CAPITAL BUDGETING TECHNIQUES EMPLOYED BY SELECTED SOUTH AFRICAN STATE-OWNED COMPANIES

by

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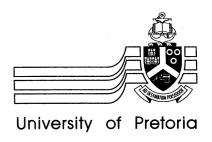
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1 INTRODUCTION

1.1 BACKGROUND

"The importance of capital budgeting for capital formation and the growth of a country's gross domestic product is undoubtedly one of the most important topics in economics today" (Hall & Millard, 2010:85). The South African economy has experienced significant economic growth in the past decade. Coupled with this growth is the necessity for the expansion of infrastructure to support the growth in the economy. Substantial amounts of money have been invested in capital expenditure in the various sectors as demand arising out of economic growth outstrips the existing capacity. State-owned companies (SOCs) have been instrumental in the delivery of this infrastructural capacity through their various mandates to deliver services in their respective sectors.

In the past decades, the theme of capital budgeting has been the subject of much interest and there has been a proliferation of research on the subject. Many of the studies on capital budgeting have, however, been done on the private sector businesses. (The term "private sector" is used in this context to refer to businesses that are not owned by the government.) This is proven by the fact that the samples of these studies are often drawn from the local security/stock exchanges. However, in the United States (US) and Canada the studies by Burns & Walker (1997:3) and Chan (2004:40) are examples of capital budgeting studies in the context of government-owned utilities. In the South African context, research into the available literature turned up no evidence of studies on capital budgeting in the public sector, although various studies have been conducted on private sector businesses, for example Hall (2000), Hall (2001), Gilbert (2003), Du Toit and Pienaar (2005), Correia and Cramer (2008) and Hall and Millard (2010).

The literature reveals a gap between what is advocated in capital budgeting theory and what is actually applied in practice. However, the trends are positive in that there appears

to be an increasing adoption (albeit at a slow rate) of the academically supported theory-based techniques such as net present value (NPV) and internal rate of return (IRR) thus a convergence of theory and practice, although there are still significant differences as techniques such as the payback period (PBP) and accounting returns are still being used.

1.2   PROBLEM STATEMENT

Despite the significant number of studies conducted over the decades, both locally and internationally, on the capital budgeting techniques employed by private entities (and government utilities internationally), there is no evidence of such a study on state-owned companies (SOCs) in the South African context.

1.3   PURPOSE STATEMENT

The main purpose of this study is to address the knowledge gap of the absence of research on capital budgeting techniques for SOCs. The study seeks to determine the capital budgeting techniques employed by SOCs in South Africa and to explore the methods used by these entities to determine the weighted average cost of capital (WACC), with special focus on the cost of equity or its proxy.

The study covers Eskom, the South African National Roads Agency Limited (SANRAL), Transnet and the Airports Company of South Africa (ACSA) amongst others. The study also looks at capital budgeting techniques that state-owned development finance institutions (DFIs) such as the Industrial Development Corporation (IDC) and the Development Bank of Southern Africa (DBSA) employ to advance funding to their clients.

1.4   RESEARCH OBJECTIVES / SPECIFIC RESEARCH QUESTIONS

The objectives of this study are to determine:

- What capital budgeting techniques selected SOCs use for the purposes of their projects;

- What discount rate is used for capital budgeting purposes;

- How the discount rate, in particular the cost of equity or its proxy, if applicable, is derived; and

- How risk is accounted for in the capital budgeting process by these institutions.

1.5   IMPORTANCE AND BENEFITS OF THE STUDY

The research seeks to add to the body of academic knowledge by identifying the thinking that is applied by the SOCs in capital budgeting. For the benefit of SOCs this study will highlight where techniques are used incorrectly and make the necessary recommendations.

Furthermore, the determination of the cost of equity of SOCs that do not have the benefit of the stock exchange to determine proxies and betas, holds immense potential for new understanding. The lack of academic research in this field presents an opportunity for new learning. The opportunity should also be seen against the backdrop of the massive investment drive in South Africa to catch up with the backlog caused by previous underinvestment and unprecedented economic growth in the last decade. In addition, the study serves as a comparative study to previous studies and makes recommendations for possible future actions.

Some of the subjects of the study issue publicly traded investments such as bonds and obtain substantial amounts of funding from the private sector in the form of banks. Apap and Masson (2005:[1]) observe that knowledge of capital budgeting techniques applied by publicly traded utilities is useful not only to the management of the utilities, but also to investors.

The document consists of three main parts. Firstly, it defines the delimitations that are applicable to this study, followed by the definition of key terms and abbreviations used in the study. Thereafter, the literature review provides a synthesis of the current available literature, both internationally and locally, on the subject of capital budgeting, in particular:

- cash flow determination,
- capital budgeting techniques,
- the determination of the discount rate,
- risk analysis,
- the theory versus application gap and,
- new developments in the field.

This is followed by a discussion of the research design and methods, empirical results and analysis, and finally, a conclusion and recommendations for further studies.

1.6   DELIMITATIONS

The study is subject to some delimitations. Firstly, it is limited to selected South African SOCs and state-owned DFIs.

Secondly, it is limited to only those entities that are involved in major infrastructural development projects. In terms of the DFIs, the study focuses on the criteria applied to funding major infrastructural development projects for SOCs.

Finally, the literature review explores capital budgeting techniques in both international and local sources and in the private and public sectors.

1.7   DEFINITION OF KEY TERMS

Below is a list of key terms used in the document with their meanings in the context of the research study.

Capital budgeting is "the analysis and evaluation of investment projects that normally produce benefits over a number of years" (Correia, Flynn, Uliana & Wormald, 2007:8-3).

Discounted cash flow (DCF) techniques are capital budgeting techniques that require the estimation of cash flows of a project and discounting them to present values using a discount rate.

The IRR technique is a DCF technique that determines a discount rate that equates the present value of future cash flows with the cost of the initial outlay.

NPV is a DCF technique that discounts future cash flows with a discount rate to present values and subtracts the initial outlay.

Risk is "the expectation that the actual outcome of a project may differ from the expected outcome" (Correia *et al.*, 2007:3-2).

Sensitivity analysis is "the examination of the sensitivity of some variable to changes in another. The primary purpose of sensitivity analysis is not to quantify risk, but to establish how sensitive the NPV and IRR are to changes in the values of key variables in the evaluation of investment projects" (Hall, 2001:401).

Table 1 provides a list of abbreviations used in the document and their meanings.

Table 1:   **Abbreviations used in this document**

Abbreviation	Meaning
ACSA	Airports Company of South Africa
ARR	Accounting Rate of Return
CAPM	Capital Asset Pricing Model
CA(SA)	Chartered Accountant (South Africa)
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CO^2	Carbon Dioxide
DBSA	Development Bank of Southern Africa
DCF	Discounted Cash Flows
DFI	Development Finance Institution
EVA®	Economic Valued Added
IDC	Industrial Development Corporation
IRR	Internal Rate of Return
LSM	Living Standard Measure
MBA	Master of Business Administration
MIRR	Modified Internal Rate of Return
MVA®	Market Value Added
NEF	National Empowerment Fund
NPV	Net Present Value
PBP	Payback Period
PI	Profitability Index
PVP	Present Value Payback
ROI	Return on Investment
SOCs	State-owned Companies
SAICA	South African Institute of Chartered Accountants
SANRAL	South African National Roads Agency Limited
TCTA	Trans-Caledon Tunnel Authority
UK	United Kingdom
US	United States
WACC	Weighted Average Cost of Capital

The following section explores the existing literature and studies relating to capital budgeting techniques both locally and internationally.

2   LITERATURE REVIEW

Given the amount of monies, period and risks involved, capital budgeting is an important and topical subject in finance and extensive literature exists on research in the field. The theory of finance is concerned with, amongst others, the undertaking of investment projects that increase the value of the business (Gilbert, 2005:19). As such, management is tasked with determining the value embedded in a potential investment with a view to undertaking the project if the value exceeds the cost and thereby increases the value of the firm. Academics generally contend that the DCF techniques, and in particular NPV, are the best techniques to use for capital budgeting purposes (Gilbert, 2005:19). Although the DCF techniques are viewed as academically superior (Gilbert, 2005:20; Du Toit & Pienaar 2005:25; Ryan & Ryan, 2002:355), in practice, the acceptance and incorporation of these methodologies are not universal and they are sometimes used in conjunction with the techniques that are regarded as academically inferior.

The literature review of this study explores the evolution of capital budgeting techniques, including the incorporation of risk in the capital budgeting process based on international studies and focuses specifically on South African studies.

The literature review is structured along themes emanating from the different literature sources. The first part deals with *cash flow determination* which is consistently rated as one of the most important and complex stages of the capital budgeting process (Wolmarans, 1999:533; Hall & Millard, 2010:90; Burns & Walker, 2009:83). This is followed by a focus on the processes used to *determine the discount rate* used in the evaluation of projects. Thereafter the findings of previous studies on the use of the various *capital budgeting techniques* are reviewed. The *incorporation of risk analysis* into the capital budgeting process has been advocated by academics (Hall & Millard, 2010:93; Burns & Walker, 2009:85). However, the incorporation into practice has been less than universal. This is followed by a discussion of the *theory versus application* gap. The review then assesses emerging *approaches and developments* that may be incorporated into capital budgeting in the future and finally provides a synthesis of the conclusions drawn from the major trends and themes that are evident in the existing literature.

2.1 DETERMINATION OF CASH FLOWS

The determination of cash flows is consistently considered to be one of the most important and complex stages of the capital budgeting process. Dayananda, Irons, Harrison, Herbohn and Rowland (2002:7) define it as the financial appraisal stage of the project which involves determining future cash flows, analysing risks in the cash flows, developing alternative cash flows and determining sensitivities around cash flows. In using the DCF technique, Brealey, Myers and Allen (2011:132) assert that correct practice dictates that project assessment should be based on project cash flows and not accounting income, because accounting income comprises non-cash flow items. Common errors relate to the treatment of depreciation and the interest expense. Depreciation is not a cash flow and should be excluded from operating income. The discount rate used to discount cash flows already includes an element of the cost of debt; therefore, including interest cash outflows would be double-counting its effect, resulting in erroneous results.

An important aspect of determining cash flows is the treatment of the impact of inflation on the cash flows. Bennouna, Meredith and Marchant (2010:229) observe that omitting inflation understates cash flows and the resulting NPV, particularly in long-term investment projects. There are two approaches to account for inflation: either real cash flows are discounted at a real rate or nominal cash flows are discounted at a nominal rate (Bennouna *et al.*, 2010:229).

2.1.1 <u>International studies</u>

In their survey of Taiwanese firms, Haddad, Sterk and Wu (2010:179) found that approximately half of the respondents considered project definition and cash flow determination as the most difficult aspects of the capital budgeting process, while more than half considered financial analysis and project selection to be the most critical stage of the process.

In their evaluation of the capital budgeting techniques applied by Canadian companies, Bennouna *et al.* (2010:229) found that previous studies indicated that Canadian firms did not properly determine cash flows in their capital investment analysis. Non-cash expenses

such as depreciation in accounting income, subtracting interest expenses from the cash flows and not deducting income tax were some of the aspects that were misapplied. Subtracting interest expenses results in the double-counting of the cost as the cost of interest is accounted for in the cost of debt portion of the cost of capital.

However, in their research, Bennouna *et al.* (2010:234) found that an overwhelming percentage of firms (91.5%) correctly computed NPV or IRR on a cash flow basis rather than accounting income. A large proportion (87.7%) dealt with inflation correctly in contrast to previous research findings. Interest expenses and other financial costs were treated properly by the majority (70%) in that they were not included in the cash flows but in the discount rate, thus not duplicating the costs.

These studies, however, do not indicate the methods used to determine the cash flows.

2.1.2 <u>South African context</u>

It is interesting to note that in the South African context, Hall (2000:359) and Brijlal and Quesada (2009:42) found that the respondents regarded project definition and cash flow estimation as the most important and difficult stages of the capital budgeting process, followed by the financial analysis stage. The findings were confirmed in a later study (Hall & Millard, 2010:90), although they were found to be equally risky to project implementation.

It is, therefore, not surprising that the estimation of cash flows is based on a combination of methods, in particular subjective management estimations with consensus of expert opinions and quantitative methods (Hall, 2000:360). This is presumably to mitigate the risk inherent in this stage of the capital budgeting process. Of concern though, is that almost a quarter of the respondents used only management subjective estimates or was not able to say how their cash flows were determined. Also of concern in his study of risk analysis, Hall (2001:409) found that a significant number of South African companies did not make adjustments for inflation impact on cash flows when assessing their projects.

In a more recent study, Hall & Millard (2010:91) confirmed the disturbing trend that subjective management estimates was a more popular method of determining cash flows than formal quantitative measures. However, what was encouraging was that an increasing number of firms made adjustments for inflation in their cash flows, reversing trends observed in previous surveys (Hall & Millard, 2010:95).

2.2   DETERMINATION OF THE DISCOUNT RATE

The cost of capital is a key parameter of DCF calculation. Firms are expected to use the weighted average cost of capital from various sources including debt, preferred stock and common equity (Bennouna *et al.*, 2010:229). Ryan and Ryan (2002:362) highlight that in academia, WACC is held as a superior form of the discount rate. Furthermore, the weights used in calculating the cost of capital should preferably be based on the firm's capital structure target or market values, rather than on book values. Target values are the ideal, but market values are a good proxy for target values (Bennouna *et al.*, 2010:229).

