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Capital Budgeting Techniques and Firm Performance in the South African Mining Industry

A research report submitted to the Wits Business School, University of the Witwatersrand,

In partial fulfilment of the requirements for the degree of

Master of Management in Finance and Investment

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Abstract

This research investigated the application of capital budgeting and risk analysis techniques and their effect on company performance in the South African mining industry. Studies internationally and locally have reported an improved application of capital budgeting techniques— away from the naïve, non-discounted cash flow techniques of the Payback Period (PBP) to the more appropriate discounted cash flow methods of Net Present Value (NPV) and Internal Rate of Return (IRR).

In a survey distributed to the Finance Managers, Officers and Directors of mining companies in South Africa, we confirmed the increased sophistication in capital budgeting— the results suggest that 83.3% prefer NPV, 61.5% always use IRR and only 58.3% use PBP. On the other hand, and in contrast to capital budgeting, risk analysis is still comparatively naïve; with sensitivity analysis being the dominant technique used in the mining industry. The sophisticated methods of scenario testing and real option analysis (ROV) are rarely employed.

An empirical analysis on the effects of capital budgeting and risk analysis on company performance has yielded results in contradiction with the theory of capital budgeting. The finding of the study is a negative and/or insignificant relation of capital budgeting and risk analysis sophistication to company performance as measured by return of assets (ROA). Although this finding is counterintuitive and contradicts theory, it is, however, consistent with international studies of this nature.

Keywords: Capital Budgeting; Risk analysis; Net Present Value; Internal Rate of Return; Payback Period; Accounting Rate of Return; Real Options Analysis; Company Performance; Capital Intensity; Return on Assets; Mining industry

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1. Introduction

1.1. Background

The decision for investors to make available funds for a project in order to generate cash flows in the future, with the ultimate goal of creating value for the firms and all shareholders, is referred to as capital budgeting (Seitz & Ellison, 2005). The capital investment processes involve a series of steps – from the establishment of goals, development of strategy, exploring investment opportunities, evaluating those opportunities, selecting the investment, implementing and monitoring and finally, a post audit analysis (Seitz & Ellison, 2005).

The investments, termed capital investments, are characterised by a huge initial capital outlay that is committed for a long period of time. Capital budget allocation is dependent on various valuation techniques, such as the Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PBP), and Profitability Index (PI) (Seitz & Ellison, 2005).

Equally important to the capital budgeting techniques are risk assessment methods. The understanding of the risks, their nature, likelihood and probability of occurrence, as well as the inclusion and quantification is vital in capital budgeting and project evaluation (Zare, Sereshki & Aziz, 2008). Estimates of the capital outlay and the potential cash flow generation are projected for the projects and usually over long periods of time.

This then presents uncertainty as a result of the assumptions made, with regard to the project's start and completion date, potential production inputs and outputs. Successful incorporation of risks presented by uncertainties into the capital budgeting process results in a decision that creates value for the firm and maximizes the shareholders' wealth, which is the primary objective of capital budgeting.

This study, therefore, focuses on capital budgeting and risk analysis techniques used by firms in the South African mining and metals industry. The mining and metal industry has been in existence for over 200 years, contributing significantly to the Gross Domestic Product (GDP) and economic development. However, the contribution has been declining in recent years from 21% in 1970 to 8.3% in 2012 (Chamber of Mines, 2013). The declining importance of the mining industry is largely attributed to the decline in gold and uranium specifically. This is primarily due to maturation of the gold and uranium sector and specific factors such as productivity, capital and labour (Fedderke & Pirouz, 2000).

Moreover, the easily mineable reserves and areas are mostly mined out, leaving the difficult, rich and deep reserves in the ground (Cawood, 2011). While this presents a challenge for the mining industry; technological advances have, to some extent, presented a solution. Thus, the key to maintaining mining's significance in the economy lies in the application of these technological approaches to enhance productivity and reduce costs, and through strategic allocation of capital, facilitating continued investments in mining and metals (Willis, Dixon, Cox & Pooley, 2004).

For this reason, capital budgeting becomes critical in evaluating new investments, appraising capital projects for new technology, new projects and expansion of existing operations for sustainability and further growth in the mining industry. Additionally, the mining industry in South Africa, especially, has been subjected to several changes in the past years, due to deep level mining and rising labour costs, resulting in high extraction costs which have caused a major shift in the industry (Willis et al., 2004).

The introduction of mechanised mining, as opposed to the labour intensive mining activities, over the past two decades, has been a major game changer and a solution to high labour intensive conventional mining (Willis et al., 2004). With mechanisation, automation of some activities in the mining cycle became prominent. While these advances have created a new era

in mining, they require huge capital investments; thus, capital budgeting has become crucial for the advancements of these technologies and the mining as a whole.

Over the past years, the risk factors have shifted from mostly social licence issues to financial factors; with capital allocation at the top of the list (EY, 2014). Other important risk factors include price and currency volatility, capital project execution, margin protection and productivity.

Table 1 illustrates the changes in the risk focus in the mining and metals industry over recent years. In a report by PWC highlighting the trends in the South African mining industry, inappropriate capital decision making was identified as a major risk facing the mining industry (PWC, 2014). This is a vital concern since capital, and new investments, are required to further grow the sector.

Table 1: Top 10 Business Risks in 2013 and 2008

Top 10 Risks		Over six years	
2013		2008	
1	Capital dilemmas - Capital allocation and access (New in 2009)	1	Skill shortage
2	Margin protection and productivity improvement (Was cost inflation)	2	Industry consolidation (not a threat in 2013)
3	Resource nationalisation	3	Infrastructure access
4	Social license to operate	4	Maintaining social license to operate
5	Skill shortage	5	Climate change concerns (not in top 10 in 2013)
6	Price and currency volatility (New in 2010)	6	Rising costs (Margin improvement)
7	Capital project execution (new in 2011)	7	Pipeline shrinkage (not in top 10 in 2013)
8	Sharing the benefits (new in 2012)	8	Resource nationalisation
9	Infrastructure access	9	Access to secure energy (not in top 10 in 2013)
10	Threats of substitutes (new in 2013)	10	Increased regulation (not in top 10 in 2013

Source: EY, 2014

Capital access and allocation is at the top of the risks faced by mining companies in South Africa, in the 2013-2014 year (EY, 2014). Therefore, it is important to investigate how the past studies and corporate finance theories taught in most finance classes and business schools have influenced how projects are evaluated. It is the objective of this study to further establish the link between the capital budgeting techniques and the firms' performance, looking specifically at profitability in order to establish if the value creation of capital budgeting is linked to specific techniques.

Profitability, for this study, is operationalised as Return on Assets (ROA), which is measured as a ratio of earnings after interest and tax (EAIT) and total assets (TA) (Firer, Ross, Westerfield, & Jordan, 2012). Capital budgeting techniques can be used in evaluating projects at different stages in mining and for different purposes as outlined as follows:

- New mine project: This generally refers to the development of new reserves in an area where there is no prior mining. Such projects are commonly identified as Greenfield projects (Porter, 2007).
- Expansion project: Projects where the life of the existing mine will be significantly extended. These projects are commonly identified as Brownfields projects (Porter, 2007).
- Stay In Business (SIB) projects: Continuous business improvement projects to the existing operation to take advantage of changing circumstances and/or market conditions (Porter, 2007).
- Social projects (licence to operate)[1]: Projects associated with the social upliftment of the communities where mining firms operate as highlighted in the Social Labour Plan.

[1] The Mineral and Petroleum Resources Development Act, 2002, (Act No 28 of 2002) (MPRDA) requires of the mining industry to embark on social development plans, to aid transformation and improve the communities in and around areas they operate (DMR, 2010).

This is a requirement by the government under the Mining Charter. Such projects could be the building of a new school, health care centre, etc.

- Safety projects: Refers to projects engaged in, to mitigate the risk to human life. Such projects could be the replacement of existing equipment for safer equipment, mining re-design to incorporate new safety regulations.

The financial evaluation techniques employed could differ, depending on the stage, and the purpose, of the capital outlay. A good evaluation technique is one that maximises value for shareholders, irrespective of the classification of the project.

1.2. Research Question

This research investigates the capital appraisal and risk analysis practices used in the mining industry and their impact on mining company performance. Capital budgeting approaches are classified as either sophisticated, that is, those that take into account risk and the estimated cash flows associated with the project; or naïve, those that do not (Pinches, 1982). The study attempts to answer several questions in order to establish whether the companies in the mining industry use the sophisticated or naïve capital budgeting approach in project appraisal.

Firstly, what are the capital budgeting techniques (NPV, IRR, PBP, PI etc.) used in capital investment evaluation in the mining sector? This would help us understand what are deemed important techniques to use by financial managers in deciding whether to take on an investment or not, and thus, in ranking projects that are mutually exclusive.

Secondly, the question of what risk analysis methods (Sensitivity Analysis, Real Option Valuation, Monte Carlo Simulations, etc.) are used to critically evaluate the projects' fundamental assumptions with regard to estimated future cash flows. In other words, what do financial managers and/or decision makers deem necessary and important with regard to risk and how is it evaluated?

Finally, the study seeks to establish whether there is a positive or negative relationship between the capital budgeting techniques and company performance, operationalised as Return on Assets (ROA). While the first and the second points above seeks to establish whether firms in the mining industry in South Africa use the sophisticated approaches or the naïve approaches, the third part seeks to link such approaches to company performance using available financial data.

1.3. Motivation

Capital budgeting is a topic mostly covered in corporate finance courses and research. However, it is not practically applied as per the recommendations of these studies and findings of Haque, Topal & Lilford (2014), Hall & Millard (2010) and Ryan & Ryan (2002). There are different reasons and justifications for the use of one technique over another.

The decision to make available funds for an investment is important and could be the difference between firms realising value growth in the future or facing decline and collapse. This is particularly true for the mining and metals industry, because of the complex, long term nature of the projects and the high initial capital outlays, and resources that are finite and depleted over time.

Furthermore, commodities cycles affect mostly the mining and the metals industry, especially since commodity producing companies are price takers (Baurens, 2010). In addition, mining firms face uncertainty occasioned by risks associated with geology, and the ability to profitably recover reserves at the correct ore grade quality and in the required quantities (Baurens, 2010).

Moreover, mining and metals play a vital role in the South African economy. Although the contribution to the GDP has been declining for years, it is still significant and important to the

economic development of the country. Mining and metals contributed 8.3% directly to the GDP (17% indirect) in 2012 (Chamber of Mines, 2013).

Mining continues to foster private investment, where it accounted for 19% of the private investment and 11.9% of overall investment in the economy (Chamber of Mines, 2013). The industry continues to be a key component of the Johannesburg Securities Exchange (JSE), with a 24.7% contribution to the all share index and 24.4% of all equities' market capitalisation. Mining accounted for over 50% of the foreign exchange and 13.2% of the corporate tax receipts for the year 2012 (Chamber of Mines, 2013).

Therefore, there is no question that the South African mining industry is vital to the development of the economy. However, the business risks, such as capital allocation and access, capital project execution, margin protection (faced by this industry), could hinder the growth and development of this industry. Hence, the critical need to understand the capital appraisal and risk analysis techniques used in the industry and their impact on company performance.

1.4. Report Outline

The remainder of the study is structured so that it gives the reader a background of previous studies on the subject of capital budgeting practices and corporate performance, internationally and locally. Chapter Two of this study also reflects on the theory of capital budgeting techniques and their application in order to maximise shareholders' wealth and add value to the companies. It further reviews the previous academic studies of the subject and the results from surveys and empirical analysis.

The methods used in the study are outlined in Chapter Three. The survey questionnaire, sample selection and the empirical analysis framework methods are detailed in this chapter. Chapter

Four details the results of the survey questions and the analysis of the capital budgeting and risk analysis techniques used in the mining industry.

The empirical exercise to establish the effects of capital budgeting practices, size of company and capital intensity on the company performance, is discussed in Chapter Five. In this chapter, the regression model is defined, and regression results reported and analysed. Conclusions, limitations and recommendation for further studies are outlined in Chapter Six.

2. Theoretical Framework and Literature Review

2.1. Theoretical Framework

2.1.1. Capital Budgeting

The best capital budgeting decision is that which maximises the firm's value and, as a result, maximises shareholders' wealth (Firer, Ross, Westerfield & Jordan, 2012). The value is determined through a series of estimated cash flows, resulting from the investment decision. Due to the uncertainty of the future cash flows and the behaviour of these cash flows, a variety of decision making methods and/or techniques have been developed in the quest to establish the true value of an investment, so that an investment that fulfils the goal of capital budgeting by creating value for the company and for the shareholders is selected (Firer et al., 2012).

Typically, capital budgeting methods are categorised into two classes; the sophisticated approach, which are the capital budgeting techniques that consider risks and the time value of money (discounted cash flows); and the naïve approach, which does not consider risk nor the time value of money (Pinches, 1994). The most popular sophisticated approach of capital budgeting is the NPV and the IRR, while the most popular naïve approach is the Payback Period and Accounting Rate of Return methods (Pike, 1984).

Discounted Cash Flows

Net Present Value (NPV)

The simplest definition of the net present value is "the difference between an investment's market value and its cost" (Firer et al., 2012). The NPV measures in monetary terms the amount of value that will be created, or the wealth increase as a result of the proposed investment (Seitz & Ellison, 2005). This technique of capital budgeting takes into account the time value of money by discounting all the estimated future cash flows, so as to compare the gains from the

investments with the costs of acquiring the investment at the present moment. Equation 1 defines NPV, as calculated in investment appraisals.

Equation 1: NPV (Seitz & Ellison, 2005)

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+K)^t} - I_0$$

Where; $CF_{t\ is}$ the estimated cash flow at time t

I_0 is the initial capital outlay required to acquire the investment

K is the discounting rate reflecting the rate of return that could be earned if capital was invested in other investments with similar risk.

