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Capital Budgeting Sophistication and Operating Performance in South African Companies

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A research report submitted to the faculty of Commerce, Law and Management, University of Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master in Business Administration.

Johannesburg
November 2008

ABSTRACT

The academic community has tried to convince corporate business managers that the capital budgeting decision-making process can be made more effective by using more sophisticated capital budgeting techniques. There are different capital budgeting tools and techniques available. The question that needs to be answered is whether using sophisticated capital budgeting techniques will give business a competitive edge?

The study investigates the relationship between a firm's capital budgeting sophistication and its long term operating performance. The study firstly investigates the use of different capital budgeting techniques. Using this information, a capital budgeting sophistication score is calculated.

Secondly, financial information of the firm is used to calculate the firm's average operating rate of return for the firm, relative to the average operating rate of return for the industry. The study takes into account firm size, capital intensity, operating risk and the degree of focus.

Thirdly, the capital budgeting sophistication of companies and operating performance are compared to investigate a possible statistical relationship.

It is concluded that there is a statistically significant, positive relationship between the degree of capital budgeting sophistication of a company and its operating performance.

It would therefore be beneficial to industry to increase capital budgeting sophistication. This would lead to increase in return to shareholders, increasing the value of the company.

DECLARATION

I declare that this research report is my own unaided work. It is submitted in partial fulfilment of the requirements for the degree of Master in Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

_____

Johann Peek
November 2008

DEDICATION

To my wife, Jankie, and my daughters, Leanke and Carike, who had to endure several evenings and weekends without a husband and father.

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to:

1. God, who provided me with the insight, knowledge and ability to complete this study.
2. My supervisor, Douglas Taylor, for his guidance during the final part of the research process.
3. Anthony Stacey, for his invaluable insight into statistical methods.
4. My family and friends for their support and patience.

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1. Introduction to the research

1.1. Purpose of the Study

This research attempts to measure the relationship between the degree of capital budgeting sophistication of a company and its operating performance.

1.2. Context of the Study

The academic community has tried to convince corporate business managers that the capital budgeting decision-making process can be made more effective by using more sophisticated capital budgeting techniques. There are different capital budgeting tools and techniques available. The question remains whether using sophisticated capital budgeting techniques will give business a competitive edge?

Many studies, including Klammer (1972), Gitman & Forrester (1977), Kim & Farragher (1981), Parry & Firer (1990), Bierman (1993), Farragher, Kleiman & Sahu (1999) have indicated a trend towards increased use of sophisticated capital budgeting techniques by corporate business managers. The studies of Klammer (1973), Kim & Farragher (1982), Pike (1984) and Farragher, Kleiman & Sahu (2001) proposed to find a relationship between capital budgeting sophistication and corporate performance.

This study will build on previous studies by incorporating real option analysis into the capital budgeting decision-making process. Real option analysis was not incorporated previously.

1.3. Problem Statement

The researcher proposes to find an association between the degree of capital budgeting sophistication and a company's operating performance. The problem is divided into three major goals, namely:

- Rating companies on their degree of capital budgeting sophistication.
- Rating companies' performance, using an industry adjusted measure for operating rate of return; and
- Investigating a possible relationship between the degree of capital budgeting sophistication and company performance.

1.4. Délimitations and Limitations

- The research will be limited to companies listed on the JSE Securities Exchange.
- The research will be limited to companies listed on the main board of the JSE Securities Exchange (Excluding Mining and Financial Services Sectors).
- The research does not aim to prove the effectiveness of different capital budgeting procedures.

1.5. Significance of the Study

"Effective allocation of a company's capital resources is a key to corporate success" (Farragher, Kleiman & Sahu, 1999: 137).

Management's main aim is to increase shareholder wealth, Kim & Ulferts (1996) and Ryan & Ryan (2002). Allocation of capital resources directly affects the financial position of the firm. It is thus important to effectively allocate the resources in such a way as to maximise the firms' financial performance in the long term.

When capital is allocated for a financial year, it is the company's retained earnings that are spent first. Only after this, is external funding, equity or debt used as capital.

A company will not withstand too many capital projects that cannot stand alone, with a return high enough to increase the return of the company. Proper capital budgeting reduces the risk of a company failing. The question remains whether applying more sophisticated capital budgeting processes will increase the probability of the firm to deliver better financial results in the long term.

If a relationship is found between the company's degree of capital budgeting sophistication and its results, it could lead to an increased focus on proper capital budgeting processes. This would lead to increased shareholder value.

1.6. Assumptions

1.6.1. The First Assumption

The five-year average operating rate of return for the firm, relative to the operating rate of return for its industry is an appropriate way to measure companies' results. This is similar to the studies done by Pike (1984) and Farragher *et al* (2001).

1.6.2. The Second Assumption

The data that is provided about the companies' results by the BFA McGregor are true and accurate.

1.7. Definitions of Terms

Company results: A company's results are defined as five-year average operating rate of return for the firm, relative to the operating rate of return for its industry.

Capital Budgeting Sophistication: Defined in the section on "Definition of Capital Budgeting Sophistication"

2. Literature Review

2.1. Introduction

The researcher could not find any research on the relationship between capital budgeting sophistication and business performance in South Africa. As a consequence this review will rely almost entirely on international research.

Two main directions were followed in academic research on the use and application of sophisticated capital budgeting processes:

- Researching changes in the use of sophisticated capital budgeting techniques, Klammer (1972), Gitman & Forrester (1977), Kim & Farragher (1981), Parry & Firer (1990), Bierman (1993), Faragher *et al* (1999).
- Researching the association between sophisticated capital budgeting practices and corporate performance, Klammer (1973), Kim & Farragher (1982), Pike (1984) and Farragher *et al* (2001).

2.2. Existing Studies

2.2.1. The Move in the Use of Sophisticated Capital Budgeting Processes

Kim & Farragher (1981) note that capital budgeting practices of large corporations at the time consisted of four areas, namely:

- Project Evaluation Techniques. The most popular method was Internal Rate of Return (IRR). The Payback period continued to be used by a large number of firms as a secondary evaluation technique.
- Risk Assessment. Mostly, subjective assessment of risk was used. The most popular quantitative tools used, were sensitivity analysis and probabilistic (Monte Carlo) simulation.
- Risk Adjustment. The most popular quantitative methods used for risk adjustment were shortening the acceptable payback period and increasing the minimum, required rate of return.
- Management Science Techniques. These techniques were generally not employed in capital budgeting processes.

They compared the results of previous studies between 1959 and 1979 on the use of quantitative tools in capital budgeting and came to the following conclusions:

- There is an increased use of IRR and Net Present Value (NPV) as the primary evaluation techniques. Payback is still used, but mainly as a secondary technique.
- Sophistication in terms of risk assessment is increasing slowly, with sensitivity analysis being the most important technique.
- There is a positive trend in quantitative risk adjustment, with discount rate adjustments and shortened payback the favoured methods.

- There is a slight upward trend in the use of management science techniques from a very low base.
- In general, large industrial corporations are becoming more sophisticated in the use of quantitative tools in their capital budgeting processes.

The study by Kim & Ulferts (1996) concludes that discounted cash flow techniques became more popular. Multi-national companies follow the theoretically superior approach in project evaluation techniques, but that they are yet to adopt academically favoured risk analysis techniques. The most popular techniques used for risk adjustment are adjusted payback and the increased accepted rate of return.

Farragher *et al* (1999) draws the following conclusions:

- The use of Discounted Cash Flow measures is still the most popular primary evaluation measure, and its use is increasing over time.
- Few companies employ quantitative risk assessments and those that do favour sensitivity analysis.
- The most popular method for adjusting for risk is raising the required rate of return.

It is clear from the four studies mentioned above that the same trends in the use of sophisticated capital budgeting systems were depicted in prior research. These similarities are best summarised in the findings of Farragher *et al* (1999), above.

2.2.2. Studies on the Association between Capital Budgeting Sophistication and Corporate Performance

The main difference in previous studies was the definition of capital budgeting sophistication.

Klammer (1973) defines capital budgeting sophistication as using discounted cash flow analysis and having a formal method for considering risk. His measure of corporate performance is an industry-adjusted operating rate of return. He adjusts for asset size, capital intensity and risk. No significant relationship between capital budgeting sophistication and corporate operating performance was found. A possible reason for this result might be his narrow definition of capital budgeting sophistication.

Kim & Farragher (1982) expanded on Klammer's (1973) work by extending the definition of capital budgeting sophistication to include the entire range of activities associated with the allocation of resources to separate investments. The metric they used, included whether or not a company:

- Prepares a long-term capital budget;
- Employs full-time capital investment staff;
- Undertakes a systematic search for investment opportunities;
- Uses a formal screening committee;
- Employs discounted cash flow analysis;
- Formally incorporates risk analysis;
- Monitors the implementation of accepted proposals; and
- Conducts a post-audit of operating investments.

This is a significant change in the definition Klammer (1973) used. Kim & Farragher (1982) measured corporate performance by an operating rate of return, a measure similar to what Klammer (1973) used. They control for company size, operating and financial risks. They found a significant positive relationship between capital budgeting sophistication and corporate performance. Farragher *et al* (2001) claim that the definition of capital budgeting sophistication used by Kim & Farragher (1982) was too narrowly defined. It does not include whether or not a company incorporates strategic analysis, company-wide

return/risk goals, and cash flow forecasting. Also, the explanatory variables in their regression equation were not industry adjusted.

Pike (1984) sees the degree of sophistication in capital budgeting processes as a concept capable of definition and estimation through the formulation of a single metric variable. He divides capital budgeting systems into procedures and techniques. Twelve procedural activities and sixteen quantitative techniques are incorporated.

He used five- and ten-year average operating rates of return as performance measures. These measures were calculated by dividing pre-interest profit by total year-end capital employed, excluding short-term borrowings. He then adjusts for firm size, degree of risk, capital intensity and industry classification. A significant negative relationship between the use of sophisticated capital budgeting systems and increased corporate performance were found; better performing companies are less likely to use a sophisticated capital budgeting process than worse performing companies.

Farragher *et al* (2001) expand on Pike's (1984) definition of capital budgeting sophistication by including whether or not a company's capital budgeting process incorporates strategic analysis, company wide return/risk goals and cash flow forecasting. The activities used by Farragher *et al* (2001) stems from research done by Farragher *et al* (1999) on capital investment practices. They use an industry-adjusted measure of corporate performance, defined as the operating rate of return for the firm, relative to the operating rate of return of its industry.