Payne, Heath and Gale (1999:22) reported that Canadian firms used their judgement in the determination of the discount rate compared to their US counterparts. Furthermore, Bennouna *et al.* (2010:229, 234) observed that previous Canadian studies found that although the majority of firms used WACC, a significant number misapplied it by using theoretically incorrect methods such as using book values to determine the rate or using the cost of debt only. However, it was found that over 76% of firms correctly employed WACC, suggesting a reduction in the theory - practice gap compared to past studies. The later study by Ryan and Ryan (2002:362) found an overwhelming preference (83.2%) for the use of WACC in line with academic thinking.

In the study of public utility companies, Brigham and Pettway (1973:12) found that in a regulatory process, a target or allowed rate of return is specified by the regulatory authority. In addition, they found that an overwhelming majority of utilities used the current cost of capital as the discount rate (Brigham & Pettway, 1973:20). For publicly traded utilities in the US, Apap and Masson (2005:[7]) found that over half of the respondents used WACC while an insignificant number used different rates for different business units.

Although the sources of funding came from the state or provincial government allocations, tax revenues and debt, Chan (2004:45) found that Canadian municipalities used the cost of debt as their discount rate. Given that there would not be a cost of equity component, they argued that the use of debt may be a better proxy in such a situation. However, the study revealed only a minority of the sample applied the discount rate in accounting for inflation and cash flows (nominal versus real discount rates and cash flows) (Chan, 2004:49).

In a study of firms in European countries, Brounen, De Jong and Koedijk (2004:84) reported that the cost of equity was predominantly determined using the Capital Asset Pricing Model (CAPM), although it was not as popular as in US companies. Public companies were also found more likely to adopt CAPM than private firms, which is not surprising given the availability of market data to compute the CAPM for publicly listed companies. Furthermore, European firms predominantly did not take the specific risk factors of their projects into consideration (Brounen *et al.*, 2004:86). However, where risks were considered, the firms adjusted either their discount rate or their cash flows. They also found an extensive use of company-wide discount rates and not project-specific rates.

In Australian companies it was found that 88% of companies used the cost of capital to evaluate capital projects with CAPM being the most popular technique (74%), followed by the cost of debt plus an equity premium (Truong, Partington & Peat, 2008:107). In estimating WACC, most companies (60%) reported using the target weights whilst 40% reported using the current weights on the book in contrast to popular theoretical prescript of WACC (Bruner *et al.*, 1998:26; Ryan & Ryan, 2002:362; Bennouna *et al.*, 2010:229). Almost an equal number of respondents in the Australian study reported using market weights and book weights (51% and 49% respectively) while most companies were found to use the same WACC across the divisions (Truong *et al.*, 2008:118).

In their survey of Canadian companies, Baker, Dutta and Saadi (2011:175-177) observed that an encouraging number of companies (over 63%) used WACC, especially large companies. This was followed by the use of management experience (44%) and cost of specific funds for the project (38%) to determine the WACC. The study also found that of the companies that used WACC, more than 57% used market values as weights for

WACC, followed by target values and book values. The determination of the cost of equity was found to be mostly based on subjective judgement (60%), whilst just over 50% used the cost of debt adjusted by an equity premium. Large firms were found to be more likely to use CAPM compared to smaller firms. In addition, Baker *et al*. (2011:162) found that subjective judgement was used to adjust the discount rate for risk considerations and to determine the cost of equity in Canadian companies.

Interestingly, less than 15% of Indonesian companies reported using the CAPM to determine the cost of equity despite the high rate of adoption of DCF techniques (Leon, Isa & Kester, 2008:189).

In the South African context, the Gilbert (2003:15) study found that South African manufacturing firms did not use project-specific risk-adjusted discount rates as prescribed by academic theory. Correia and Cramer (2008:41) found that 71% of South African listed companies determined the cost of equity using variants of the CAPM. This contrasted with the findings of the last 15 to 25 years where there was evidence of low usage. A significant 65% of the companies also indicated that they used the target debt-to-equity ratio as propagated by financial theory, while the rest resorted to using the actual debt-to-equity ratio as it existed in the current financial statements (Correia & Cramer, 2008:47). In terms of determining the discount rate for capital budgeting purposes, Brijlal and Quesada (2009:43) found that almost a quarter of the respondents in the Western Cape used the cost of debt whilst 12% used WACC and 15% used previous experience. The study did not detail how the discount rates, where applicable, were determined.

In conclusion, internationally there is still a significant use of judgement in determining the discount rate and the trend in the adoption of WACC and CAPM as tools for the DCF techniques is positive. However, from a South African point of view, the application of WACC is mixed and not consistent but appears to be positive.

The following section reviews the findings of previous studies on capital budgeting techniques.

2.3   CAPITAL BUDGETING TECHNIQUES

Capital budgeting techniques are categorised into DCF and non-DCF methods. The DCF techniques include NPV, IRR and the modified internal rate of return (MIRR), and are considered to be academically superior to the non-DCF methods as they provide an analysis based on discounted cash flows. Moreover, financial theory advocates using the superior NPV rather than IRR as the latter may give incorrect results where the projects are mutually exclusive (Bennouna *et al.*, 2010:238).

This view is supported by Du Toit and Pienaar (2005:25) who assert that the preference for the use of IRR over NPV may mean that decision-makers are making incorrect decisions in evaluating mutually exclusive projects as a result of different timings in cash flows and different cost outlays. The NPV is also superior because it is not sensitive to multiple sign changes in cash flows, assumes a reasonable rate of reinvestment compared to the IRR assumption and shows the expected change in the shareholder wealth (Ryan & Ryan, 2002:356).

The popular non-DCF methods include amongst others, the PBP, the accounting rate of return (ARR) and the return on investment (ROI).

Below is a discussion of the findings of previous studies on the usage of the identified capital budgeting techniques from both international and South African points of view. The findings of international and South African studies qualitative considerations are also discussed.

2.3.1   <u>International studies</u>

Burns and Walker (1997:3) noted the increase in the use of DCF methodologies to evaluate projects and a move away from the more crude methods (non-DCF techniques). In their study of the capital budgeting techniques of the Fortune 500, Burns and Walker (1997:5-12) found that IRR was the most used capital budgeting technique. Furthermore, the technique gained usage faster than the NPV method. This was followed by the equal usage of the NPV and the PBP methods. This is a concern, given the theoretical

supremacy of the NPV method over the other two. The major reason for the continued use of the PBP method is the ease of use. Another reason for its continued use is to supplement the DCF methods. The use of the ARR method was justified as a means to reconcile financial reporting.

In a study comparing US and Canadian firms, Payne *et al.* (1999:22) found that while Canadian firms applied capital budgeting techniques to all their projects, their US counterparts only applied those techniques to larger projects. This suggests that a contributing factor to the adoption of theoretically sound capital budgeting techniques could be the perceived benefits that will be derived from investing time and other resources in applying these techniques. Furthermore, the study found that the size of the firm was a determining factor in the adoption of sound capital budgeting techniques (Payne *et al.,*1999:22). This view was supported by previous studies of listed Irish firms, which found that larger companies and their subsidiaries were more inclined to adopt theoretically sound techniques than smaller companies (Kester & Robbins, 2011:28). However, in their study, Kester and Robbins (2011:29) found a universal adoption of DCF techniques as a preferred method for capital investment evaluation. NPV was found to be ranked as the most important technique, followed closely by PBP and then IRR respectively. Accounting measures were least preferred.

In a study of the Fortune 1000, Ryan and Ryan (2002:355) deplored the previous preference of IRR and non-DCF methodologies over NPV. They attributed this to the lack of financial sophistication and the limited use of computers at that time. However, they noted the significant migration towards NPV as a preferred method of evaluation over IRR and the other methods. They also found a positive correlation between the size of the budget and the use of IRR and NPV (Ryan & Ryan, 2002:361). The other preferred methods were the PBP and the discounted PBP.

The Graham and Harvey (2002:1-2) study sought to examine how corporations in the US and Canada made both capital budgeting and capital structure decisions. Their view was that corporate decisions should not be read in isolation as they were interrelated and, therefore, studying the decisions together gave a better and richer perspective for decision-making. They expressed the concern that evidence in practice suggests that what

corporations practised in terms of capital budgeting and capital structure was not always consistent with what was advocated academically. However, they found that most firms were in alignment with academic principles and employed NPV techniques in their capital budgeting exercises. In terms of capital structure, firms did not apply academic principles and relied mostly on practical rules. Graham and Harvey (2002:7) found that almost 75% of the respondents always or almost always used NPV techniques whilst just over 75% always or almost always used IRR. Consistent with the Ryan and Ryan (2002) study, IRR was found to be used more often. Furthermore, Graham and Harvey (2002:8) lamented finding that the usage of the PBP method was still quite high, with over 56% responding that they always or almost always used it, despite its weaknesses. The consolation was that there was an increasing usage of the NPV technique.

The Brounen *et al.* (2004:72) study also looked at the practice of corporate budgeting, capital structure and corporate governance in the European context as they felt the three subjects were interlinked as corporate governance may influence financial management in a business. Brounen *et al.* (2004:81) found that European firms still used the PBP method for capital budgeting purposes instead of the DCF techniques, with more than 50% of companies opting to use PBP, and in some European countries as much as 69%. The use of the PBP method was followed by the NPV where the usage ranged between 41% and 53%, and IRR methods where the usage ranged between 35% and 70%. Interestingly, already in 2000, Arnold and Hatzopoulos (2000:622) observed that in the United Kingdom (UK), firms were increasingly using theoretically correct DCF techniques and only a small minority of firms did not comply, although the use of crude methods was still prevalent.

NPV, PBP and IRR were found to be the most frequently used techniques in Australia with over 90% of the respondents in the Truong *et al.* (2008:102) study reportedly using NPV and PBP as the most popular techniques for capital budgeting. The NPV stood out as the most popular technique with over 57% usage. It must be noted that, consistent with other studies, most companies reported using more than one capital budgeting technique. Despite its inherent weaknesses, Truong *et al.* (2008:104) still found a high degree of usage of PBP, attributing it to the fact that it was easy to compute and understand, it was used in conjunction with other techniques and it was popular amongst smaller firms.

Bennouna *et al.* (2010:233) found that more than 80% of the firms used DCF techniques and that NPV was widely utilised by Canadian corporations, whilst a substantial percentage still used IRR as their primary model in capital decision-making. Despite it not being superior to the NPV method, Bennouna *et al.* (2010:234) suggested that the fact that IRR reflected results in terms of percentages made it appealing to managers as they found it easier to compare. This was consistent with the view that was put forward by Ryan and Ryan (2002:356).

In a later study on Canadian companies, Baker *et al.* (2011:158) observed a consistent trend noting that recent studies on the topic of capital budgeting indicated a convergence of theory and practice over time. In their study, they also observed that there was an increasing preference for NPV over IRR and PBP in contrast to previous studies where IRR and PBP dominated NPV (Baker *et al.*, 2011:161). A vast majority of the survey respondents (84%) indicated that they used DCF techniques with at least 58% using it as a primary method and 26% using it in addition to another tool as a secondary method (Baker *et al.*, 2011:168). An encouraging 75% of the respondents often or always used the NPV technique, whilst more than 68% and 67% often or always used the IRR and PBP methods respectively (Baker *et al.*, 2011:172). The results were, therefore, consistent with the observations of the Ryan and Ryan (2002:356) study and the Bennouna *et al.* (2010:233) study.

More than 60% of Indonesian companies reportedly used DCF techniques including NPV, IRR and Profitability Index (PI). Leon *et al.* (2008:189), however, found that most companies used more than one method of capital budgeting, which was consistent with other studies. The use of the PBP technique was prominent as a secondary measure.

More than 52% of Taiwanese firms in the Haddad *et al.* (2010:180) study indicated that they always or almost always used the inferior PBP technique to evaluate capital projects. This was followed by the IRR and NPV techniques with 47% and 30% respectively.

In their survey of listed Irish companies, Kester and Robbins (2011:29) also observed an increasing adoption of theoretically sound techniques with all the respondents indicating that they adopted DCF techniques, although other non-DCF techniques were also used.

NPV was the most popular method followed by the PBP method and the IRR. In Sweden, Kempe and Meyer (2011:33) observed that the PBP method was the most frequently used method of capital investment analysis. They also asserted that the PBP method was also used as a risk measure as a result of the complexity of quantifying cash flows.

In the study of public utility companies, Brigham and Pettway (1973:17) found a strong preference for DCF methods, which was strangely in contrast to other findings of the Fortune 500 industrial firms in that era. These findings were supported by a later study by Apap and Masson (2005:[7]), which found that although there was significant use of the PBP technique, NPV and IRR had strong support. The study found a shift in the use of methods over time from non-DCF methods to a preference for IRR and NPV methods. Support for the DCF methods was attributed to the use of cash flows and the use of time value of money principles. It is of concern that they found that more than a quarter of the respondents did not use capital budgeting techniques at all. This phenomenon may be attributed to the other qualitative factors influencing capital projects in the public utility space.

A study by Chan (2004:40) on Canadian municipalities found that politics played a major role in the consideration of capital projects. The five considerations prescribed by the *Municipal Capital Project Handbook* were health and safety issues, cash savings/payback, asset maintenance/replacement, growth-related needs and service enhancement. The study, however, found a low adoption of capital budgeting techniques. This could be attributed to the fact that the projects were not undertaken for profit and they had to fulfil essential services (Chan, 2004:48). For those who adopted capital budgeting techniques, half preferred to use the PBP technique (possibly as a result of its simplicity and ease of use) instead of the DCF method. Those who adopted DCF analysis used NPV more than IRR, although it was not always used correctly.