The main criterion for selection is that an investment with NPV of more than zero should be accepted, and an investment with NPV of less than zero should be rejected (Seitz & Ellison, 2005). Because the key goal of capital budgeting is to create and maximise value for the company and for the shareholders, NPV is the best measure of the value created by an investment (Seitz & Ellison, 2005). The superiority of the NPV as the technique in capital budgeting stems mainly from its advantages, listed below:

- It takes into account the time value of money; a concept that incorporates the trade-off between money now and money sometime in the future (Firer et al., 2012).
- All estimated future cash flows are taken into account for the life of the investment, including the salvage value at the end of project,
- It is able to evaluate all kinds of investment; with normal and abnormal (conventional and unconventional) cash flows, hence it allows for all the investments' cash flows to be evaluated,
- It considers the reinvestments of all the cash inflows,

- Because of all these advantages, it ensures that shareholders' value, and wealth, is maximised (Seitz & Ellison, 2005).

The major disadvantage of NPV is that it reports value in absolute monetary terms, and there is no consideration regarding the size of investment, which could lead to rejecting a value adding project mainly because it was compared to a large scale investment (Seitz & Ellison, 2005). For mutually exclusive investment with different lives and sizes, by merely accepting the investment with a high NPV could be misleading, so that a project with high NPV requiring a high initial outlay is selected as opposed to a project with lower NPV, but with a low initial outlay (Seitz & Ellison, 2005).

However, selecting a positive NPV investment will always ensure that value is created (Arnold & Hatzopoulos, 2000). Because of discounting future cash flows and consideration of time value, NPV and other DCF methods are considered to be the sophisticated approach to capital budgeting (Pike, 1984; Pinches, 1994).

Internal Rate of Return (IRR)

Internal Rate of Returns refers to the discount rate that equates the NPV to zero. IRR takes the NPV concept further where it establishes the required return for the investment. It also takes into account the discounted future cash flows of the investments and compares them to the cost of acquiring the investment, just like in the case of NPV (Firer et al., 2012). Equation 1 is re-written to illustrate that rate of return (k) that equates the NPV to zero, which is referred to as the IRR. An investment adds value and is hence accepted if the IRR exceeds the required rate or return.

Equation 2: Rewritten NPV equation to demonstrate IRR (Seitz & Ellison, 2005).

$$NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+K)^t} - I_0 = 0$$

Major advantages of the IRR

- It states the profitability of an investment in a manner most managers are familiar with (reported in terms of returns)
- Similar to NPV, it considers the time value of money, hence all future cash flows are discounted
- It also considers all the cash flows during the life of the investment (Seitz & Ellison, 2005).

The common disadvantages of IRR include the inability to evaluate and handle investments with abnormal / unconventional cash flows, and the re-investment assumptions (Seitz & Ellison, 2005). Even with these disadvantages, IRR has been superior to NPV for a long time mainly due to its simplicity in explaining and presentation as a percentage. (Ryan & Ryan, 2002).

Because IRR is represented as a rate of return, most non-finance investors understand it better than the concept of NPV, hence its popularity over the years (Seitz & Ellison, 2005). In theory, a company that uses the DCF techniques (NPV, IRR) in capital budgeting will create value and maximise shareholders' wealth (Seitz & Ellison, 2005).

Non-Discounted Cash Flows

Payback Period (PBP)

Payback Period refers to the time (period) it takes for the investment to generate cash flow equal to the initial investments (Firer et al., 2012). An investment is accepted when the calculated Payback Period is less than that prescribed by the company. Although this method is easy to use and apply, it has more disadvantages than advantages as compared to the other capital budgeting techniques. Theoretically the major advantages of PBP are:

- Its ease of computation and interpretation

- It adjusts for the uncertainty in the cash flows expected later in the investment, by only considering the early cash flows
- It is biased towards liquidity. A shorter payback period would indicate that the investment generates greater cash flows per period (Firer et al., 2012).

There are more shortcomings with PBP than there are advantages, considering its ability to add value and maximise wealth. This technique takes no regard of the discounted cash flow, hence it does not consider the time value of money (Firer et al., 2012). It requires in its accept/reject criteria an arbitrary cut-off point, beyond which the cash flows are not considered.

Therefore, it generally leads to a reject signal for large, lengthy investments, which are a characteristic of capital investment (Firer et al., 2012). For this reason, it is regarded as the naïve approach to capital budgeting and decision making (Pike, 1984). PBP is generally useful for smaller investments, where the cost of a sophisticated analysis might be more than the investment evaluation (Seitz & Ellison, 2005). It is more generally suited as a screening method than as a final decision method (Firer et al., 2012).

Accounting Rate of Return (ARR)

Accounting rate of return, usually referred to as the Return on Investment (ROI) is the ratio of the average annual income from the investment (inflows) to the total initial investment outlay (outflow) (Firer et al., 2012). The accept/reject criteria for this technique, are usually based on the company's existing rate of return and/or company's targeted rate of return. The continued use of this method is mainly because it is simple to calculate and interpret, given the company's required rate (Seitz & Ellison, 2005). It further reports the accounting income, for managers mostly concerned with the income (Seitz & Ellison, 2005).

However, just like the payback period, ARR does not take into account the time value of money and hence does not consider the time value of money. It ignores the life of the investment and

only focuses on the income (Arnold & Hatzopoulos, 2000). ARR is best illustrated by equation 3.

Equation 3: ARR calculation for an investment (Seitz & Ellison, 2005).

$$ARR = \frac{EBIT\ (1 - tax\ rate)}{(Begining\ value + Ending\ value)/2}$$

In theory, the best techniques for investment appraisal are those that consider the time value of money and hence use the discounted cash flows in the analysis of the future cash flows (Seitz & Ellison, 2005). Even among the DCF techniques, NPV is regarded as superior. Mainly because, it states exact monetary value by which the investment will increase the wealth and hence add value to the firm (Seitz & Ellison, 2005). Since capital budgeting is concerned with adding value and maximising wealth, companies that employ the DCF techniques will add value and hence, perform better (Seitz & Ellison, 2005).

2.1.2. Capital Budgeting Process

The capital budgeting process involves a series of steps in order to make investment decisions that will add value to companies and shareholders. The process involves the establishment of goals, development of strategy, exploring investment opportunities, evaluating opportunities, selecting an investment, implementing and monitoring and finally, posting an audit analysis (Seitz & Ellison, 2005).

2.1.2.1. Establishment of Investment Goal

This is the initial process in capital budgeting where an organisation establishes the goal of the investment, and then identifies suitable projects that are in line with the goal. A goal to increase market share (for example), and expand the current operation will typically be followed by identifying opportunities, such as replacement of current assets, modification of current assets and purchasing of new assets as the capital projects (Seitz & Ellison, 2005). Goals may be

monetary or non-monetary, such as to reduce injuries, improve reading ability, mostly associated with non-profit organisation goals (Seitz & Ellison, 2005).

2.1.2.2. Development of Strategy and Cash Flow Estimations

Following the identification process, strategy that mainly sets the direction on how the investment will be carried out is developed, and proposals for different strategies are outlined (Seitz & Ellison, 2005). Project life, output quantities and cash flow estimates are developed for each of the proposals outlined in the initial process of establishing a goal.

2.1.2.3. Financial Analysis and Project Selection

This process evaluates all the cash flows estimated in the previous step, for all the proposed investment opportunities. The selection criterion is based on the capital budgeting techniques used to evaluate the investment. Selection criteria can be the DCF such as the NPV, IRR and PI or the non-DCF methods such as the PBP, and ARR (Seitz & Ellison, 2005). Important also at this stage is the valuation of the cost of capital and its effect on the investment decision. The outcome of this process is the selection of the investment that will satisfy the outlined goal, given the selection criterion (Seitz & Ellison, 2005).

2.1.2.4. Project Implementation

Upon selection and approval of a capital investment, the actual implementation phase starts, involving the physical construction or acquisition, depending on the nature of investment (Seitz & Ellison, 2005).

2.1.2.5. Project Control, Post Audit and Review

Project control and monitoring is key, especially during the course of the implementation phase, where costs may overrun, the project may go over schedule (Seitz & Ellison, 2005). Post audit and review phase is mainly a reactive measure in the capital budgeting process and the

very last phase. This process includes the assessments of the fundamental assumptions, and estimations made in order to evaluate the investment's actual performance against the forecasted performance (Seitz & Ellison, 2005).

2.1.3. Risk in Capital Budgeting

In capital budgeting, risk refers to the exposure to variability in outcomes, specifically, negative outcomes, such as getting less than was expected (Seitz & Ellison, 2005). Variability in outcomes could arise mainly from the predicted future cash flows. The risk is that varying cash flows could change the decision on whether to accept an investment or not. Methods of evaluating risks are classified as quantitative and qualitative.

Qualitative assessment is a process where all the risks are identified and assessed, giving each of them a weighting mainly using subjective, intuitive (qualitative) measures such as likelihood and severity of impact (Seitz & Ellison, 2005). Such methods are generally simple and descriptive; they often rely on the use of a risk matrix to evaluate the level of risk, and to quantify how it is assessed and prioritised (Seitz & Ellison, 2005). Some of the commonly used quantitative measures of risk are discussed below.

Sensitivity Analysis

This is a method of testing the effect of key variables on the overall investment. Key variables that are inputs to the cash flow, are varied to establish their overall impact on the investment, and the risk levels for these variables (Seitz & Ellison, 2005). Uncertainty is quantified with Sensitivity Analysis without estimating any probabilities. Key variables such as sales quantity, prices, and costs are varied to see the impact on the NPV of the project, in order to establish which is more sensitive and risky to the project (Seitz & Ellison, 2005).

What is an added advantage of sensitivity analysis is the ability to show which of the inputs are key variables and are critical to the investment (Seitz & Ellison, 2005).

Monte Carlo Simulation

Monte Carlo simulation is a model that allows for the testing of different variables utilising randomly drawn values at a controlled probability to the actual occurrence (Seitz & Ellison, 2005). Monte Carlo is generally referred to as one of the sophisticated techniques of risk analysis in capital budgeting for its complexity in, and the use of, probability of occurrence. The results of a Monte Carlo simulation are generally a distribution of all the probabilities, and their outcomes in terms of the NPV (Seitz & Ellison, 2005).

Real Options Valuation (ROV)

This is a valuation method that allows for the modelling of the uncertainty within a project. ROV's main advantage over other DCF methods is its ability to vary with the situations and the times as they change with the investment. It provides capital investments/projects and the tools to adapt to change and varying parameters and hence does not assume variables are fixed for the duration of the evaluation as DCF methods do (Haque et al., 2014). Some advantages of ROV are;

- The ability to implement an investment/project in phases, based on the suitability of changed variables,
- The ability to make a decision to defer an investment for the future owing to the present unfavourable conditions,
- The ability to vary investment inputs, and constantly monitor the viability of an investment, throughout the investment period (Collan & Liu, 2003).

2.1.4. Corporate Performance and Capital Budgeting

Capital budgeting theory indicates that the use of the more sophisticated DCF method in investment selection, would lead to a company selecting the kind of investments that will add value and hence improve their performance (Seitz & Ellison, 2005). Two performance measures are generally used and are relevant.

Measures used in the past studies of this nature were categorised as either accounting performance, which refers to performance derived from financial statements, or economic performance, which is performance based on the firms' stock performance on the exchange (Axelsson et al., 2003).

Studies, however, have argued the relevance of financial performance measures in evaluating capital investments over stock performance indicators. Quoted from a study by Klammer, (1973) that investigates the relation of capital budgeting sophistication to corporate performance; the following reasons argue the relevance of financial performance over stock performance (Klammer, 1973).

- Shareholders know little about the capital budgeting techniques used by firms
- There is no basis for isolating the stock price influence of this knowledge if they do have it
- Firms management attempt to accept projects which return satisfactory profits
- The market, presumably, will value the stock on the basis of investor satisfaction, in light of expectations with the financial results obtained
- Firm financial data are more directly influenced by capital budgeting results than is stock market price (Klammer, 1973).

Financial Corporate Performance Measures

Financial ratios have been widely used to measure performance, and financial effectiveness. The most frequently used accounting performance measures are output related factors such as change in sales and change in profits over a specified period. Noted was the fact that financial ratios present a good idea of the accounting performance measures. (Axelsson, Jakovicka, Kheddache, 2003).

Return on Equity (ROE)

This is a measure of profitability that evaluates how well the shareholders fared for the specified period. It is a good measure of performance that ensures shareholders' value is maximised. It is calculated by the ratio of net income (net profit after tax) to total equity (Firer et al., 2012). Although it is a good measure of how much value is generated for shareholders, it does not consider the use of financial leverage, only equity, therefore it does not give an overall impression of corporate performance (Firer et al., 2012).

Equation 4: Return on Equity (Firer et al., 2012)

$$ROE = \frac{Net\ Income\ (EAIT)}{Total\ equity\ (TE)}$$

Return on Assets (ROA)

Return on Assets (ROA), is defined as the ratio of net income or earnings after interest and tax (EAIT) to total assets as expressed in equation 5 (Firer et al., 2012). The key advantage of this measure is that it gives an indication of how well managers use the total assets to generate income and profits for the company (Firer et al., 2012). Because it measures the profit per unit of money of assets, it reflects the operating performance of the company.

Equation 5: Return on Assets (ROA) (Firer et al., 2012).

$$ROA = \frac{Net\ Income\ (EAIT)}{Total\ Assets\ (TA)}$$

The use of financial ratios, and especially operating performance, in evaluating performance is not new to this study. Studies of this nature have used this measure of performance because of its relevance to capital investment. Klammer (1973) measured performance by the operating rate of return, utilising the ratio of the net income before interest and tax to total assets (Klammer, 1973).

In a study by Pike (1984), a performance measure of the average operating rate of return was used. This measure was defined by the before interest and tax earnings divided by total capital involved, not including the short-term loans (Pike, 1984). Farragher et al. (2001) measured performance by operating rate of return, defined by the operating cash flows divided by total assets (Farragher et al., 2001). Furthermore, performance was measured as the operating rate of return by Return on Assets, defined as the after tax profit divided by the total assets (Olawale, Olumuyiwa, & Gorege, 2010).

