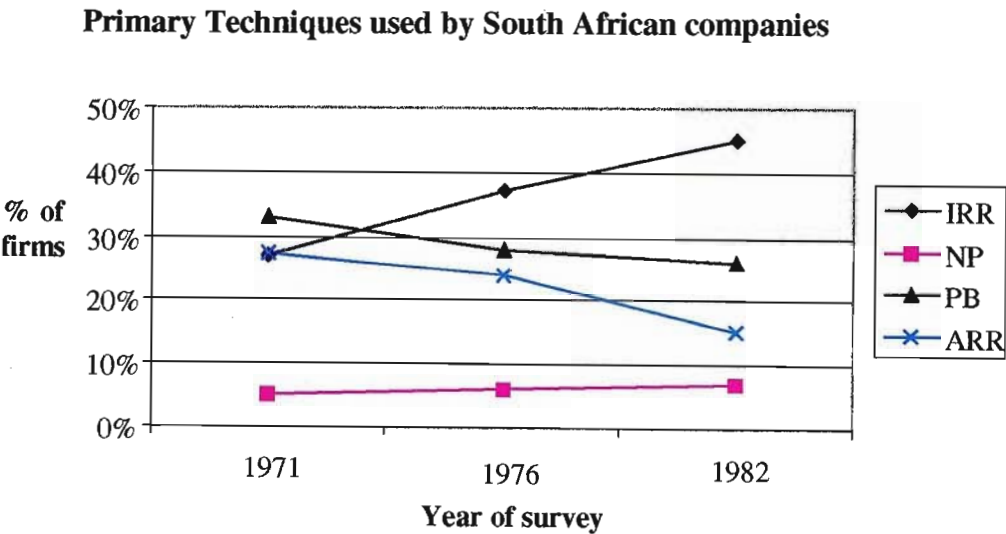
Correia (1996: 4) graphically presents the trend information regarding the usage of the payback (PB), accounting rate of return (ARR), internal rate of return (IRR) and net present value (NPV) techniques as reported in surveys by Lambrechts (1972), Andrews and Butler (1982) and Parry and Firer (1986).

It is clear from the above graph that the discounted cash flow techniques are being used on an increasing basis in practice, with the internal rate of return method most utilised by practitioners (utilisation of 78.3% reported by Coltman against 64.8% usage of the net present value methodology in Correia (1996: 3)).

This increase in the use of discounted cash flow methods is mirrored in studies performed in other countries (refer below). Correia (1996: 5) suggests that the increase in the use of sophisticated capital budgeting techniques may be traced to higher inflation in developed countries as well as the increase in the use of cost-effective, yet powerful computing tools such as spreadsheets. The obvious concern raised at this point is whether these sophisticated techniques are being correctly applied in practice. Where a practitioner does not have a full grasp of the shortcomings of these methods as well as the key drivers underlying each model, the access to a computer does not ensure good decision-making.

It is interesting to note that where research was conducted as to the primary evaluation tool utilised by companies (refer Andrews and Butler (1986: 31)) that the internal rate of return method was found to enjoy dominance and that the increase in the use of the net present value method seen in general has not been at the expense of the use of the internal rate of return as the principal evaluation technique but rather to the declining use of the accounting rate of return and payback methodologies.

The primary technique utilised by companies surveyed over time is represented graphically as follows (Correia 1996: 7):



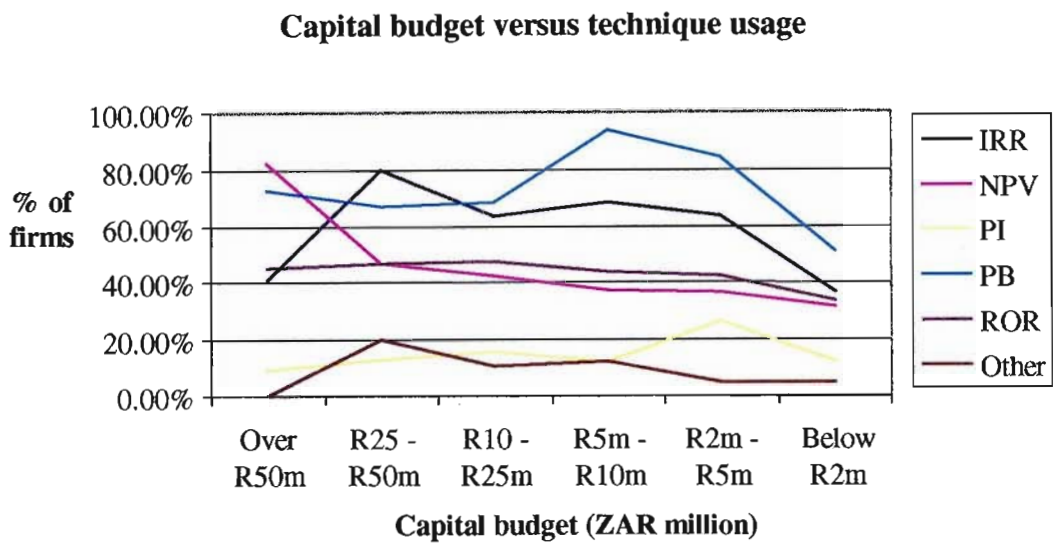
7.2.2.2 Use of DCF methods linked to characteristics of responding firm

Correia (1996: 9) asserts that research has shown that the greater the size of the firm, the more likely it is that the firm will utilise the sophisticated evaluation techniques such as net present value and internal rate of return. In addition, Correia (1996: 9) states that it is more probable that larger firms will utilise the net present value methodology rather than the internal rate of return method. It is important here to bear in mind that the surveys under review probably incorporate some degree of response bias in that larger firms have historically responded at a greater rate than their smaller counterparts – the sample results will therefore overstate the usage of net present value and other sophisticated methods since these methods predominate to a greater extent in larger firms.

Indeed, findings by Andrews and Butler (1986: 33) indicate that not only the size of the firm but also the size of the capital budget of the respondent affects the capital budgeting methods in use. In tabular form, the results recorded by Andrews *et al* may be represented as follows:

Capital Budgeting Methods in use in South Africa						
Technique Employed						
Size of annual capital budget	IRR	NPV	PI	PB	ROR	Other
Over 50 million	40,9%	81,8%	9,1%	72,7%	45,2%	0,0%
R25 million - R50 million	80,0%	46,7%	13,3%	66,7%	46,7%	20,0%
R10 million - R25 million	63,2%	42,1%	15,8%	68,4%	47,4%	10,5%
R5 million - R10 million	68,7%	37,5%	12,5%	93,7%	43,8%	12,5%
R2 million - R5 million	63,2%	36,8%	26,3%	84,2%	42,1%	5,3%
Below R2 million	36,6%	31,7%	12,2%	51,2%	34,1%	4,9%
All respondents	59,5%	39,7%	14,1%	68,6%	41,3%	8,3%

These results may be graphically represented using a line graph to clearly show the increasing utilisation of the sophisticated techniques as the significance of the capital budget increases:



Andrews *et al* (1986:36) also investigated whether the sophistication of the capital budgeting processes used by respondents could be linked to the industry in which they operated. A ‘sophistication index’ was calculated for each respondent on the basis of five factors:

1. Perceived sophistication of primary capital budgeting method used
2. Risk assessment methodologies reported
3. Whether the respondent makes allowances for inflation in the capital budgeting process
4. The sophistication in dealing with mutually exclusive projects
5. Assumptions made in respect of reinvestment of project cash flows.