2.3.2   South African context

Brijlal and Quesada (2009:37) observed that whilst a considerable amount of research had been done on the topic of capital budgeting in developed countries, developing countries have not received the same amount of coverage with regard to the research of capital

budgeting techniques. However, below is an assessment of some the available literature on the subject of capital budgeting techniques in South Africa.

In the South African context, Hall (2000:360) found that ROI and IRR were almost equally popular followed by NPV and present value payback (PVP) by South African companies listed in the Industrial Sector of the JSE Stock Exchange. The popularity of IRR over NPV was found to be consistent with previous South African studies (Hall, 2000:361). The reasons were similar to those cited for other studies in the US and Canada, namely that it was easy to understand and compare as it was a percentage and that it did not require a discount rate. Interestingly, the study found a correlation between the method used and the size of the budget where the larger budgets were analysed using the IRR technique (Hall, 2000:361). The PBP technique was not regarded as one of the important methods, in contrast with the US and Canadian studies.

At the same time, Napier (2000:133) observed the increased usage of sophisticated capital budgeting techniques (i.e. those that took the time value of money into account) in the South African context. Furthermore, he noted that businesses were using a basket of measures and did not rely on one capital budgeting technique. This was consistent with other international studies.

A 2003 study by Gilbert (2003:13) of South African manufacturing firms found a dearth in the use of the theoretically superior DCF techniques and a very clear preference for PBP and ROI. He cited a lack of knowledge as a possible reason (Gilbert, 2003:16,). However, this was in contrast with Hall's assertion that South African decision-makers were academically well-qualified and experienced (Hall, 2001:410; Hall & Millard, 2010:89). Although he found that DCF and non-DCF techniques were used in combination, there was a clear preference for and high usage of non-DCF techniques (Gilbert, 2003:15). A negligible minority used only DCF techniques. Even where DCF techniques were used (in combination with non-DCF techniques) there was a slight preference for IRR over NPV. This correlates with the findings of the Hall study (2000:361), the bigger the firm, the bigger the preference for DCF techniques.

The findings of the Du Toit and Pienaar (2005:22) study of large South African companies were encouraging in the sense that a positive trend was emerging where there was growth in the use of DCF techniques, although the preference was for the IRR over the NPV technique. The concern was that there was still a high usage of non-DCF techniques. As in the Gilbert (2003:15) study it was found that the techniques were used in combination, with each respondent using up to three techniques. The increased preference for DCF techniques with the increase in the size of the budget was consistent with previous South African studies (Hall, 2000:14).

The study by Correia and Cramer (2008:36) found that an overwhelming 82% of South African listed companies always or almost always used the NPV and IRR techniques with a high preference for the IRR. The study observed a significant decline in the use of the PBP and accounting return methods compared to previous studies, although a significant number of companies (56%) still used the PBP technique.

The Brijlal and Quesada (2009:39) South African review focused on small, medium and large businesses that operated in various sectors in the Western Cape. In terms of capital budgeting techniques, 39% of respondents indicated a preference for the PBP technique while 36% preferred the NPV technique. IRR and PI were preferred 28% of the time. Disturbingly, 10% of the respondents did not use any technique but relied on gut feeling and intuition. Brijlal and Quesada found that smaller and medium businesses preferred the PBP technique and larger enterprises used the NPV and IRR techniques. They attributed the preference for the PBP technique to its simplicity and its focus on the liquidity of the business in response to concerns by lenders for the repayment of their loans (Brijlal & Quesada, 2009:40). The higher proportion of small and medium enterprises in the sample may be the reason for the higher preference for the payback method.

These findings were supported by the Olawale, Olumuyiwa and George (2010:1278) study of small manufacturing businesses in the Nelson Mandela Bay Metropolitan Area in South Africa, which found that the respondents did not use sophisticated capital budgeting techniques to evaluate their investments. However, the study did not define what it referred to as "sophisticated investment appraisal techniques" but presumably included techniques that took the time value of money into account (Pike in Napier, 2000:33). In

summarising previous cross-sectional studies on the subject, Gilbert (2005:21) also observed that larger firms were more likely to use DCF techniques than smaller firms and that, generally, smaller firms did not formally consider capital budgeting techniques.

The study by Hall and Millard (2010:91) on listed South African firms confirmed the results of the Hall (2000:360) study, indicating a strong preference for the ROI technique over the DCF techniques. However, the ROI technique was followed by preference for the NPV and then IRR. Although the use of NPV had grown against the use IRR, it was still a concern that there was no significant difference, despite the academic preference for the latter, especially in the evaluation of mutually exclusive projects (Hall & Millard, 2010:92). They attributed the preference for NPV to the fact that the sample consisted of large firms with well-educated decision-makers.

In the South African motoring sector, Viviers and Cohen (2011:87) found that 50% of the respondents considered NPV and IRR to be the most important criteria for capital budgeting purposes. NPV was found to be used in conjunction with IRR 50% of the time.

Gilbert (2005:34) concluded that whilst DCF techniques played an important role in capital budgeting decisions, they were a challenge to conduct completely and had limitations. Furthermore, other considerations such as the company's "competitive environments and strategic reactions to these environments" were important.

To conclude, from a South African point of view, there is evidence of a positive trend towards the adoption of DCF methods, particularly the NPV (Correia & Cramer, 2008:34).

Whilst financial considerations are an integral part of the investment decision, other qualitative factors also play a role in the decision-making process. The following section delves into these considerations.

2.3.3 The influence of qualitative factors

Financial considerations are not the only factors that play a role in the acceptance of projects. Capital budgeting is done in the context of other considerations that determine the success or failure of a business. Non-financial (qualitative) factors play a growing and significant role in the capital budgeting process (Hall & Millard, 2010:96). The following were cited as some of the reasons for this phenomenon in the South African context:

- Employee safety (Hall, 2000:365);
- The continuity of existing product lines (Hall, 2000:365);
- Legal requirements (Du Toit & Pienaar 2005:24);
- Strategic factors (Du Toit & Pienaar, 2005:24);
- Environmental considerations (Du Toit & Pienaar, 2005:24; Viviers & Cohen, 2011:83);
- Keeping up to date with technological developments (Du Toit & Pienaar, 2005:24); and
- Increased government regulations (Hall & Millard, 2010:96).

Interestingly, the Apap and Masson (2005:[6]) study of publicly traded utilities in the US found similar results with the most common reasons being government regulations, strategic requirements, safety regulations, environmental regulations and other business reasons.

2.3.4 The case against DCF

Despite their academic superiority and the encouraging trajectory towards their adoption, DCF techniques are not without their weaknesses and dissenters.

Adler (2006:4) enumerated, amongst others, the static discount rate, the exclusion of non-financial benefits, the emphasis on the short-term view, the treatment of inflation and the behavioural consequences (manipulation and cheating) DCF techniques promoted amongst decision-makers. However, in objection to these concerns, Adler (2006:4) observed that others have argued that it was the user who was at fault for not using the techniques properly and not the techniques themselves. Bennouna *et al.* (2010:229)

supported this view and asserted that there was nothing wrong with the theory but its application.

Another key concern is the accessibility and quantifiability of data, especially when projects move from the operational to the strategic, where data does not exist (Adler, 2006:5,10). Adopting real options in addition to DCF as suggested to mitigate its weaknesses does not avoid the problem of data accessibility and quantifiability.

In lieu of DCF, Adler pointed to successful entrepreneurs Ted Turner, Richard Branson and Ian Taylor and seemed to advocate gut feeling, hard work and intuition as the solution instead of reliance on mathematical techniques. As a result, Adler (2006:9) suggested that DCF techniques should be dropped from the teaching curricula, or at the very least be pruned. However, he failed to provide an alternative solution with the exception of intuition.

In response to Adler's criticism of DCF techniques, Weil and Oyelere (2006:25) acknowledged the weaknesses inherent in DCF techniques. However, they suggested that instead of completely discarding the techniques (especially since Adler did not provide an alternative solution), the weaknesses and limitations should rather be highlighted to users. The prominence of DCF should be reduced by using this technique in conjunction with other techniques, an already common finding in existing studies. Users should rather be empowered to use the right technique under the right circumstances (Weil & Oyelere, 2006:27). They discarded Adler's argument that DCF was not useful because information was not available. Instead they argued that the use of DCF forced a "rational estimation" of the benefits to be derived from an investment and that technological advances made the use of DCF more possible and accurate (Weil & Oyelere, 2006:26).

In conclusion, while the DCF methods have their weaknesses, they have proven useful in the past. In the absence of a viable alternative, they should not be discarded completely, but they should rather be complemented by other techniques.

The investment decision is taken in the context of risks. The following section investigates how risk considerations are taken into account in the process of the investment decision.

2.4 RISK ANALYSIS TECHNIQUES

The area of capital budgeting is fraught with many unknowns and uncertainties which affect the derivation of the key parameters required to compute the necessary financial evaluation. Hall (2001:400) asserts that capital investment requires a systematic assessment of risk, since poor decisions are not easily reversible and can cause losses for a firm as the capital budgeting decision is often a long-term commitment.

Hall (2001:400-401) suggests two main categories of adjustment for risk, namely the adjustment of the discount rate and the adjustment of the cash flow estimation. Various specific methods are available for adjusting risk, namely the *mean, variance and coefficient of variation*, the *certainty equivalent method*, the *risk-adjusted discounted rate method*, *sensitivity analysis* and *computer simulations*. Other techniques include more sophisticated ones such as *probabilistic risk analysis*, *decision-tree analysis* and *Monte Carlo Simulation* which is a technique that allows for the simulation of different probabilities (Bennouna *et al.*, 2010:231).

Hall (2001:398) points out that it may be argued that the discount rate includes a component to account for the risks inherent in the project. However, he counters this argument by pointing out that the WACC of the company may not be the same as the WACC for the project and may, therefore, require an adjustment. Payne *et al.* (1999:16) concur with this observation, stating that the theory of capital budgeting requires the firm-wide hurdle rate, assuming the risk profile of the project is similar to the firm's risk and the rate must be adjusted where there is a variation in this risk assessment between the firm and the specific project.

Below is a discussion of the findings of international and South African studies of the analysis of risk in capital budgeting.

2.4.1 <u>International studies</u>

Bennouna *et al.* (2010:234) found that the majority of Canadian firms used risk analysis tools, with the most popular being sensitivity analysis, followed by scenario analysis and

then risk-adjusted discount rate. Compared to past research, this study showed a substantial increase in sensitivity analysis and risk-adjusted discount rate (Bennouna *et al.*, 2010:234). The results were consistent with the Ryan and Ryan (2002: 361) study, which also found that sensitivity analysis was the most popular tool, followed by scenario analysis. Ryan and Ryan (2002:361) also reported usage of inflation adjusted cash flows. They further concluded that the more complex mathematical, linear programming and option methods were not widely used by companies.

Brigham and Pettway (1973:17) found little acceptance of risk-adjusted WACC while there was acceptance of sensitivity analysis and "arbitrary downward adjustment in the expected life of an abnormally risky project." Interestingly, they found that more utilities applied risk analysis than Fortune 500 companies did in that era.

The study of Canadian municipalities found that amongst those that applied DCF methods, risk adjustments were made to the discount rate (Chan, 2004:49).

Hall and Millard (2010:87) reported that there was evidence in international studies of the increased adoption of more sophisticated risk analysis techniques for capital budgeting processes, although there was a lag in implementation.

Graham and Harvey (2002:8) found that highly leveraged firms (firms with large amounts of debt) were more likely to use simulation and sensitivity analysis. This was presumably as a result of the higher risk faced by these firms. This view was confirmed by the 2009 survey by Kester and Robbins (2011:29) on listed Irish companies which found that there was a high usage of scenario analysis and sensitivity analysis, with the more sophisticated Monte Carlo Simulation not generally being used. In terms of risk adjustment, the majority of firms applied a single discount rate to all the projects under consideration despite the level of project-specific risk compared to the overall firm's risk which was theoretically incorrect. Swedish industrial firms on the other hand relied more on intuitive methods than quantitative analysis (Kempe & Meyer, 2011:34).

In line with theoretical prescripts, Baker *et al.* (2011:168) found that Canadian managers considered project-specific risk in their assessment of capital projects, especially in firms

with chief executive officers (CEOs) who had Masters of Business Administration (MBAs) degrees. Furthermore, 44% of the respondents indicated that they adjusted the discount rate to cater for risk differentials, whilst 23% indicated that their adjustments for risk were reflected in the cash flows. Interestingly, over 25% indicated that they adjusted both the cash flows and the discount rate (Baker *et al.*, 2011:169). Firms with CEOs who had MBAs were found to be more likely to adjust either risk or cash flows and firms managed by CEOs who did not have MBAs were more likely to adjust both the discount rate and the cash flows. However, Baker *et al.* (2011:162) found that Canadian companies mainly used subjective judgement to determine risk. More than 75% reported using subjective judgement, followed by sensitivity analysis and decision-tree analysis (Baker *et al.*, 2011:175).

Amongst Indonesian firms, Leon *et al.* (2008:189) found that sensitivity analysis and scenario analysis were the most frequently used techniques to assess risk. Just more than 10% of the respondents used a risk adjusted discount rate to account for risk inherent in the projects.

Only 22% of the Taiwanese firms indicated that they always or almost always used sensitivity analysis to assess the risk inherent in capital projects (Haddad *et al.*, 2010:180).