2.2. Empirical Literature

2.2.1. International Studies

Previous studies on the preference of firms, managers and officers for capital budgeting techniques have revealed varying results. Over the years, studies on this subject have revealed the dynamic nature of firms' preference for capital budgeting techniques, changing from one to the other. The study done on US major firms in 1977 revealed the preference was more on IRR, as opposed to the NPV in evaluating projects (Gitman & Forrester, 1977). The analysis was based on 103 firms which were then categorised by industry class, asset size, annual capital size and project size (Gitman & Forrester, 1977).

There is still evidence of varying preference in techniques even in recent studies and surveys, as can be seen in the studies done in the past 14 years. A survey of how CFOs make capital budgeting and capital decisions by Graham and Harvey (2002) sampled the Fortune 500 companies' CFOs and the CFOs who are members of the Financial Executive Institute (FEI) in the United States of America (Graham & Harvey, 2002). The survey revealed that IRR and NPV were the most used capital budgeting techniques from the sample of 392 CFOs who participated in the survey. IRR is mostly used, and is mostly used by 75,7% and 74,9% always used NPV (Graham & Harvey, 2002).

The theory/practice gap in capital budgeting was surveyed for United Kingdom firms from the Times 1000, where 300 firms classified by size into large, medium and small were sampled. Of the 300, 145 questionnaires were returned, representing a response rate of 49% (Arnold & Hatzopoulo, 2000). This study confirms that the theory-practice gap has been narrowed, compared to the studies in the 1970s, with the DCF methods of IRR and NPV preferred by most of the firms, across all sizes (Arnold & Hatzopoulo, 2000). 97% of the large firms used NPV, as compared to 84% that used IRR, and over 90% of the small and the medium firms used DCF methods (Arnold & Hatzopoulo, 2000).

A survey on the Fortune 1000 CFOs in the USA in 2002 showed that NPV was the most preferred and popular technique followed by IRR; the third most popular technique was the Payback Period (Ryan & Ryan, 2002). The sample consisted of 205 firms' CFOs who responded to the survey, resulting in a 20.5% response rate (Ryan & Ryan, 2002). The study showed that 96% of the companies always used NPV, with 92% using always using IRR, and 74.5% always using PBP (Ryan & Ryan, 2002).

The study further highlights the fact that managers had never been in agreement on which specific method is the best and most superior to use. It also appeared that sometimes the choice

of the method used is determined by the ease and lower complexity of the method, and not necessarily the best technique (Ryan & Ryan, 2002).

Researchers investigated the practices of capital budgeting in India, where 100 manufacturing companies were sampled, and received a response rate of 30% (30 companies returning the questionnaire) (Verma, Sanjeev & Roopali, 2009). The findings of this study revealed that the traditional capital budgeting techniques are still the most popular, and that PBP is the method always used, at 77%, compared to 76.7% for IRR and NPV at 63% (Verma et al., 2009).

A similar study of the use of capital budgeting techniques by Jordanian industrial corporations listed on the Amman Stock Exchange, highlighted inconclusive evidence of the superiority of DCF methods over non-DCF methods (Khamees, Al-Fayoumi & Al-Thuneibat, 2010). The study was conducted on 81 firms, with 53 of the firms responding to the survey. The results of the study revealed firms always used the Profitability Index (PI) 61.4% and PBP 58.6%, compared to the use of IRR 55.7%, ARR 50.71%, and NPV at 49.3% (Khamees et al., 2010).

These results Khamees et al. (2010) regarded as inconclusive, given the marginal difference between the % preference from one technique to the other. Shinoda (2010) distributed a survey on the use of capital budgeting techniques, to 2224 companies listed on the Tokyo Stock Exchange (TSE) of Japan, where 225 usable responses were collected, for the periods between 2008 and 2009 (Shinoda, 2010).

The findings of this study highlighted that there is still evidence of the superiority of the PBP, even in recent years. The respondents indicated they always used PBP at 50.2%, NPV at 30.5%, IRR at 24.5%, and DPBP at 20.4% (Shinoda, 2010). The study was highly conclusive given the large sample, and hence the non-DCF methods are mostly used as opposed to the DCF in Japanese companies listed on the TSE (Shinoda, 2010).

In Canada, the survey to investigate the capital budgeting practices included also the Real Options Valuation (ROV) and its adoption across the country. The survey was distributed to 500 large firms in Canada, which were included in the *Financial Post* magazine. The survey received a response rate of 18.4%, which was deemed sufficient, given the quantity of the sample (Bennouna, Meredith & Marchant, 2010).

The results of this study highlight further the popularity of the DCF methods in recent years, with NPV, always used at 94.2%, IRR always used at 87% and PBP always used at 78.5% (Bennouna et al., 2010). Only 8.1% of the companies indicated the use of the ROV method, even with the increasing literature that recommends and clearly states the advantages of ROV (Bennouna et al., 2010). Table 2 summarises some of the results from international studies, on the subject of capital budgeting and its application in practice.

Research and studies, such as those of Haque et al. (2014), reveal the importance of modelling the risk of commodity price fluctuations in valuating economic viability and the investment decisions for mining projects (Haque et al., 2014).

These fluctuations and the complex nature of mining require an evaluation method that recognises these special features. It is due to this reason that the traditional Discounted Cash Flows (DCF) methods are not as appropriate as the Real Options Valuation (ROV) in evaluating mining projects given their nature (Haque et al., 2014). However, due to the complex application of this model, managers and project appraisers still prefer the DCF model, and the ROV model is rarely used in practice (Haque et al., 2014). This finding is in agreement with the finding of Ryan and Ryan (2002)'s study as highlighted above.

Table 2: Summary of international studies on Capital budgeting practices

Author(s)	Year of survey	Publication year	Country	Sample Description	Sample size	Results
Graham J & Harvey C	2001	2002	USA	Fortune 500 companies	392	IRR (75.7%) NPV (74.9%)
Arnold G & Hatzopoulo P	1997	2000	UK	Times 1000 firms (Ranked by capital employed, classified into small, medium and large)	145	NPV (97%) IRR (84%)
Ryan P & Ryan C	2001	2002	USA	Fortune 100 Companies	205	NPV (96%) IRR 92.1%) PBP (74.5%)
Khamees, B, Al-Fayoumi, N, & Al-Thuneibat, A.	2009	2010	Jordan	Jordanian Industrial Corporations listed on the Amman Stock Exchange	53	PBP (58.6%) IRR (55.7%) ARR (50.7%) NPV (49.3%)
Shinoda T	2008	2009	Japan	2224 Companies listed on Tokyo Stock Exchange	225	PBP (50.2%) NPV (30.5%) IRR (24.5%) DPBP (20.4%)
Bennouna, K., Meredith, G., & Marchant, T	2009	2010	Canada	500 Large firms in Canada		NPV (94.2%) IRR (87%) PBP (78.5%)
Verma S, Sanjeev G, Roopali B.	2008	2009	India	100 manufacturing firms	30	PBP (77%) IRR (76.7%) NPV (63%)
Maquieira C, Preve L & Sarria-Allende V		2012	Latin American Countries (Argentina Chile, Peru Uruguay Peru, Ecuador Colombia)	LATAM firms	290	NPV (72.4%) IRR (70.0%) PBP (62.1%) PI (53.8%)

2.2.2. Local Studies

The question of which capital budgeting techniques best demonstrate the value created by capital investment has also been studied in South Africa. A study by Maroyi and Van der Poll (2012) stated that the commonly used techniques for South Africa until the 1980s has been the ARR (most common), PBP, IRR and NPV (least common) (Maroyi & Van de Poll, 2012).

The trend has been moving towards the international studies where the Discounted Cash Flow techniques (NPV, IRR) are mostly preferred. In recent years however, it is still not clear which techniques are always preferred, and superior, to the others with non-DCF methods still the most preferred techniques for some companies, as highlighted in the findings from the different studies below.

A study of the 500 largest firms in South Africa, conducted to investigate the use of capital budgeting techniques, indicated that 45% of the respondent's firms used IRR as the primary method for selection (Andrews & Butler, 1986). The study had a response rate of 26.4% with 132 companies taking part in the survey (Andrews & Butler, 1986). The results of this study further revealed evidence that some of the companies had not employed any formal techniques for capital budgeting, with one firm in twenty that did not use any of the capital budgeting techniques (Andrews & Butler, 1986).

Furthermore, larger companies were found to employ the more sophisticated DCF method for capital budgeting and that positively correlated with growth rates and profitability (Andrews & Butler, 1986). In 1998, Hall did a survey of industrial firms listed on South Africa's Johannesburg Security Exchange. He sampled 300 companies and received 65 usable responses, representing a 21.67% response rate (Hall, 2000). The results of the survey showed that Return on Investment (ROI) and Internal Rate of Return (IRR) are the preferred methods of evaluating the viability of projects. He further suggested that this preference could be due to the understanding that percentages are a good presentation of comparative measurements (Hall,

2000). As a result, IRR would be preferred for it is presented as a percentage rather than the NPV that is in monetary terms, and the PBP that is in years and is not comparative (Hall, 2000).

A survey on how companies listed on the main board of the JSE practically make capital investment decisions was conducted in 2002. The study sampled 524 companies and received 67 usable samples, representing a response rate of 13%. Their findings showed that size of the capital required mattered and influenced how such projects are evaluated. The study reveals that firms prefer IRR and the NPV techniques for projects that require relatively large capital amounts (Du Toit & Pienaar, 2005). Another study by Hall and Millard (2010) showed that ROI is still a popular capital budgeting technique among large South African listed companies surveyed, with NPV and IRR, second and third respectively (Hall & Millard, 2010). A new trend of NPV superiority over IRR was highlighted by this study (Hall & Millard, 2010).

In a survey on the cost of capital, capital structure and capital budgeting practices used by the South African listed companies in 2006, Correira and Cramer (2008) found that companies always or almost always use the DCF capital budgeting technique, such as the NPV and IRR, to evaluate investments (Correira & Cramer, 2008). The study was based on 28 companies listed on the JSE that responded to the survey, yielding a response rate of 8% (Correira & Cramer, 2008). The study shows that 82% of CFOs always use NPV, 78.6% always use IRR, 53.6% always use PBP and less than 15% always used all other methods such as ARR, ROV, PI and Adjusted Present Value (APV) (Correira & Cramer, 2008).

A more recent and relevant study on the South African mining industry listed on the JSE selection techniques indicated that the 69% of the firms in the survey preferred Net Present Value (NPV) over the 46% who preferred internal rate of return (IRR), and 23% that preferred the Payback Period(PBP) (Maroyi & Van de Poll, 2012). The study demonstrates and highlights the trend picked up by recent studies, where the NPV is mostly preferred to IRR and

PBP. The survey was based on the 35 companies listed at the end of 2010, 17 questionnaires were sent out and 10 responded (Maroyi & Van de Poll, 2012).

A review of the capital budgeting practices in South Africa highlighted the significant growth in the DCF capital budgeting methods, particularly the NPV and showed a decline in the use of non DCF methods such as PI, DPBP for the periods from 1972 to 2008 (Correira, 2012). The review further concludes that larger companies are more likely to use DCF methods such as NPV and IRR, while smaller companies tend to use the non DCF methods, such as PBP due to the level of capital intensity (Correira, 2012).

The subject of risk is surveyed in recent studies for the listed South African firms, but not specifically mining and metals firms, as this study intends to do. In a study on risk analysis and evaluation of capital investment projects, findings show that there is no formal method of risk analysis used by the firms surveyed (Hall, 2001). Sometimes management's subjectivity is used in estimating annual cash flows (Hall, 2001). In a more recent study, the survey revealed that project implementation is rated the most risky process in the capital budgeting process and that there are no formal risk techniques used (Hall & Millard, 2010). Some of the firms which used risk methods only used sensitivity analysis, while 35% either used adjusted cash flows or adjusted discount factor (Hall, 2001).

Correira and Cramer (2008) also found that sensitivity analysis is a method mostly used by firms in assessing project risks, and there is a low utilisation of sophisticated techniques such as probabilities, Monte Carlo Simulations and decision trees within South African firms (Correira & Cramer, 2008). This finding is consistent with the study by Hall (2001) and Hall and Millard (2010) on the subject of risk and the use of risk analysis techniques.

2.2.3. Capital Budgeting and Firm Performance

Performance measures used in the past studies were categorised as either accounting performance that is performance derived from financial statements, or economic performance that is performance based on the firms' stock performance (Axelsson, et al., 2003).

Earlier studies on the subject of performance and capital budgeting found that there is no consistent significance in the association of capital budgeting sophistication and company performance (Klammer, 1973). The study used a sample of 369 manufacturing firms and the response rate was 49.9%, with 184 companies returning the survey questionnaires (Klammer, 1973). In the study, a multiple regression model was established to regress operating rate of return (Return on Operating Assets), against various variables that indicated the level of capital budgeting sophistication, such as the use of DCF methods, PBP, ARR and other variables, such as size, and risk (Klammer, 1973).

In this study, Klammer argues the use of financial performance measures as the appropriate measure in establishing value created by capital investment as opposed to market/stock performance. The fact that financial data and information better reflects the capital budgeting results than stock information is the reason for the use of financial performance measures (Klammer, 1973). Moreover, Klammer (1937) stated that shareholders knew little about the capital budgeting techniques managers used to select investments and that the market values stock on the basis of investor satisfaction which is influenced by the outlook of the financial data (Klammer, 1973).

Furthermore, a study to explore the subject of capital budgeting sophistication and firm performance in the United Kingdom, was conducted where 144 firms' information was used in empirical analysis (Pike, 1984). In this study, specific firm characteristics of size, risk, and industry class and capital intensity were employed as the controlling variables (Pike, 1984).

The findings of the study were consistent with the findings of Klammer (1973), where a negative and significant relation of capital sophistication system and firm performance was evident (Pike, 1984).

A similar study in the United States of America (USA) on the relationship between capital budgeting sophistication and corporate performance revealed that there is no distinct relation between the two (Farragher, Kleiman & Sahu, 2001). The data for this study were collected through a survey questionnaire sent to 396 CFOs of United States companies, where a 34 % (117 CFOs) response rate was achieved (Farragher et al., 2001). The study further concludes that there is a positive relationship between the size of the firm, operating risk of the firm, capital intensity for the firm and the degree of focus for the firm and corporate performance, but a negative and non-significant coefficient for capital budgeting sophistication (Farragher et al., 2001).