After adjusting for firm size, operating risk, capital intensity and degree of focus, they find no significant relationship between capital budgeting sophistication and corporate performance.

At the time of the research done by Farragher *et al* (2001), companies started to incorporate real option analysis and economic value added metrics into their capital budgeting decision-making process. Neither of these evaluation techniques was used in the research of Farragher *et al* (2001). This might be the reason for them finding no significant relationship.

A summary of the existing studies is presented in the table below:

	Klammer (1973)	Kim & Farragher (1982)	Pike (1984)	Farragher, Kleiman & Sahu (2001)
Measure of firm performance	Industry-adjusted operating rate of return	Operating rate of return	Five- and ten-year average operating rates of return	Operating rate of return for the firm, relative to the operating rate of return of its industry
Industry Adjustments	• Asset size • Capital Intensity • Risk		• Company size • Capital intensity • Operating risk • Industry	• Firm size • Operating risk • Capital intensity • Degree of focus • Industry
Result of Research	No significant relationship	Significant positive relationship	Significant negative relationship	No significant relationship

Table i - Summary of existing studies

2.3. Methodology applied

2.3.1. Definition of Capital Budgeting Sophistication

The definition of capital budgeting sophistication evolved over time from Klammer's (1973) narrow definition, to the more complete definition used by Farragher *et al* (2001).

Klammer (1973) defines capital budgeting sophistication as using discounted cash flow analysis and having a formal method for considering risk.

The metric Kim & Farragher (1982) used included whether or not a company:

- Prepares a long-term capital budget,
- Employs full-time capital investment staff,
- Undertakes a systematic search for investment opportunities,
- Uses a formal screening committee,
- Employs discounted cash flow analysis,
- Formally incorporates risk analysis,
- Monitors the implementation of accepted proposals, and
- Conducts a post-audit of operating investments.

Pike (1984) divides capital budgeting sophistication into twelve procedural activities and sixteen quantitative techniques. Procedures cover areas such as planning, administration and control. Techniques are subdivided into evaluation methods, risk analysis techniques, and management science techniques.

Farragher *et al* (1999) found the following activities used by companies in a survey on sophisticated capital investment practices:

- Strategic Analysis
- Establishing investment goals
- Searching for investment opportunities
- Forecasting investment cash flows
- Risk-adjusted evaluation of forecasted cash flows
- Decision making
- Implementation of accepted opportunities
- Post-audit operating performance

These are the same techniques Farragher *et al* (2001) use in their study on the association between capital budgeting sophistication and corporate performance.

The current study will use the definition of capital budgeting sophistication, as defined in the study done by Farragher *et al* (1999). This is the most recent study done and should present, accurately the activities currently used by companies.

2.3.2. Calculation of Capital Budgeting Sophistication

Pike (1984) uses a formula consisting of the following variables:

- The use or non-use of a specific capital budgeting activity.
- Whether the capital budgeting activity is of primary or secondary importance.
- The sophistication of the capital budgeting activity.

The sophistication of the activity is based on the views of respondents, and according to the following scale:

Extremely sophisticated	5
Very sophisticated	4
Moderately sophisticated	3
Not too sophisticated	2
Not at all sophisticated	1

Pike (1984) draws a distinction between the degree of importance of an activity, based on usefulness and usage, and the degree of sophistication, which encompasses both theoretical precision and complexity.

The formula used to calculate the sophistication score was:

$S = \sum u.i.w$, where *u* is the use (1) or non-use (0) of an investment method, *i* the primary (1) or secondary (0.5) importance of each method, as indicated by the respondents and *w* the sophistication of each capital budgeting item, Pike (1984).

Farragher *et al* (2001) used a similar approach. Firstly, they calculated a score for each capital budgeting activity. The activity consists of one or more components. The formula used to calculate the capital budgeting activity score (*s*) is:

$s_k = \sum_{i=1}^{n} \frac{x_i}{N}$, where *k* is the capital budgeting activity and *N* the number of components in capital budgeting activity *k*. *x* would be equal to 1 if the respondent conducts the component of the activity and equal to 0 if the respondent does not conduct the component of the activity. The degree of capital budgeting sophistication was then calculated by multiplying the capital budgeting activity score with the weight assigned to the capital budgeting activity. The weights assigned were based on respondents' opinions.

The formula used to calculate the final score for the Degree of Capital Budgeting Sophistication (DCBS) is:

$DCBS = \sum_{k=1}^{n} (s_k).(w_k)$, where *w* is the weight assigned to the capital budgeting activity by the respondents from the study (Farragher *et al*, 2001).

2.3.3. Adjustments

Pike (1984) adjusts for the following:

- Firm size. Klammer (1973) showed that both performance and capital budgeting sophistication is influenced by firm size. It is measured in terms of net fixed assets.
- Degree of risk. Higher average returns and greater variation in those returns are expected for high-risk businesses, Jacquemin & Saez (1976). Pike (1984) measures risk in terms of the standard deviation of each firm's average operating rate of return over both a five-year and a ten-year period.
- Capital Intensity. This might influence the choice of capital budgeting methods the firm employs, Pike (1984). It is measured in terms of net fixed assets per employee.
- Industry classification. Pike (1984) created eight industry groups, using the Financial Times industry classifications, to isolate effects of industry on performance.

Farragher *et al* (2001) adjusts for the following:

- Firm size, for the same reason as Pike (1984). Farragher *et al* (2001) define firm size as the total assets of the firm relative to average total assets of its industry.
- Operating risk, for the same reason as Pike (1984). Farragher *et al* (2001) calculated the operating risk as the coefficient of variation of the firm's operating income over a five-year period relative to the coefficient of variation of the industry's operating income.
- Capital intensity, as Capon, Farley & Hoenig (1990) found that capital intensity is positively related to performance at industry level. Farragher *et al* (2001) define capital intensity as net fixed assets per employee for the firm, relative to the average net fixed assets per employee in the industry.

- Degree of focus. Denis & Denis (1984) showed that firms operating in a large number of different industries are more likely to have poorer performance than firms operating in a small number of industries. The degree of focus is defined as the number of industries the firm operates in relative to the number of segments for firms in the same industry.

The main difference between industry adjustments made by Farragher *et al* (2001) and Pike (1984) is that Farragher *et al* (2001) adjust all measurements for industry, where the industry adjustment in Pike's (1984) research is done separately. Apart from this, Farragher *et al* (2001) add another adjustment, "degree of focus".

2.3.4. Measurement of Performance

2.3.4.1. Measurement Criterion

Heneman (1974) and Merchant (1981) showed that in cross-sectional studies, an attempt to measure investment performance at anything below corporate level becomes heavily subjective, because of a lack in secondary data.

The normative goal of capital budgeting is to maximise the net economic gain to the owners of the firm, Pike (1984). Therefore Pike (1984) suggests that it might seem preferable to isolate the influence of corporate capital budgeting practices on share prices. This approach would not be appropriate to capital budgeting studies, as there is a lack of information on investment practises available to shareholders and difficulty in isolating the effects of such information on accounting returns. It is also difficult to assess the direct impact of changes in capital budgeting practices on accounting returns.

Francis (1980) found that managers place much higher importance on return on capital and profit growth goals than on shareholder goals. Pike (1984) found that 82% of respondents regarded return on assets an important goal, where-as only 38% gave stock market goals the same priority. This sentiment is echoed by

Andrews & Black (2002). They argue that managers should focus on making a return on assets, while shareholders want to make a return on investment.

Klammer (1973), Kim & Farragher (1982), Pike (1984) and Farragher *et al* (2001) use an operating rate of return in their studies. Farragher *et al* (2001) use an industry adjusted operating rate of return, defined as the operating rate of return for the firm, relative to the operating rate of return for its industry.

2.3.4.2. Time-period for measuring performance

The time period used in Pike's (1984) study is ten years, as Sundem (1980) showed that capital expenditure has an adverse short-term effect on the earnings of a firm. Farragher *et al* (2001) use five years as the time-period. This study will use a five-year period. This will minimise the effect of changes in the degree of capital budgeting sophistication within companies on the research.

2.3.5. Estimating the Association between Corporate Performance and Capital Budgeting Sophistication

Pike (1984) as well as Farragher *et al* (2001) use multiple regression models to examine the association between corporate performance and capital budgeting sophistication. Both research parties used stepwise regression.

2.4. Further Research

Farragher *et al* (2001) suggest that the use of real option analysis and economic value added metrics should be incorporated into sophisticated capital budgeting processes when researching the subject further.

2.4.1. Real option analysis

Cotter, Marcum & Martin (2003) echo the suggestion made by Farragher *et al* (2001). Sophisticated capital budgeting processes should include the use of real option analysis.

Cotter *et al* (2003) call for the use of real option analysis in capital budgeting decisions. Most companies are still using the traditional discounted cash flow (DCF) analysis techniques, but according to Cotter *et al* (2003) this renders the company at a disadvantage.

The objection to the use of the traditional discounted cash flow techniques is mainly the techniques' inability to capture management's flexibility to alter decisions and outcomes once a project is undertaken. They refer to the traditional discounted cash flow approach as a "static" model. The value of management's decision-making flexibility inherent in the acquisition of most operating assets is ignored by the static model. Myers (1987) refers to this managerial flexibility as "real options". To overcome this inability of the static model, practitioners apply sensitivity analysis to their DCF projections, Cotter *et al* (2003).

Cotter *et al* (2003:72) describe real options as follows:

> "Real options can capture the value of effective management by modeling (*sic*) potential responses to the revelation of additional information as the project evolves through time."

Copeland & Tofano (2004) describe real option analysis as a tool that captures the contingencies in managing growth opportunities. Real options can be categorised into four general types, namely:

- Expansion
- Abandonment
- Deferment

- Operating options

Busby and Pitts (1997) found in a survey that managers acknowledged the contingent components of potential investment projects, but rarely incorporated the option to abandon into their analysis. In a survey by Graham & Harvey (2001), it was found that 27% of a group of 4000 Chief Financial Officers claimed they “always or almost always” used some sort of option approach to evaluating and deciding upon growth opportunities, Copeland & Tofano (2004). This depicts fast growth in the acceptance of the real option analysis technique into sophisticated capital budgeting processes. Cotter *et al* (2003) state that it seems as if the world started to realise the importance of incorporating real options into capital investment decisions.

This study will include real option analysis as an evaluation tool in the sophisticated capital budgeting process.

2.4.2. Economic Value Added Metric

Hartman (2000) mentioned that the Economic Value Added (EVA) measure has been used for:

- Evaluating companies
- Evaluating cash flows at project level
- Evaluating performance, determining compensation and bonus packages for managers.