2.4.2 <u>South African context</u>

While previous South African studies found a large gap between theory and practice regarding risk analysis, with a significant number of respondents reporting that they used subjective methods and a quarter stating that they did not adjust for risk at all, Hall (2001:402) found that more than a third of the respondents did not have risk analysis mechanisms. Of those that did employ risk analysis mechanisms, sensitivity analysis was the most used, although it was not purely a risk analysis tool but simply measured the sensitivity of certain variables to defined input factors (Hall, 2001:406). The prevalence of the use of sensitivity analysis was found among firms with capital budgets exceeding R50m. This was followed by adjustments to the required rate of return. The study concluded that risk analysis was largely ignored by South African companies and, where it was applied, sensitivity analysis was the preferred method because of its ease of

understanding and cost effectiveness. However, the method's weakness was that it did not quantify risk. The study suggested that the lack of quantification methodologies was not a result of ignorance on the part of qualified financial decision-makers in South Africa, but rather as a result of the complexity involved in arriving at such quantifications (Hall, 2001:410).

The concept of adjusting the discount rate to cater for risk attributable to a specific project is supported by Gilbert (2003:16) in the context of making investment decisions in risky environments, although in his study he found that 21% of manufacturing firms adjusted the discount rate to adjust for project-specific risk.

Correia and Cramer (2008:39) found that listed South African companies indicated that over 71% preferred using scenario analysis to assess risk with 68% employing the sensitivity analysis technique. Monte Carlo Simulation and decision-tree analysis had a low usage rate (14% and 10% respectively). The low usage of the Monte Carlo Simulation is supported by the lack of adoption of real options analysis as the Monte Carlo Simulation is also used for the valuation of real options.

The findings of the Hall & Millard (2010:94) study were consistent with the previous studies in terms of risk analysis in the sense that there was a preference for the use of sensitivity analysis followed by adjustments to the discount rate. These were followed by scenario analysis and adjustments to the cash flows. It is encouraging that a significant number of firms now employ risk adjustment techniques, possibly due to "an increasingly uncertain world where risk factors have to be incorporated in any financial decision" (Hall & Millard, 2010:94).

In the study of large South African companies, Du Toit and Pienaar (2005:23) concluded that the high usage of the PBP method (over 40%) could be attributed to the use of the method as a risk measure as it provides an assessment of the period of recovering the capital spent.

Brijlal and Quesada (2009:44) found that in the Western Cape more than two thirds of the respondents used subjective (non-quantitative) methods of risk adjustment and that of the

40% who applied quantitative methods, the preferred methods were reducing the PBP (29%), increasing the profitability requirement (16%), making conservative cash flow estimates (21%) while 16% reported using more than one method of risk assessment.

The findings of previous studies appear to suggest that sensitivity analysis is the prominent measure for risk assessment, followed by the adjustment of the discount rate and cash flows.

2.5 BRIDGING THE GAP BETWEEN THEORY AND PRACTICE

The gap between what is advocated and taught as theoretically superior and what is actually applied in the practice of capital budgeting is a recurrent theme in the capital budgeting literature, in particular with regard to the degree of adoption of NPV. The gap tests the degree of congruence between theory and practice (Bennouna *et al.*, 2010:234; Ryan & Ryan, 2002:355; Gilbert, 2003:11). Hall (2009:87) and Mao (1970:349) agree with this observation, stating that although executives understand the new analytical approaches and recognise their importance, there is a lag in implementation. Amongst others, the size of the firm, the size of the projects and the educational characteristics of management and advancement in technology seem to play a role in bridging the theory - practice divide.

Wolmarans (1999:533) compared the importance of the various finance topics as rated by both practitioners and academics and found a chasm. The study found that academics rated capital budgeting and risk versus return as more important than practitioners did. It would have been interesting to understand the reasons for this gap.

The Ryan and Ryan (2002:362) study of the Fortune 1000 companies concluded that there was a stronger sense of agreement between theory and practice regarding capital budgeting than in previous studies whilst Bennouna *et al.* (2010:236) found that a theory - practice gap remained in the DCF application among large firms in Canada. Apart from not using DCF, where it was used, several aspects of DCF analysis were misapplied. They concluded that their evaluation showed there still was a theory - practice gap in the detailed elements of DCF capital budgeting decision techniques and in real options

(Bennouna *et al.*, 2010:225). On the positive side, possible explanations for the increased use of DCF methods are the availability of computer software and the increased level of education of managers. This is supported by Bennouna *et al.* (2010:236) who recommend that firms should provide training for their managers based on "normative textbook approaches" to entrench academically correct methods and to narrow the theory - practice gap.

Graham and Harvey (2002:7) found that firm size and executive characteristics also played a role in the choice of capital budgeting techniques and therefore, the adoption of theoretically sound techniques. In terms of firm size, Graham and Harvey (2002:7) found that larger firms were more likely to use NPV techniques than smaller firms. Furthermore, highly leveraged firms were more likely to use NPV and IRR techniques compared to firms with lower leverage levels, suggesting that the presence of risk necessitated robust techniques to manage this risk.

Evidence from the Baker *et al.* study (2011:188) of Canadian firms suggests that the size of the firm and the educational background of the CEOs influence some corporate finance practices, where large firms with CEOs who have MBAs are more likely to adopt more sophisticated capital budgeting techniques than smaller firms with CEOs who do not have MBAs.

Interestingly, however, Truong *et al.* (2008:105) did not find a significant relationship between the usage of capital budgeting techniques and firm size in the Australian context. Whilst in Europe, the size of the firm had an influence on the method of determining capital projects, with smaller firms being more keen on the PBP technique than larger firms. In general, Brounen *et al.* (2004:73) concurred with the view that corporate financial management practices were influenced by the size of the firm. Larger firms and firms managed by CEOs who had MBAs (except in the UK where MBAs were found to be rare) were more inclined to use the NPV technique (Brounen *et al.*, 2004:81). In addition, they found that firms that stated shareholder value maximisation as an objective were also more inclined to use the NPV technique (Brounen *et al.*, 2004:81).

The educational background of the chief financial officer (CFO) and the period since the listing of the enterprise were the main factors that influenced the use of the DCF techniques in Indonesian companies (Leon *et al.*, 2008:190). Interestingly, firm size was not a factor. A similar finding was made by Kempe and Meyer (2011:34) who observed that capital budgeting was given a low priority in Swedish industrial firms and that the low exposure of senior management to modern finance theory was a factor in the theory - practice gap. However, they found that even where there was formal education, the reluctance to deviate from existing traditions embedded in the firms was also an important factor in the low uptake of sophisticated capital budgeting techniques.

In the Western Cape in South Africa, Brijlal and Quesada (2009:40) found that the less formally educated decision-makers relied on gut feeling and intuition, compared to their more formally educated counterparts who employed more sophisticated DCF techniques. Gilbert (2003:16) also bemoaned the lack of adoption of theoretically superior methods and the preference for non-DCF techniques in South African manufacturing firms, attributing this to a lack of experience in or knowledge of the methods.

To conclude, education levels, the size of the business (and budgets of projects), management experience and the availability of computer technology seem to be the key factors influencing the convergence of what is advocated in theory by academics and what is actually applied in the practice of capital budgeting.

3   THE EVOLUTION OF CAPITAL BUDGETING TECHNIQUES

This section of the literature review explores the evolution of recent developments in capital budgeting, in particular the real options pricing model. It concludes with an overall synthesis of the findings of previous studies on capital budgeting.

3.1   NEW APPROACHES AND DEVELOPMENTS

Although the application of capital budgeting techniques has been advocated extensively over time in literature, it appears that there is room for implementation of new developments as weaknesses have been identified in the existing DCF techniques.

The failure of DCF techniques to account for the value created by flexibility (the existence of uncertainty and options) (Gilbert, 2004:49) is identified as a key weakness resulting in the need for methods that take this potential into account in the form of real options pricing techniques. Baker *et al.* (2011:159,182) support this view, pointing to the weakness of DCF techniques in the sense that they do not provide a sound valuation where there is uncertainty and flexibility in the business environment. Real options valuation however is able to deal with high levels of uncertainty and flexibility.

The sentiment is shared by Cotter, Marcum and Martin (2003:71) who decry the traditionally accepted DCF methods as inadequate, conservative and static. With advancement in technology, they suggest the adoption of more dynamic and advanced methodologies to ensure that the correct projects will be accepted for investment purposes. They assert that the fundamental flaw of DCF methods is management's inability to alter decisions and the resultant outcomes once an investment decision has been made (flexibility). They believe that real options should be included in the investment decision-making process. Cotter *et al.* (2003:71) observe that the method used for evaluating the possibility of deviation from the existing assumptions is sensitivity analysis. However, this method only tests changes in one assumption at a time, whereas real options allow for the testing of multiple variables at a time and, therefore, allow for managerial flexibility. Furthermore, Cotter *et al.* (2003:72) observe the increased inclusion

of real options in academic textbooks as a sign of the growing importance and acceptance of the method.

Bennouna *et al.* (2010:225) support this observation, asserting that the main area for management focus should be real options, stating that one of the main developments in the capital budgeting literature in the last decade has been real options, as most capital investment projects have options such as to expand or to abandon a project. They recommend that conventional DCF analysis should be complemented by real options analysis in order to determine the true NPV.

Verbeeten (2006:108) affirms that it is the presence of uncertainties in capital budgeting that necessitates the need for sophisticated capital budgeting techniques, which he defines as real options reasoning and/or gaming theory. Furthermore, he points out that traditional capital budgeting techniques have been found wanting in some respects, especially where the information that is required to conduct valuations using the DCF methods is not readily available. This is consistent with the view presented by Block (2007:256) who asserts that a key weakness of the NPV and other DCF techniques is their lack of flexibility to adapt to changes in other options once a decision has been made to undertake a project. This weakness is attributable to the fact that information may be unknown when the capital budgeting decision based on DCF is undertaken (Block, 2007:256).

In terms of the definition of uncertainties, the findings of the Verbeeten (2006:117) study were that an increase in financial uncertainties resulted in firms viewing sophisticated capital budgeting processes as necessary in line with the theoretical assertion. He indicated that exchange rate and interest rate were financial uncertainties. Social uncertainties, market uncertainties and input uncertainties however, were found to have no influence on the adoption of sophisticated capital budgeting processes.

Triantis and Borison (2001:8) observe that in the current environment, which is characterised by change, uncertainty and the need for flexibility, there is a need to develop tools that can accommodate these dynamics in the evaluation of investments. The real options technique is one such tool. Triantis and Borison (2001:8-9) found that the real

options technique was applied by firms with large investments with a degree of uncertainty in their returns. Whilst the traditional DCF techniques assume that risk is constant over time, the real options technique takes the fact that risk changes over time into consideration (McDonald, 2006:35).

The above studies overwhelmingly concur with the assertion that uncertainty and flexibility are the key weaknesses of DCF techniques and are the ingredients for the case of adopting and applying the real options technique

Given this assertion, it is expected that real options will be used in industries that face these circumstances. Truong *et al.* (2008:98) found an increase in usage of real options in research companies and those involved in natural resources where flexibility is key. Baker *et al.* (2011:182) found that the technique was used mainly by large industrialised firms with substantial capital investments and high levels of uncertainty. This includes the mining, gas and biotechnology sectors.

Verbeeten (2006:118) found that firms in the financial services, construction and utilities industries were more likely to use sophisticated capital budgeting techniques than firms in other sectors. This may be indicative of the degree of exposure to financial uncertainties that these firms faced. Truong *et al.* (2008:105) found that the material and the industrial sectors made use of real options pricing. Block (2007:258) observed the use of real options where there was a high degree of uncertainty in the nature of the decisions required, such as new product decisions and research and development decisions. Interestingly, Block (2007:263) found a very low interest in and usage of real options in the finance community while the technology and energy sectors dominated in their adoption of the methodology.

The view by Block (2007:263) is supported by Triantis and Borison (2001:8-9) who also found that engineering-driven businesses used real options more while the financial fraternity showed less interest. This is confirmed by the fact that where it was applied, it was often not driven by financial people but managers with direct involvement in the development of the business, often engineers and scientists. McDonald (2006:28)

observed that the adoption was higher in energy and pharmaceutical companies while other industries relied more on the traditional DCF techniques.

In his study, Verbeeten (2006:107) sought to understand the use of sophisticated capital budgeting techniques which were defined as real options reasoning and/or gaming theory. The study found that sophisticated capital budget techniques were used to support rather than replace the more traditional methods such as the NPV and PBP techniques, supporting the recurring theme that multiple capital budgeting techniques were used. The study also found that multiple capital budgeting methods were adopted to highlight different aspects of the investment decision to management and that sophisticated capital budgeting techniques were used to augment rather than replace the traditional methods (Verbeeten, 2006:117). This finding was supported by Block (2007:261) who found that 82% of those who used real options indicated that they used it in addition to the traditional NPV technique. McDonald (2006:35) also observed that decision-makers were making capital budgeting decisions based on multiple capital budgeting methods with a measure of subjective judgement.

The acceptance of the real options pricing model has been varied. In 2001, Triantis and Borison (2001:8) already observed that real options had taken a solid albeit limited foothold in the market place in terms of its acceptance. They observed that most companies in their study did not view real options as a "revolution" but an "evolution" of investment and capital appraisal (Triantis & Borison, 2001:9).

McDonald (2006:28) observed that whilst the Black-Scholes-Merton options pricing model (a mathematical formula for the pricing of options) had been successfully implemented and applied to the pricing of derivatives in the last three decades, the equivalent real options pricing model for capital budgeting did not enjoy similar levels of success. He found that less than a quarter of surveyed companies reported using the real options pricing model for capital budgeting purposes.