A study on the relationship between performance of Small Medium Enterprises (SMEs) in the United Kingdom (UK) and strategic planning as well as capital budgeting yielded results consistent with theoretical expectations. The study found that SMEs perform better when they utilise the capital budgeting techniques that are more detailed and strategic, such as the NPV and IRR, as a result, firm value is created (Peel & Bridge, 1998). The study was based on the 150 out of the 1012 SMEs that returned the questionnaire, representing a 14.8% response rate (Peel & Bridge, 1998).

Findings of another study on the subject of capital budgeting and company performance, further highlights the negative relation; a finding consistent with other previous studies and also contradicting previous studies (Axelsson et al., 2003). The study further concludes that the relationship between capital budgeting technique and firm performance is hence ambiguous (Axelsson et al., 2003). Furthermore, a study of capital budgeting techniques and firm

performance of the Jordanian listed service firms, reveals no relation between firm performance and capital budgeting sophistication (Alzoubi & Alazawi, 2010).

The study surveyed 63 service firms listed on the Amman Stock Exchange and received 32 usable replies (Alzoubi & Alazawi, 2010). The results of the survey showed that PBP is more dominant and the preferred capital budgeting technique, followed by NPV, PI, ARR and IRR was the least preferred method (Alzoubi & Alazawi, 2010). The study further notes the preference for subjective judgement other than the formal DCF methods (Alzoubi & Alazawi, 2010).

In South Africa, the impact of investment appraisal on the performance of small firms was investigated where it was concluded that the use of non-sophisticated capital budgeting techniques negatively affected the profitability of firms (Olawale et al., 2010). The study surveyed 124 small manufacturing firms in Nelson Mandela Bay, where 69% of the respondents did not use any sophisticated (DCF) capital budgeting techniques (Olawale et al., 2010).

The present study serves to update and to complement these studies, by surveying a significant representative of the mining companies in South Africa. The study also seeks to understand the risk analysis technique component of the capital budgeting decisions and how it is incorporated into the analysis of capital budgeting decisions, which the Maroyi and Van de Poll (2012) survey does not investigate. In addition, the study investigates, in depth, the relationship between the capital budgeting techniques used by the mining companies and company performance, a subject not researched as much locally as it is internationally.

The studies of this nature seem to contradict capital budgeting theory (Klammer 1973; Pike, 1984; Farragher et al., 2001), while others are consistent with the theories (Peel & Bridge, 1998; Olawale et al., 2010), especially for SMEs, as can be seen in both international and local

studies. This study differs from earlier studies, in a sense that it is industry specific, it investigates capital budgeting techniques, risk analysis techniques and the effect on performance, where similar studies locally investigated capital budgeting (Hall, 2000 & Maroyi & Van de Poll, 2012) and/or risk analysis techniques, but not their relation to performance.

In light of the theoretical framework and the previous studies on this subject, the study seeks to test the following hypotheses in order to answer the research questions and reach the objectives of the study.

H_1: South African mining companies **do not** use DCF methods for capital investment appraisal (hence they use the Naïve approach to capital Budgeting)

H_2: South African Mining companies **do not** use Quantitative risk measures in capital budgeting (Use of qualitative risk measures in capital budgeting)

H_3: Size of capital investment **does not** affect the capital budgeting technique used (size does not matter in terms of which capital technique is used)

H_4: Companies that utilise the sophisticated capital budgeting techniques **have superior** corporate performance than those who do not.

3. Methodology

The methodology for this study involved a cross sectional research on the South African mining industry in the form of survey research. In the second part of the study that analysed the relation of capital budgeting and firm performance, secondary data were gathered through financial statements and empirically analysed using regression modelling. Survey research involves data collection through a series of questionnaires, distributed among a population (Glasow, 2005). It is usually used to gather information relating mainly to the opinions of a large group of the population regarding a specified cause or problem. Surveys are well suited for gathering information relating to assessments of needs, examination of the impact, composition of the population (demographic data) as well as evaluation of demand (Glasgow, 2005).

A poll of questions was established, which served to address the objectives of the study. The questionnaires addressed mainly the questions of specific capital budgeting and risk analysis techniques used in the mining and metal industry in South Africa with detailed and specific questions relating to the capital budgeting techniques used and the criteria for selection. This was then repeated for the risk part of the study.

The use of the survey questionnaire instrument as a method for research, and investigation of the practical use of the capital budgeting technique is not new. Similar studies that have attempted to investigate this subject have used this method, from history till now (Klammer, 1973; Pike, 1984; Hall, 2000; Graham & Harvey, 2002; Du Toit & Pienaar, 2005; Maroyi & Van de Poll, 2012). The questionnaires are typically structured so that the specific characteristics of the company, such as size in total assets, size of capital budget are asked. Furthermore, specific questions relating to the use of the traditional and other capital budgeting

techniques are asked (Hall, 2000; Graham & Harvey, 2002; Du Toit & Pienaar, 2005; Maroyi & Van de Poll, 2012). .

3.1. Survey Method

3.1.1 Survey Questionnaire

The study used the sample questionnaire initially used in a study by Maroyi and Van de Poll, (2012) and further modified it with the risk part of the questionnaire from a study by Hall (2001) and Hall and Millard (2010). The study was segmented into different parts, classified as size, capital budgeting techniques, risk analysis techniques, firm performance measures and the decision maker's profile.

Part A questioned the size, that is the size of the company, the size of the capital available per annum, sizes of projects deemed capital projects. Of importance also in this section of the questionnaire was the year of incorporation of the firm. This aspect assisted in distinguishing and classifying companies into new and old firms, to better understand the extent to which previous practices of capital budgeting perpetuated into recent years.

Chapter Two of this study highlighted the latest trends that highlight the adoption of DCF techniques and the increasing dominance of the NPV, and IRR as the preferred techniques in recent years (Gitman & Forrester, 1977; Hall, 2000; Graham & Harvey, 2002). This part of the survey assisted in classifying companies by size and analysing the results on the size of capital and size of budget for capital investments.

Part B focused on the capital budgeting techniques used and the most preferred method for investment decisions. The section further questioned the preference of technique for each project's criterion classified in part A (size). The most popular techniques, as highlighted in previous studies of this nature, were given as options for the respondents to select from and to rank, based on frequency of use, from never used to always used. Together parts A and B

assisted in categorising results by size to see if this has any effect on the choice of the capital budgeting technique. This also assisted in establishing if there are companies using different techniques for different capital budget size projects.

Part C focused on the risk analysis methods used, for the identified project classes and the reasons for the method used. In this part, the capital budgeting processes were outlined to establish which were deemed the most important and which the most risky. The capital budgeting process involves steps from; the establishment of goals, development of strategy, exploring investment opportunities, evaluating opportunities, selecting an investment, implementing and monitoring and finally, a post audit analysis (Seitz & Ellison, 2005).

Part D focused mainly on key firm performance monitoring indicators. Financial performance indicators were used as opposed to the market or economic firm performance measures. Measures mostly used to evaluate performance, in this case profitability, were Return on Assets (ROA), which was defined as the ratio, net income or earnings after interest and tax (EAIT) over total assets (Firer et al., 2012). As a result, the respondents were asked to estimate the average annual earnings for the firm. They were also asked to indicate their average sales growth over a specified period, which is another indicator of value add by capital investment (Axelsson et al., 2003).

Part E questioned financial managers and/or decisions makers' profiles, that is age, level of qualification and work experience. The decision maker's profile helped in validating the responses to all the questions in the survey and the level of knowledge with regard to the subject of capital budgeting.

3.1.2. Sample

In survey research, the sample of the population is important and could determine the credibility of the results obtained from such a survey. The sample should be of a size that

represents the population, for the specific purpose of such research (Glasow, 2005). As a result, the sample of firms that were surveyed was carefully selected based on a broad representation of the mining industry in South Africa. Sample selection took into account small, medium to large firms, looking at the market capitalisation for firms that are listed and financial statements of those not listed.

Data from the Chamber of Mines was used to establish the major role players in the South African mining industry. In 2014, there were 69 companies listed as members of the Chamber; 6 were direct mining contractors, 8 were service firms, and 55 were mining companies (Chamber of Mines, 2015). Together, the members of the Chamber of Mines accounted for about 90% of the country's mineral production in 2014 (Chamber of Mines, 2015). This means 90% of the South Africa's mineral production is as a result of the 55 direct mining companies of the Chamber of Mines. Most of these 55 companies serve as parent companies to a lot of smaller companies, and, for the purpose of this study, only the parent companies which are JSE listed, and members of the Chamber of Mines, were surveyed.

The survey was distributed to all 55 mining companies which are members of the Chamber, and also included in that were the 35 South African mining companies listed on the JSE and operating in South Africa (JSE, 2015). Through the companies' websites, the contact details of the relevant people within the companies were established. Further contacts were acquired through the South African Colliery Administrative and Financial Managers' Association (SACAFMA), an organisation for the coal mines' financial managers and financial administrators as well as the South African Colliery Managers Association, SACMA.

Using survey software from SurveyMonkey, the questionnaire was sent through emails to the persons and/or the departments responsible for the capital budgeting decision (CFOs, financial managers, or departments) in each firm. To increase the response rate, the emails were sent in

batches to at least five representatives per company where contacts were available. In total four groups of emails were sent out at a weekly interval to the companies' financial managers and/or financial personnel on capital projects/investments.

3.1.3. Validity and Limitations

Survey research methods are well suited for gathering information relating to assessments of needs, examination of impact, composition of the population (demographic data) as well as evaluation for demand (Glasow, 2005). Validity is mainly concerned with the ability of the instrument to measure what it is intended to measure, and it includes content validity, internal and external validity (Cooper & Schindler, 2014).

Content validity refers to the ability for the instrument to address and reflect the key issues that are being researched; internal validity, concerns with whether the questions asked explain the outcomes of the research; external validity is concerned with the ability of the questionnaire to fit the sample for which it is generated, hence using the terms and jargon that will resonate with the sample population (Cooper & Schindler, 2014).

For this study, an already designed questionnaire was adopted; however, the questionnaire was further evaluated for content, internal and external validity, and before distribution for the final survey, it was further tested on a group of subject specialists within the mining industry.

A major limitation of a survey study is the lack of the full representation of the population studied, as a result, the sample selection is very important in counteracting this limitation, as highlighted in the preceding heading. By including all the Chamber of Mines member companies which accounted for over 90% of the country's production, this problem is minimised.

Consistency of questions, for different studies that researched the same topic of capital budgeting, is another limitation of this research method. This inconsistency makes it difficult

to compare results of similar studies; this was evident even in the literature review, and other studies of this nature.

3.2. Empirical Analysis

The process of formulating a model for empirical analysis requires a series of steps. Such steps involve the definition of the problem statement and theoretical model estimation, collection of data relevant to the theory in question, estimation of the model, and definition of the relevant model specifications, testing the validity and adequacy of the model, interpretation of the model and finally using the model for analysis and forecasting purposes (Brooks, 2014). These steps are described below and shown how they are applied in this study.

3.2.1. Economic or Financial Theory

The purpose of creating a model is to be able to test some theory, and economic logic, hence the first and important step in model development is to define the economic and logical theory, clearly stating the statement of the problem (Brooks, 2014). Chapter 1 of this study stated and explained thoroughly the statement of the problem that this study sought to investigate. Furthermore, chapter 2 outlined the theoretical framework and the literature of capital budgeting, and its implications on corporate performance were discussed.

Therefore, the model served to determine the relationship of capital budgeting sophistication and corporate performance as measured by Return on Assets. The dependent variable of performance, and independent variables of capital budgeting sophistication, size, and capital intensity are tested in the model. The hypothesis to be tested is “companies that utilise the sophisticated capital budgeting techniques **have superior** corporate performance than those that do not.”

3.2.2. Data Collection

To be able to test for the relationship, the relevant data with regard to the problem statement, and the economic theory must be collected (Brooks, 2014). The primary data from the questionnaires, and the respondents' views and use of capital budgeting were used to establish the capital budgeting sophistication scores. Secondary data was sourced in order to further analyse the key performance measures of the respondents' firms. Such data was obtained from sources such as the financial reports of the different companies that responded to the survey. The individual company's websites together with the McGregorBFA database were used to collect the company's financial information from the published financial statements.

3.2.3. Model Estimation

A textbook definition for regression is the "evaluation of the relationship between a given variable and one or more variables" where the movement in the one variable can be referenced to the movements in one or more variables (Brooks, 2014). Regression analysis models are very familiar in this type of analysis as used in previous studies, where the capital budgeting practices and corporate performance relationships were tested (Klammer, 1973; Pike, 1984; Farragher et al, 2001; Olawale et al 2010; Alzoubi &Alazawi, 2010). In a similar way, this study uses a regression model established by these studies to analyse the relationship between capital budgeting practices in the mining industry in South Africa and the company performance.

A simple linear regression refers to a regression where only one dependent variable is explained by one or more variable, and the relationship is diagrammatically described by a straight-line (Brooks, 2002). In this analysis, a multiple regression model is defined to analyse the relation of corporate performance to capital budgeting and the other firm characteristics' variables.

The key measure of performance used in the study is ROA, which is the dependent variable to be defined by the key independent variables, of size, capital intensity and capital budgeting sophistication. A model developed by Klammer (1973) in a study to develop the association between capital budgeting techniques and firm performances, used the average return on operating assets as the performance measure (Klammer, 1973).

A multiple regression model with the performance measure (Oz) as the dependent variable and the capital budgeting techniques, (Payback (P), Accounting Rate of Return (A), Discounting (D) techniques), risk techniques (R), size of the company (L), risk of the company (S), Capital Intensity (I) and the sum of the unspecified factors (u) as the independent variables as in equation 6 (Klammer, 1973) was used.

Equation 6: Firm operating performance and capital budgeting techniques (Klammer, 1973).

$$O_z = a_0 + a_1C + a_2P + a_3A + a_4D + a_5R + a_6M + a_7L + a_8I + a_9S + u$$

A similar model was used in a study to determine the impact of capital budgeting sophistication on the profitability of small manufacturing firms in South Africa (Olawale, et al, 2010). The model is depicted by the equation.