Each of the above factors was weighted using ratings agreed upon by financial analysts and combined into a single sophistication index (reported below). In addition, the standard deviation (measured as percentage of mean) of the sophistication indexes of respondents within each sector was calculated in order to determine how significant intra-industry differences in sophistication are.

The results of this investigation are as follows:

Sophistication in capital budgeting by industry category		
Industry Sector	Mean Sophistication Index	Standard Deviation
Coal, petroleum and chemical industries	90.1	30.6
Supermarkets, department and variety stores	88.8	29.1
Automotive products	78.9	30.7
Mining	77.1	33.7
Miscellaneous manufacturing	75.0	36.5
Food, beverage and tobacco	74.4	30.2
Other	71.5	38.5
Primary metals and fabrication	68.6	28.3
Wood, pulp and paper	65.0	29.8
Electrical and electronics	64.5	41.9
Construction and industrial equipment	52.0	47.9
Household and personal products	49.7	37.8

As is obvious from the information presented above, the more capital intensive industries (who we can assume expend more on capital expansion and maintenance) have a higher level of sophistication in their evaluation of capital projects. Andrews *et al* (1986: 33) utilised linear regression on this data and found statistically significant results to support the following contentions:

1. Larger firms are more sophisticated in capital budgeting techniques than smaller firms. In an American study performed by Moore & Reichart (1983: 639) on 298 Fortune 500 companies it was found that the implementation of the newer, more sophisticated

capital budgeting techniques was uneven across different industries – suggesting differing levels of capital budgeting sophistication in different industries.

2. Firms having larger capital budgeting expenditures use more sophisticated capital budgeting techniques.
3. Firms that are using more sophisticated capital budgeting techniques are growing faster.
4. Firms that are using more sophisticated capital budgeting techniques are more profitable (Andrews & Butler 1986: 36). This contention has been refuted both by Klammer (1973) and Haka, Gordon & Pinches (1985) but supported by Coltman (in Correia 1996: 14) and Kim and Farragher (1983).

7.2.3 Conclusion

An examination of the above information allows us to make some important conclusions regarding the state of capital budgeting practice in South Africa. It is clear that the level of capital budgeting sophistication in existence is increasing over time, but that significant room for improvement still exists. Areas where practitioners could increase the accuracy and theoretical correctness of their work include the inclusion of adjustments in their evaluation process for inflation, risk, taxation issues and for a more in-depth understanding of the techniques which they implement.

7.3 International research

In order to augment our understanding of the South African capital budgeting position *vis a vis* the rest of the world, a review was performed of the studies completed internationally in the past 30 years.

7.3.1 *Increased importance of discounted cash flow techniques*

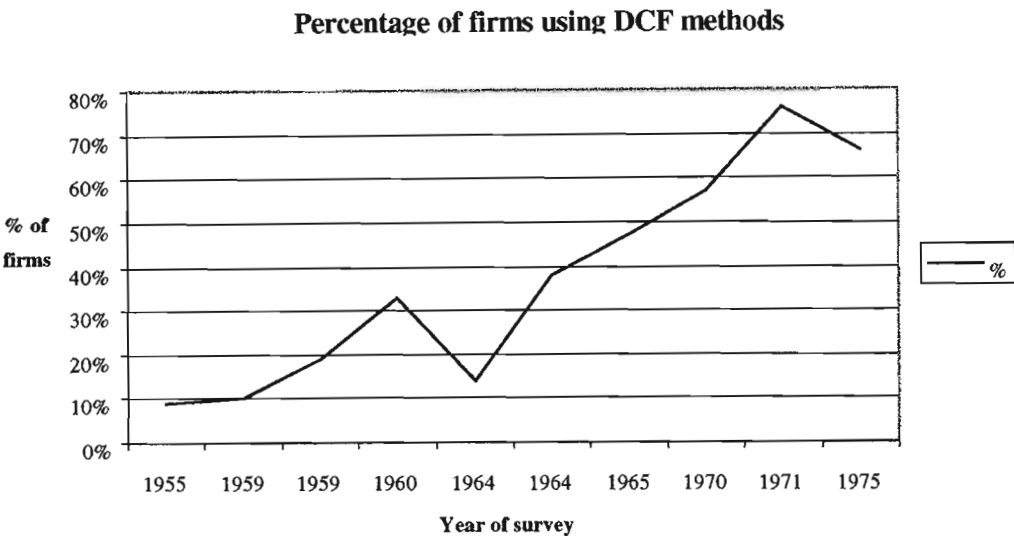
In a very similar study to the Correia paper quoted above, Rosenblatt and Jucker (1979: 63 – 69) attempted to measure the use of discounted cash flow capital budgeting techniques through the examination of a spectrum of studies performed between 1960 and 1975. Although Rappaport (1979: 101) and others have cautioned against accepting such comparisons at face value, the results of the survey show significant increases in the use of discounted cash flow methods as was reported in the South African context by Correia (1996: 14).

The surveys examined and the results derived from each were as follows (1979: 64):

Percentage of Firms Using Discounting Methods		
Year	%	Reference
1955	9	Robichek AA & MacDonald JG 1966. Financial Management in transition, Long Range Planning Service. Stanford Research Institute, Menlo Park, California, Report No. 268, January.
1959	10	Istvan DF 1961. Capital expenditure decisions: How they are made in large corporations. Bureau of Business Research: Bloomington.
1959	19	Klammer TP 1973. The Association of Capital Budgeting Techniques with Firm Performance. Accounting Review, Fall, 353 - 364.
1960	33	Miller JH 1960. A glimpse at practice in calculating and using return on investment. National Association of Accountants Bulletin. Vol. 41, June, 65 - 76.
1964	14	Christy GA 1966. Capital Budgeting : Current Practice and their efficiency. Bureau of Business and Economic Research: Eugene.
1964	38	Klammer TP 1973. The Association of Capital Budgeting Techniques with Firm Performance. Accounting Review, Fall, 353 - 364.

Percentage of Firms Using Discounting Methods		
1965	47	Robichek AA & MacDonald JG 1966. Financial Management in transition. Long Range Planning Service. Stanford Research Institute: Menlo Park.
1970	57	Klammer TP 1973. The Association of Capital Budgeting Techniques with Firm Performance. Accounting Review, Fall, 353 - 364.
1971	76	Fremgen JM 1973. Capital Budgeting Practices: A Survey. Management Accounting, May, 19 – 25.
1975	66	Petry GH 1975. Effective use of capital budgeting tools. Bus. Horizons, October, 57 – 65.

The trend behind these results is easier to identify when presented graphically as follows:



It is clear from the above that practitioners have been found to be increasingly using the more sophisticated discounted cash flow methodologies. A similar study performed by Stanley & Block (1983: 61 – 72) designed to research the management and financial variables influencing the capital budgeting decision in multi-national corporations in the 1980’s reported an increase in the utilisation of sophisticated capital budgeting techniques over time (with the greatest increases in utilisation being seen in the implementation of the internal rate of return (Stanley & Block 1983: 65). Stanley *et al* also reported a ‘significant relationship’ between the size of the firm surveyed and the technique used as primary evaluation tool. This finding replicates

that of Petry (1975:65) who found that larger firms tend to use a greater number of capital budgeting techniques than their smaller counterparts. Principally, Stanley & Block were able to show (concurring with the results of Andrews *et al* above) that firms in the upper quartiles of those sampled were more likely to use the internal rate of return method, and less likely to use accounting rate of return or payback as the primary evaluation technique (Stanley *et al* 1983: 65).