Block's (2007:257) findings were similar in that 14.3% respondents used real options. Various reasons were given for the slow uptake of the technique. According to Block (2007:261), top management's reluctance to support real options was the most prominent

reason. The reluctance was attributed to management's feeling that their decision-making powers were being reduced. The second reason for not adopting real options was the preference for the well-established NPV and IRR methods. This was also influenced by academics' preference for these methods. The third reason for not using real options was the degree of mathematical sophistication associated with the method. Block (2007:262) found that where real options were used, there was higher utilisation within the engineering and technology (with a higher concentration of scientists) sector as opposed to other sectors. The fourth reason for not using real options was the perception that they encouraged excessive risk-taking by qualifying projects that might otherwise have been disqualified had it not been for the inclusion of real options in the valuation (Block, 2007:263).

Block (2007:260) suggests that the formula for project valuation should be:
Total value = passive NPV +/- real options value +/- other adjustments.

The formula suggests that a project may have a negative NPV and if this is used alone the project would be rejected. However, by including real options, the value of the project may nevertheless be positive and therefore acceptable. Block (2007:261) emphasises that this may be the case, especially where there is not only a high degree of uncertainty or risk inherent in the project but also a high degree of flexibility. In his study, Block (2007:261) found that 32% of the decisions to reject projects on the basis of NPV valuation were reversed once real options were introduced. He also asserted that whilst the NPV may have value in the short-term period of the cash flow assessment, real options may provide a better valuation of the longer term with the uncertainty and flexibility associated with the longer period. Block (2007:261), therefore, supports the use of NPV augmented with real options to obtain a more accurate value for decision-making.

The results of the Block (2007:257) study are supported by Correia and Cramer (2008:37) who also found that there is a very low rate of adoption of real options with more than 50% of South African listed companies not using the technique. They attributed this to the lack of understanding of emerging techniques and the complexity associated with these techniques.

Truong *et al.* (2008:105) found that approximately one third (32%) of the respondents reported using real options although they did not consider it very important. Whilst in their study, Bennouna *et al.* (2010:236) observed that an insignificant number of firms used real options when deciding on investment projects. They considered this surprising, given the extensive coverage of the method in recent literature. They suggest "scepticism, complex and cumbersome techniques, lack of management support, DCF being considered a proven method, and real options being too risky" as possible reasons for this lack of uptake, ,echoing sentiments similar to those found in the Block (2007:261) study.

In a more recent study in Canada, the use of real options was found to be very low and the least preferred method for capital budgeting purposes with only 17% of the respondents using it (Baker *et al.*, 2011:159,182). The most prominent reasons for Canadian managers not using real options were the lack of expertise and knowledge, followed by complexity and inapplicability (Baker *et al.*, 2011:185).

The levels of usage of the technique were found to be varied. In their study, Triantis and Borison (2001:10) found three different levels of usage of real options. Firstly, they found that they were used as a "way of thinking". The language of real options was used to highlight the existence of uncertainty, flexibility and options in project decision-making. Secondly, real options were used as an analytical tool to give value to projects with well-defined option characteristics. Lastly, real options were used as an organisational process where they were used to "identify and exploit strategic options" in the broader context.

The future outlook for real options is uncertain but cautiously positive. Triantis and Borison (2001:23) conclude that going into the future they foresee "a quiet, modest evolution" of real options. Furthermore, acceptance and embedding the methodology will depend on whether it is perceived to add value to the decision-making process. They found that the response to the question of whether the methodology will add value to the decision-making process was overwhelmingly positive. In addition, they identified two impetuses that may increase or accelerate the rate of adoption of real options. Firstly, peer pressure where some companies will start talking the real options language and influence their peers to adopt the method and secondly, Wall Street will "push" for the use of real options in the

valuation of a business providing a common language for valuation (Triantis & Borison, 2001:23).

McDonald (2006:36) asserts that while managers may not state that they are using real options, their behaviour is such that they do use it without using "the formal apparatus of options pricing theory." The behaviour of managers and the results of pricing decisions have been found to be consistent with options pricing theory, albeit without the explicit use of the model (McDonald, 2006:37).

Block (2007:265) concludes his study by stating that although the usage is currently low, the outlook is positive as more than 43% of the non-user respondents suggested that they would consider using the methodology in the future and only 26% rejected it completely. Truong *et al.* (2008:105) concluded that the real options theory may have a foot in the door of capital budgeting but has not attained the same degree of acceptance as the traditional capital budgeting techniques.

In South Africa, Gilbert (2004:49) decries the limitations of the traditional NPV techniques as they do not address uncertainty and flexibility. He observes that the technique commonly used to deal with uncertainty is to have a risk adjusted discount rate for the projects. He comments that adjusting the discount rate treats the uncertainty as a variance of distribution (either positive or negative). Decision- makers are more concerned about the downside variance or negative outcomes. In addition, defining risk in terms of one adjustment does not take the existence of other sources of uncertainty into consideration. The proper treatment of uncertainty should give the decision-maker a range of cash flows that may result from the project.

In dealing with flexibility, Gilbert (2004:50) bemoans the fact that the traditional NPV method only looks at one course of action and it is likely that the most profitable course of action will be valued. However, managers may have flexibility in practice to change their minds as other possibilities transpire, resulting in a different course of action (such as to expand, adjust scope, contract or even abandon a project). The NPV technique does not consider this aspect of capital budgeting.

However, real options techniques are able to take these flexibility and uncertainty factors into consideration in the valuation of a capital project and force management to consider their existence in capital projects. Gilbert (2004:51) outlines the steps involved in options analysis as follows:

- Identification of the traditional NPV technique as it provides the basis for further analysis;
- Identification of key uncertainties and their parameters;
- Identification of management's existing opportunities to respond to these uncertainties;
- Combination of the uncertainties and flexibilities into a valuation framework,;
- Application of the technique by capable management teams.

In terms of the adoption of the method in South Africa, Hall and Millard (2010:87) reported that recent surveys revealed an increased use of sophisticated risk analysis techniques, while from a South African point of view, they found that the use of options analysis was considered a complex technique of dealing with risk and there was a disappointingly low uptake of the technique (Hall & Millard, 2010:95).

Another area that is finding momentum is Economic Value Added (EVA®) and Market Value Added (MVA®). EVA seeks to determine the value added by a project by deducting the cost of capital invested from the profits of the project (Ross, Westerfield, Jordan & Firer, 2001:394), whilst MVA is defined as the "cumulative value created by management in excess of the capital invested by shareholders" (Kramer & Peters, 2001:42). Ryan and Ryan (2002:361) found that EVA® and MVA® "received strong acceptance" although they were relatively new developments. Furthermore, MIRR is also emerging as an acceptable technique to companies (Ryan & Ryan, 2002:362).

3.2   CONCLUSION

Extensive literature on the subject of capital budgeting gives an indication of the evolution of the concepts and themes over a period of time, both internationally and locally.

Whilst the cash flow determination stage is consistently rated as one of the most important and risky activities in capital budgeting, it is deeply disturbing to observe the high use of subjective management judgement and the lack of quantitative methods for such an integral component of the capital budgeting process, especially considering the considerable amounts concerned.

Where project cash flows are discounted, previous studies found an encouraging adoption of WACC as the discount rate, although there is still a significant use of management estimates and other methods such as the specific borrowing costs associated with the project. Furthermore, as propagated by finance theory, the use of the target debt-to-equity ratio is more pronounced than other measures such as the current debt-to-equity ratio. According to Helfert (1997:101), the debt-to-equity ratio shows the relative proportions of all lenders' claims to ownership claims.

Although there is an encouraging positive trajectory towards the adoption of theoretically sound capital budgeting techniques, there is still a high rate of usage of the academically inferior methodologies (particularly PBP and IRR).   This raises concerns since such methods are being used to determine decisions that have a lasting impact on businesses and the economy in general. The continued high usage is attributed to the fact that methods such as PBP are easy to calculate and understand. However, there is an encouraging trend to use the more academically acceptable DCF techniques, especially in larger businesses and projects and where education levels are higher.

The findings of the literature review regarding the incorporation of risk in capital budgeting are also positive in the sense that the importance of this stage in the capital budgeting process appears to be recognised. However, there is still a lag in that the most commonly used method is not a risk analysis tool (such as Monte Carlo Simulation, decision trees or certainty equivalents) but simply a tool that measures sensitivities to changes in certain

variables. The adoption of the adjustment of the discount rate as a risk analysis tool must be lauded as it is academically sound.

The review reveals the gap between what is considered theoretically sound and what is actually applied in practice. Baker and Fox (2002:125) describe this as "an uncomfortable gap between investment appraisal models in literature and current practice." There is an obvious schism between the two, although the signs of narrowing the gap are evident as academically sound capital budgeting practices are gaining momentum and being brought into the workplace. Despite this gap, it appears that new concepts are already emerging and gaining momentum and may soon be adopted in the workplace.

It is important to acknowledge that capital budgeting is not done in isolation by accountants but involves various spheres of a business. In fact, one of the criticisms of DCF techniques is the inability to determine the impact of non-financial costs and benefits. Financial considerations are not the only relevant factors. Qualitative factors are increasingly playing a significant role in capital budgeting decisions.

Whilst DCF capital budgeting techniques are advocated as being theoretically superior, they have their dissenters who point out their weaknesses. However, no reasonable alternatives are offered to replace these methods and they remain superior to the other existing methods. The suggested solution is that DCF techniques should not be used in isolation but in conjunction with other techniques in decision-making. This is evident in previous research as many surveys reveal the use of multiple techniques in investment decision-making.

In terms of emerging trends and advanced methods on the subject, existing literature seems to point towards incorporating advanced methods such as real options in the capital budgeting sphere. The presence of uncertainties and the possibility of flexibility are characteristics that cannot be addressed by the static traditional DCF techniques and are best addressed by real options pricing. However, the uptake of real options is disappointing, although existing literature seems to point to the fact that it has gained a foothold in the market place and will probably gain momentum in future as technology and education levels improve. Reluctance to use these methods has been attributed to the

perceived complexity of running various simulations or iterations on investment decisions (Cotter *et al.,* 2003:79). However, with the continued advocating by academics and the advancement in software which makes the process easier, it appears inevitable that real options will become embedded, at least to complement the DCF methods in capital budgeting.

The findings of the emerging themes identified in the review of existing literature provide an insightful view of current practice and a good yardstick to compare the results of the study in the context of SOCs in South Africa as set out in the objectives of this study. In order to achieve these stated objectives, the following section discusses the research design and methods that were adopted for this study.

4   RESEARCH DESIGN METHODS

This section describes the broad research design and methods employed to reach the objectives of this study, namely, to determine:

- What capital budgeting techniques selected SOCs use for the purposes of their projects;

- What informs the decisions to use such techniques;

- What discount rate is used for capital budgeting purposes;

- How the discount rate, in particular the cost of equity or its proxy, if applicable, is derived;

- How risk is accounted for in the capital budgeting process by these institutions.

This section also discusses the sampling, data collection techniques and steps taken to ensure the quality and rigour of the study.

4.1   RESEARCH PARADIGM AND PHILOSOPHY

The need to understand one's philosophical position in relation to research is to understand one's own assumptions about how the world works and not to take these

views for granted (Saunders, Lewis & Thornhill, 2009:109). The philosophical position assists in the understanding of the way one approaches the research and the personal values one may impose on the outcome of the research (Saunders *et al.,* 2009:109). Research philosophies in management research are summarised below.

Saunders *et al.* (2009:110) and Ponterotto (2005:13) observe that *ontology* is concerned with the nature of reality and being, Saunders *et al.* (2009:110) further note that there are two views, namely *objectivism* and *subjectivism*. Whilst *objectivism* suggests a separation between social entities and actors, *subjectivism* suggests that the perceptions and actions of the actors actually create the social phenomenon.

Saunders *et al.* (2009:112-113) assert that *epistemology* is concerned with what constitutes acceptable knowledge in a field of study. They distinguish between a "resources researcher" who collects facts (where resources can be seen and measured) and considers them to be important and a "feelings researcher" who considers feelings and attitudes (where resources cannot be seen or measured) to be important.

According to Saunders *et al.* (2009:116), *axiology* is concerned with the study of judgements about value. The suggestion is that the study is subjective and can influence the integrity of the results of the research.

Positivism relates to working with observable social realities (Saunders *et al.,* 2009:113). Plack (2005:226) observes that positivists seek to use "valid and reliable methods to describe, predict and control human behaviour." Furthermore, Saunders *et al.* (2009:114) suggest that with *positivism*, the "resources researcher" is external to the process of data collection and there is little that can be done to alter the substance of the data as opposed to the "feelings researcher" who is more involved. Whilst *positivism* suggests reducing complexities into a series of generalisations, *interpretivism* argues against this simplification and advocates that the complexities be understood (Saunders *et al.,* 2009:116). *Interpretivism* encourages the individual to interpret the meaning of his/her context as they experience it.

According to Plack (2005:228), *constructivism* asserts that "human behaviour must be viewed and interpreted according to the individual's motives, intentions, or purposes for action as well as through rules that have been consensually agreed upon and validated by people in society."

In terms of *realism*, Saunders *et al.* (2009:114) assert that objects are viewed as existing independently of the human mind. They distinguish between *direct realism,* which suggests that what we experience sensually is the accurate portrayal of the world, and *critical realism,* which suggests that we do not experience the world directly, but merely sensations and images of the world (Saunders *et al.,* 2009:115).

The approach to this study was *positivism. Ontologically,* the researcher was external to and independent of the participants in the research (Saunders *et al.*, 2009:119). The method of the survey lends credit to this assertion as the researcher presented a standardised questionnaire.. *Epistemologically*, only observable data in the form of current capital budgeting practices were used for the purposes of the research and the researcher sought to draw generalisations from the results (Saunders *et al.,* 2009:119). *Axiologically*, the research was undertaken in a value-free way meaning that the researcher was independent (accepting data at face value) and remained impartial (Saunders *et al.*, 2009:119).