Equation 7: Firm profitability and capital budgeting sophistication (Olawale, et al, 2010).

$$ROA = \alpha + \beta_1 NPV + \beta_2 ARR + \beta_3 PB + \beta_4 IRR + \beta_5 PI + \beta_6 DPB + \beta_7 Size + \varepsilon_1$$

Pike (1984) investigated the association of capital budgeting sophistication and corporate performance by defining a model with a five and ten year average operating rate of return by dividing the pre-interest profit by the total capital employed (Pike, 1984). Furthermore, the firm's characteristic variables were defined, together with the measure of capital budgeting sophistication. Firm size, degree of risk, capital intensity and industry classifications where the variables of firm characteristics were included in the model for their interactive influence on the relationship under question (Pike, 1984).

The model defined by Pike (1994) is demonstrated in equation 8

Equation 8: AORR and degree of capital budgeting sophistication (Pike, 1984)

$$P = \beta_0 + \beta_1 Da + \beta_2 Sb + \beta_3 Rc + \beta_4 Cd + \beta_5 I1 \dots\dots\dots + \beta_{12} I8 + \varepsilon_1$$

Where P is the Average Operating Rate or Return (AORR); D is the degree of capital budgeting sophistication; S is the size of the firm; R is the risk level variable; C is the capital intensity variable; I1- I8 is the industry dummy variable; and then e is the error term (Pike, 1984)

Furthermore, Farragher et al. (2001) modified the above model, establishing the capital budgeting sophistication and using this variable in the model to identify the use of capital budgeting techniques (Farragher et al., 2001). A multiple regression model established considered most of the variables used in the Klammer (1973) and Pike (1984) models and was re-written as in the equation below (Farragher et al., 2001).

Equation 9: Corporate performance and capital budgeting sophistication (Farragher et al., 2001).

$$OIROA\, j = b_0 + b_1 AT_j + b_2 OICV_j + b_3 FAEMP_j + b_4 SEG_j + b_5 DCBS_j + \sim j$$

where the performance of company j, as indicated by ROA, is described by a model with size of the firm (AT), operating risk of the firm, capital intensity of the firm, degree of focus of the firm and the degree of capital budgeting sophistication of that firm (Farragher et al., 2001).

This study however, used the modified version of the model omitting some of the variables, such as the operating risk of the firm, because the study was based on firms in the same risk class and industry. The model used for this analysis sought to describe company performance (ROA) using the size of the company (TA), the level of capital budgeting sophistication (CapS), the level of risk analysis sophistication (RAS) and the capital intensity of the company

(CapI). Equations 10 and 11 below describe the models for performance and capital budgeting and risk analysis technique sophistication relations as they exist for the mining companies.

Equation 10: Performance and capital budgeting sophistication

$$ROA_j = b_0 + b_1\,TA_j + b_2\,CapS_j - b_3\,CapI_j + \mu$$

Equation 11: performance and risk analysis sophistication

$$ROA_j = b_0 + b_1\,TA_j + b_2\,RAS_j - b_3\,CapI_j + \mu$$

Regression Specifications

The key variables under question in the study are the capital budgeting practices and firm performance in the South African mining industry. While major variables are the measures of corporate performance, and the level of capital budgeting sophistication, other factors jointly affect performance when focusing on capital budgeting. The main dependent variable of the analysis is the performance measure.

Return on Assets

The dependent variable is that variable that is described by the other variables, where the variations in other variables cause variations in the dependent variable, hence the term. ROA is chosen for this study as the dependent variable of performance to be defined by the independent variables below. The ROA was calculated using the net earnings as in the income statements of the company's financial statement and was divided by the total assets in the balance sheet for that similar financial statement. The financial statements and data were acquired through the McGregorBFA database and the companies' websites.

Size (Total Assets -TA)

A measure mostly used to denote the size of a company in studies of this nature is the total assets, although there are other measures such as sales and number of employees, which can

be used to present the size of the company (Capon, Farley & Hoenig, 1990). The size of the company as presented by the total assets the company holds, seems to greatly affect the performance of a firm, as highlighted in previous studies (Klammer, 1973; Farragher et al, 2001).

Based on these studies, this variable was included in the model to be a factor that will positively affect firm performance in capital budgeting, hence the positive sign on the model (Equations 10 & 11). The total assets for each firm were read from the balance sheets as in the financial statements published.

Capital Sophistication

Defined earlier, this term in its simplest form refers to the capital budgeting techniques and practices that consider risks and the time value of money in the evaluation (Pinches, 1994). An important part of capital budgeting focuses on the techniques used in appraising investments and the evaluation of the risks.

A score based on the responded use or lack of use of the sophisticated capital budgeting techniques was established. A score ranged from 5 being the most sophisticated capital budgeting approach, to 1 being the naïve capital budgeting approach. Although there are various definitions of capital budgeting sophistication, and steps in establishing the sophistication level of the capital budgeting practices, as in studies by Klammer (1973) and Pinches (1994), this study takes the simplistic view of capital sophistication. Hence it focuses more on the effects on corporate performance than the factors that define the term.

The capital method was ranked as indicated below, defining the most sophisticated to the least sophisticated. Theoretically and intuitively and as indicated by respondents in a study by Pike (1984), the rankings for the most sophisticated to the least sophisticated are listed in table 3.

Table 3: Capital Budgeting techniques and level of sophistication

Ranking	Capital Budgeting Method	Level of Sophistication
1	PBP	Not at all sophisticated
2	ARR	Not sophisticated
3	DPD /PI	Somewhat sophisticated
4	IRR	Very sophisticated
5	NPV	Extremely sophisticated

Risk Analysis Sophistication

Respondents were asked to indicate the use of risk analysis techniques in the survey questionnaire distributed. In a same way, they were asked to indicate their use of capital budgeting techniques, risk analysis techniques were listed and respondents indicated which technique they used always (5), and which they never used (1). The theoretically superior methods are the ones referred to as extremely sophisticated in this study and are those that would result in risk highly minimised, leading to selection of investments that will add value to an organisation. A similar ranking method to that in determining capital sophistication was used to determine risk analysis sophistication. ROV, extremely sophisticated (5); Monte Carlo and scenario testing, Very sophisticated (4); Risk Adjusted rate of return and risk adjusted cash flows, somewhat sophisticated (3); Sensitivity analysis, not sophisticated (2).

Capital Intensity

Capital intensity is another good measure of how well capital is used. It refers to the amount of financial resources, capital in this case, required to produce goods (Firer et al., 2012). It is usually measured by the ratio of total fixed assets to total labour, however, it can be measured

as the ratio of capital to output, investment to sales, capital to sales, yielding similar types of results (Axelsson et al., 2003). Capital intensity was defined as the fixed assets per employee, in Farragher et al., (2001), where a positive and a significant relation to corporate performance was established (Farragher et al., 2001).

In a study by Klammer (1973), capital intensity was defined as the ratio of yearly depreciation to yearly operating assets, and the results of the regression showed that it is insignificant in explaining variations in firm performance (Klammer, 1973). For this study, capital intensity is calculated as the ratio of fixed assets to the sales, in order to understand how efficiently the assets are employed to generate sales. This variable is expected to have a negative relationship to performance where high capital intensive companies are expected to perform less than low capital intensive companies. Consistent with the findings of the study on the determinants of financial performance, where on a firm level the relation to performance is negative, hence the negative sign in the model to be described (Capon, et al., 1990).

3.2.4. Validity and Reliability

To evaluate the statistical adequacy of the model, it is important to evaluate if any of the assumptions for the selected model have been violated. To model the dataset with the model defined, basic assumptions with regard to the data need to be obtained, such that the model gives the Best Linear Unbiased Estimators (BLUE) (Brooks, 2014). These assumptions of a linear regression are

(1) E (ut) = 0 the errors have zero mean

(2) Var (ut) = $\sigma 2 < \infty$ the variance of the errors is constant and finite over all values of xt

(3) Cov (ui , $u\,j$) = 0 The errors are linearly independent of one another

(4) Cov (*ut* , *xt*) = 0 There is no relationship between the error and corresponding *x* variate

(5) *ut* ∼ N (0, σ2)−i.e. that *ut* is normally distributed (Brooks,2014).

Assumption 1: The tests to validate non-violations of the assumptions are presented in Appendix ll. Linearity tests are carried out to examine any violation of the first assumption of the mean of the error term is zero. Plotting of the scatter plots give a graphical presentation of linearity as well as the R^2 and the adjusted R^2 results (Brooks, 2014).

Assumption 2: To test for heteroscedasticity where the error term does not have a constant variance, the Goldfeld-Quandt test is analysed (Brooks, 2014). This test requires the splitting of the sample into two sets and evaluating the variances from each set (Brooks, 2014). The white test can also be used.

Hypothesis that $\sigma_1^2 = \sigma_2^2$

Assumption 3: Testing that the covariance of the error term is zero over time, that is, they are uncorrelated, the lagged values of one variable is added (Brooks, 2014. The Durbin-Watson (DW) test can be carried out, however the Breush-Godfrey test was more reliable (Brooks, 2014). The null hypothesis of serial covariance is tested, and, for the t-stats greater than the critical t-stats, we fail to reject the hypothesis (Brooks, 2014). This is the criterion for testing the hypothesis.

Assumption 4: non-stochastic nature of the independent variables, therefore testing for collinearity of the variables (Brooks, 2014). Correlation analysis is the best way to test for the violation of this assumption (Brooks, 2014), where the dependent variable and the one independent variable are tested for any collinearity observing the value of the R^2. An R^2 between 0.8 and 0.9 will indicate potential violation of this assumption (Brooks, 2014).

Assumption 5: Normality of the error term can be tested by observing the fourth moments of the distribution, that is, the skewness (0) and the coefficient of kurtosis (3) (Brooks, 2014). Furthermore, it is best represented by the Bera Jarque, where the coefficient of kurtosis and skewness are jointly 0 (Brooks, 2014). The null hypothesis of normality is rejected if the residuals are skewed, or leptokurtic (Kurtosis not equal to 3) (Brooks, 2014).

Robustness Tests

Further tests on the reliability and validity of the model established, includes robustness checks and/or cross validation tests, where the certainty of the estimated regression coefficients is tested by either modifying, varying or removing some of the regression variables (Brooks, 2014). This step is important in confirming the validity of the model, where if the estimated coefficients are plausible and highly robust, then the model describes the data.

The step-wise, regression analysis was conducted on this model to establish the best combinations of independent variables that described the dependent variable of company performance as defined by ROA. For all four different independent variables, a 4 step, stepwise regression analysis was carried out, taking note of the t-stats and the corresponding p-values as well as the R^2.

Furthermore, the capital budgeting sophistication and risk analysis sophistication variables were replaced by the most superior of the techniques for each (that is the NPV, and ROV scores) to establish the new coefficient. Most importantly the signs and significance of this new variable of capital sophistication (CapS) and risk analysis sophistication (RAS) were established. The results for the robustness test are discussed in Chapter five of this study.

4. Empirical Results

The questionnaire was distributed to all 55 mining companies, between the periods of November 2015 and February 2016. A total of 20 usable surveys were collected with all the questions answered, however these 20 respondents represented 16 firms due to receiving responses from more than one representative of a firm in some cases. These 16 responses out of the 55 companies that were polled represents a response rate of 29.1%. Based on other studies of this nature internationally and locally, such as in table 4 with an average response rate of 18.88%, the response rate of 29.1% is acceptable for this kind of study.

Table 4: Response rate of previous studies

Author	Year of Survey	No of Firms	Response rate (%)
Hall J.	1998	65	21,67
Graham J. & Harvey C.	1998	392	8,8
Du Toit M. & Pienaar A.	2002	64	13
Ryan A. & Ryan G.	2002	205	20,5
Correia C. & Cramer P.	2006	28	8
Hall, J. and Millard, S	2010	41	23,2
Maroyi V. & Van der Poll H.	2010	13	37
Average			**18,88**

4.1. Firm Size

The characteristics of the company in terms of the size of the firm, size of capital projects and the year of incorporation assists in establishing the company profile. This is important in analysing results of the respondents. Conclusions from past studies such as Peel & Bridge (1998), Correia (2012) and Olawale et al. (2010) highlight the existence of the relationship between the firm size and the capital budgeting sophistication (Peel & Bridge, 1998; Correia, 2012; Olawale, et al., 2010). Larger companies tend to use the more sophisticated approaches

to capital budgeting and hence the use of Discounted Cash Flow methods such as NPV and IRR, as opposed to the smaller companies (Correia, 2012).

The results of the company's total assets are displayed in table 5 and figure 1, showing that 68.6% of the companies (representing 11 companies) have total assets more that R10 billion and as per this study they are classified as large companies. 6.3% (1 company) of companies have assets between R5 billion and R10 billion, together with the 11 companies with more that R10 billion assets, there are 12 companies classified as large companies based on their total assets.

Large companies for this study are those companies with total assets of more than R5 billion and small companies have total assets of less that R500 million. There were no small sized companies who responded, although they were part of the survey sample. Medium sized companies contributed 25.1% which is made up of one company with total assets of between R500 Million and R1 Billion, and three companies with total assets between R1 billion and R5 billion.