In light of the logical difficulties involved in comparing disparate survey information and given the fact that much of the information utilised is fairly dated, research by Pike (1988: 341 – 351) is worthy of a mention. Pike sent the same survey to the same sample of companies in 1980 and 1986 and compared the response information. This approach effectively eliminates problems relating to survey question differences as well as differences in survey population. The responses relating to the so-called financial appraisal techniques were as follows (Pike 1988: 344):

CAPITAL INVESTMENT EVALUATION METHODS 100 LARGE UK FIRMS	1986 %	1981 %
Payback	92	81
Average Accounting Rate of Return	56	49
DCF Methods (IRR or NPV)	84	68
Internal Rate of Return	75	57
Net Present Value	68	39

The above information was used by Pike (1988: 346) to make the following observations:

1. There has been a marked increase in the adoption of the net present value methodology although the internal rate of return is still the dominant technique in use. This confirms the earlier findings of Stanley *et al* (1983: 65) and Oblak & Helm (1980: 38).
2. The increase in the use of sophisticated capital budgeting techniques has not come at the expense of the non-sophisticated methods such as the payback and accounting rate

of return methods – managers are more content to use a combination of appraisal methods to gain a more representative view of the risk, return and timing of project cash flows (64% of firms were found to be using 3 or more methods; 74% utilising a combination of naïve and sophisticated methods). The average degree of sophistication of practitioners as far as capital budgeting is concerned, however, is seen to be increasing over time (this contention was supported by the respondents, 60% of whom stated that they believed that their capital budgeting systems had become more sophisticated between the first and second sample dates (1980 to 1986)).

3. Respondents felt that the shift towards the consistent use of the sophisticated methods increased the effectiveness of project evaluation and control (Pike 1988: 350).

7.4 Primary research

The primary research conducted in the completion of this dissertation was composed mainly of the design, distribution and interpretation of questionnaire information. Questionnaires were sent to the designated population in October 1997. Questionnaires were again distributed to non-responding companies in December 1997 in order to ensure that the sample of responses received would be statistically significant in terms of the questions posed and as representative as possible of the underlying population. The statistical analysis of such research data received was conducted in December 1999 during the final drafting of the dissertation with the assistance of the University of the Witwatersrand's statistics department staff.

7.4.1 *Population characteristics*

The population of companies sampled during the primary research study was composed of the companies in the Financial Mail's 1997 Top 100 companies ranked by total assets as well as the Top 100 companies ranked by current period capital budget (refer to Appendix B for a list of the population concerned). The inclusion of the Top 100 capital spenders increased the population from 100 to 132 companies (the increase related to companies ranking within the Top 100 capital budgets but which did not fall with the Top 100 companies ranked by total assets).

Responses were received from 46 companies representing a response rate of 35%. This total number of responses was achieved after a secondary mailing of questionnaires to non-responding companies during the latter part of 1997. It is interesting to note that 62% of questionnaires received were as a result of the first mailing and 38% as a result of the second. This underlines the importance of the second distribution of questionnaires in achieving a statistically significant sample. The overall response rate compares well with that achieved in the six South African studies cited by Correia (1996: 3) in which a mean response rate of 37% was reported.

83% of respondents provided information regarding the capital budget of the company for the forthcoming financial period. These 38 companies represent a planned capital spend of R12.487 billion or an average of R328.6 million per respondent.

7.4.2 *Response efficiency*

An examination of the designation of the responding officer listed in questionnaires received indicated that persons of adequate seniority were providing response information with the majority (78%) being financial directors, group financial managers or capital budgeting managers. This addresses to an acceptable extent the risk that the research data is tainted by inaccurate information furnished by persons with inadequate access to the correct response information.

The issue of response bias is required to be investigated in interpreting the results of any research. Response bias (Scapens & Sale 1981: 403) in the context of this dissertation would refer to the possibility that respondents to the questionnaire would exhibit higher than average levels of capital budgeting sophistication as it is those companies who implement best practice measures who are most motivated to respond or that respondents were not correctly interpreting questions posed in the questionnaire and providing inappropriate responses which would be incorrectly interpreted.

The issue of response bias was evaluated in two different ways. Firstly, telephonic discussions were held with two respondents (New Africa Investments Limited and Engen Limited) as regards their responses to the questionnaire in order to ensure that these respondents correctly interpreted the questions posed and that no pervasive misunderstandings skewed the research data obtained. No evidence of such misunderstandings was in evidence in the discussions held, nor were enquiries received from recipients of the questionnaire as to the actual intention behind the questions posed. In addition, the questionnaire was vetted by several experienced researchers from the Department of Accountancy and the Department of Business Administration at the University of Natal (Pietermaritzburg) to ensure understandability, ease of use and efficient capturing of respondent information. Secondly, the characteristics of respondents and the responses received were investigated on a heuristic basis to evaluate the possibility of outlier responses being consistently reported – no evidence of this type of bias was found.

7.4.3 Capital budgeting process findings

7.4.3.1 Capital budgeting staff

As detailed above, respondents represented an average of R328.6 million forecast capital spend for the forthcoming budget period. It was interesting to note that only 23.81% of respondents (by number) have a capital budgeting department or designated staff complement employed to evaluate capital budgeting issues. In order to evaluate whether the use of the average capital spend to describe the population is misleading, the percentage of forecast capital spend utilising dedicated capital budgeting staff was investigated and found to be somewhat higher at 32.54% (this means that 32.54% of the R12.487 billion was reported to be expended by companies with capital budgeting departments). This figure appears to be reasonable particularly in the light of the fact that other companies utilise their management accounting staff to perform detailed project financial analysis and yet cannot claim to have dedicated capital budgeting staff. Companies with such staff complements report an average of 7 persons in such divisions.

7.4.3.2 Sourcing of capital investment proposals

81.40% of respondents claim to be sourcing capital budgeting proposals from all employees while the balance rely on finance staff to research and propose investments. This response is surprising from the perspective that in most industries it is the operational rather than finance staff who are best placed to evaluate the need for capital investment, particularly as relates to the replacement of productive assets. In addition, it contradicts the established best practice principle that all employees in the business should be invited to contribute towards the sourcing and evaluation of capital investments. This practice is designed to engender employee buy-in as regards capital investments made, as well as ensuring that an adequate stream of high-quality projects and investments are made known and evaluated by the business.

7.4.3.3 *Capital budgeting manuals*

66.66% of respondents report the existence of a capital budgeting manual which describes in detail the procedures to be followed by employees in the motivation and evaluation of capital projects within the overall capital budgeting process. The fact that a third of respondents have not committed capital budgeting policy to an authorised and prescribed document goes against the best practice propagated by academics, and impacts significantly on the following areas:

1. consistency in evaluations performed
2. treatment of significant project issues such as inflation and risk
3. ensuring authorisation of projects in line with company policy
4. placing the motivation, evaluation, authorisation and implementation of projects within a standardised framework which maximises the level of control and feedback to the employees concerned.

It is informative in this context to note that of the 33.33% of respondents who do not have a capital budgeting manual (or equivalent document) 85.71% claim to have a formalised capital budgeting framework. What is at issue here therefore is to what degree the components of this framework are communicated to all concerned and the materiality of the risk that a lack of a formal document may translate into operational capital budgeting errors.

7.4.4 *Capital investment evaluation process findings*

The second section of the questionnaire survey related to the investment evaluation process (the 'Analysis' process detailed in section 4.6 above). The findings in this area mirror to a large degree those reported by Correia (1996: 1 – 18) as is shown below. The questions posed in this section related to the existence of pre-evaluation elimination of unsuitable projects, capital budgeting techniques utilised by respondents and the primary evaluation tools used.