An interesting view on the economic value added metric for capital budgeting sophistication is given by Sullivan (1997) and defended by Hartman (2000). Their view is that the market value added (MVA) measure of worth is economically equivalent to the traditional net present value (NPV) measure of worth, if the external interest rate and cost of capital are equal when analysing after-tax cash flows. MVA is the net present value of a series of EVA values.

Hartman (2000:163) concludes, “MVA and NPV measures of worth are equivalent for all methods of depreciation and any assumption on the sale of the capital investment (gain or loss in any time period) assuming cash flows are discounted at the cost of capital.”

Hartman (2000) explains the popularity of the use of the MVA metric for capital allocation in that EVA explicitly charges a cost against the balance of a capital investment in a project. This makes managers and decision-makers aware that capital is not free.

As there is no difference in the NPV and MVA (EVA) measure for capital budgeting sophistication, the EVA measure will not be included in the study for capital budgeting sophistication.

3. Hypotheses

The hypothesis is that a higher degree of capital budgeting sophistication is associated with companies’ achieving better operating performance.

The null hypothesis, H_O:

The null hypothesis states that there is a statistically significant, positive relationship between the degree of capital budgeting sophistication of a company and its operating performance.

The alternative hypothesis, H_A:

The alternative hypothesis states that there is not a statistically significant, positive relationship between the degree of capital budgeting sophistication of a company and its operating performance.

4. Research Methodology

4.1. The Research Population

The population of this research is the companies listed on the main board of the Johannesburg Securities exchange, excluding the following sectors:

- Mining
- Financial

The reasons for the exclusion of the above sectors were:

- Unsatisfactory data from the mining sector via the questionnaire.
- The financial industry is not fixed asset intensive. The research focuses more on fixed asset capital expenditure, similar to Jiang, Chen & Huang (2006).

The population consists of a total of 136 companies, listed on the Johannesburg securities exchange. The results of these companies are published on a six-monthly basis. The results were obtained from BFA McGregor.

4.1.1. Sampling: Size, Selection and Methodology

A questionnaire was sent to the Chief Financial Officers of the above-mentioned companies. The sample is a convenience sample, as only:

- The companies returning a completed questionnaire will be considered for research purposes.

Pike (1984) had a response rate of 83.7% and the final sample size was 144. Farragher *et al* (2001) had a response rate of 34% and the final sample size was 117.This research had a response rate of 22.8%, with a total sample size of 31.

4.2. Data Collection

Data collection was done via an e-mail survey.

4.2.1. Questionnaire design

The questionnaire followed the same format as used by Farragher *et al* (2001).

The reason for keeping the questionnaires similar is for the results of this study to be comparable to the results of Farragher *et al* (2001) and to ensure reliability as the questionnaire is standardised between the study done by Farragher *et al* (2001) and the current study, Leedy & Omrod (2001). The main difference between this study's questionnaire and the questionnaire used by Farragher *et al* (2001) will be the inclusion of the following as components in the "Evaluation" activity of capital budgeting:

- Real Option Analysis
- Computer simulation and mathematical programming
- PERT/Critical Path

The questionnaire is appended in Appendix 2.

4.3. Validity

4.3.1. Measurement Instrument

Leedy & Omrod (2001:98) describe validity of the measurement instrument as "the extent to which the instrument measures what it is supposed to measure".

The questionnaire is closely related with similar questionnaires used in similar studies.

4.3.2. Internal Validity

If respondents to a mail survey are biased or non-informed, the results may be misleading, Farragher *et al* (2001). It could be argued that companies with more sophisticated capital budgeting processes are more likely to respond than the companies with less sophisticated capital budgeting processes. The researcher tested for internal validity through doing a normality test on the respondents' degree of capital budgeting sophistication scores.

To avoid the problem of non-informed respondents, the respondent was asked to indicate whether he or she is responsible for capital budgeting analysis and or decision-making or parts there-off. If the respondent is not responsible for either one of the two activities or parts there-off, the questionnaire was not used for research purposes.

4.3.3. External Validity

The research is applicable to within as well as outside of the South African context. Accounting practises are standardised globally. Therefore the research will be valid internationally.

4.4. Reliability

Leedy & Omrod (2001) describe the reliability of a measurement instrument as the extent to which the instrument will yield consistent results when the main characteristic that is measured did not change.

Test-retest reliability is covered, as the questionnaire used in this study is similar to the questionnaire used by Farragher *et al* (2001).

4.5. Data Analysis

The association between the degree of capital budgeting sophistication (DCBS) and company performance (IAORR) is evaluated using regression analysis. The variables in the regression equation include industry-adjusted measures of:

- Firm Size (IAFS)
- Capital Intensity (IACI)
- Degree of Focus (IADF)
- Operating Risk (IAOR)

Two sets of data were acquired, namely the questionnaires from the respondents and the financial results from the BFA McGregor Database. The yearly financial results of the population were extracted from BFA McGregor for the years 2003 – 2007.

4.5.1. Calculation of Operating Rate of Return (ORR)

The Industry average operating rate of return (IAORR) is used to measure the performance of the companies in the sample. This is similar to all four existing studies reviewed, Klammer (1973), Kim & Farragher (1982), Pike (1984) and Farragher *et al* (2001). The formula used is:

$$ORR = \frac{Operating_Cash_Flow}{Total_Assets} \quad (1)$$

The ORR of each company is calculated for each of the years 2003 – 2007 respectively. The average of the five years' ORR is calculated, giving a company Average ORR (AORR).

$$AORR = Average(ORR_for_Years_2003to2007) \quad (2)$$

Each company's AORR is adjusted for the industry by dividing the number by the ORR of the industry (ORRI), similar to Farragher *et al* (2001).

$$IAORR = \frac{AORR}{ORRI}$$, where: (3)

$$ORRI = Average(AORR_of_all_firms) \quad (4)$$

The IAORR is depicted as a fraction and not a percentage.

4.5.2. Calculation of Firm size

Firm size is industry adjusted. The firm size is calculated as follows:

$$IAFS = \frac{Average_Total_Assets_of_Firm}{Average_Total_Assets_of_Industry} \quad (5)$$

The Average Total Assets (ATAF) of each firm is calculated by taking the average of the total assets over the period 2003 – 2007. This is adjusted for the industry by dividing the ATAF by the Average Total Assets of the Industry (ATAI). The ATAI is calculated as the average of all the firms ATAF's.

$$ATAI = Average(ATAF_of_all_firms) \quad (6)$$

This gives an indication of a specific firm's size relative to the industry.

The regression coefficient for IAFS is expected to be positive, as Klammer (1973) showed that firm size is positively related to both performance and capital budgeting sophistication. Farragher *et al* (2001) also found a positive relationship between firm size and the performance of the firm.

4.5.3. Calculation of Capital Intensity

Capital intensity (CI) is industry adjusted. Capital intensity is defined as the net fixed assets per employee for the firm divided by the average net fixed assets per employee for the industry. The net fixed assets for the firm (ANFAF) are calculated as an average of the firm's net fixed assets for the period 2003 – 2007.

$$ANFAF = Average(Net_Fixed_Assets_of_Firm_for_Years_2003to2007) \quad (7)$$

The ANFAF is divided by the number of employees of the firm in the year 2007. This is the firm's Capital Intensity (CI).

$$CI = \frac{ANFAF}{No_of_Employees_for_Firm_in_2007} \quad (8)$$

The firm's CI is then divided by the average of all the firms CI's. This gives an Industry Adjusted Capital Intensity (IACI) number, indicating the firm's Capital Intensity relative to the Industry.

$$IACI = \frac{CI}{Average(CI_of_all_Firms)} \quad (9)$$

As Capon *et al (1990)* found a positive relationship between capital intensity and financial performance; this coefficient is expected to be positive.

4.5.4. Calculation of Degree of Focus

The degree of focus (DF) for a firm is adjusted for the industry. The Industry adjusted DF is defined as the number of segments the company operates in divided by the average amount of segments all companies operate in.

$$IADF = \frac{Number_of_Segments_Company_Operates_in}{Average_Amount_of_Segments_Companies_Operates_in} \quad (10)$$

This gives an indication of the DF of a firm relative to the industry.

Denis & Denis (1984) and Farragher *et al* (2001) showed that there is a negative relationship between lesser focused companies and performance. Therefore, the coefficient for this variable is expected to have a negative sign.

4.5.5. Calculation of Operating Risk

The operating risk is adjusted for industry. The operating risk is defined as the coefficient of variation in the firms operating income over a five-year period, divided by the average for the industry.

The firm's operating risk (OR) is calculated as follows:

$$OR = ABS\left(\frac{STDEV(Operating_Income_over_Years_2003to2007)}{Average(Operating_Income_over_Years_2003to2007)}\right) \quad (11)$$

The OR is adjusted for the industry as follows:

$$IAOR = \frac{OR}{Average(OR_of_all_Firms)} \quad (12)$$

Both Jacquemin & Saez (1976) and Farragher *et al* (2001) found a positive relationship between higher risk businesses and performance at the industry level.

4.5.6. Calculation of the Degree of Capital Budgeting Sophistication

The degree of capital budgeting sophistication is calculated in the same way as done by Farragher *et al* (2001).

Firstly the Capital Budgeting Activity Score is calculated:
The score for capital budgeting activity *a* for firm *f* is calculated as follows:

$s_{af} = \sum_{i=1}^{n} \frac{y_i}{N}$, where: (13)

y_I = 1 if the company conducts component activity *a*

y_I = 0 if the company does not conduct component activity *a*

N = Number of component activities

Secondly the importance of the different capital budgeting components is calculated using the relative importance attributed to each component by the respondents. A five point Likert scale is used for this purpose:

Extremely important	5
Very important	4
Moderately important	3
Not too important	2
Not at all important	1

The Degree of Capital Budgeting Sophistication is then calculated using the following formula:

$DCBS = \sum_{a=1}^{n} (s_{af}).(w_{af})$, where: (14)

s_{af} = score for capital budgeting activity *a* for company *f*

w_{af} = weight as indication of the importance of the activity by company *f*

n = number of capital budgeting activities

4.5.7. Calculation of Regression Equation

The equation used for the regression analysis is:

$$IAORR = \beta_0 + \beta_1.IAFS + \beta_2.IACI + \beta_3.IADF + \beta_4.IAOR + \beta_5 DCBS + \varepsilon \quad (15)$$

Stepwise regression is used to determine the significance of the various variables within the model. The significant variables are then used to construct a multiple regression model.