4.2   DESCRIPTION OF INQUIRY STRATEGY AND BROAD RESEARCH DESIGN

Below is a description of the inquiry strategy and broad research design adopted for the research.

4.2.1   <u>Description of the study's strategy of inquiry</u>

The study's strategy of inquiry is descriptive quantitative research by means of a questionnaire. A survey research is often obtained by means of a questionnaire and involves the acquisition of information about people or groups of people by asking them questions and tabulating the answers (Leedy & Ormrod, 2010:187; Saunders *et al.*, 2009:144).

The research is a cross-sectional study in that it captures a picture at a certain point in time (Saunders *et al.*, 2009:155).

Support for this strategy is also informed by previous similar studies conducted in the private sector in the South African context. For a similar study on South African manufacturing firms, Gilbert (2003:13) adopted a postal survey for the purposes of his research. In his studies on capital budgeting techniques and risk analysis, Hall (2000:356; 2001:403) also made use of a questionnaire. Du Toit and Pienaar (2005:20) made use of a postal survey by means of a questionnaire. However, Hall and Millard (2010:88) made use of personal interviews by means of a questionnaire for their study on capital budgeting by listed South African companies.

4.2.2   **Basic characteristics of quantitative research**

A key concern regarding questionnaires is the response rate of respondents (Leedy & Ormrod, 2010:189). In the study, this concern was exacerbated by the fact that the population in the survey was not large as discussed below. Leedy and Ormrod also identified reading, writing and interpretation skills of the respondents as concerns. However, for the purposes of this study, it was not a significant concern as the respondents were well-educated and qualified individuals.

Leedy and Ormrod (2010: 188-189) caution that certain weaknesses may exist in the survey approach. Firstly, a survey reports the results of a snapshot at a certain point in time and it may be incorrect to infer the results over a longer period as they may not be constant. However this study observes trends as they emerge from previous studies (snapshots) as discussed in the literature review. Secondly, they also caution that surveys are based on self-reporting, implying that they are based on the respondents' opinions and what they think the researcher wants to hear. It may be that the respondents wish to portray a good self-image to the researcher, thus distorting the facts and the subsequent results. Thirdly, their response may not be well thought-out and may be heavily influenced by recent events.

However, the advantage of a questionnaire is that it is economical (Saunders *et al.*, 2009:144). Given the dispersion of the respondents in this study, this method was the most feasible proposition. The respondents were more likely to be honest as their responses were anonymous (Leedy & Ormrod, 2010:189).

4.2.3 Classification of the study's overall research design

The following descriptors apply to the research design:

- *Empirical research*: The study involved the collection and analysis of primary data on capital budgeting techniques adopted by South African SOCs.
- *Basic research*: According to Saunders *et al.* (2009:588), basic research aims at understanding processes and outcomes mainly for the academic community. This study sought to understand capital budgeting processes and outcomes.
- *Descriptive research*: According to Saunders *et al.* (2009:590), the purpose of this form of study is the accurate presentation of persons, events or situations. Capital budgeting events were researched for the purposes of this study.
- *Cross-sectional research*: The results of the study produce a snapshot of a phenomenon at a specific point in time (Saunders *et al.,* 2009:590). The participants were requested to provide information once and the results represent that particular point in time.
- *Non-experimental research*: The study did not involve the variation of conditions and was not subject to any form of controlled intervention (Saunders *et al.,* 2009:591).
- *Primary data*: Saunders *et al.* (2009:598) define primary data as data collected specifically for the research project being undertaken. In the study, questionnaires were used to collect primary data to address the research objectives.
- *Quantitative data*: The results obtained from the questionnaires were quantified numerically (Saunders *et al.,* 2009:598).

4.3 SAMPLING

For the purposes of this study, SOCs formed both the *units of analysis* and the *sampling units.* The population consisted of South African SOCs involved in the execution of

infrastructural projects and SOCs that provided such companies with funding. Given the limited number of such organisations, the approach adopted for the study was to include all entities that met the identified requirements and, therefore, sampling was not required. The following entities were identified and approached for purposes of this study:

- Airports Company of South Africa (ACSA);
- Alexcor;
- Broadband Infraco;
- City Power;
- Denel;
- Development Bank of Southern Africa (DBSA);
- Eskom;
- Industrial Development Corporation (IDC);
- The National Empowerment Fund (NEF);
- Rand Water;
- South African Forestry Company Limited;
- The South African National Roads Agency Limited (SANRAL);
- Transnet;
- The Trans-Caledon Tunnel Authority (TCTA).

4.4   DATA COLLECTION

The sections below detail the approach adopted in terms of data collection.

4.4.1   <u>Survey method</u>

The primary data was collected by means of a survey based on structured questionnaires.

The questionnaires were distributed to the CFOs or their equivalent in the organisations by way of electronic mail. This was preceded by a courtesy telephone call to give a high-level briefing to the individual on the study.

Follow-up calls were also made to determine whether the questionnaires had been received and to clarify issues that may have been misunderstood or were unclear to the recipients.

4.4.2 <u>Measurement</u>

The respondents were measured on the rate of adoption of methods used for capital budgeting purposes. As suggested by Borne and Clark (1994) in Saunders *et al.* (2009:374), the approach for the questionnaire was to adopt and adapt questions used in previous studies to facilitate comparability of results. However, as the context of SOCs differs from private companies, it was acknowledged that some new questions had to be developed to accommodate such differences.

The questions entailed the numerical ranking and rating (Saunders *et al.*, 2009:378-379) of the various techniques and concepts applied in capital budgeting by the respondents.

4.4.3 <u>Pretesting</u>

The questionnaire was pilot tested on a group of ten professionals who were asked to complete the questionnaire and provide commentary feedback on its face value (Saunders *et al.,* 2009:394). A shorter follow-up questionnaire was given to the group to determine which issues warranted further attention in the questionnaire. Amongst others, the following suggestions by Bell (2005) in Saunders *et al.* (2009:394) were incorporated as part of the feedback:

- Time required to complete the questionnaire;
- Clarity of the instructions;
- Unclear or ambiguous questions;
- Opinion on major topic omissions;
- Layout of the questionnaire;
- Additional comments.

The results of the pilot test were incorporated to refine the content and format of the questionnaire for the actual survey.

4.5   DATA ANALYSIS

The research instrument used for this study reflected the collected data (see Appendix A). The data is predominantly categorical as it cannot be measured numerically but describes characteristics and was ranked in some cases (Saunders *et al.,* 2009:417). Some of the data is dichotomous (Saunders *et al.,* 2009:418) as it required "yes" or "no" responses. Descriptive and ranked data constituted a substantial number of the responses of the research participants.

The data collection questionnaire was in the form of an interactive Excel spread sheet with drop-down menus to save time for the participants and to ensure accuracy of the results. Upon collection, the data was consolidated manually into one sheet. Given the limited size of the sample, it is envisaged that there are minimal errors in the consolidation of the data.

4.6   ASSESSING AND DEMONSTRATING THE QUALITY AND RIGOUR OF THE RESEARCH DESIGN

Potential threats to the credibility of this study are a reality where the findings may be questioned and found wanting in terms of their accuracy and conclusions (Saunders *et al.,* 2009:156; Leedy & Ormrod, 2010:29). However, the issue is to mitigate this risk as far as possible by putting measures in place that will increase the likelihood of accurate findings and conclusions (Saunders *et al.,* 2009:156).

The two potential threats to the study are *reliability*, which refers to the ability of the study to yield consistent results and *validity*, which refers to the ability of the study to measure what it sets out to measure (Saunders *et al.,* 2009:157,372; Leedy & Ormrod, 2010:29).

4.6.1 <u>Reliability of the study</u>

Saunders *et al.,*(2009:373) observe that reliability in the context of a questionnaire survey is concerned with whether or not it will produce consistent results at all times and under differing circumstances.

For the purposes of this study, *internal consistency* (Saunders *et al.,* 2009:374) was used to determine the reliability of the study where the responses in the questionnaire were triangulated to determine the level of consistency. Judgement was also used to determine the final outcome.

Furthermore, as some of the entities are regulated entities, publicly available information was used to test the consistency of the responses of the organisations.

4.6.2 <u>Validity of the study</u>

To determine the *content validity* of the study (Saunders *et al.,* 2009:373), the questionnaire was tested on a group of ten professionals who were not part of the final study, but who understood the concepts of capital budgeting. Professionals with post-graduate financial qualifications were used to test the questionnaire. In addition, the questionnaire was tested for rigour and completeness by comparing it to questionnaires used for similar capital budgeting studies in the past.

The following section provides an in-depth analysis of the data collected by means of the research instrument and is followed by an analysis of the findings.

5 EMPIRICAL RESULTS AND ANALYSIS

The results of the study provide a unique view of the capital budgeting procedures in SOCs which form an important sector of the South African economy where no evidence of previous studies on the subject could be found.

Although the sample included 14 SOCs, only six responded, despite several attempts to obtain a higher ratio of returns. Confidentiality was quoted as the greatest concern by those who did not return the research instrument, despite assurances that the responses would be treated with the strictest confidentiality and that the SOCs would not be associated with the data. Understandably, some of the SOCs had been receiving extensive negative media coverage regarding their capital programmes and this may have been a contributing factor to their reluctance to participate in the study.

The research instruments of the six SOCs that responded were all of a usable quality. This is predominantly the result of the fact that they were willing to engage with the researcher where clarity was required. Therefore, the response rate was approximately 42%.

5.1 COMPANY AND DECISION-MAKER'S PROFILE

The SOCs represented in the responses came from various sectors of industry, namely energy, transport, aviation and manufacturing.

As indicated, the data collection instrument was directed at the CFOs of the organisations or their equivalent by way of electronic mail. In most cases, however, due to demands on their time, the questionnaires were delegated to staff directly responsible for capital budgeting processes reporting to the CFOs or their equivalent. In one case, the questionnaire was completed by the CEO of the SOC. The other respondents to whom the questionnaires were delegated indicated that they were all chartered accountants [CAs[SA]) in various positions who played an advisory role in capital budgeting decisions. The CFOs were ultimately responsible for the final capital budgeting decisions.

Table 2 reflects the age profile of the CFOs. In terms of the CFO age profile, half of the responding companies had CFOs between the ages of 40 and 49 whilst a third of the CFOs were below the age of 40. All of the CFOs were CAs[SA] with one having a master's degree.

Table 2:   CFO age profile (years)

CFO age profile (years)	%
Less than 40	33%
Between 40 and49	50%
Between 50 and59	17%
More than 60	0%
	100%

Furthermore, 83% of the CFOs had been with their companies for less than four years while only one had been with the company for more than 9 years.

The extent of the fixed assets managed by the SOCs and the revenue they generate are a reflection of the strategic importance of these entities in the delivery of essential services to the country. Table 3 reflects an even distribution of assets with only one company managing assets of less than R5bn and two companies managing fixed assets of between R11bn and R50bn.

Table 3:   Fixed assets net of depreciation

Total Assets	%
Less than R5bn	17%
R5bn - R10bn	0%
R11bn - R50bn	33%
R51bn - R100bn	17%
R101bn - R200bn	17%
More than R200bn	17%
	100%

With the exception of two companies that generate annual revenue in excess of R100bn, the distribution of revenue generated by SOCs is even as reflected in Table 4 below.

Table 4:   Annual revenue generated by SOCs

Annual revenue	%
Less than R5bn	17%
R5bn - R10bn	17%
R11bn - R50bn	17%
R51bn - R100bn	17%
R101bn - R200bn	33%
More than R200bn	0%
	100%

Whilst the annual capital expenditure by SOCs is substantial, the revenue generated seems disproportionate to the expenditure on capital projects as listed in Table 5 with more than 50% of the companies spending less than R10bn on their capital projects annually, and 33% spending between R10bn and R50bn. This could be attributed to the fact that in the last few years, some SOCs have embarked on substantial infrastructure expansion projects funded by significant borrowings that resulted in finance costs that now require to be paid by generated income.

Table 5:   Annual capital expenditure by SOCs

Annual capital expenditure	%
Less than R10bn	50%
R10bn - R50bn	33%
R51bn - R100bn	17%
R101bn - R200bn	0%
More than R200bn	0%
	100%

The following sections deal with the responses of the SOCs on capital budgeting processes, namely the stages of the capital budgeting decisions, capital budgeting techniques, cash flow estimation methods, risk adjustment techniques and qualitative considerations.

5.2   STAGES OF CAPITAL BUDGETING

The research instrument sought to determine the *importance* that the SOCs attached to the various stages of the capital budgeting process from project definition to post-implementation review. Furthermore, the respondents were asked to rate the *complexity* of each stage of the capital budgeting process. Table 6 reflects the results.

Table 6:   **Capital budgeting stages: importance and complexity**

Capital budgeting stage	Most important	Most complex
Project definition and cash flow estimation	22%	40%
Analysis and selection	22%	0%
Implementation	56%	60%
Post-implementation review	0%	0%
	100%	**100%**

Interestingly, project implementation was considered the most important and complex stage of the capital budgeting process. This is inconsistent with the findings of previous studies discussed in the literature review where the cash flow estimation stage was consistently rated as one of the most important and risky activities in capital budgeting.

This could be attributed to the fact that SOCs face challenges as they have to compete with the private sector for the necessary skills. Furthermore, capacity to execute large-scale infrastructure projects has proven to be a challenge for the SOCs. This could be attributed to the fact that there is an acknowledgement that an increase in the demand for services has not been matched by growth in the capacity, resulting in a backlog in the past decade. The SOCs are, therefore, trying to catch up with demand in a short space of time, making implementation a challenge. Funding of projects has also been a challenge with the National Treasury having to meet requirements that continue to put a strain its funding capacity.