7.4.4.1 *Intermediate screening of projects*

95.35% of respondents reported that an intermediate screening of projects takes place thereby reducing wasted evaluation effort on projects which do not fit the strategic plan of the firm or which are clearly not feasible or profitable. This finding mirrors that of Oblak & Helm (1980: 38), Mukherjee (1987: 39), Petty, Scott and Bird (1975: 159 – 172) and Hammer, Carter & Usry (1993: 655). When requested to detail the basis of such intermediate screening decisions the following results were obtained (note that the results add up to greater than 100% as many respondents use a combination of the criteria provided):

1. Prescribed financial criteria – 78.05%
2. Qualitative criteria – 53.66%
3. Discretionary calculations – 39.02%

It would appear therefore that this intermediate screening process relies heavily on financial indicators to eliminate non-viable projects (seen from the high emphasis on the prescribed financial criteria and the use of discretionary calculations) but that qualitative considerations also play a material role. Research indicates that these qualitative considerations often relate to the evaluation of cost-centre investments such as the installation of medical facilities, child-care or entertainment facilities (Bishton 1979: 32).

7.4.4.2 *Project evaluation responsibility*

Respondents were requested to detail which party/ies within the organisation were responsible for the evaluation of capital investments. These responses indicated a strong tendency for such analysis to be performed by the department head of the division proposing the investment. The response results detail were as follows:

1. Department head – 83.33%
2. Capital budgeting staff – 23.81%
3. Project proposer – 21.43%

The total responses received tally to 129% as a significant minority (24%) reported that evaluation of projects is performed by more than one of the above parties. The preference for

performing capital budgeting evaluations at divisional / departmental head level is consistent with defined best practice in that it allows management with sufficient experience in dealing with capital investments as well as the appropriate level of experience in the industry concerned to evaluate and designate those projects to be accepted.

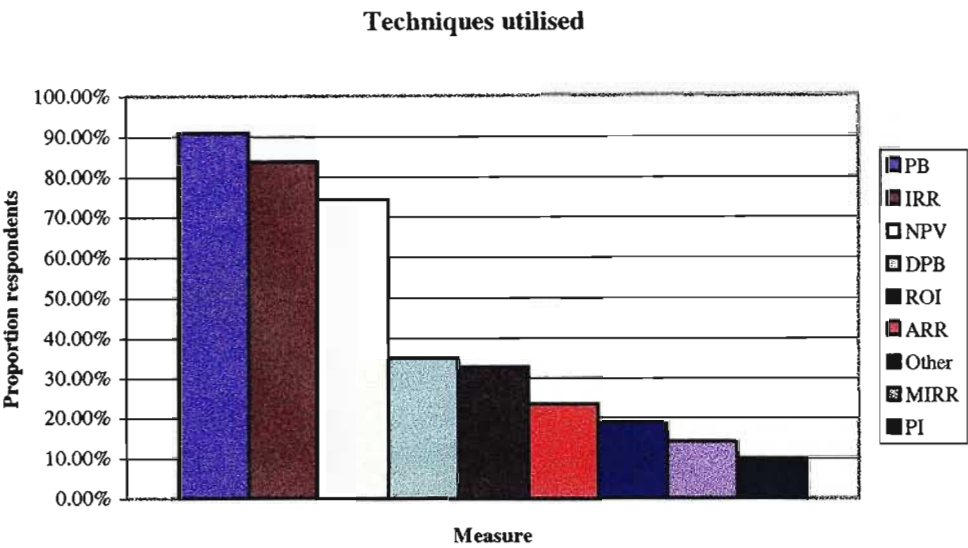
7.4.4.3 Capital budgeting techniques utilised

The section of the questionnaire which investigated the techniques utilised to evaluate projects required respondents to detail those measures regularly utilised and those measures utilised as primary evaluation techniques.

The responses received in respect of the measures regularly utilised revealed that most organisations use several techniques with the reported average techniques per respondent amounting to 3.63. Techniques utilised (in descending order of popularity) are as follows:

1. Payback period – 90.70%
2. Internal rate of return – 83.72%
3. Net present value – 74.42%
4. Discounted payback period – 34.88%
5. Return on investment – 32.56%
6. Accounting rate of return – 23.26%
7. Other methods – 18.60%
8. Modified internal rate of return – 13.95%
9. Profitability index – 9.30%

The above findings are best interpreted when reviewed in graphic format as follows:



Sorted in descending order it is clear that three principal techniques (payback period, internal rate of return and net present value methods) are the most important evaluation techniques used in practice. It is also clear that the other five techniques included in the questionnaire are used in a significant sample of the respondents’ processes but that a large difference exists between the extent of the implementation of such measures – the fourth-most popular technique after the net present value method is that of the discounted payback method but is reported to be used 40% less. This large disparity between the popularity of the implemented measures is in line with the findings of Correia (1996: 3) as well as the strength of the academic arguments for their use.

When asked to specify the primary evaluation tool utilised, 53.49% of the respondents specified more than one measure which may indicate that organisations do not, as a matter of policy, rely on a single hurdle measure or evaluation benchmark. This practice is not only advisable from a common-sense perspective, but also recommended academically in the sense that each technique developed to date has particular strengths and weaknesses which make it more or less useful in particular practical circumstances.

Excluding the multiple-measure responses from the sample leaves the following primary-technique results:

1. Internal rate of return – 60.87%
2. Net present value – 17.39%
3. Return on investment – 8.70%
4. Payback period – 8.70%

The above would indicate that the internal rate of return is the most popular primary evaluation tool followed by the net present value technique. This finding is consistent with that of other South African studies – the magnitude of the difference in utilisation of internal rate of return and net present value methods is far higher than that reported by others. It is suggested that the exclusion of the multiple-measure responses leaves a sample which is not representative of the population as a whole and that to conclude that the internal rate of return is more than three times more popular than the net present value method would be incorrect. This conclusion is borne out by an examination of the multiple-measure responses – in all cases where internal rate of return is listed as one of the primary evaluation tools utilised, so too is the net present value method.

Although it is considered ill-advised to rely on the reported primary evaluation technique information, it is important to place in context the reported usage of the three most popular evaluation tools namely, the payback period, internal rate of return and net present value methods. In the paper published by Correia (1996: 3) the research findings of a study by Coltman (unpublished) which was conducted in 1995 reported very similar usage percentages of these three methods. In attempting to identify a trend in the utilisation of these central methods, one is able only to show that in the two years between the Coltman study and the questionnaire survey performed by this author that the use of the payback period remained static, the use of the internal rate of return method increased marginally by approximately 4% and the use of the net present value tool increased significantly by approximately 9%. These findings reinforce those of Pike (1988: 346) reported above who claimed that the increase in the use of sophisticated techniques has not come at the expense of the other less sophisticated

ones but rather that firms are using a more comprehensive spread of measures to evaluate investment opportunities.

7.4.4.4 Improvement in capital budgeting processes

When asked to respond as to whether the capital budgeting process has improved in the preceding five year period, 73.81% of respondents claimed that the process had indeed improved. It is interesting to interpret this assertion in the light of the fact that 94.12% of respondents claimed not to have changed their primary evaluation techniques in the preceding five years.