5. Presentation of Results

This chapter presents the data obtained from the study.

5.1. Degree of Capital Budgeting Sophistication

The full set of information from the questionnaires is attached in Appendix 1. Below is shown the calculated Degree of Capital Budgeting Sophistication of the respondent firms.

Company	DCBS Score
1	25.5
2	26.7
3	18.0
4	38.0
5	44.2
6	26.8
7	12.7
8	45.0
9	21.0
10	17.2
11	39.0
12	17.0
13	31.5
14	29.5
15	45.0
16	43.3
17	30.8
18	39.0
19	20.6
20	29.7
21	25.0
22	39.8
23	18.2
24	30.2
25	42.5
26	31.8
27	33.0
28	31.0
29	36.3
30	36.9
31	29.9

Table ii - DCBS Scores

The distribution of the respondents' DCBS scores is shown graphically below:

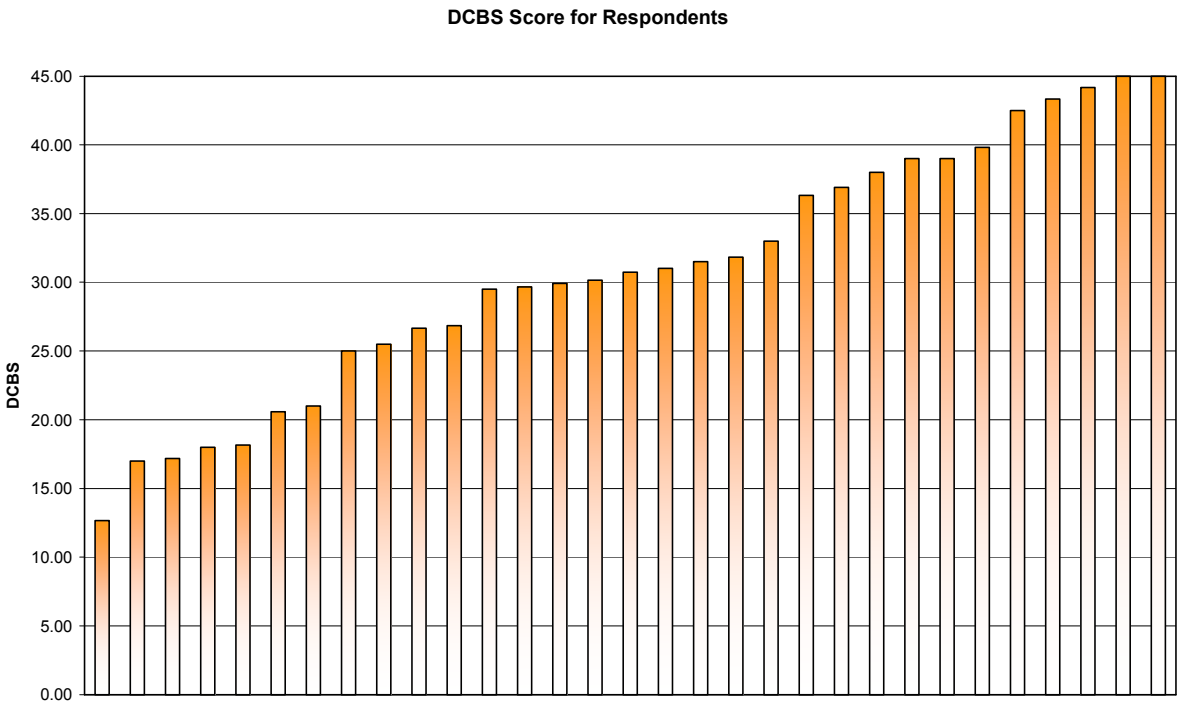


Figure i - DCBS Scores

A Chi-Square test was done on the abovementioned results using the StatPro add-in in Excel. The data is shown below:

Frequency table and normal test for DCBS

Upper limit	Category	Frequency	Normal	Distance measure
10	<=10	0	0.546	0.546
15	10- 15	2	1.224	0.491
20	15- 20	4	2.789	0.526
25	20- 25	3	4.886	0.728
30	25- 30	6	6.586	0.052
35	30- 35	7	6.829	0.004
40	35- 40	6	5.447	0.056
45	40- 45	6	3.342	2.113
	>45	0	2.351	2.351

Test of normal fit

Chi-square	6.868
p-value	0.333

You cannot reject the null hypothesis at the 10% significance level.

Table iii - Frequency Table of CHI-Square Test of DCBS Scores

The graph of the Chi-Square fit is shown below:

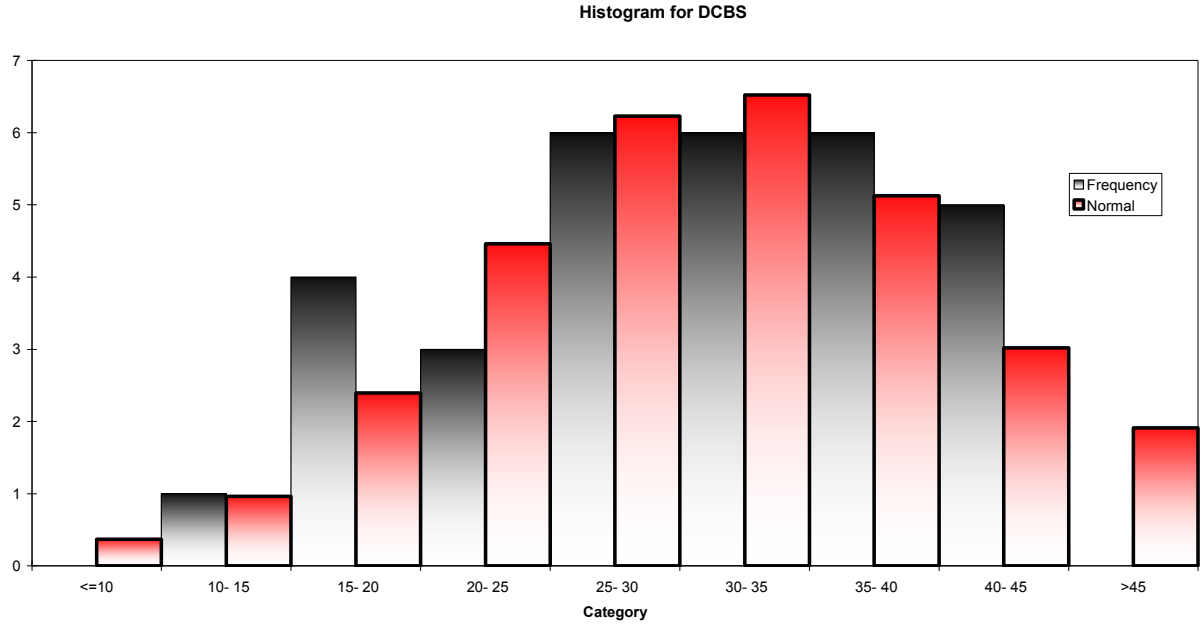


Figure ii - Histogram of DCBS Scores

The Chi-Square test results indicate that the sample represents a normal distribution for the DCBS values. This indicates that companies across the spectrum responded to the questionnaire. This proves that not only companies employing advanced capital budgeting techniques responded to the survey. This indicates internal validity of the study[1].

[1] Refer to section 4.3.2

5.2. *Relative Importance of Capital Budgeting Activities*

The relative importance of the different Capital Budgeting Activities was indicated by the respondents on a 5 point Likert scale. A weight was assigned to each activity dividing the mean score by the total mean score for all activities.

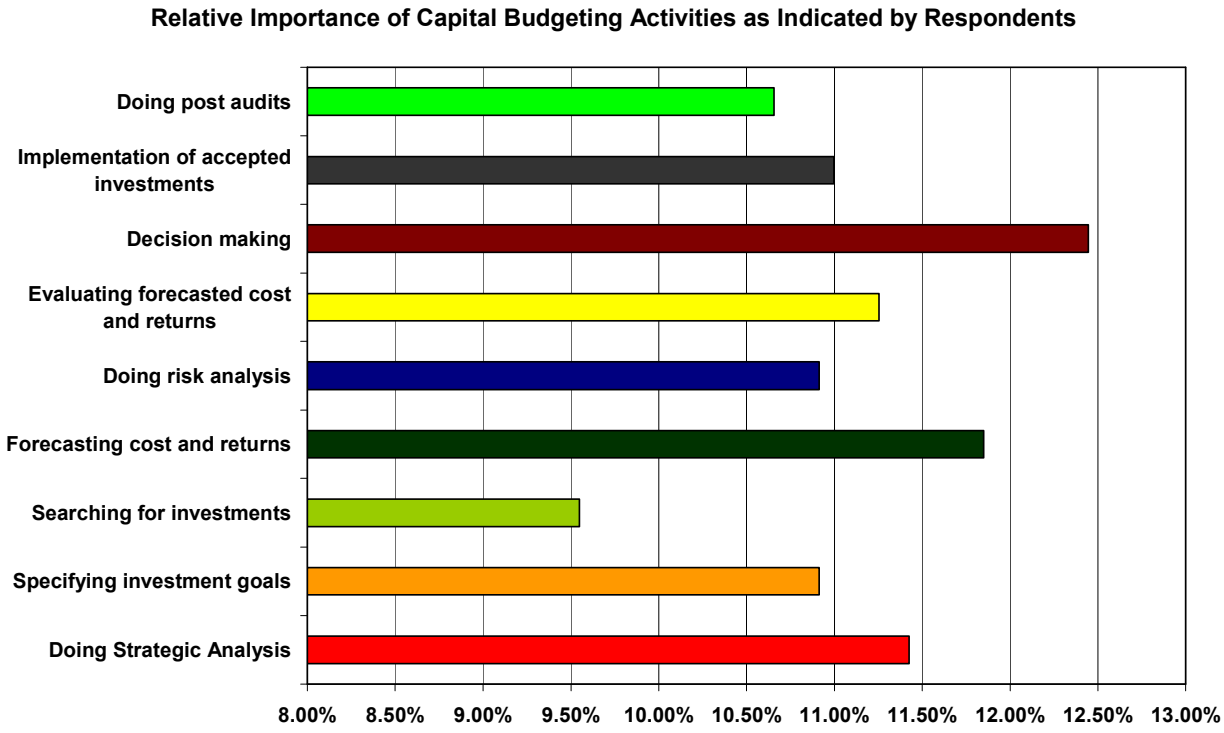


Figure iii - Relative Importance of Capital Budgeting Activities

A comparison with the results of Farragher et al (2001) is shown below:

	Current Study		Farragher et al. (2001)	
Capital Budgeting Activity	**Mean Score**	**Weight**	**Mean Score**	**Weight**
Doing Strategic Analysis	4.32	11.42%	4.48	**12.66%**
Specifying investment goals	4.13	10.91%	4.38	12.37%
Searching for investments	3.61	**9.55%**	3.86	10.90%
Forecasting cost and returns	4.48	11.85%	4.01	11.33%
Doing risk analysis	4.13	10.91%	3.52	9.94%
Evaluating forecasted cost and returns	4.26	11.25%	3.96	11.19%
Decision making	4.71	**12.45%**	3.84	10.85%
Implementation of accepted investments	4.16	11.00%	4.15	11.72%
Doing post audits	4.03	10.66%	3.2	**9.04%**
	37.84	100.00%	35.4	100.00%

Table iv - Comparison of Importance of Capital Budgeting Activities

An interesting difference between the two studies is what is seen as the least important activity by the different respondents. In the current South African study, the least important activity is “Searching for Investments”, whereas in the American study conducted by Farragher et al. (2001), the least important activity is “Doing Strategic Post Audits”. A possible explanation for this is the fact that South Africa is still a developing economy, whereas America is a developed economy. Within a developing economy, opportunities for development come along more frequently than in developed economies, therefore the difference in focus.