The importance attached to the implementation stage can also be attributed to the pressure exerted on Government to deliver on services to the general population.

In contrast to the findings of previous studies, 40% of the respondents considered the project definition and cash flow estimation stage to be the most complex stage of the capital budgeting process. The complexity of cash flow estimation is supported by the significant cost overruns of major infrastructural projects across the country.

Considering the size of the projects as evidenced by the extent of annual capital expenditure budgets, it is of concern that none of the respondents rated the post-implementation review of the projects as either important or complex. Only half of the respondents reported doing any form of post-audits. Hall and Millard (2010:90) observe that this stage is important for learning from previous experience and ensuring the transfer of knowledge in the organisation. It is also important for the prevention of potentially expensive errors. Given the increased negative media coverage of infrastructural projects by SOCs, it is expected that in future this stage of the capital budgeting process will receive a greater deal of attention and a higher rating.

5.3   CASH FLOW ESTIMATION METHODS

As indicated above, the project definition and cash flow estimation stage was ranked the second most complex stage of the capital budgeting process. When asked to respond on how they determined the cash flow requirements of the projects, the respondents indicated that they used a combination of techniques and did not rely on one technique only. Table 7 reflects the results of the responses.

Table 7:   Cash flow estimation methods

Cash flow estimating methods	%
Management estimates	13%
Expert opinions	27%
Quantitative methods	13%
Previous experience	33%
Other	13%
	100%

Previous experience was the most popular technique adopted for estimating cash flows. This is interesting considering that post-implementation review of projects was not considered an important stage of the capital budgeting process (see Table 6). It may

suggest that errors in the process of estimating cash flows may occur if the previous experience was not modified to take into consideration the actual cash flows that occurred during the project. The mitigating factor for this risk is that, as indicated, the respondents use more than one technique to determine cash flows.

Previous experience was followed by the utilisation of expert opinions (27%) in generating cash flow estimates. Management estimates, quantitative methods and "*Other*" techniques received an equal rating. The SOCs that used "O*ther*" techniques indicated that they used indicative market budget quotes received from potential suppliers.

It was comforting to observe that more than 50% of the respondents used formal techniques (excluding the use of management subjective estimates and previous experience) for cash flow estimation. Previous studies reported a high use of subjective management judgement and a lack of quantitative methods for such an integral component of the capital budgeting process, this despite the substantial amounts concerned.

5.4   CAPITAL BUDGETING TECHNIQUES

The respondents were asked to indicate their preferred capital budgeting techniques. Similarly to the cash flow estimation techniques, the respondents indicated a preference for more than one capital budgeting technique. One respondent indicated that the company's investment committee required the results of all the techniques with the exception of real options. Table 8 reflects the most preferred capital budgeting techniques.

Table 8:   **Preferences for capital budgeting techniques**

Preferences for most used capital budgeting technique	%
Net present value (NPV)	25%
Internal rate of return (IRR)	17%
Modified internal rate of return (MIRR)	8%
Profitability index (PI)	17%
Payback period (PBP)	17%
Return on investment (ROI)	8%
Real options	0%
Other	8%
	100%

It was disappointing to observe that only 25% of the SOCs preferred to use the NPV method. If the primary usage of IRR is included, this brings the total for these techniques to 42%. In cases where the NPV was not the most preferred technique, 15% indicated that the technique was used as a secondary technique to support the primary technique. Overall, there is a significant use of DCF techniques for capital decisions.

The preference for NPV over IRR supports financial theory that advocates using the superior NPV rather than IRR as the latter may give incorrect results in the case where multiple projects which are being assessed are mutually exclusive (Bennouna *et al.*, 2010:238). In contrast to the study on listed South African companies where Hall and Millard (2010:92) found that there was not a significant difference between the preference for NPV and IRR, the results of this study found a significant preference for NPV compared to IRR.

The IRR and PBP techniques received an equal and significant rating of 17% usage each. This is consistent with previous studies which observed that the use of IRR and PBP remain high, although there is a trajectory over time towards the NPV technique. It is likely that the continued usage of the techniques is attributable to the fact that the methods are easy to calculate and understand. The MIRR, ROI and "*Other*" techniques also received an equal rating of 8%.

Although the real options technique was not the respondents' preferred technique, two SOCs indicated that they used it as a secondary technique. This is in contrast to the

findings of previous studies that found that there was an emergence of the use of real options in engineering-driven, construction and large industrial businesses that had substantial capital investments and high levels of uncertainty (Triantis & Borison, 2001:8-9; Verbeeten, 2006:118; Baker *et al.*, 2011:182). The insignificant use of the real options technique by SOCs could be attributed to pressure to increase the capacity to meet rising demands for their services and, therefore, there is no realistic option to abandon projects once a decision has been made and communicated. This may also be the reason for the significant cost overruns.

In the case of "*Other*", the respondents indicated that in some cases the projects are approved, irrespective of the outcome of any capital budgeting technique based on considerations such as legal requirements. A detailed discussion on qualitative considerations follows later in this paper.

In terms of the cash flows used for NPV and IRR purposes, the respondents were also asked whether they used project cash flows as accounting income to which an encouraging 83% indicated that they did. However, 50% indicated that they deducted interest and other finance costs associated with the projects from the cash flows.

When NPV and IRR were used, the respondents were asked which of the two was preferred, to which 66% indicated preference for the NPV technique. Whilst the use of NPV and IRR is significant and encouraging, the fact that they are not universally used is also a concern given that the principals responsible for the capital budgeting process from a financial point of view were all CAs[SA] and were in a position to influence senior management to use theoretically correct techniques. In addition, the equal ranking of IRR, PI and PBP is a concern, given the qualifications of the responsible parties. This is perplexing, given the fact that approximately 83% of the CFOs are below the age of 50 and it would have been expected that they would be familiar with any recent developments in the field of capital budgeting.

There is room for improvement in the use of theoretically correct techniques and the correct definition of cash flows in the capital budgeting processes of SOCs.

5.5 DETERMINING THE DISCOUNT RATE

An important consideration in the use of the NPV is the discount rate. Where the respondents indicated that they used the NPV technique they were requested to indicate the discount rate used. All the respondents indicated that they used WACC. Furthermore, 83% indicated that they used the CAPM to determine the cost of equity while one company indicated that it used a proxy of a listed entity. In other words the company based its cost of equity on the cost of equity of a listed peer in a similar industry.

Table 9:   Determination of the cost of equity

Determination of the cost of equity	%
Proxy of other private entity	17%
Estimated figure	0%
Capital asset pricing model (CAPM)	83%
	100%

All the SOCs indicated that where WACC was used, the government bonds were used as a proxy for the risk-free rate. In determining the beta, 50% indicated that they used the betas of listed peer companies whilst the rest used published sources and own determined betas.

Table 10:   Determination of beta

Determination of beta	%
Published source	17%
Own determined beta	33%
Other (benchmarked against peers)	50%
	100%

Of the respondents, 67% indicated that they used published sources for determining the market risk premium while 83% indicated that they used long-term targets of debt and equity in their consideration of WACC.

Table 11: Determination of the market risk premium

Determination of the market risk premium	%
Published source	67%
Own-determined market risk premium	33%
Other	0%
	100%

All respondents also indicated that they discounted real cash flows with a real discount rate or alternatively, nominal cash flows with a nominal discount rate. Furthermore, half of the respondents had only one company-wide discount rate whilst the other half used different discount rates for various subsidiaries, divisions and projects.

The approaches used by the SOCs in their use of WACC appear to be sound with correct theoretical precepts generally being used.

5.6   QUALITATIVE CONSIDERATIONS FOR CAPITAL PROJECTS

Owing to the nature of infrastructure projects undertaken by SOCs and their mandates emanating from their shareholder's (government) priorities, it is understandable that considerations other than quantitative factors would play a significant role in the capital budgeting process of these companies As indicated earlier, one respondent observed that in the consideration of the capital budgeting techniques, the outcome of the quantitative calculation could be completely overridden by statutory or regulatory considerations.

Previous studies found that non-financial (qualitative) factors play a growing and significant role in the capital budgeting process of firms in the private sector (Hall & Millard, 2010:96).

The respondents were asked how they would rank the importance of quantitative factors against qualitative factors in the decision-making process on capital projects. Table 12 reflects the response of the SOCs.

Table 12:   Quantitative and qualitative considerations

Quantitative and qualitative factors	%
Quantitative	56%
Qualitative	44%
	100%

On average, the SOCs responded that quantitative factors carry 56% of the weight in the decision- making process for capital budgets. While quantitative factors carry the most weight, it is interesting to observe that qualitative factors play a significant role in the decision-making process with a weight of 44%.

Whilst Table 12 reflects the average responses, a closer scrutiny of the responses revealed that 33% of the SOCs indicated that quantitative factors carry a weight of 40% or less, the balance indicated that quantitative factors carry a weight of between 60% and a maximum of 70%.

Table 13 sets out what the SOCs considered to be the most important qualitative considerations.

Table 13:   Qualitative considerations

Most important qualitative considerations	%
Political influences	0%
Environmental factors	29%
Service delivery considerations	29%
Employment creation	7%
Government regulations	28%
Other	7%
	100%

Environmental factors, service delivery considerations and Government regulations received an equal rating of 29%.

Some of the respondents leave a significant footprint on the environment, such as considerable levels of carbon dioxide (CO_2) emissions and the consumption of scarce natural resources such as water. It is, therefore, not surprising that environmental factors

are an important consideration. The significant rating given to this consideration is also a reflection of the pressure that funders of some of these projects have brought to bear on the SOCs. Some conditions imposed as part of the funding agreements stipulate that considerations of the environment should be given a high priority and this should be reflected in the technologies used in the projects.

There has been a sharp focus on service delivery in the country with the sentiment that not enough has been done in terms of improving the lives of many in the lower living standard measure (LSM) groups, for example, failing and dilapidated infrastructure and capacity limitations. This has resulted in public protests. It is, therefore, expected that service delivery considerations would be given a significant ranking, given the mandates of the SOCs to deliver essential services.

As far as service delivery considerations are concerned, some of the entities are regulated by Government, primarily because they are virtually monopolies in the industries in which they conduct their business. (In order to introduce a semblance of a competitive environment, the entities are regulated to simulate competitive markets). Some of the regulations impose minimum requirements on the level of service and, therefore, prescribe specific investments to meet these requirements.

Other Government regulations relate to the procurement of services and products from previously disadvantaged groups in order to redress the imbalances caused by previous Governments. Although this was not addressed specifically in the research instrument, it is an area that warrants further research.

Given the levels of poverty and unemployment in the country and the priority of the Government to increase employment, it is surprising that SOCs did not rank the employment creation considerations higher. With the massive capital expansion budgets, the SOCs are in a position to influence the creation of employment in not only the construction of the infrastructural projects, but also the continued operation of the assets. This low priority of employment creation given by SOCs, is also in contrast to the call by the Government to the private sector to create employment opportunities.

In terms of "*Other*" considerations, the respondents indicated that the continued delivery of their services would sometimes outweigh any financial considerations to the point that they would be justified in operating projects at a loss if they had to. Considering that some of these entities are monopolies and suppliers of last resort, this rationale is understandable because the sector could collapse if they do not provide the service.

Whilst the creation of shareholder wealth may be the overriding consideration in capital budgeting in the private sector, imperatives other than the creation of shareholder wealth would play a more significant role in SOCs.

5.7   RISK CONSIDERATIONS IN CAPITAL BUDGETING

Hall and Millard (2010:93) observe that the incorporation of risk considerations in the capital budgeting process has been advocated for some time and various techniques are available to the practitioner.

The respondents were requested to indicate the techniques they used in the consideration of risks in the capital budgeting process. Table 14 outlines the responses.

Table 14:   Risk adjustment techniques

Risk adjustment techniques	%
Scenario analysis (i.e. base case, worst case, best case forecasts)	38%
Certainty equivalent method	0%
Sensitivity analysis	38%
Simulation analysis (e.g. Monte Carlo Simulation)	12%
Decision-tree Analysis	12%
Other	0%
	100%

All the respondents indicated that they included risk considerations in their capital budgeting process and used more than one technique for risk considerations. Scenario analysis and sensitivity analysis received an equal rating of 38%, while simulation and decision-tree analysis received a lower rating of 12%. Hall and Millard (2010:95) observed that sensitivity analysis is not a risk-measuring technique but tests the sensitivity of the

project to variables that may influence the project. The appeal of this technique is attributed to its simplicity and cost-effectiveness.

Real options analysis was addressed under the heading Capital Budgeting Techniques. Only two respondents used this method and then only as a secondary technique.

The respondents were also asked which method they used to incorporate risk in the capital budget process. Table 15 outlines the responses.

Table 15: Methods to incorporate risk adjustments

Methods to incorporate risk adjustments	%
Risk-adjusted discount rate	20%
Adjustment to cash flows	60%
Certainty equivalent units	0%
Other	20%
	100%

It is clear that the most popular method is the adjustment to cash flows to incorporate risk in the process. Adjustment to the discount rate and "*Other*" methods received a 20% rating each.

As far as "*Other*" methods are concerned, the respondents indicated that they would adjust technical assumptions of the project which feed into the capital budgeting considerations such as the rate of usage of the assets or operating level of the assets.