7.4.5 Treatment of inflation

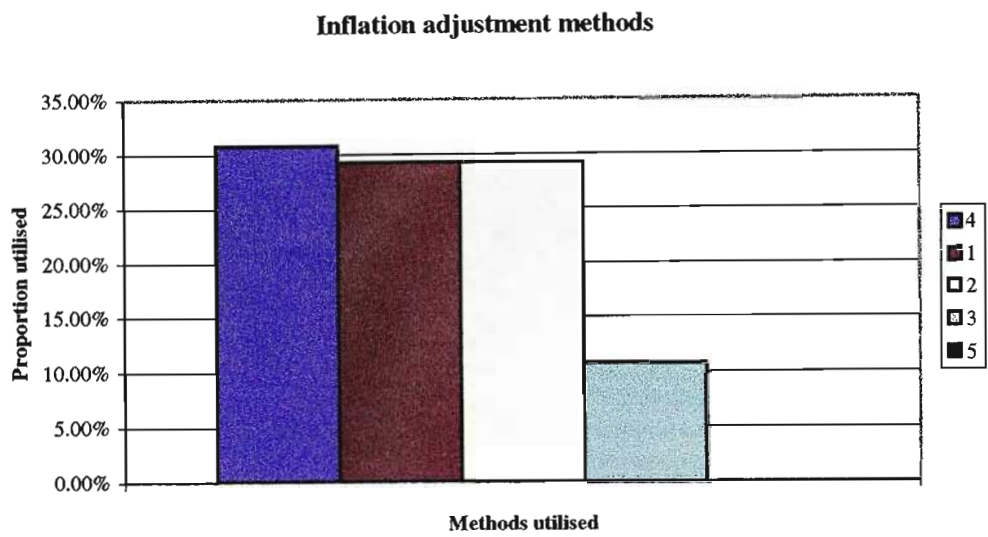
In the section investigating the recognition and treatment of inflation in the capital budgeting process, it was found that 9.30% of respondents claim to ignore inflation in the evaluation of potential capital projects. This clearly represents a significant deviation from recommended best practice from an academic perspective and, given the materiality of the impact that inflation can have on the profitability of investments undertaken, introduces a major unnecessary inaccuracy into the evaluation and forecasting process.

When presented with a selection of the more common inflation adjustment methods and requested to highlight those methods regularly used by the companies concerned, respondents exhibited no clear preference showing that each method (with the possible exception of specifying cash flows in future prices and discounting by a nominal weighted average cost of capital) is used to a greater or lesser degree in practice.

Detailed findings were as follows:

1. Specify cash flows at constant prices and discount using a real rate of return – 29.23%
2. Utilise a general rate of inflation for all costs and revenues – 29.23%
3. Specify cash flows in future prices and discount using a nominal cost of capital – 10.77%
4. Utilise different rates of inflation for costs and revenues – 30.77%
5. Other method – 0.00%

These findings may be graphically represented as follows (using the numbers associated with the descriptions above):



It is clear from the above illustration that of the four methodologies suggested for practitioner selection, the three most popular inflation adjustment approaches are utilised almost as frequently as each other. It is important to note that these three methodologies are the simplest detailed in the literature and essentially involve the recognition of inflation in its most basic form and assuming a uniform impact thereof on the cash flows of the business (both of a revenue and of a cost nature).

As was detailed in Chapter Six above, the technically most correct method of providing for inflation in project evaluation is to estimate the cash flows to be received by the business in nominal terms, using different forecast rates of inflation for the most significant classes of cash flow (e.g. categories of revenue and significant costs such as wages and raw material inputs). It was noted above that although this method provides the user with the potential for a more accurate calculation and evaluation process, the task of estimating differing rates of inflation for each revenue and cost stream may be sufficiently difficult to perform accurately as to nullify the potential benefits thereof. The results achieved above bear this out and would appear to indicate that although 90.70% of respondents consider inflation in their evaluation process the consideration thereof usually merely involves the assumption that inflation will

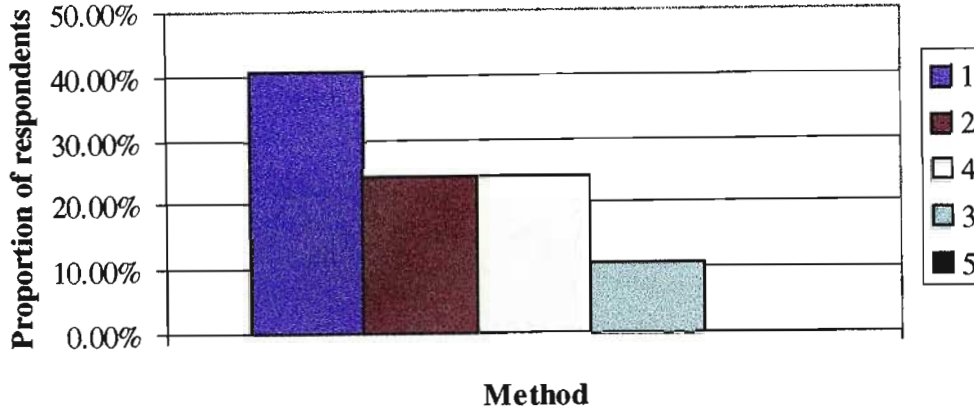
affect revenue and cost cash flows equally (equivalent to the gross profit per unit methodology detailed in Chapter Six above).

This assertion is clearly borne out by the responses received in respect of which technique is used most often by businesses in the adjustment for inflation:

1. Specify cash flows at constant prices and discount using a real rate of return – 40.54%
2. Utilise a general rate of inflation for all costs and revenues – 24.32%
3. Specify cash flows in future prices and discount using a nominal cost of capital – 10.81%
4. Utilise different rates of inflation for costs and revenues – 24.32%
5. Other method – 0.00%

These results, graphically depicted below, show a clear predilection for the specification of forecast cash flows in constant currency and discounting using a real rate of return. This methodology has the advantage that it is simple and does not require the specification of the effect of inflation on the company but does not make allowance for the fact that certain forecast cash flows, such as taxation wear and tear allowances, will have a constant annual currency amount (where the write-off is calculated on the straight line basis) but differing values to the business under inflation. The utilisation of this technique may lead to inaccuracies in the capital budgeting decision-making process if inflation is a significant factor in the economy in which the investment is to perform or if the quantum of non-inflation adjusting cash flows (such as the wear and tear flows mentioned above) are material in relation to the aggregate flows of the project as a whole.

Primary inflation treatment method



7.4.6 Post-implementation audit findings

7.4.6.1 Implementation of post-implementation audits

Respondents were requested to participate in the investigation of the use and perceived usefulness of post-implementation audits in the capital budgeting process. In this investigation, practitioners were requested to disclose whether they implemented some form of post-implementation audit and to consider the applicability of certain possible benefits of the PIA process.

87.50% of respondents claim to implement post-implementation audits in their organisations. The fact that 12.50% of the companies participating in the survey do not implement such procedures is unexpected, given the many benefits to be derived therefrom (examined under section 4.11.3 above). In addition, the fact that the companies participating in this survey are of the largest in South Africa (and therefore more likely to exhibit greater capital budgeting sophistication) must surely indicate that the use of post-implementation audits in other, smaller businesses is significantly lower. The non-implementation of PIA's is another significant deviation from benchmarked best-practice and represents an area in which business can choose to improve the efficiency and effectiveness of their capital budgeting operations. The ability of a business to learn from its experiences and to effectively measure performance and reward achievers is considered key to the establishment and maintenance of competitive advantage –

to comprehend why 5 of the 40 companies responding to this section, spending an average of R328.6 million on capital expenditure each, do not have a formal process of evaluating projects on an ex-post basis is difficult.

7.4.6.2 Benefits of the post-implementation audit process

In investigating the perceived benefits of the post-implementation audit process, respondents were presented with a list of six possible benefits and asked to disclose their opinion as to whether they agreed, were neutral or disagreed with the potential benefits listed. Their responses were graded using a 7 point Likert scale according to the following scale: 1 – Strongly disagree, 2 – Disagree, 3 – Slightly disagree, 4 – Neutral, 5 – Slightly agree, 6 – Agree, 7 – Strongly agree.