5.3. Use of Different Evaluation Techniques for Capital Budgeting

The use of different capital budgeting evaluation techniques of the respondents is shown below:

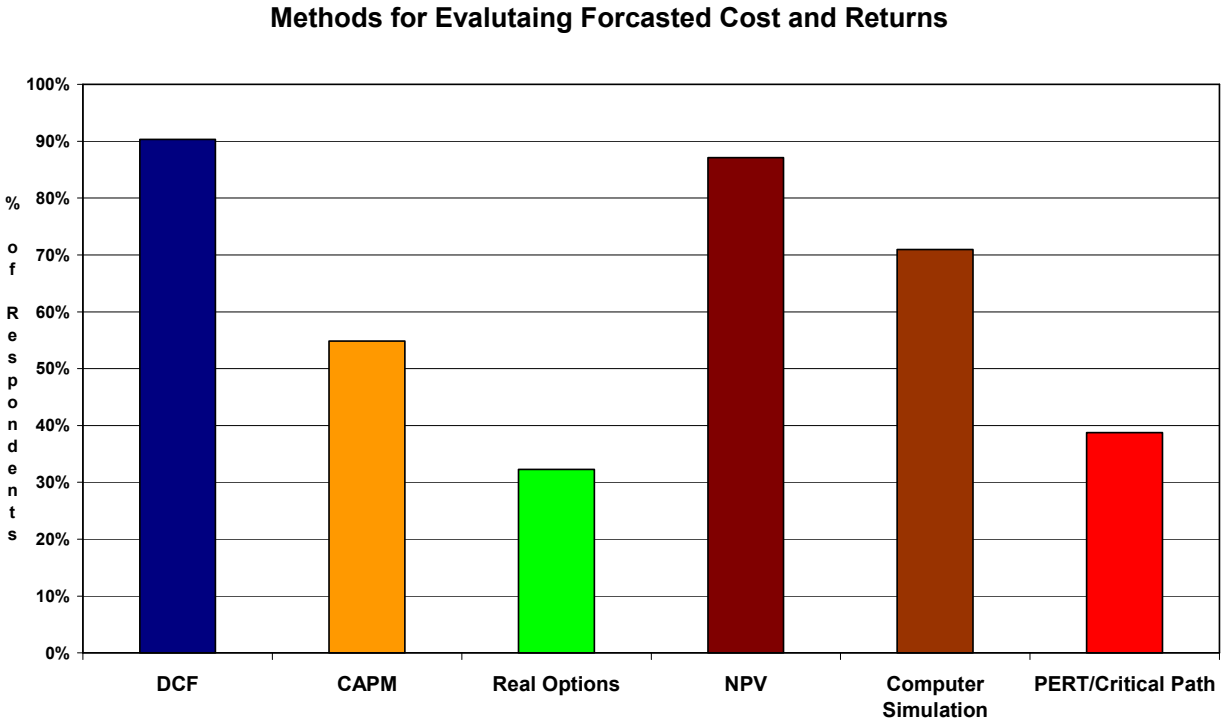


Figure iv - Methods for Evaluating Forecasted Cost and Returns

In a survey by Graham & Harvey (2001), 27% of the respondents indicated that they use some form of Option analysis when evaluating growth opportunities, Copeland & Tofano (2004). This correlates well with the current study, where 32.3% of the

respondents indicated that they make use of Option analysis. It also indicates that the use of Option analysis is not yet widely accepted within the South African business environment.

The Discounted Cash Flow technique is widely accepted in the South African business environment, with NPV following closely. The use of computer simulations is also widely in use, as indicated by 71% of the respondents.

In the study by Parry & Firer (1990), they found that in 1990, only 10% of South African companies used the NPV as a method for evaluating forecasted Cost and Returns. During the current study 87% of respondents indicated the use of NPV.

It is obvious from the current study that the most preferred methods for evaluating capital expenditure is the “Discounted Cash Flow” and “Net Present Value” Methods, similar to previous studies, Farragher *et al* (1999).

5.4. Financial Data

The financial data, including the DCBS score for all respondents is shown below:

Company	DCBS	IAORR	IAFS	IACI	IAOR	IADF
1	25.50	0.841	1.229	0.368	0.318	1.283
2	26.67	1.232	0.484	0.096	0.176	0.642
3	18.00	0.666	0.162	0.041	0.310	0.642
4	38.00	1.535	5.201	2.178	0.154	0.321
5	44.17	1.932	0.388	0.139	0.290	0.321
6	26.83	0.828	2.067	0.124	1.234	0.962
7	12.67	0.946	0.112	0.091	0.971	1.604
8	45.00	0.720	0.066	0.405	0.320	1.283
9	21.00	0.711	0.153	0.064	0.291	0.642
10	17.17	1.512	0.210	1.574	0.190	0.321
11	39.00	0.670	0.076	0.125	0.763	0.962
12	17.00	0.112	0.035	0.028	1.801	0.962
13	31.50	0.687	1.006	0.045	0.380	0.962
14	29.50	1.095	0.060	0.093	0.197	0.642
15	45.00	1.796	3.096	73.806	0.096	0.321
16	43.33	0.991	0.326	0.113	0.237	0.642
17	30.75	0.870	1.698	0.026	0.240	0.962
18	39.00	0.122	0.012	0.045	0.623	2.566
19	20.58	0.431	0.068	0.198	0.548	0.321
20	29.67	1.043	1.494	0.049	0.271	0.962
21	25.00	0.526	1.736	0.074	0.373	1.925
22	39.83	0.999	2.168	0.434	0.070	1.604
23	18.17	1.102	0.400	0.456	0.137	0.642
24	30.17	0.821	0.074	0.176	0.599	2.245
25	42.50	2.300	0.800	0.714	0.241	0.962
26	31.83	1.705	1.823	0.105	0.293	1.283
27	33.00	0.487	1.211	0.384	0.713	1.925
28	31.00	1.244	18.255	2.426	0.314	0.962
29	36.33	0.997	1.837	0.049	0.321	2.245
30	36.92	2.083	0.036	0.253	0.238	0.962
31	29.92	0.577	0.086	0.129	0.199	0.962
Average	30.81	1.02	1.50	2.74	0.42	1.07
Maximum	45.00	2.30	18.25	73.81	1.80	2.57
Minimum	12.67	0.11	0.01	0.03	0.07	0.32

Table v - Final Data Set

The Chi-square test shows that the Industry Average Operating Rate of Return in the Sample is normally distributed. This indicates that not only well performing companies took part in the research. The data is shown below:

Frequency table and normal test for IAORR

Upper limit	Category	Frequency	Normal	Distance measure
0.1	<=0.1	0	1.356	1.356
0.3	.1- .3	2	1.454	0.205
0.5	.3- .5	2	2.377	0.060
0.7	.5- .7	5	3.389	0.765
0.9	.7- .9	6	4.215	0.756
1.1	.9- 1.1	6	4.571	0.447
1.3	1.1- 1.3	3	4.324	0.405
1.5	1.3- 1.5	0	3.567	3.567
1.7	1.5- 1.7	2	2.567	0.125
1.9	1.7- 1.9	2	1.611	0.094
2.1	1.9- 2.1	2	0.882	1.419
	>2.1	1	0.687	0.143

Test of normal fit

Chi-square	9.343
p-value	0.406

You cannot reject the null hypothesis at the 10% significance level.

Table vi - Frequency Table of CHI-Square Test of IAORR Scores

The graph of the Chi-Square fit is shown below:

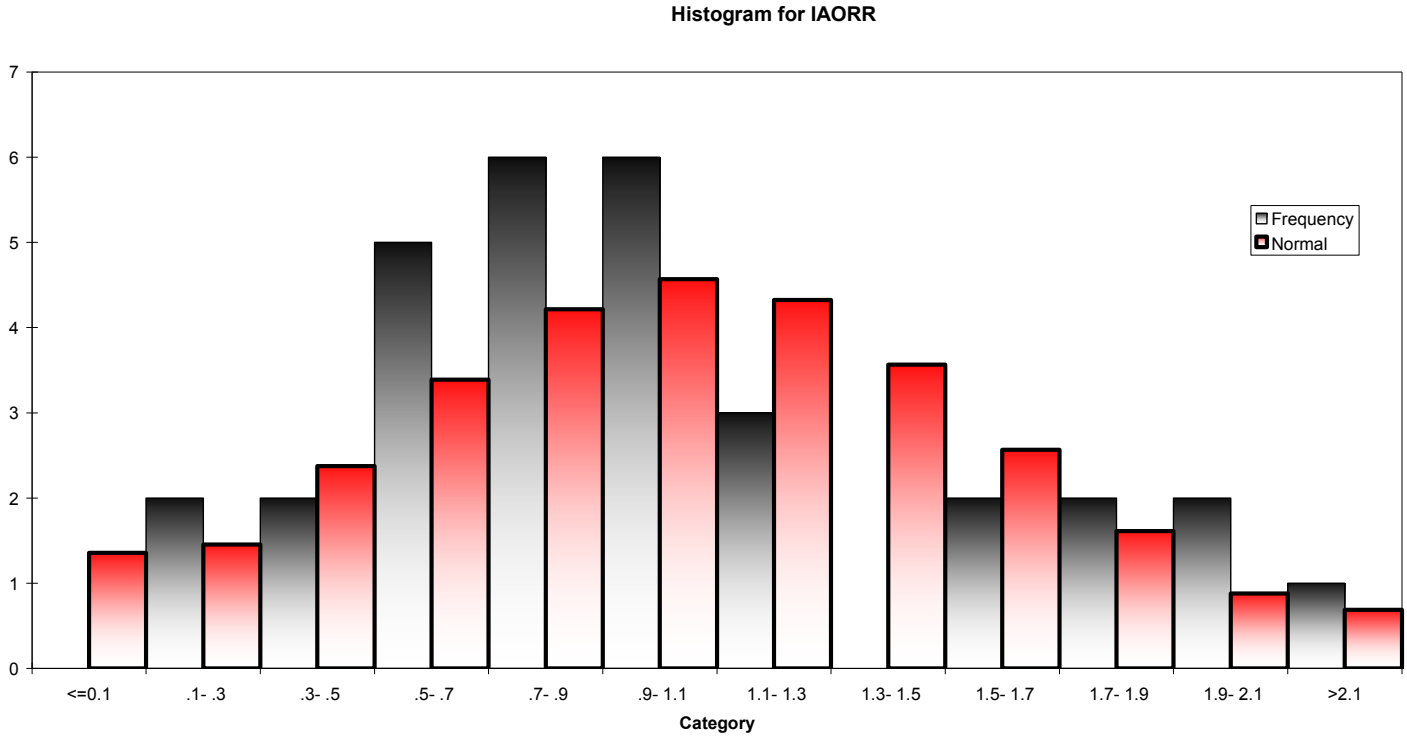


Figure v - Histogram for Industry Average Operating Rate of Return

The Chi-Square test results indicate that the sample represents a normal distribution for the DCBS values.

5.5. Regression Analysis

The first step in constructing a model was a Stepwise regression, using NCSS. The stepwise regression indicates which of the variables is significant and should therefore be included into the final multiple regression model. Equation 15 is used for the regression analysis:

$$IAORR = \beta_0 + \beta_1.IAFS + \beta_2.IACI + \beta_3.IADF + \beta_4.IAOR + \beta_5 DCBS + \varepsilon \qquad (15)$$

5.5.1. Stepwise Regression with Raw Data

Stepwise Regression Report

Page/Date/Time 1 2008-09-29 08:46:21
Database
Dependent IAORR

Iteration Detail Section

Iteration 0: Unchanged

In	Variable	Standard. Coefficient	R-Squared Increment	R-Squared Other X's	T-Value	Prob Level	Pct Change Sqrt (MSE)
No	DCBS		0.144010	0.000000	2.2088	0.035244	-5.8986
No	IAFS		0.028767	0.000000	0.9268	0.361685	0.2359
No	IACI		0.080502	0.000000	1.5934	0.121911	-2.4703
No	IAOR		0.252599	0.000000	3.1307	0.003959	-12.0697
No	IADF		0.160958	0.000000	2.3586	0.025294	-6.8348

R-Squared = 0.000000 Sqrt(MSE) = 0.5376304

Iteration 1: Added IAOR to equation

In	Variable	Standard. Coefficient	R-Squared Increment	R-Squared Other X's	T-Value	Prob Level	Pct Change Sqrt(MSE)
Yes	IAOR	-0.5026	0.252599	0.000000	-3.1307	0.003959	13.7265
No	DCBS		0.046481	0.125207	1.3626	0.183855	-1.4453
No	IAFS		0.011668	0.015428	0.6664	0.510632	0.9726
No	IACI		0.039897	0.029965	1.2566	0.219291	-0.9835
No	IADF		0.083783	0.057134	1.8802	0.070526	-4.1036

R-Squared = 0.252599 Sqrt(MSE) = 0.47274

Iteration 2: Unchanged

In	Variable	Standard. Coefficient	R-Squared Increment	R-Squared Other X's	T-Value	Prob Level	Pct Change Sqrt(MSE)
Yes	IAOR	-0.5026	0.252599	0.000000	-3.1307	0.003959	13.7265
No	DCBS		0.046481	0.125207	1.3626	0.183855	-1.4453
No	IAFS		0.011668	0.015428	0.6664	0.510632	0.9726
No	IACI		0.039897	0.029965	1.2566	0.219291	-0.9835

No	IADF		0.083783	0.057134	1.8802	0.070526	-4.1036

R-Squared = 0.252599 Sqrt(MSE) = 0.47274

Iteration 3: Added IADF to equation

In	Variable	Standard. Coefficient	R-Squared Increment	R-Squared Other X's	T-Value	Prob Level	Pct Change Sqrt(MSE)
Yes	IAOR	-0.4313	0.175424	0.057134	-2.7206	0.011073	10.4874
Yes	IADF	-0.2981	0.083783	0.057134	-1.8802	0.070526	4.2792
No	DCBS		0.076529	0.157772	1.8760	0.071499	-4.2167
No	IAFS		0.010138	0.016065	0.6472	0.522974	1.0542
No	IACI		0.020527	0.071001	0.9283	0.361454	0.2477

R-Squared = 0.336381 Sqrt(MSE) = 0.4533407

Iteration 4: Unchanged

In	Variable	Standard. Coefficient	R-Squared Increment	R-Squared Other X's	T-Value	Prob Level	Pct Change Sqrt(MSE)
Yes	IAOR	-0.4313	0.175424	0.057134	-2.7206	0.011073	10.4874
Yes	IADF	-0.2981	0.083783	0.057134	-1.8802	0.070526	4.2792
No	DCBS		0.076529	0.157772	1.8760	0.071499	-4.2167
No	IAFS		0.010138	0.016065	0.6472	0.522974	1.0542
No	IACI		0.020527	0.071001	0.9283	0.361454	0.2477

R-Squared = 0.336381 Sqrt(MSE) = 0.4533407

Iteration 5: Added DCBS to equation

In	Variable	Standard. Coefficient	R-Squared Increment	R-Squared Other X's	T-Value	Prob Level	Pct Change Sqrt(MSE)
Yes	DCBS	0.3014	0.076529	0.157772	1.8760	0.071499	4.4023
Yes	IAOR	-0.3113	0.077586	0.199313	-1.8890	0.069684	4.4854
Yes	IADF	-0.3541	0.113831	0.092234	-2.2880	0.030191	7.2964
No	IAFS		0.006524	0.021275	0.5405	0.593442	1.3372
No	IACI		0.004050	0.153688	0.4250	0.674356	1.5528

R-Squared = 0.412911 Sqrt(MSE) = 0.4342248

Iteration 6: Unchanged

In	Variable	Standard. Coefficient	R-Squared Increment	R-Squared Other X's	T-Value	Prob Level	Pct Change Sqrt(MSE)
Yes	DCBS	0.3014	0.076529	0.157772	1.8760	0.071499	4.4023
Yes	IAOR	-0.3113	0.077586	0.199313	-1.8890	0.069684	4.4854
Yes	IADF	-0.3541	0.113831	0.092234	-2.2880	0.030191	7.2964
No	IAFS		0.006524	0.021275	0.5405	0.593442	1.3372
No	IACI		0.004050	0.153688	0.4250	0.674356	1.5528

R-Squared = 0.412911 Sqrt(MSE) = 0.4342248

List of Variables Selected
DCBS, IAOR, IADF

The variables selected as significant by the Stepwise Regression of the raw data were:

- DCBS
- IAOR
- IADF

The abovementioned variables were used to construct a multiple regression model, using NCSS.

5.5.2. Multiple Regression Model Constructed with Raw Data

Multiple Regression Report

Page/Date/Time	1 2008-09-29 08:44:33
Database	
Dependent	IAORR

Run Summary Section

Parameter	Value	Parameter	Value
Dependent Variable	IAORR	Rows Processed	31
Number Ind. Variables	3	Rows Filtered Out	0
Weight Variable	None	Rows with X's Missing	0
R2	0.4129	Rows with Weight Missing	0
Adj R2	0.3477	Rows with Y Missing	0
Coefficient of Variation	0.4262	Rows Used in Estimation	31
Mean Square Error	0.1885512	Sum of Weights	31.000
Square Root of MSE	0.4342248	Completion Status	Normal
Completion			
Ave Abs Pct Error	47.891		

Descriptive Statistics Section

Variable	Count	Mean	Standard Deviation	Minimum	Maximum
DCBS	31	30.80677	9.21177	12.67	45
IADF	31	1.065807	0.610681	0.321	2.566
IAOR	31	0.4163871	0.3658637	0.07	1.801
IAORR	31	1.018742	0.5376304	0.112	2.3

Regression Equation Section

Independent Variable	Regression Coefficient b(i)	Standard Error Sb(i)	T-Value to test H0:B(i)=0	Prob Level	Reject H0 at 10%?	Power of Test at 5%
Intercept	0.9995	0.3445	2.901	0.0073	No	0.7985
DCBS	0.0176	0.0094	1.876	0.0715	No	0.4402
IADF	-0.3118	0.1363	-2.288	0.0302	No	0.5973
IAOR	-0.4574	0.2422	-1.889	0.0697	No	0.4451

Estimated Model

.999495932162378+ .017592999503591*DCBS-.311754384239474*IADF-.457429462169657*IAOR

Regression Coefficient Section

Independent Variable	Regression Coefficient	Standard Error	Lower 95% C.L.	Upper 95% C.L.	Standardized Coefficient
Intercept	0.9995	0.3445	0.2925	1.7064	0.0000
DCBS	0.0176	0.0094	-0.0016	0.0368	0.3014
IADF	-0.3118	0.1363	-0.5913	-0.0322	-0.3541
IAOR	-0.4574	0.2422	-0.9543	0.0394	-0.3113

Note: The T-Value used to calculate these confidence limits was 2.052.