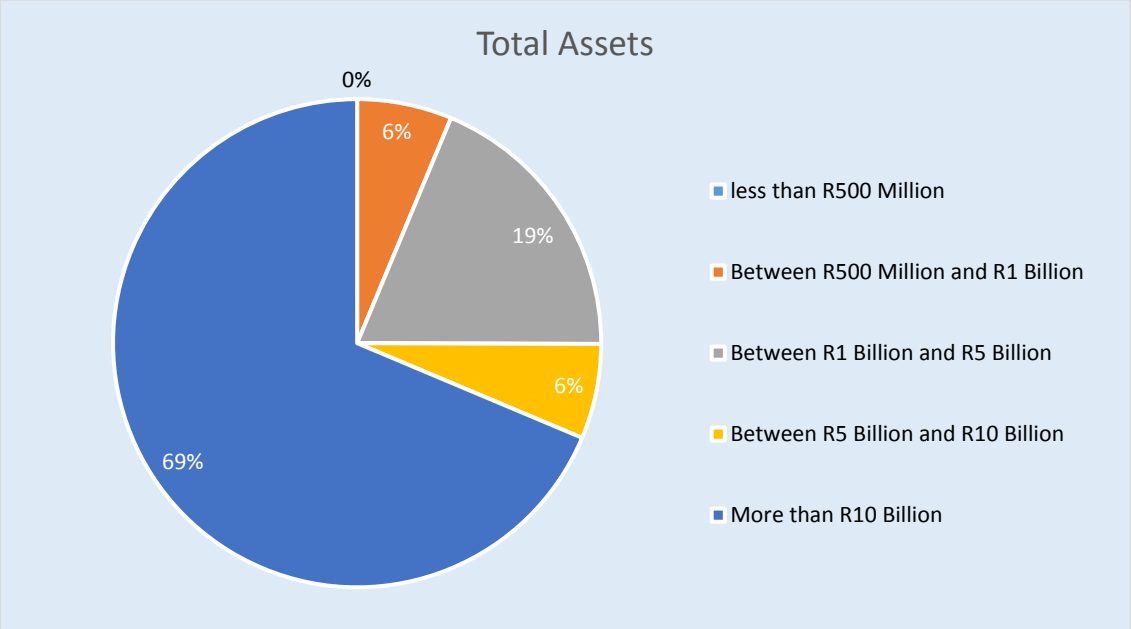


Figure 1: Total Assets

Table 5: Total assets of respondent companies

Total Assets	Response Percent	Response Count
less than R500 Million	0,0%	0
Between R500 Million and R1 Billion	6,3%	1
Between R1 Billion and R5 Billion	18,8%	3
Between R5 Billion and R10 Billion	6,3%	1
More than R10 Billion	68,6%	11
	100,0%	16

Another important measure of size is the average annual sales as represented by the turnover. From the results of the question on total annual turnover, one can see consistency in the total assets, with 75.0% companies (representing 12 companies) having an estimated annual turnover of more than R5 billion. None of the respondents have a turnover of less than R200 million, consistent with the above finding of total assets, hence none of the respondents companies can be classified as small, not by total assets nor by annual turnover. 12.5% indicated a turnover of between R1 billion and R5 billion, while 6.3% indicated a turnover of between R200 million and R500 million as well as between R500 million and R1billion. The results for this part of questionnaire are presented in figure 2 and table 6 below.

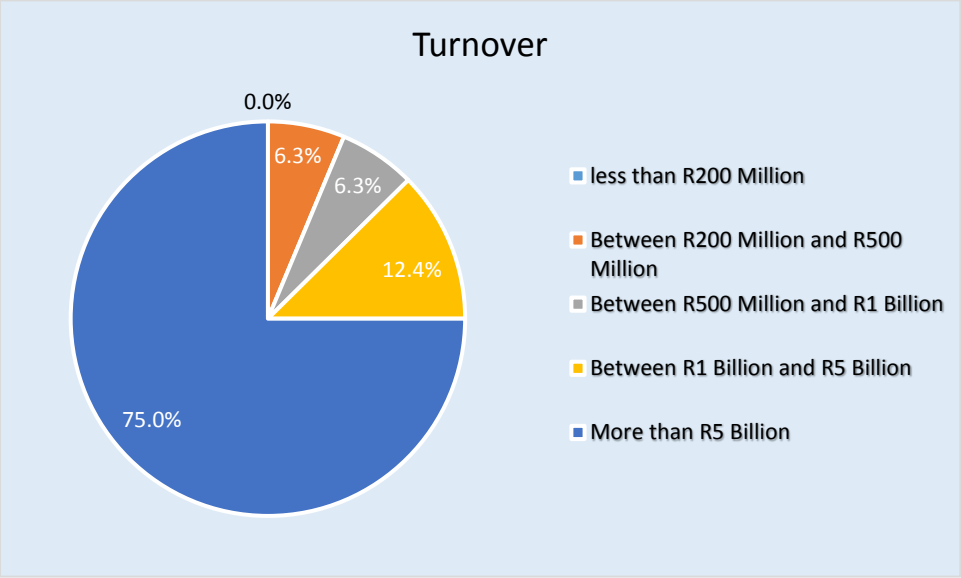


Figure 2: Estimated Annual Turnover

Table 6: Response for Annual Estimated Turnover

Estimated Turnover	Response %	Response Count
less than R200 Million	0.0%	0
Between R200 Million and R500 Million	6.3%	1
Between R500 Million and R1 Billion	6.3%	1
Between R1 Billion and R5 Billion	12.4%	2
More than R5 Billion	75.0%	12
	100.0%	16

Respondents were further asked to indicate the size of capital budget allocation per annum in order to establish the level of capital budgeting and the budget provisions for it. 68.6% of the companies have a budget for capital investment of over R500 million per annum. Asked to further specify the amounts on the comments line of the questionnaire; most of the 68.6% indicated that they have over R1 billion per annum set out as the budget for capital investments. 12.5% have an annual budget of less than R50 million. Table 7 below presents the results for the annual budget for capital investments.

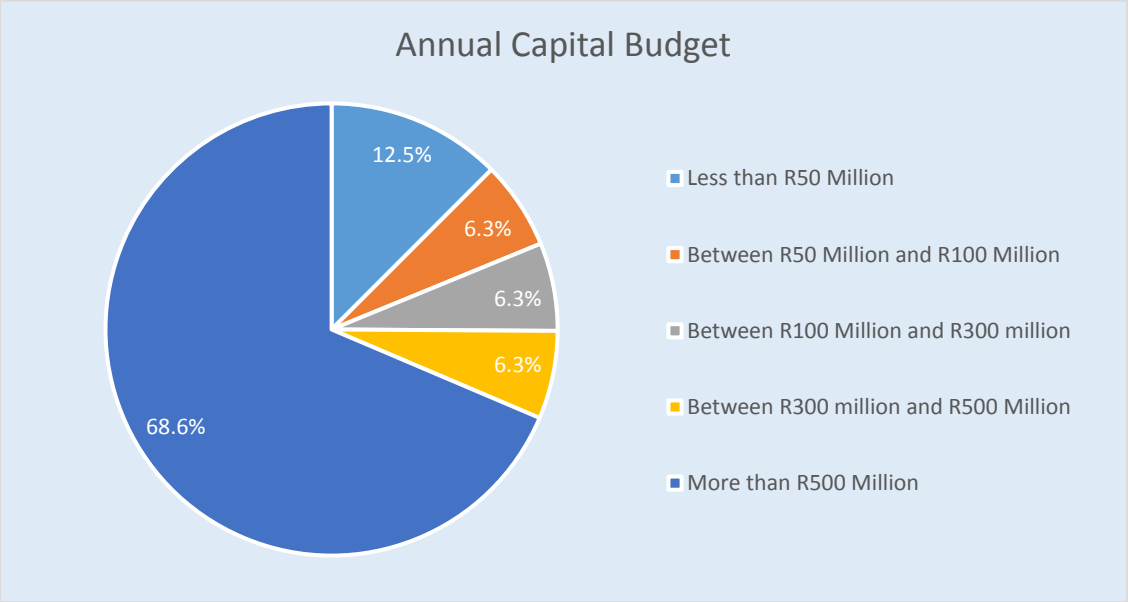


Figure 3: Annual Allocated Capital Budget

Table 7: Responses for Annual Allocated Capital Budget

Annual Capital Budget	Response Percent	Response Count
Less than R50 Million	12.5%	2
Between R50 Million and R100 Million	6.3%	1
Between R100 Million and R300 million	6.3%	1
Between R300 million and R500 Million	6.3%	1
More than R500 Million	68.6%	11
	100.0%	16

Important also is to define what size projects are generally regarded as capital investments or capital projects, where the necessary capital budgeting techniques and processes will be used for decision making. A total of six companies making up 37.5% regarded projects and investments with the initial outlay of less than R20 million as capital investments, while 25% regarded investments of between R20 million and R50 million as capital investments. 18.75% classified only those projects with an initial capital outlay of more than R200 million as capital projects.

Only three companies representing (18.7%) represented those companies that have total assets of more than R10 billion and an annual turnover of more than R1 billion, such companies can be classified as large companies. Although there were 12 of those classified as large companies, only 25% had a high cut off when it came to investments regarded as capital investment and hence used capital budgeting processes and techniques to evaluate them. However, a considerable number (75%) of those companies that are classified as large companies indicated that investments and projects of less than R20 million are classified as capital investment.

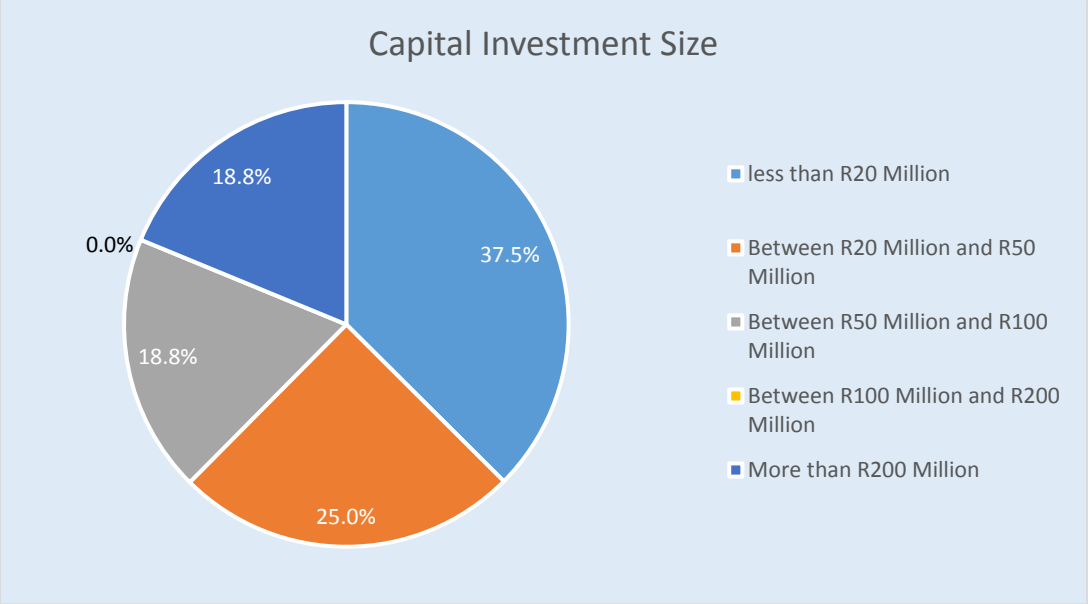


Figure 4: Size of Capital Investment

Respondents were asked to specify the year of incorporation of their companies, and 79% of the companies have been in the business for over five decades as can be seen by the distribution in table 8. The subject of capital budgeting and capital project appraisal techniques has been studied and researched over the years, as highlighted already in chapter two of this report, and the results are dynamic, highlighting the evolution over time of this subject. In the review study of the capital budgeting practices in South Africa, Correia (2012) highlights this fact by plotting the trend in figure 5, and presenting the results of each study from 1972 to 2006 (Correia, 2012).

Table 8: Distribution of the age of the companies sampled

Years of incorporation	% distribution	No. Companies
1900-1920	19%	3
1920-1940	6%	1
1940-1960	44%	7
1960-1980	0%	0
1980-2000	19%	3
over 2000	12%	2
Total	100%	16

The importance of the age and year of incorporation of the company is mainly to establish whether the choice of capital budgeting techniques could somehow be influenced by the age of the company and the dominant technique in those years. It also assists to establish to what level the companies have evolved with their approaches to capital budgeting by looking at the trends over years of capital budgeting.

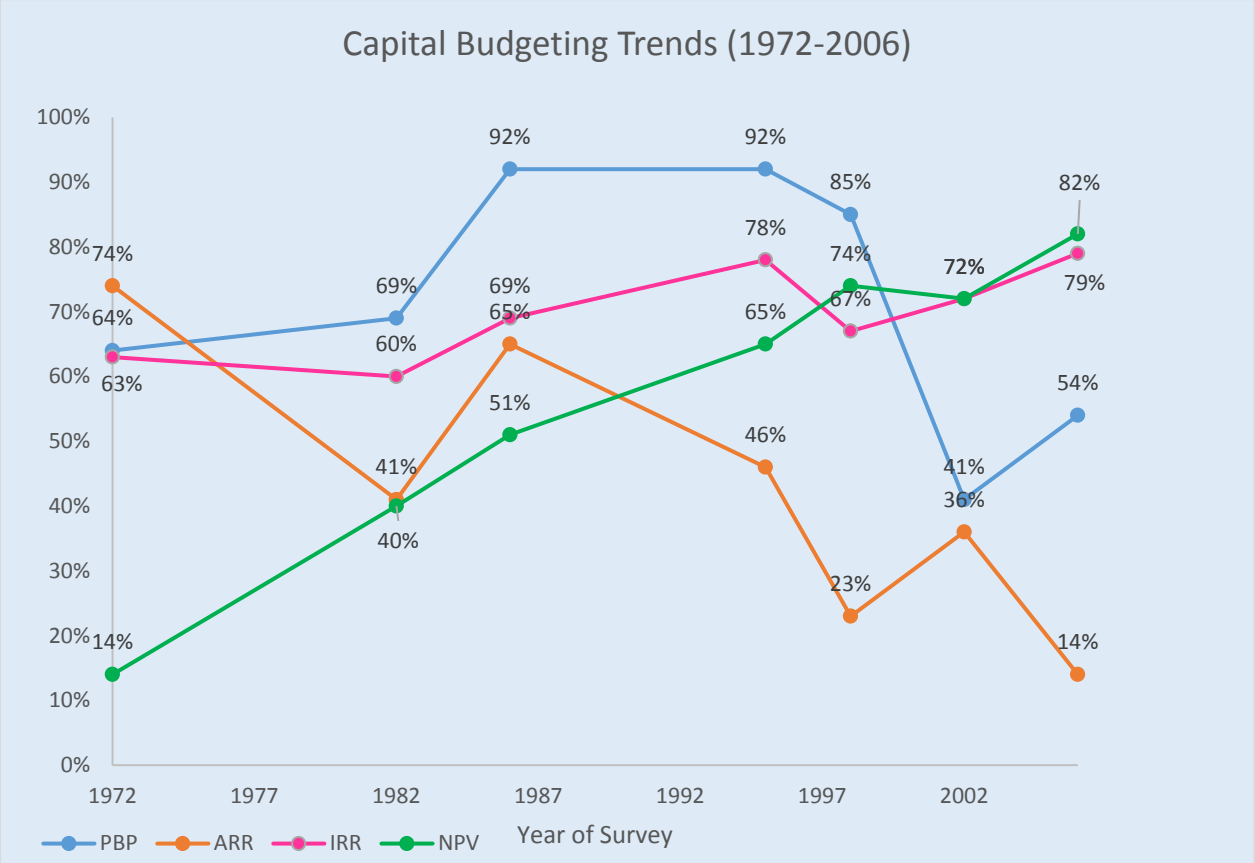


Figure 5: Capital budgeting practices in South Africa (Correia, 2010)

4.2. Capital Budgeting Techniques

The focus for this survey was mainly the capital budgeting techniques used in investment appraisals in the mining industry. Respondents were asked to specify the frequency at which they use specific capital budgeting techniques on a scale of 1 being the least frequent and never used to 5 the most frequent and always used. Specific capital budgeting techniques such as the Net Present Value (NPV), Internal Rate of Return (IRR), payback period (PBP), Discounted payback (DPB), Profitability Index (PI), Accounting Rate of Return (ARR), and Adjusted

Internal Rate of Return (AIRR) were listed; as guided by questionnaires to surveys of the same nature (Hall, 2001; Hall & Millard, 2010; Maroyi & Van de Poll, 2012). An option for 'other' was listed on the questionnaire, and respondents indicated the use of other methods such as ratio analysis.