In descending order of ‘agreement’, the following responses were received (with the mean response listed after perceived benefit):

1. Ensure improvements in future planning – 6.35
2. Evaluate outcome of capital budgeting proposals – 5.88
3. Delineate and remedy difficulties early in project life – 5.24
4. Evaluate management expertise in project appraisal – 5.23
5. Discourage bias in project proposals – 4.28
6. Use in employee compensation or evaluation process – 3.27

From the above findings it is clear that with the exception of the last potential benefit listed, practitioners subscribe in varying degrees to the belief that the post-implementation audit process significantly assists the business in a number of areas relating to capital budgeting. The strongest benefit listed is that of the post-implementation audit’s ability to assist the business ‘learn’ from its experiences by pinpointing areas of weakness in which improvements could be made in the future.

7.4.7 Correlation statistics

A fair proportion of the research studies examined in the compilation of this dissertation considered (either with or without statistical evidence supporting such consideration) whether the sophistication of respondent capital budgeting processes was correlated to the size of the business or perhaps the existence of dedicated capital budgeting staff. It was decided to investigate these two issues statistically in the course of the primary research undertaken by the author.

7.4.7.1 Relationship between capital budget size and capital budgeting sophistication

In the first instance, it was decided to investigate whether a statistically significant relationship existed in the research sample between the evaluation techniques utilised and the size of the capital budget for the forthcoming period. Two assumptions are inherent in this test – firstly, that companies with larger capital budgets will tend towards greater sophistication, and secondly, that the forecast capital budget for the forthcoming year is a useful indicator of present capital spend (as respondents' information relates to current capital budgeting practice it would be optimal to compare current capital spend with current capital procedures).

The Fischer two-tail statistical test (designed to measure the correlation between two sets of data in a table-wise manner – comparable to the popular Chi-square test but less demanding in terms of the number of observations required in order to make a statistically valid conclusion as regards the correlation of the data sets) was utilised to measure the correlation between capital budget size and the sophistication of the company concerned. In this regard, it was determined that respondents with capital budgets in excess of R180 million would be deemed to be large from a capex perspective while those with budgets under this level would be deemed to be small (R180 million is the median observation for capital budget from the sample). It was found that a statistically significant relationship existed between the size of the firm and the usage of the 'sophisticated' evaluation tools (i.e. discounted payback period, internal rate of return, modified internal rate of return and net present value). The Fischer 2-tail score for this relationship amounted to 0.494 (a score of 0.25 and lower indicates two data sets which are significantly different from each other and are deemed to be statistically unrelated). Interpreted differently, this means that 49.4% of the behaviour of one data set may

be explained by fluctuations in the other. This means that half of the changes in perceived sophistication of the methods used by respondents may be ‘explained’ by differences in their size. The reader will note that this proportion, whilst showing that a relationship does exist, is far from being definitive – it is important to note though that a relationship between the size of the firm and the sophistication of the capital budgeting methods implemented was found which is deemed statistically significant.

7.4.7.2 Relationship between capital budgeting department and evaluation sophistication

Further it was investigated whether a statistically significant relationship existed between the use of a dedicated capital budgeting department and the use of the sophisticated capital budgeting techniques. The Fischer 2-tail score for this test was 1.00 indicating that all firms reporting the use of a capital budgeting department use a sophisticated technique as their primary evaluation tool.

7.4.7.3 Relationship between improvement in capital budgeting process and techniques utilised

As detailed above, respondents were asked to report whether they believed that their capital budgeting process had improved over the preceding five year period. 73.81% reported that they believed that the process had indeed improved in spite of the fact that 94.12% had not changed their primary evaluation tool during the period. It is interesting to note that a statistically significant relationship was found to exist between the use of the sophisticated evaluation tools and the perception that the process was improved. The Fischer 2-tail score for this correlation amounted to 0.734. This is perhaps confirmation of the fact that practitioners understand and support academics’ contention that the sophisticated techniques are superior to their unsophisticated counterparts.

8 Chapter 8 – Conclusion

8.1 Achievement of objectives

When capital budgeting was chosen as the research topic for this dissertation, four primary objectives were set. In brief, these objectives were to:

1. Examine the capital budgeting techniques available for use in practice.
2. Examine the degree of implementation of such techniques in practice found by other primary research studies conducted.
3. Conduct empirical research into the degree of implementation of current capital budgeting theory in South Africa at present.
4. Predict the future direction of capital budgeting practice in South Africa, and the likely usefulness of the further developments in this field of academia.

In Chapters 4 – 7, objectives 1 to 3 have been addressed through a review of secondary and primary research results. In summary, research would appear to indicate certain key findings as regards capital budgeting theory and practice.

Firstly, it is clear that a great deal of effort has been expended by academics in the study and development of the body of theory relating to capital budgeting. The greater part of the development of such theory took place during the 1970's with the development of the technically superior sophisticated techniques achieving prominence during this period.

Capital budgeting theory continues to develop with particular emphasis being placed at present on methods of dealing with risk through the application of management science techniques and the further enhancement of techniques which seek to accurately quantify risk adjusted hurdle rates for use in discounting calculations.

Practitioners were found to generally possess a good knowledge of the major techniques recommended by academics (reviewed in Chapter 5). This would suggest that the process of transferring knowledge from academics to practitioners is operating effectively (this assertion is supported by the fact that no enquiries received from practitioners consulted in the

compilation of this dissertation related to the nature of the techniques named in the questionnaire).

Practitioners are increasingly implementing capital budgeting decision-making on the basis of a basket of measures rather than relying on a single hurdle rate or profitability indicator. It is the author's contention that this is indicative of a decent understanding on the part of those in practice that each technique has particular strengths and weaknesses which contribute to and detract from the quality of the information provided by their use.

The degree of implementation of the sophisticated techniques has increased markedly, contributing directly to greater quality of decision-making. When placed within the context of other research studies performed in South Africa, it was found that respondents are using all techniques more often than was previously reported. This supports not only the contention that aggregate decision-indicators are in use, but also that practitioners are increasingly comfortable with the application of the sophisticated techniques.

Responses received from practitioners gives credence to the belief that increasing attention is being paid to the 'value-added' dimensions of capital budgeting i.e. those issues which contribute to greater accuracy and value of information produced, but which are not critical to the implementation of most evaluation techniques e.g. quantification of risk and the adjustment for inflation.

8.2 Future directions

The final objective of this study was to compare the research findings achieved by the author in the South African context with those found in international studies in order to attempt to reach some conclusions as to the possible future direction of capital budgeting theory and practice in South Africa. The premise underlying this objective is that capital budgeting in South Africa lags behind that of more developed economies and that the path followed by such countries is a good indicator of the steps to be taken domestically in the future.

The result of the comparison of international and domestic research is, perhaps surprisingly, that in the main no significant lag is distinguishable between capital budgeting practice domestically and abroad. The degree of implementation of sophisticated evaluation techniques

found by the author compares favourably with similar European and American studies examined as does the findings relating to inflation, risk and the implementation of an integrated capital budgeting implementation framework.

Given the fact that South African practice appears to be at least as sophisticated as that of our international counterparts it is necessary to look to academic theory to judge where future changes in capital budgeting practice will emanate from. In this regard, the author posits that a number of trends will extend into the future.