Multiple Regression Report

Page/Date/Time	2 2008-09-29 08:44:33
Database	
Dependent	IAORR

Analysis of Variance Section

Source	DF	R2	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1		32.17289	32.17289			
Model	3	0.4129	3.580511	1.193504	6.330	0.0022	0.9398
Error	27	0.5871	5.090883	0.1885512			
Total(Adjusted)	30	1.0000	8.671394	0.2890465			

Analysis of Variance Detail Section

Model Term	DF	R2	Sum of Squares	Mean Square	F-Ratio	Prob Level	Power (5%)
Intercept	1		32.17289	32.17289			
Model	3	0.4129	3.580511	1.193504	6.330	0.0022	0.9398
DCBS	1	0.0765	0.6636158	0.6636158	3.520	0.0715	0.4402
IADF	1	0.1138	0.9870731	0.9870731	5.235	0.0302	0.5973
IAOR	1	0.0776	0.6727766	0.6727766	3.568	0.0697	0.4451
Error	27	0.5871	5.090883	0.1885512			
Total(Adjusted)	30	1.0000	8.671394	0.2890465			

Normality Tests Section

Test Name	Test Value	Prob Level	Reject H0 At Alpha = 5%?
Shapiro Wilk	0.9475	0.132949	No
Anderson Darling	0.4475	0.279800	No
D'Agostino Skewness	1.6374	0.101546	No
D'Agostino Kurtosis	0.1078	0.914178	No
D'Agostino Omnibus	2.6927	0.260187	No

Multiple Regression Report

Page/Date/Time	3	2008-09-29 08:44:33
Database		
Dependent	IAORR	

Regression Diagnostics Section

Row	Standardized Residual	RStudent	Hat Diagonal	Cook's D	Dffits	CovRatio
25	2.3232	2.5487	0.0888	0.1315	0.7956	0.5230
30	1.9915	2.1158	0.0502	0.0524	0.4865	0.6486

Plots Section

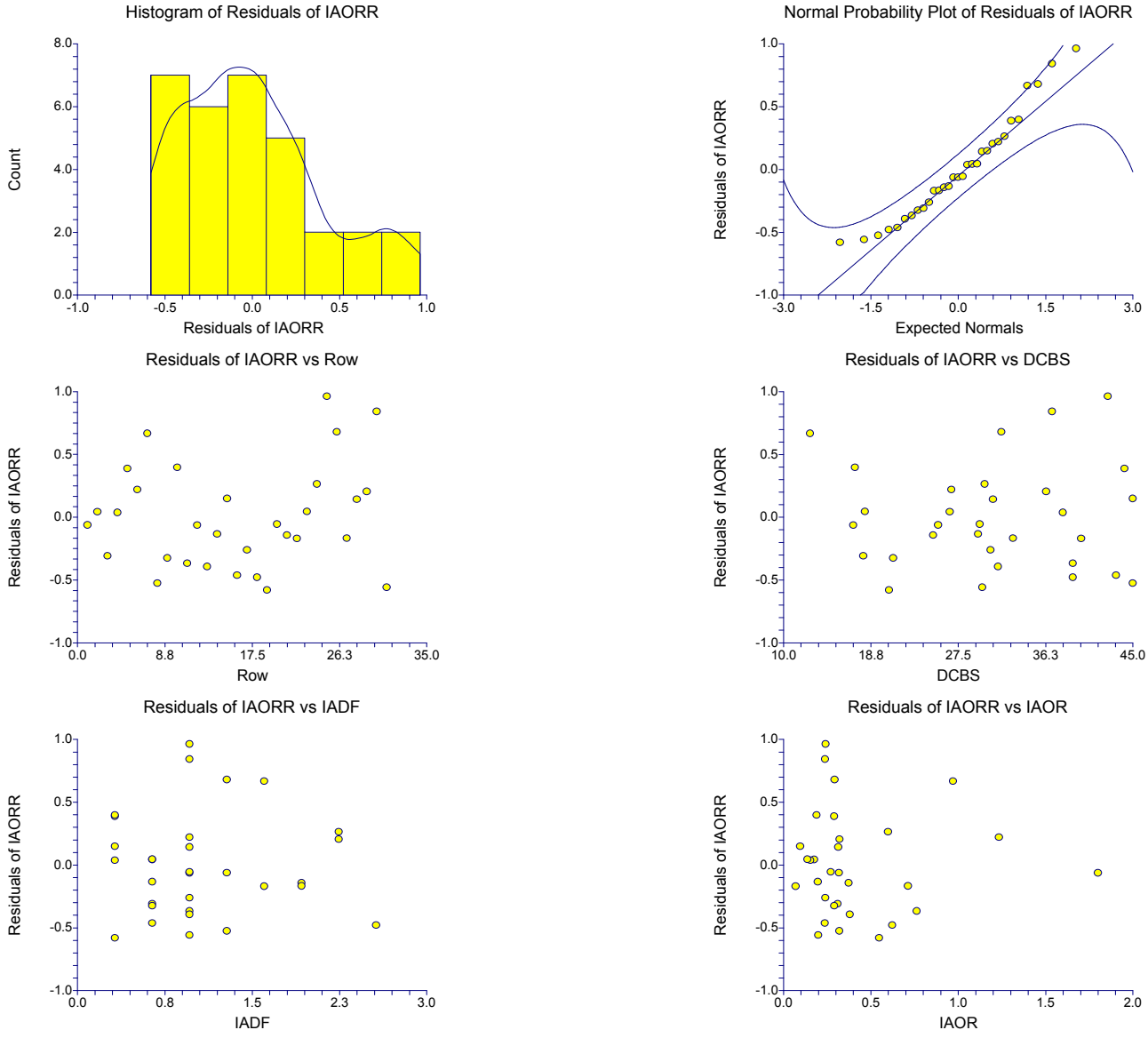


Figure vi - Residual Graphs of Multiple Regression Analysis

The estimated model is:

IAORR = 0.9995 + 0.0176(DCBS) - 0.3118(IADF) - 0.4574(IAOR)

The R^2 = 0.4129

6. Interpretation of Results

6.1. Assumptions of regression analysis

The regression model indicates that R^2 = 0.4129. This indicates a relatively good fit. There are no indications of homoscedasticity in the Residual Graphs shown above. None of the plots of residuals shows any specific patterns. The model is statistically significant.

6.2. Expected Results

6.2.1. Degree of Capital Budgeting Sophistication

The model indicates a positive relationship between DCBS and IAORR. This is expected.

6.2.2. Degree of Focus

Denis & Denis (1984) and Farragher *et al* (2001) showed that there is a negative relationship between lesser focused companies and performance. Therefore, the coefficient for this variable is expected to have a negative sign. In the multiple regression model constructed, the coefficient is in fact negative.

6.2.3. Operating Risk

Both Jacquemin & Saez (1976) and Farragher *et al* (2001) found a positive relationship between higher risk businesses and performance at the industry level. In the multiple regression model constructed, the coefficient is negative. This is contrary to what was expected.

6.3. Problem Statement

The researcher proposed to find an association between the degree of capital budgeting sophistication and a company's operating performance.
The problem was divided into three major goals, namely:

- Rating companies on their degree of capital budgeting sophistication.
- Rating companies' performance, using an industry adjusted measure for operating rate of return.
- Investigating a possible relationship between the degree of capital budgeting sophistication and company performance.

All three of the above mentioned goals were achieved as described in the previous chapter.

6.4. Research result

The model constructed using the multiple regression technique is statistically significant. The model indicates a positive, statistically significant relationship between the DCBS and IAORR.

Therefore the null Hypothesis, H_o cannot be rejected. It is therefore concluded that there is a statistically significant, positive relationship between the degree of capital budgeting sophistication of a company and its operating performance.

7. Conclusions and Recommendations

Similar to Kim & Farragher (1982) this study concludes that there is a statistically significant relationship between the degree of capital budgeting association of a company and its operating performance. This indicates the value of a well developed capital budgeting program. Industry would increase shareholder value in the long term if the capital budgeting sophistication increases.

It should be noted that the Industry adjusted measure for Capital Intensity is affected by the country's labour legislation. South Africa has advanced labour legislation. The resultant inflexibility in the labour market resulted in companies outsourcing all non-core business during the 1980's and 1990's. Recently, legislation is changing to such an extent that outsourcing does not in all cases give the same benefits as previously. Therefore companies are starting to in-source some of these non-core businesses again. In South Africa it would mean that the number of people employed by the company might be a skewed number, due to legislation, resulting in a skewed Capital Intensity number.

The study shows that the use of capital budgeting evaluation techniques in South Africa is consistent with previous studies. The study also shows the adoption of the real option analysis technique, albeit slowly and the widespread use of NPV since the earlier South African study, Parry & Firer (1990),

It is suggested that future research takes into account country specific economic conditions and the legal business environment.

8. Appendix 1: Summary of Questionnaires

Company	1	2	3	4	5	6	7	8	9	10
Capital Budgeting Activity										
Doing Strategic Analysis	3	5	4	4	5	4	2	5	4	5
Specifying investment goals	3	4	5	5	5	4	2	5	2	2
Searching for investments	4	3	3	3	5	3	2	5	2	4
Forecasting cost and returns	5	5	4	5	5	5	4	5	5	2
Doing risk analysis	4	5	3	4	5	4	3	5	5	4
Evaluating forecasted cost and returns	5	5	3	4	5	5	4	5	4	2
Decision making	4	5	5	5	5	4	5	5	4	5
Implementation of accepted investments	4	4	5	4	5	3	2	5	0	4
Doing post audits	2	2	4	5	5	4	2	5	4	2
1	1	1	1	1	1	1	0	1	1	1
2	0	1	0	1	1	1	1	1	1	1
3	0	1	0	1	1	1	1	1	1	1
4	1	1	0	1	1	1	1	1	0	0
5	1	1	1	1	1	1	1	1	1	0
6	0	0	0	1	1	1	1	1	0	0
7	1	1	1	1	1	1	0	1	1	1
8	1	1	1	1	1	0	0	1	1	1
9	0	0	0	0	1	0	0	1	0	0
10	1	1	0	1	1	1	1	1	1	1
11	1	1	0	1	1	0	1	1	0	1
12	0	1	0	1	1	1	0	1	0	0
13	1	1	1	1	1	1	1	1	0	0
14	1	1	1	1	1	1	0	1	1	1
15	1	1	1	1	1	1	1	1	1	0
16	0	0	0	1	1	1	0	1	0	1
17	1	1	1	1	1	0	0	1	1	1
18	1	1	1	1	1	1	0	1	1	0
19	0	1	1	1	1	1	0	1	0	0
20	1	0	0	1	1	0	0	1	0	0
21	1	1	1	1	1	1	0	1	1	0
22	1	0	0	1	1	1	1	1	1	0
23	1	0	1	1	0	1	0	1	0	0
24	1	1	1	1	1	1	1	1	1	0
25	1	1	1	1	1	1	1	1	1	1
26	1	0	0	1	1	0	0	1	1	0
27	1	1	1	1	1	1	0	1	1	1
28	1	0	0	1	1	0	0	1	1	0
29	1	0	0	1	1	0	0	1	1	0
30	1	0	0	1	1	1	1	1	1	0
31	0	0	0	1	1	1	1	1	1	0