Results were consistent with recent studies of capital budgeting, with 83.3% of mining companies always using NPV in investment appraisal, 61.5% indicated they always use IRR, 58.3% always use PBP. Figure 6 displays graphically the results of the use of capital budgeting techniques. Observed also with this study, were the large number of companies who indicated the use of discounted payback period techniques most of the time (ranked 4). 42.9% of the companies indicated the use of this modified payback period method to take into account the discounted cash flows, hence recognising the time value of money, which is a huge disadvantage of the payback period (Firer et al., 2012). Together with the 14.3% that indicated they always used the DPB, a total of 57.2% used this technique in the investment appraisal.

What was observed with this study is the use of multiple techniques by mining companies in making capital investment decisions. Most of the respondents indicated that they always used all three (NPV, IRR, PBP) techniques equally in decision making. Where companies utilised the PBP method, it was not used in isolation, it was always used together with the sophisticated Discounted Cash Flow methods. Similar studies such as that by Maroyi & Van de Poll on South African mining companies listed on the JSE, revealed the superiority of the NPV over IRR and PBP, with 69%, 46% and 23% preferences respectively (Maroyi & Van de Poll, 2012).

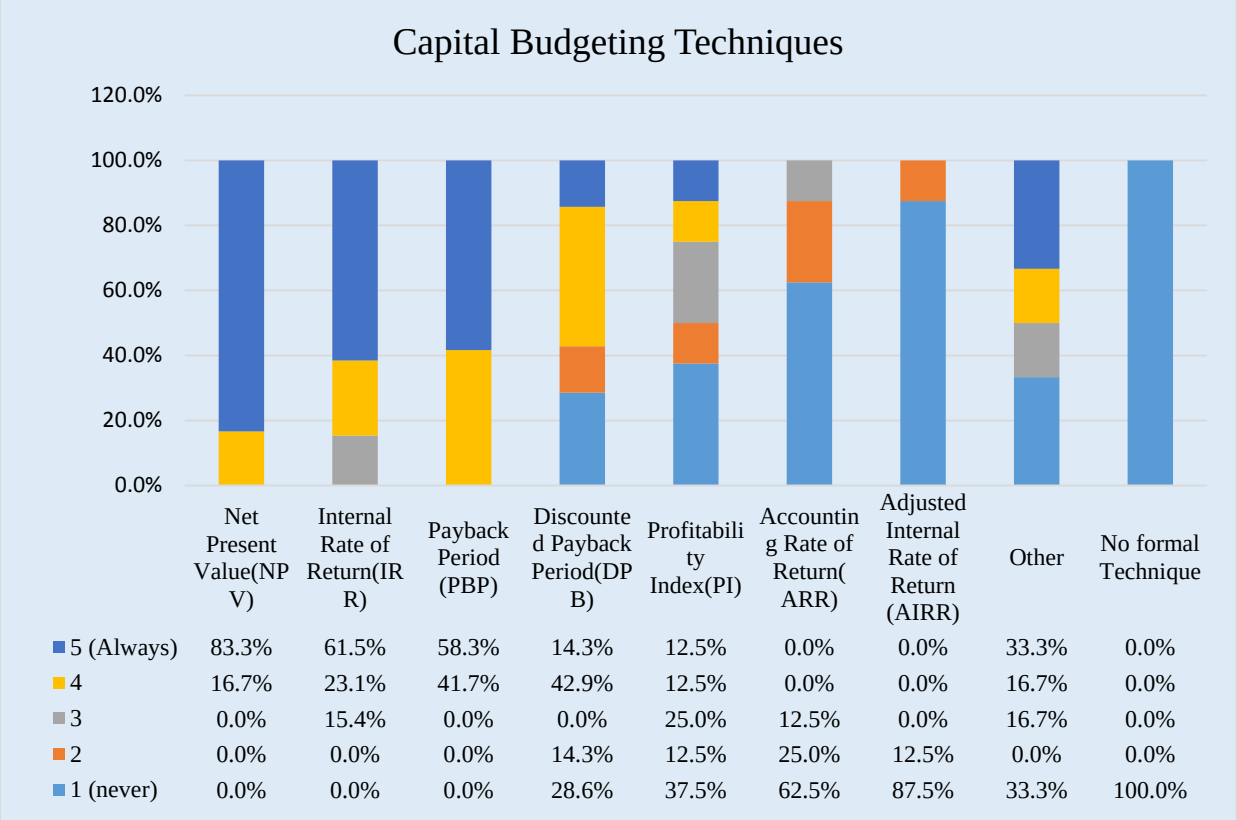


Figure 6: Capital Budgeting Practice

Further results from previous studies show an increased trend towards the use of sophisticated capital budgeting techniques, as with the study in 2002 on the JSE listed Companies where 37% indicated the use of IRR and 27.4% used NPV, an overall 64.5% use of sophisticated capital budgeting techniques (Du Toit & Pienaar, 2005). When grouped by industry or sector, Du Toit and Pienaar reported 62.5% use of NPV, 25% use of IRR and 12.5% use of other methods in the mining industry (Du Toit & Pienaar, 2005).

Another study highlighted the use of Return on Investment as a technique for capital investment appraisals, with 33.3% of the respondents using this method, 28.6% using NPV, 23.7% using IRR and 4.8% using discounted payback (Hall & Millard, 2010). Results of the method CFOs always used, highlighted the superiority of the DCF methods, with 82.1% of the CFOs always using the NPV technique, 78.6% always using the IRR technique and 53.6% always using PBP (Correia & Cramer, 2008).

However, there is still evidence of the naïve approach to capital budgeting, with companies always utilising PBP (frequency rate of 5) and using NPV most of the time (frequency rate of 4). A reasonable number of mining companies indicated that they used other methods of evaluation over and above these commonly used techniques, as reflected in the 14.3% of companies who seldom used (ranked 3) other methods, 14.3% who used other methods most (ranked 4) of the times and 28.6% who always used (ranked 5) other methods.

When asked to comment on the other methods used in the decision making, respondents indicated ratio analysis, such as capital intensity, the ratio of NPV to initial capital and cash margin analysis. Respondents highlighted the use of these methods together with the commonly known capital budgeting techniques in ranking the capital investment. What is comforting and worth noting however is the 0% use of non-formal capital budgeting techniques across the mining industry sample.

Respondents stated reasons such as group requirements and company policy for the choice of capital budgeting. Furthermore, respondents gave reasons such as the need to select cash positive projects and as a result they always used NPV. The need for the rate of return to exceed the cost of the investment was stated as the reason for always using IRR, and the importance of knowing the period after which the project will start adding value was the reason to always use PBP. Updating the trends of the capital budgeting technique from the initial graph drawn in a study on the review of the South African capital budgeting practices over time with recent surveys results is presented in figure 7.

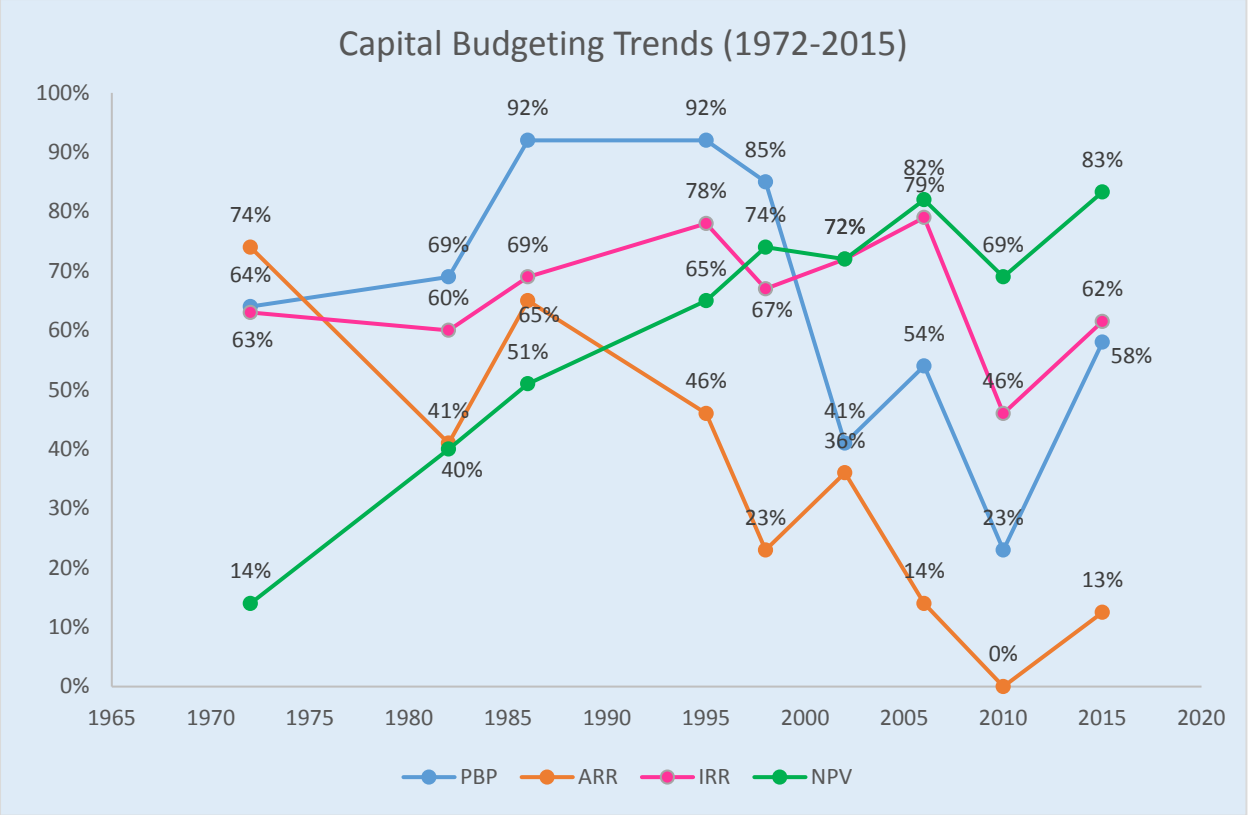


Figure 7: Capital budgeting trends in South Africa: 1972-2015 (Correia, 2010).

To further understand the capital budgeting techniques used, respondents were asked to indicate the techniques they used for different size projects based on the initial capital required as guided by similar surveys (Maroyi & Van de Poll, 2012; Hall & Millard, 2010). From the results, it is clear that NPV is still preferred and the technique always used by many firms. For smaller investments, that are below the specified amount of R50 million, the payback period is a preferred technique, and it is used 78% of time in the mining industry, as opposed to NPV and IRR used equally 56% of the time.

Although the use of multiple capital budgeting techniques was further highlighted, it also appeared that PBP was deemed ideal for smaller projects than for the projects that required a lot of capital. For capital investments of over R100 million the choice of capital techniques is consistent with the results of the capital budgeting technique always used by mining firms. NPV is utilised 78% of the time by the mining companies to appraise projects that require R100

million and above, with IRR utilised 67% of the time and PBP used 44% of the time. The multiple technique analysis practice is made even clearer with these results of capital project size and capital budgeting techniques, as can be seen in table 9.

The overall findings for this part of the survey that questioned the capital budgeting technique used by the South African mining companies are consistent with recent studies. Further highlights of the use of sophisticated capital budgeting techniques by the mining companies showed that 84.6% always used NPV, 71.4% always used IRR and 61.5% always used PBP. Another finding is that PBP is preferred and always used by 78% as opposed to 56% for NPV and IRR, used for smaller capital projects. The results for projects of R100 million and above are consistent with the earlier findings where NPV is preferred and always used by 78%, and IRR and PBP always used by 67% and 44% respectively.