8.2.1 *Identified trends*

The first trend which has been identified in the last thirty years of capital budgeting practice, is the increase in the use of the sophisticated evaluation techniques, in conjunction with the historically favoured techniques such as payback and accounting rate of return. The use of a basket of measures to evaluate a particular capital investment is expected to extend into the future as a result of a number of factors the most significant of which include the increase in the sophistication of practitioners, the availability of powerful software at relatively low cost and an increasingly enforced shareholder requirement that management act in line with their fiduciary duty in a logical and justifiable manner. A practical example of the impact of shareholders enforcing their will on companies in which they are investors is the recent forced dismissal of Coca-Cola Chief Operating Officer, Doug Ivester by two major shareholders in the company, Warren Buffett and Herbert Allen (Morris & Sellers 1999: 32).

The second trend identified is that greater and greater attention will be paid to the quantification of the weighted average cost of capital applicable to the investment concerned. In this regard, effort will continue to be expended in the calculation of the enterprise-wide cost of capital, as well as the calculation of suitable divisional and departmental hurdle and discount rates. This trend is underlined by an increasing awareness in practice of the high cost of equity capital and the greater interest of a broader spectrum of investors in the performance of their investment in the company.

The third significant trend expected to impact theory and practice in the future is the increasing importance attached to the quantification and pricing of investment risk in the evaluation of potential projects. While it is common cause that projects of greater perceived

risk will be required to compensate their investors for the increased risk (Brigham & Gapenski 1996: 283), the inclusion of this factor in the capital budgeting process, other than on a heuristic basis, has been limited to date. It is expected that management science and corporate finance techniques will be of the most assistance in this area with the development of tools such as the Capital Asset Pricing Model (CAPM), sensitivity analysis, scenario analysis and Monte Carlo simulation.

The evidence gathered in the primary research study would appear to indicate that the link between academics and practice is a strong one – the key capital budgeting processes, tools and techniques appear to be known to those in practice and implemented in a manner which is consistent with the intention of those most involved in their development. This would indicate that future developments and refinements of these techniques and others stand a good chance of being accurately transferred to practitioners where implementation is to take place.

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Appendix A – Covering letter & questionnaire

Private Bag X01
Scottsville
3209

6 October 1997

The Financial Director

Company Name

Johannesburg

2001

Dear Sir / Madam

COMPLETION OF RESEARCH QUESTIONNAIRE

I am at present conducting research into the capital budgeting practices of the Financial Mail's 1997 Top 100 Companies (by Fixed Assets and by Capital Expenditure) at the University of Natal (Pietermaritzburg) towards an M.Com degree. The objective of this research is to study the degree of application of current capital budgeting theory in practice in South Africa today, and the progress which practitioners have made in introducing sophisticated capital budgeting techniques.

I should appreciate it if you would complete the attached questionnaire, or direct the questionnaire to the person charged with the responsibility of evaluating capital expenditure proposals within your company.

As I am only distributing this questionnaire to the Top 100 Companies, your response is very important. It should take no longer than 15 minutes to complete the questionnaire. Please note that respondents may remain anonymous.

Any queries relating to the questionnaire may be directed to me at (0331) 260 5392.

Your co-operation is much appreciated.

Yours faithfully,

Jason Napier
B. Com (Hons)

CAPITAL BUDGETING PRACTICE IN SOUTH AFRICA
QUESTIONNAIRE

Please place a cross in the appropriate box/s.

SECTION 1 : COMPANY DETAILS

1. Company Name (Optional) :
2. Name of Respondent (Optional) :
3. Title of Respondent :

SECTION 2 : IDENTIFICATION STAGE OF CAPITAL BUDGETING

1. What is the approximate size of your capital budget for the current financial year?

Rand

2. Does your company have a Capital Budgeting Department?

Yes

No

3. If "Yes" to 2. above, how many employees are employed in this department?

4. Are capital expenditure proposals sought from all employees, or is the task of finding investment opportunities limited to capital budgeting or finance staff?

All
Employees

Finance
Staff

5. Does your company have a written manual prescribing steps taken in the capital budgeting process?

Yes

No

6. Is there a formal process for submitting investment proposals?

Yes

No

7. If "Yes" to 6. above, please describe this process.

8. Are ideas screened at some intermediate level/s (e.g. at division manager level) before being subject to full financial evaluation? Yes No

9. What criteria are used for such screening? (Please tick the appropriate box/s).

Prescribed Financial Criteria	Discretionary Calculations	Qualitative Criteria
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SECTION 3 : EVALUATION AND SELECTION OF PROJECTS

Capital Budgeting Evaluation Techniques

1. Who analyses capital budget proposals?

Departmental Head	Capital Budgeting Staff	Proposal Originator
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2. Which of the following techniques are used, on a regular basis, in the evaluation of capital projects? Please also indicate which of the methods is used as the primary evaluation method (i.e. the method given the most weight in project evaluation).

FINANCIAL APPRAISAL METHODS	Used Regularly	Primary Method
Payback Period		
Discounted Payback Period		
Average Accounting Rate of Return		
Simple Return on Investment		
Profitability Index (PI)		
Internal Rate of Return		
Modified Internal Rate of Return		
Net Present Value		
Other Method : Please name :		

3. Five years ago, which of the above, if any, was the primary evaluation technique utilised by your company?
4. Are you employing “better” capital budgeting techniques than you did 5 years previously?

Yes

No

Discount Rates

5. Which of the following are used as the appropriate discount rate in time value calculations (before adjusting for risk)? Please also indicate which of the discount rates is used as the primary evaluation technique (i.e. the technique given the most weight in project evaluation).

<u>COST OF CAPITAL METHOD</u>	Used Regularly	Primary Method
Cost of specific finance to be employed.		
Weighted average cost of capital based on target capital weightings		
Weighted average cost of capital based on current book values		
Weighted average cost of capital based on current market values		
Current Return on Assets (ROI)		
Other method : Please name :		

6. Are discount rates specified for use throughout the organisation - or is some discretion allowed in rates employed?

Specified rates employed

Discretion Allowed
7. If such specified rates exist, are they company-wide, division-wide, or project-specific?

Company-wide

Division-wide

Project-specific

8. Where a weighted average is employed, are the component costs of capital based on:

Historic Costs	Current Market Rates	Estimated Specific Costs
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Adjustments for Risk

9. Does your company make allowance for differing levels of risk in projects evaluated?

Yes

No

- If “No”, please skip to question 12.

10. In assessing the level of project risk, which of the following techniques are utilised?
Please also indicate which of the methods is used as the primary evaluation technique (i.e. the technique given the most weight in project evaluation).

<u>RISK ASSESSMENT TECHNIQUE</u>	Used Regularly	Primary Method
Decision tree Analysis		
Monte Carlo Simulation		
Sensitivity Analysis		
Cash Flow Standard Deviation calculation		
Other Method : Please name -		

11. Which of the following method/s are used in order to make allowance for risk? Please also indicate which of the methods is used as the primary technique (i.e. the technique given the most weight in the adjustment for risk).

<u>RISK ADJUSTMENT METHOD</u>	Used Regularly	Primary Method
Increase / Decrease the Minimum Rate of Return or Cost of Capital.		
Risk-adjust the cash flows of each project.		
Risk-adjust the cost of capital applied to each project.		
Risk-adjust both the cash flow and the cost of capital.		
Use Expected Values of Cash Flows (Certainty Equivalents).		
Subjective Adjustment of Cash Flows.		
Increase / Decrease Minimum Payback Period.		
Subjective shortening of project life to penalise projects with above-average risk.		
Other Method : Please name method used -		

Treatment of Inflation

12. Does your company give specific consideration to the impact of inflation in capital expenditure proposals?

Yes

No

13. If “Yes” to question 12 above, which of the following methods of incorporating inflation into the capital budgeting process are used regularly by your organisation? Please also indicate which of the methods is used as the primary method of dealing with inflation (i.e. the technique used most often in project evaluation).