Doing Strategic Analysis	0.33	1.00	0.33	1.00	1.00	1.00	0.67	1.00	1.00	1.00
Specifying investment goals	0.67	0.67	0.33	1.00	1.00	1.00	1.00	1.00	0.33	0.00
Searching for investments	0.67	0.67	0.67	0.67	1.00	0.33	0.00	1.00	0.67	0.67
Forecasting cost and returns	0.83	1.00	0.50	1.00	1.00	0.83	0.67	1.00	0.50	0.50
Doing risk analysis	0.50	0.50	0.50	1.00	1.00	0.50	0.00	1.00	0.50	1.00
Evaluating forecasted cost and returns	0.83	0.50	0.67	1.00	0.83	0.83	0.17	1.00	0.50	0.00
Decision making	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
Implementation of accepted investments	1.00	0.50	0.50	1.00	1.00	0.50	0.00	1.00	1.00	0.50
Doing post audits	0.75	0.00	0.00	1.00	1.00	0.50	0.50	1.00	1.00	0.00
DCBS Score	**25.5**	**26.7**	**18.0**	**38.0**	**44.2**	**26.8**	**12.7**	**45.0**	**21.0**	**17.2**

Company	11	12	13	14	15	16	17	18	19	20
Capital Budgeting Activity										
Doing Strategic Analysis	5	2	5	4	5	5	4	5	4	5
Specifying investment goals	4	3	3	5	5	5	3	5	4	5
Searching for investments	3	3	3	5	5	5	3	5	4	3
Forecasting cost and returns	5	4	4	5	5	5	4	4	4	4
Doing risk analysis	5	4	5	4	5	5	3	4	2	2
Evaluating forecasted cost and returns	4	4	5	4	5	5	4	4	4	4
Decision making	5	5	5	5	5	5	5	4	4	5
Implementation of accepted investments	3	4	5	4	5	5	4	4	4	5
Doing post audits	5	4	4	4	5	5	5	4	3	4
1	1	0	1	1	1	1	1	1	1	1
2	1	0	1	1	1	1	1	1	1	1
3	1	0	1	1	1	1	1	1	1	1
4	1	0	1	1	1	1	1	1	1	1
5	1	0	1	1	1	1	1	1	0	1
6	1	0	1	1	1	1	1	1	0	0
7	1	0	1	0	1	1	1	1	1	1
8	1	0	1	0	1	1	1	1	0	1
9	1	0	0	0	1	1	0	1	0	0
10	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	0
12	1	0	1	0	1	1	0	1	0	0
13	1	1	1	1	1	1	1	1	0	1
14	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1	1	0
17	1	1	1	1	1	1	1	1	0	1
18	1	0	1	1	1	1	1	1	1	1
19	1	0	0	0	1	0	1	1	0	1
20	1	0	0	1	1	1	0	1	0	0
21	1	1	1	0	1	1	1	1	0	1
22	1	0	1	0	1	1	1	1	1	1
23	1	0	0	0	1	0	0	1	1	0
24	1	1	1	1	1	1	1	1	1	1
25	1	1	1	1	1	1	1	1	1	1
26	1	1	1	1	1	1	1	1	1	1
27	1	1	1	1	1	1	1	1	0	1
28	1	0	0	0	1	1	1	1	0	1
29	1	0	0	0	1	1	0	1	1	1
30	1	0	0	1	1	1	1	1	1	1
31	1	0	0	1	1	1	1	1	1	0

Doing Strategic Analysis	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Specifying investment goals	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.67
Searching for investments	1.00	0.00	0.67	0.00	1.00	1.00	0.67	1.00	0.33	0.67
Forecasting cost and returns	1.00	0.83	1.00	0.83	1.00	1.00	0.83	1.00	0.67	0.67
Doing risk analysis	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50
Evaluating forecasted cost and returns	1.00	0.17	0.50	0.33	1.00	0.67	0.67	1.00	0.50	0.67
Decision making	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Implementation of accepted investments	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	1.00
Doing post audits	1.00	0.00	0.00	0.50	1.00	1.00	0.75	1.00	0.75	0.75
DCBS Score	**39.0**	**17.0**	**31.5**	**29.5**	**45.0**	**43.3**	**30.8**	**39.0**	**20.6**	**29.7**

Company	21	22	23	24	25	26	27	28	29	30	31
Capital Budgeting Activity											
Doing Strategic Analysis	4	5	4	5	5	4	5	4	5	3	5
Specifying investment goals	4	5	4	4	5	5	5	4	3	5	5
Searching for investments	3	4	3	3	5	3	3	4	3	5	3
Forecasting cost and returns	3	5	4	5	5	5	4	4	5	5	5
Doing risk analysis	4	5	4	4	5	3	4	4	5	5	4
Evaluating forecasted cost and returns	4	5	3	4	5	5	4	4	5	4	4
Decision making	5	5	3	5	5	5	4	4	5	5	5
Implementation of accepted investments	5	5	4	5	5	4	5	4	3	5	5
Doing post audits	4	5	3	4	5	4	4	4	4	5	5
1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1
4	1	1	0	1	1	1	1	1	1	1	1
5	1	1	0	0	1	1	1	1	1	1	1
6	0	0	0	0	1	0	0	1	1	1	1
7	1	1	1	0	1	1	1	1	1	1	1
8	1	1	0	0	1	1	1	1	1	1	1
9	1	1	0	0	0	0	0	1	1	0	0
10	0	1	1	1	1	1	1	1	1	1	0
11	0	1	0	1	1	1	1	1	1	1	0
12	1	1	0	0	1	1	1	0	1	0	1
13	1	1	1	1	1	1	1	0	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1
16	0	1	1	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1	1	1	0
18	1	1	1	1	1	1	1	1	1	1	1
19	0	1	0	1	1	0	0	1	1	1	0
20	0	0	0	0	0	0	0	0	1	0	0
21	1	1	1	1	1	1	1	1	1	1	1
22	0	0	1	1	1	1	1	1	0	1	0
23	0	0	0	0	1	0	1	1	0	0	0
24	1	1	1	1	1	1	1	1	1	1	1
25	1	1	1	1	1	1	1	1	1	1	1
26	1	1	0	1	1	1	1	1	1	1	1
27	1	1	1	1	1	1	1	1	1	1	1
28	0	1	0	1	1	1	1	0	1	1	0
29	0	1	0	0	1	1	0	0	1	0	1
30	0	1	0	1	1	0	1	0	1	1	0
31	0	1	0	1	1	1	1	1	1	1	0

Doing Strategic Analysis	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Specifying investment goals	0.67	0.67	0.00	0.33	1.00	0.67	0.67	1.00	1.00	1.00	1.00
Searching for investments	1.00	1.00	0.33	0.00	0.67	0.67	0.67	1.00	1.00	0.67	0.67
Forecasting cost and returns	0.67	1.00	0.67	0.83	1.00	1.00	1.00	0.67	1.00	0.83	0.67
Doing risk analysis	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50
Evaluating forecasted cost and returns	0.33	0.50	0.50	0.67	0.83	0.50	0.67	0.83	0.67	0.67	0.33
Decision making	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Implementation of accepted investments	1.00	1.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Doing post audits	0.00	1.00	0.00	0.75	1.00	0.75	0.75	0.25	1.00	0.75	0.25
DCBS Score	**25.0**	**39.8**	**18.2**	**30.2**	**42.5**	**31.8**	**33.0**	**31.0**	**36.3**	**36.9**	**29.9**

9. Appendix 2: Blank Questionnaire

Questionnaire

Personal Particulars

Company:

Name:
Position:
Contact No. at Work:

1.1 Questionnaire

	Yes (Y)	No (N)
Are you responsible for capital budgeting analysis (or parts thereof)?		
Are you responsible for capital budgeting decision-making (or parts thereof)?		

On a scale of 1 to 5 please rate the following capital budgeting activities regarding the relative importance, with:

Extremely important	5
Very important	4
Moderately important	3
Not too important	2
Not at all important	1

Capital Budgeting Activity	Rating
1. Doing Strategic Analysis	
2. Specifying Investment Goals	
3. Searching for Investments	
4. Forecasting Cost and Returns	
5. Doing Risk Analysis	
6. Evaluating Forecasted cost/returns	
7. Decision-making	
8. Implementation of Accepted Investments	
9. Doing Post Audits	

Please tick the applicable box to indicate YES or NO to whether your company uses the following components in its capital budgeting process:

	Yes (Y)	No (N)
Strategic Analysis		
1. Conducting ongoing strategic analyses?		
2. Assessing your company's competitive advantages?		
3. Identifying markets/products/services where competitive advantages are most applicable?		
Goal Specification		
4. Identifying strategic capital investment goals?		
5. Quantifying a minimum required rate of return?		
6. Quantifying a maximum acceptable risk objective?		
Search for Investments		
7. Searching for new investments based on strategic goals?		
8. Conducting a search for investments on an ongoing basis?		
9. Providing rewards to sponsors of good investments?		
Forecasting Cost and Returns		
10. Making a formal link to corporate strategy?		
11. Following company wide procedures in forecasting?		
12. Reviewing the forecast through an independent management group?		
13. Considering the cost/returns over the intended holding period?		
14. Measuring the cost/returns on a cash basis?		
15. Including operating returns, residual values and working capital changes in the forecasting of cost/returns?		
Risk Analysis		
16. Doing a quantitative risk assessment?		
17. Describing the non-quantifiable aspects of an investment?		
Evaluation of Forecasted Cost and Returns		
18. Using discounted cash flow measures?		
19. Using the Capital Asset Pricing Model or certainty equivalents to adjust for risk?		
20. Using real option analysis to evaluate investments?		
21. Using Net Present Value calculations?		
22. Using computer simulation and mathematical programming?		
23. Using PERT/Critical Path?		
Decision-making		
24. Weighing an investment's returns/risks vs. investment goals?		
25. Considering strategic and financial factors in decision-making?		
Implementation of accepted investments		
26. Developing an investment implementation plan?		
27. Assigning a project manager?		
Post Audit		
28. Doing Post-audits on a regular basis, rather than optional or crisis basis?		
29. Is the Post-audits done by individual/s not associated with the investment?		
30. Doing the Post-audit report on whether variances are due to operating or forecasting errors?		
31. Is the results used to:		
• Track forecasters' ability to make good forecasts?		
• Improve forecasters' abilities?		
• Force corrections for poor performing projects?		

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