The significant use of sensitivity analysis is consistent with previous South African studies quoted in the literature review. However, previous studies found that where respondents adjusted for risk, the preference was for an adjustment of the discount rate rather than an adjustment of the cash flows. This contrasts with the findings of this study.

6   CONCLUSION AND RECOMMENDATIONS

The purpose of this study was to determine the capital budgeting techniques employed by selected South African SOCs involved in major infrastructure projects and DFIs involved in funding these projects. Despite the significant number of studies both locally and internationally on the capital budgeting techniques employed by private entities (and Government utilities internationally), there is no evidence of such a study on state-owned companies in the South African context.

An inherent challenge of the study was the small number of entities available to participate in the study. This was to be expected as South Africa is a relatively small developing country. A high response rate was thus essential to ensuring the reliability of the results. Despite many efforts, the response was limited to 42% because of the entities' concerns, for example, confidentiality.

The respondents consisted of CAs[SA] who worked in an advisory capacity and, therefore, the responses were considered to be reliable. The CFOs of the companies were also all CAs[SA] who had been incumbents of their current positions for at least four years, giving further credence to the results.

The SOCs were from various sectors and controlled the monopoly in their sectors, making them strategically important to the economy. In addition, 83% of the SOCs had assets in excess of R10bn each, with one managing assets of more than R200bn. Of the SOCs that responded, 67% had at least 10 000 employees each and one had more than 50 000 employees. Therefore, despite the small number of SOCs, their mandates to deliver on services such as energy and transport are significant.

In terms of the results of the study, project implementation was considered the most important and complex stage of the capital budgeting process in contrast to other studies which typically found project definition and cash flow estimation to be the biggest challenge. This may be a symptom of the challenge faced by the SOCs which have seen a period of massive underinvestment in the last decade and are now trying to catch up to demand that is outstripping the existing capacity. The level of public scrutiny has also

increased with extensive, mostly negative media coverage putting pressure on the SOCs to deliver on projects. Other difficulties experienced in project execution are that SOCs do not have the capacities to implement the projects due to a lack of skills and funding limitations. This is compounded by the urgency imposed on Government for service delivery throughout the country.

Whilst not considered the most important stage, project definition and cash flow estimation obtained a significant rating. The complexity of cash flow estimation is supported by the significant cost overruns of major infrastructure projects throughout the country.

A feather in the cap of SOCs is the fact that 87% of the respondents indicated that they used formal techniques for the estimation of cash flows. This is in contrast with previous studies that indicated a heavier reliance on management subjective estimates of project cash flows. However, there have been major cost overruns on major infrastructural projects and this is an area that may warrant further research.

Although all the CFOs were CAs[SA], it was disappointing to observe that only 25% of the respondents used the NPV as the primary technique for capital budgeting. (A further 15% used it as a secondary technique). In addition, 17% used the IRR, which means that only 42% of the SOCs used DCF techniques as the primary method for capital budget assessments. Notwithstanding the results, there was a notable preference for NPV over IRR in contrast to previous studies. This is supported by financial theory which observes that IRR can give an incorrect assessment under certain circumstances. Similar to previous studies, there is still a significant use of the PBP method, probably due to its simplicity to calculate and understand. It was also observed that all the SOCs used more than one technique to make decisions.

Where the NPV was used, the results showed that the respondents correctly used WACC as the discount rate. The risk-free rate was benchmarked against Government bonds in all the cases, while half of the respondents indicated that their beta was determined based on listed peer companies and that the balance was based on own determined betas. Two thirds of the respondents who used WACC indicated that they used published market risk premiums.

Owing to the nature of infrastructure projects undertaken by SOCs and their mandates emanating from their shareholder's (Government) priorities, it is understandable that considerations other than quantitative factors would play an especially significant role in the capital budgeting process of these institutions. On average, the respondents indicated that they based 56% of the capital budget decision on quantitative factors and the balance on qualitative factors. The key qualitative considerations were environmental factors, service delivery considerations and Government regulations. Given the levels of poverty and unemployment in the country and the priority of Government to create employment, it is surprising that SOCs did not rate the employment consideration higher. A Government regulation consideration that warrants further research is the impact of procurement of services and products from previously disadvantaged population groups on infrastructural projects.

In terms of risk considerations, the results of this study were in line with previous studies which found that sensitivity analysis was the most popular technique, despite its limitations in terms of measuring risk. Although current trends suggest that the real options method is emerging as a technique applied in capital budgeting, especially for construction and engineering projects, this study found that this technique was not used as a primary technique but only in a support role or as a secondary technique.

This study found that although not universal, there is a significant use of DCF techniques in the capital budgeting processes of SOCs. The standards used by SOCs to assess capital projects are not lower (and in some cases are even higher) than those applied by their peers in the private sector.

In summary, in terms of the objectives set out for this study, the results have established that SOCs use various techniques for capital budgeting purposes with a low uptake of DCF techniques as primary determinants of capital projects. The continued use of inferior capital budgeting techniques could be because of their ease of calculation and understanding. The substantial weight attributed to quantitative considerations (approximately 44%) by SOCs could also be a factor contributing to the use of non-DCF techniques. WACC emerged as the preferred discount rate for capital budgeting purposes

with the market or target debt-to-equity ratio as advocated by financial theory. The CAPM was the most popular technique for determining the cost of equity. In their consideration of risks in projects, SOCs preferred to use sensitivity analysis, despite it not being a risk measurement technique.

The implications of this study are numerous.

- Firstly, whilst all the respondents indicated that they were CAs[SA], it is disappointing that only 25% indicated that they used the NPV as a primary technique of capital budgeting. This may require that academics need to emphasise the importance of using NPV as a primary capital budgeting technique at teaching institutions for current learners and discourage the use of inferior techniques such as PBP. In addition, for those who are already working in industry, the continuous professional educational requirements of independent professional financial qualification institutions such as the South African Institute of Chartered Accountants (SAICA) should continuously encourage and test their members on the application of correct theory.

- Secondly, the uptake of new developments in capital budgeting techniques such as real options is also disappointing. This is especially true considering the nature (major infrastructure) and value of the projects undertaken by SOCs. Once again, the responsibility may lie with academics to bring these techniques to the fore to ensure that learners are familiar with the technique. Furthermore, for professionals already in the field, professional financial qualification institutions should make the learning of new developments in the field of finance a compulsory requirement for the continued membership of their institutions.

- Thirdly, the use of sensitivity analysis as a risk technique is a concern that is a common thread running through international companies, local companies and SOCs. Once again, the intervention of academics and professional qualification institutions is required to promote the use of this technique and to encourage the uptake of more correct techniques such as simulations.

- Lastly, the study also points to areas that may present further knowledge gaps in the area of capital budgeting for SOCs which require further research.

Further research in capital budgeting techniques could include SOCs that are not only involved in major infrastructural projects. This would increase the size of the sample and the number of responses.

Whilst the topic has been researched extensively in the private sector over many years and trends of development are traceable, it would be beneficial to observe the trends and developments of capital budgeting in SOCs over a period of time.

A key concern raised in this research is the observation that the post-implementation review stage of the projects received a low priority rating. Research into the post-implementation success levels of projects would be beneficial to the completion of the capital budgeting cycle. Included in this research should be the comparison of the projections of the various inputs, including project cash flows against the actual results.

A key qualitative consideration for SOCs is the procurement of services and products from previously disadvantaged groups. Research on the impact of this policy on the capital projects of SOCs would be insightful.

To conclude, the aim of this study was to research the capital budgeting techniques used by selected South African SOCs. The results provide a useful insight into the techniques used by these companies. At the same time this study also highlights the possibility of further research in other aspects of capital budgeting for the SOCs.

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APPENDIX A

- Research Instrument -

FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES

University of Pretoria

CAPITAL BUDGETING TECHNIQUES EMPLOYED BY SELECTED SOUTH AFRICAN STATE OWNED COMPANIES

1 Please indicate the IMPORTANCE attached to each of the stages of the capital budgeting processes in your company.

	Least important	Somewhat important	Very important	Most important
· Project definition and cash flow estimation				
· Analysis and selection				
· Implementation				
· Post implementation review				

2 Please indicate the COMPLEXITY of each of the stages of the capital budgeting processes as experienced in your company.

	Least complex	Somewhat complex	Very complex	Most complex
· Project definition and cash flow estimation				
· Analysis and selection				
· Implementation				
· Post implementation review				

3 How are cash flow estimates determined?

Management estimates	
Expert opinions	
Quantitative methods	
Previous experience	
Other: *(Please specify)*....................................	

4 Please indicate how frequently your company employs the following evaluation techniques when deciding which investment projects to pursue/fund? *(Please mark <u>one</u> square per line)*

	Never	Almost never	Almost always	Always
· Net Present Value (NPV)				
· Internal Rate of Return (IRR)				
· Modified internal rate of return (MIRR)				
· Profitability index				
· Payback period				
· Return on Investment (ROI)				
· Real Options				
· Other (please specify)..........................				

5 Where applied, between the two, which of the following techniques does your company prefer when deciding which investment projects to pursue/fund? *(Please mark one square only)*

- Net Present Value (NPV)
- Internal Rate of return
- Both equally preferred

6 When computing the Internal Rate of Return (IRR) or the Net Present Value (NPV) where applicable, does your company use: *(Please mark one square only)*

- Cash flows
- Accounting income

7 In computing the Internal Rate of Return (IRR) or Net Present Value (NPV) where applicable, do you deduct interest and other financing costs from revenue to arrive at cash flows?

    Yes   *No*

8 Which of the following approaches is used in your company to determine the minimum acceptable rate of return (discount rate) to evaluate proposed capital investments? *(Please mark one square only)*

- Weighted Average Cost of Capital
- Cost of debt
- Cost of equity capital
- Previous experience
- An arbitrarily chosen figure
- Other *(Please specify):………………………………*

9 How do you estimate the cost of equity? *(Please mark one square only)*

- Proxy of other privately owned entity
- Estimated figure
- Other *(Please specify)…………………………………………*

10 Where CAPM is used, how do you estimate the "risk free rate"?
- Government bonds
- Own determined rate
- Other *(Please specify):………………………………..*

11 Where CAPM is used, how do you estimate the "beta"?
- Published source
- Own determined beta
- Other *(Please specify):………………………………..*

12 Where CAPM is used, how do you estimate the "market risk premium"?
- Published source
- Own-determined market risk premium
- Other *(Please specify):………………………………..*

13 If the Weighted Average Cost of Capital is used, the weights are defined by: *(Please mark one square only)*
- Book values derived from the balance sheet
- Current market values
- Target values (long term targets)

14 If your company uses discounted cash flows (DCF) techniques, are nominal cash flows discounted at the nominal discount rate or alternatively, are real cash flows discounted at the real discount rate?

    Yes   *No*

15 Do you have different rates of return that are required for different divisions, subsidiaries or projects of the company?

    Yes   *No*

16 Which technique does you company use to assess a project's risk? *(Please mark one square per line)*

	Never	Almost never	Almost always	Always
Scenario analysis (i.e. base case, worst case, best case forecasts)				
Certainty equivalent method				
Sensitivity Analysis				
Simulation Analysis (eg Monte Carlo Simulation)				
Decision-tree Analysis				
Other *(please specify)…………………………………………*				

17 Which method does your company use to incorporate risk in capital budgeting decisions? *(Please mark one square per line)*

	Never	Almost never	Almost always	Always
· Risk-adjusted discount rate				
· Adjustment to cash flows				
· Certainty equivalent units				
· Other *(Please specify)*…………………………………				

18 Please estimate the average proportion of total capital expenditures your company made in the last five years that should be classified within these three investment categories (Total must be **100%**):

· Replacement projects	%
· Expansion projects – Existing operations	%
· Expansion projects – New operations	%
· Other *(Please specify)*………………………………	%
Total	- %

19 Is there at least one member of staff assigned full-time to capital investment analysis?

Yes ☐   No ☐

20 Does your company possess a capital investment manual (written capital investment guidelines)?

Yes ☐   No ☐

21 Does your company make use of a standardised model (for example, a standard Microsoft Excel® model) for deriving the NPV or IRR?

Yes ☐   No ☐

22 Does your company conduct post-audits of major capital expenditure?

Yes ☐   No ☐

23 How much consideration is given to the following qualitative factors in the assessment of capital projects: *(Please mark on one box for each of the items listed below)*

	Never	Almost never	Almost always	Always
	1	2	3	4
· Political influences				
· Environmental factors				
· Service delivery considerations				
· Employment creation				
· Government regulations				
· Other (Please specify) ………………………………………………..				

24 How would you rank the importance of quantitative (financial) and qualitative factors proportionally in decision-making? (Total must be **100%**)

Quantitative (Financial)	%
Qualitative	%
Total	- %

25 Please provide the following demographic information for the study. *(Please mark on one box each for the items listed below)*

a. Age of Group/Divisional CFO (years)		b. Group/Divisional CFO Tenure in current job		c. Group/Divisional CFO Education	
< 40	☐			Undergraduate	☐
40-49	☐			Postgraduate degree	
50-59	☐	< 4 years	☐	MBA degree	
		4-9 years	☐	non-MBA masters	
> 60	☐	>9 years	☐	CA(SA)	
				Other *(Please specify)*	

26 **Your job title:** ....

27 **Mark the square which represents your PREDOMINANT area of activity:**

Energy		Manufacturing		Finance		Utilities	
Retail		Healthcare		Transportation		Technology	
Other: *(Please specify)*							

28 **What is your company's approximate net fixed assets (Fixed assets net of depreciation)?**

29 **What is your company's approximate annual sales revenue currently?**

30 **What is your company's number of employees currently?**

31 **What is your company's approximate average annual capital expenditure budget?**