INFLATION TREATMENT METHODS	Used Regularly	Primary Method
Specifying cash flows at constant prices and using a real rate of return		
Specifying a general rate of inflation for all costs and revenues		
Specifying cash flows in future prices and using a nominal rate of return		
Using different rates of inflation for costs and revenues		
Other Method : Please name -		

SECTION 4 : POST-AUDIT AND ADMINISTRATION

1. Does your company conduct any form of Post-Implementation Audit?

Yes

No
2. Which of the following would you consider to be the true uses of a Post-Implementation Evaluation? (7 - Strongly Agree, 6 - Agree, 5 - Slightly Agree, 4 - Neutral, 3 - Slightly Disagree, 2 - Disagree, 1 - Strongly Disagree)

<u>POSSIBLE USES OF POST-AUDITS</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>
For use in employee compensation / evaluation schemes.							
In order to discourage bias in project proposals.							
Evaluate the outcome of capital budgeting proposals.							
To evaluate management expertise in project appraisal.							
To delineate and remedy difficulties early in project life.							
To ensure improvements in future planning.							

3. What other factors would influence your project evaluation process e.g. mandatory projects may be evaluated differently from discretionary projects.

4. What particular problems do you encounter in project evaluation in your company?

5. Would you like a copy of the findings of this study?

☐ Yes☐ No

6. If “Yes” to 5. above, please supply the address to which you would like such findings to be sent.

Your participation in this study is sincerely appreciated.

Appendix B – Sample

Financial Mail, Special Survey – Top Companies, (1997: 43 – 51; 302 – 304) (In alphabetical order).

<u>TOTAL ASSET RANKING</u>	<u>CAPEX RANKING</u>	<u>COMPANY NAME</u>
84	67	Amalgamated Beverage Industries Limited
61	81	Adcock Ingram Limited
18	18	AECI Limited
96	91	Associated Furniture Companies Limited
42	49	African Oxygen Limited
32	37	Alpha Limited
80	86	Allied Technologies Limited
2	4	Anglo American Corporation Limited
85		Amalgamated Retail Limited
50		Automakers Limited
13	8	AVI Limited
8	14	Barlow Limited
59	78	The Bidvest Group Limited
94		Boumat Limited
83	73	Cadbury Schweppes (SA) Limited
6	5	CG Smith Limited
68	79	Clinic Holdings Limited
97		Consolidated Metallurgical Industries Limited
91	84	CNA Gallo Limited
86		Consolidated Frame Textiles Limited
35	31	Consol Limited
47	52	Del Monte Royal Foods Limited

<u>TOTAL ASSET RANKING</u>	<u>CAPEX RANKING</u>	<u>COMPANY NAME</u>
92		Dimension Data Limited
72	89	Distillers Corporation (SA) Limited
54	90	Dorbyl Limited
82		Edward L Bateman Limited
29	45	Edgars Stores Limited
78		Ellerine Holdings Limited
14	35	Engen Limited
52	58	Foodcorp Limited
40		Forward Corporation
51	56	Foschini Limited
99	93	Gentyre Industries Limited
39	72	Grinaker Construction Limited
77		Grindrod Unicorn Group Limited
56		Grintek Limited
67	74	Group 5 Limited
73	98	Haggie Limited
25	30	Highveld Steel and Vanadium Corporation Limited
43	51	Hunt Leuchars and Hepburn Holdings Limited
79		Hoechst South Africa Limited
74	62	Irvin & Johnson Limited
100		IBM South Africa Group Limited
64	66	ICS Holdings Limited
60		Illovo Sugar Limited
23	17	Imperial Holdings Limited
7	6	Iscor Limited

<u>TOTAL ASSET RANKING</u>	<u>CAPEX RANKING</u>	<u>COMPANY NAME</u>
41		JD Group Limited
10		Johnnies Industrial Corporation Limited
21	46	Kersaf Investments Limited
58		Kohler Limited
95		Kolokus Holdings Limited
11		Liblife Strategic Investments Limited
66	40	LTA Limited
16	10	Murray & Roberts Holdings Limited
12	12	Malbak Limited
38		McCarthy Retail Limited
46	75	Metro Cash and Carry Limited
45	80	Metkor Holdings Limited
37		MIH Holdings Limited
70		New Africa Investments Limited
22	15	Nampak Limited
27		Nasionale Pers Limited
69	69	Pep Limited
19	21	Pepkor Limited
93		Persetel Holdings Limited
62		Perskorgroep Limited
48	65	Pick 'n Pay Holdings Limited
28	26	Plate Glass & Shatterprufe Industries Limited
98		Plessey Corporation Limited
33		Polifin Limited
81	92	Power Technologies Limited

<u>TOTAL ASSET RANKING</u>	<u>CAPEX RANKING</u>	<u>COMPANY NAME</u>
57	42	PPC Limited
17	27	Premier Group Limited
89		Real Africa Holdings Limited
63	97	Rainbow Chicken Limited
1	33	Rembrandt Group Limited
34	64	Reunert Limited
3	2	SA Breweries Limited
49	48	SA Druggists Limited
9	7	Safmarine and Rennies Holdings Limited
4	3	Sappi Limited
5	1	Sasol Limited
55	68	Searidel Investment Corporation Limited
20	19	Sentrachem Limited
44	59	Servgro International Limited
75	71	Stellenbosch Farmers' Winery Limited
36	50	Shoprite Holdings Limited
65		Siltek Limited
31		Sun International SA Limited
76	53	Stocks & Stocks Holdings Limited
71		Suncrush Limited
15	29	Tiger Oats Limited
24	36	Tongaat Hulett Group Limited
30	38	Toyota South Africa Limited
53	87	Trencor Limited
90	41	Unitrans Limited

<u>TOTAL ASSET RANKING</u>	<u>CAPEX RANKING</u>	<u>COMPANY NAME</u>
87		Voltex Holdings Limited
88	55	Waltons Stationery Company Limited
26	28	Wooltru Limited
<u>TOTAL ASSET RANKING</u>	<u>CAPEX RANKING</u>	<u>COMPANY NAME</u>
	11	Gencor Limited
	13	Anglovaal Industries Limited
	16	CG Smith Foods Limited
	9	Sentrachem Limited
	20	Samancor Limited
	22	Anglo American Corporation of SA Limited
	23	Ingwe Coal Corporation Limited
	24	Trans Natal Coal Corporation Limited
	25	Rustenberg Platinum Holdings Limited
	26	Palabora Mining Company Limited
	34	Impala Platinum Holdings Limited
	39	Anglo American Coal Corporation Limited
	43	Energy Africa Limited
	44	Duiker Mining Limited
	47	JCI Limited
	54	CNI Limited
	57	Toco Holdings Limited
	60	BTR Dunlop Limited
	61	Caxton Limited
	63	Allied Electronics Limited

<u>TOTAL ASSET RANKING</u>	<u>CAPEX RANKING</u>	<u>COMPANY NAME</u>
	70	Associated Manganese Mines of SA Limited
	76	Teljoy Holdings Limited
	77	Omnia Holdings Limited
	82	Fraser Alexander Limited
	83	Mediclinic Corporation Limited
	85	Frame Group Holdings Limited
	88	Delta Electrical Industries Limited
	94	Potgietersrust Platinum Mines Limited
	95	Karos Hotels Limited
	96	Oceana Fishing Group Limited
	99	Sea Harvest Corporation Limited
	100	McCarthy Group Limited