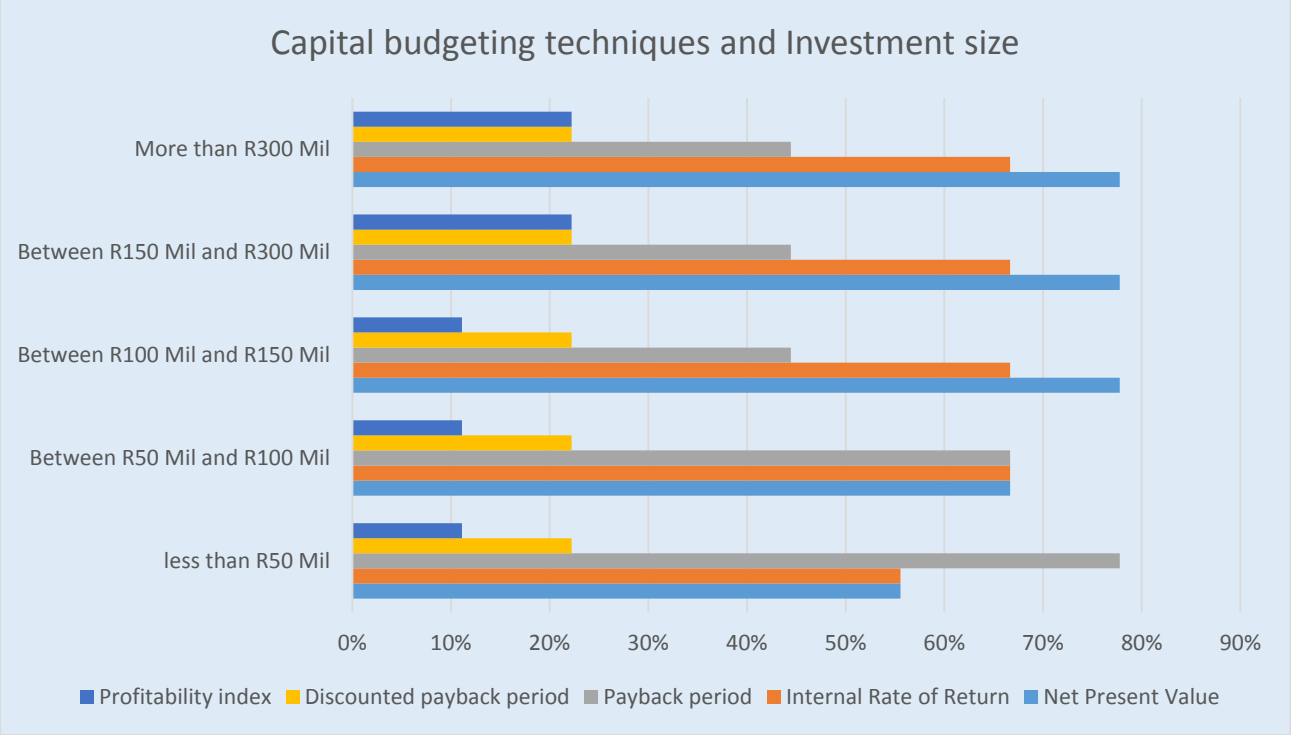


Figure 8: Capital Budgeting and Investment Size

Table 9: Distribution of Capital Budgeting practices by Investment Size

Project Size	NPV	IRR	PBP	DPB	PI	ARR	AIRR	Other	None
less than R50 Mil	56%	56%	78%	22%	11%	0%	0%	0%	0%
R50 Mil and R100 Mil	67%	67%	67%	22%	11%	0%	0%	0%	0%
R100 Mil and R150 Mil	78%	67%	44%	22%	11%	0%	0%	0%	0%
R150 Mil and R300 Mil	78%	67%	44%	22%	22%	0%	0%	0%	0%
More than R300 Mil	78%	67%	44%	22%	22%	0%	0%	0%	0%

4.3. Risk Analysis Techniques

In this part, the capital budgeting processes were outlined, and respondents were asked to rank these processes by order of importance on a scale of 1 being the least important to 5 being the most important. A similar question was further asked for the risk level, on a scale of 1 being least risky to 5 being the most risky. The capital budgeting process involves the establishment of goals, development of strategy, exploring investment opportunities, evaluating opportunities, selecting investment, implementing and monitoring and finally, posting an audit analysis (Seitz & Ellison, 2005).

Furthermore, respondents were asked to select the risk analysis techniques they used and the frequency of use based on the scale of 1 being never used, and 5 being always used. Project implementation was ranked the most risky process in capital budgeting, and cash flow estimation the most important process in capital budgeting. The overall rankings are displayed in figure 9 and table 10. The results of the survey ranked cash flow estimation, financial analysis, project identification and definition, project implementation and project control, post audit and review, by order of importance from most important to least important.

What is interesting to observe was that 43% of the respondents ranked cash flow estimation as most important at 5 (ranking), and another 43% as important at ranking 4. While a considerable distribution of respondents ranked project implementation widely, from 7% ranking it at 5,

21% ranking it 4, 36% ranking it 3, 36% ranking it 2, and 0% ranking it 1. What was consistent with the results was the project control, post audit and review ranking. Respondents deemed this step the least important in capital budgeting process, with 79% ranking it 1(least important) and 21% ranking it 2(not that important).

When asked to comment on the specific rankings, respondents stated reasons for ranking project identification at 5 such as, the importance of spending money/capital in the right areas, identifying and selecting good projects is crucial for business continuity, capital is scarce and hence identification of projects that will create value, within the capital budget is crucial. Reasons stated for ranking cash flow estimation as most important were cash flow estimations were the basis for which the project's value would be estimated, so it was highly important that estimations were well considered. The DCF, NPV, IRR and all decision criteria are informed by cash flow estimations, so it is crucial that they are correct, hence it was ranked the most important process in the capital budgeting process.

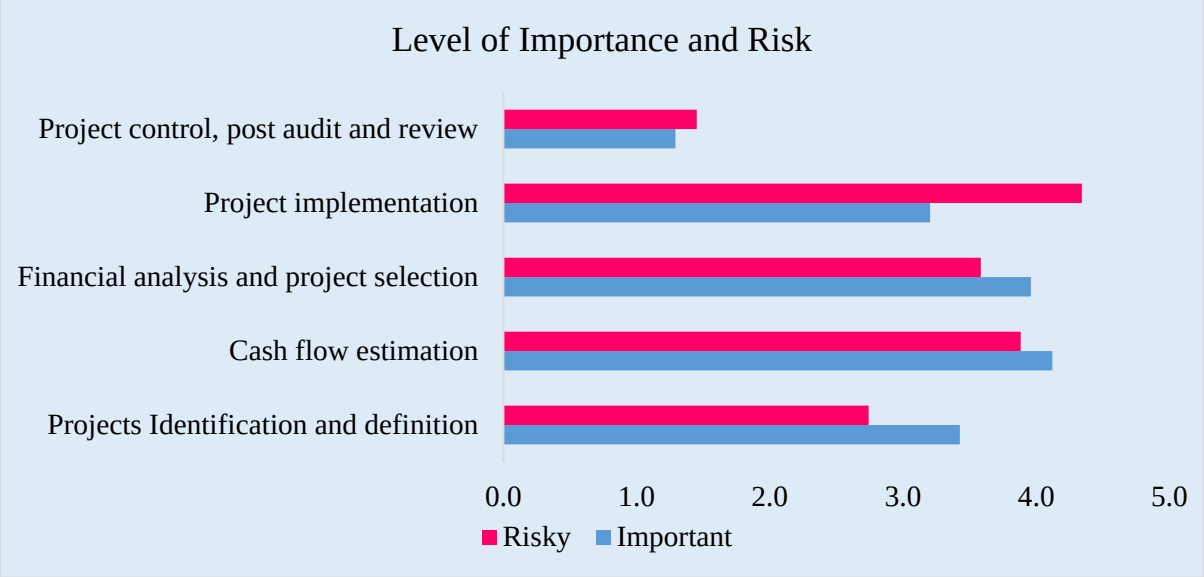


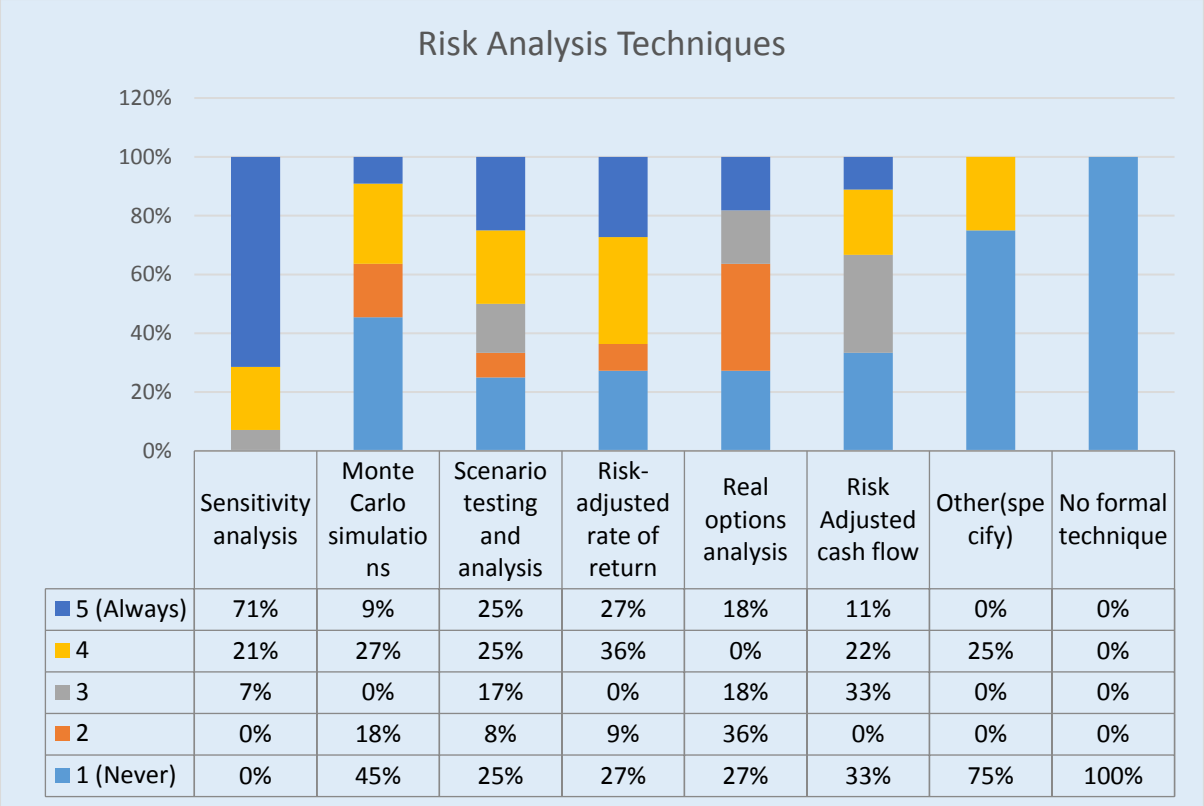
Figure 9: Risk and Importance Level of Capital Budgeting Processes

Table 10: Importance and Risk Level of Capital Budgeting Processes

	Importance		Risk	
Capital Budgeting Process	**Rating Average**	**% Rankings**	**Rating Average**	**% Rankings**
Projects Identification and definition	3.4	21%	2.7	17%
Cash flow estimation	4.1	26%	3.9	24%
Financial analysis and project selection	4.0	25%	3.6	22%
Project implementation	3.2	20%	4.3	27%
Project control, post audit and review	1.3	8%	1.5	9%
	16	100%	16	100%

Similar to capital budgeting techniques, respondents were asked how frequently they used risk analysis techniques, on the scale of 1 being never used to 5 being always used. The most common risk techniques were outlines, such as sensitivity analysis, Monte Carlo simulations, scenario testing and analysis, risk adjusted rate of return, risk adjusted cash flow and real option analysis. Respondents were asked to specify any other risk analysis methods they use apart from the ones listed and commonly used.

Sensitivity analysis is the most popular and is always used by 71% as seen in figure 10 that displays the results from the risk analysis techniques used. A considerable number (25%) indicated that they always used scenario testing and analysis and 27% used the risk adjusted rate of return. By ranking, sensitivity analysis was ranked 4.6, indicating that it is the always preferred method for assessing risks within the South African mining industry. This finding is consistent with studies of a similar nature, with sensitivity analysis being widely used and a preferred method (Hall 2001; Hall & Millard, 2010).



	Sensitivity analysis	Monte Carlo simulations	Scenario testing and analysis	Risk-adjusted rate of return	Real options analysis	Risk Adjusted cash flow	Other(specify)	No formal technique
5 (Always)	71%	9%	25%	27%	18%	11%	0%	0%
4	21%	27%	25%	36%	0%	22%	25%	0%
3	7%	0%	17%	0%	18%	33%	0%	0%
2	0%	18%	8%	9%	36%	0%	0%	0%
1 (Never)	0%	45%	25%	27%	27%	33%	75%	100%

Figure 10: Risk Analysis Techniques Used in Practise

What is important to note is the use of the more quantitative risk analysis techniques such as the real option analysis, Monte Carlo Simulations, scenario testing analysis, with 18%, 9%, and 25% respectively indicating they always use these methods. Furthermore, 100% of the respondents indicated that they never used non formal risk analysis techniques, which is comforting and a sign that capital budgeting and risk analysis in the mining industry has evolved over time, from 36.90% (ranked 1: mostly used) where there was no formal technique used, in a study by Hall on companies on the industrial sector on the JSE and 6.9% (ranked 5: moderately used) in 2010 (Hall, 2001; Hall & Millard, 2010).

4.4. Decision Makers' Profile

To establish the credibility of the respondents and the level of knowledge of the capital budgeting subject, a decision makers profile was questioned. Decision makers were asked to detail their average working experience, and level of qualifications. They were further asked

to specify what positions they held within their companies. While the survey was mainly distributed to financial managers and the company CFOs, a link was also sent which allowed respondents to redistribute the survey. As a result, it was important that the decision markers' profiles were established. In line with similar surveys, it outlined the importance of respondents' profiles in ascertaining their ability and level of skills and experience to answer questions relating to capital budgeting (Maroyi & Van der Poll, 2012; Hall & Millard, 2010).

The first question dealt with the age of the respondent, where 63% of the respondents indicated that they were within the ages of 40 to 55, and 37% indicated they were between the ranges 30 to 40 years. This shows a considerable number of the respondents can be classified as middle-aged, at an average age of 45.6 years. To establish the level of knowledge on capital budgeting theories, mostly taught in schools and in a lot of academic studies and books, the level of education was questioned.

From the respondents' level of education, one can be confident in their knowledge of capital budgeting theory as 43.8% indicated they had Honours level qualifications and 31.3% had bachelor's degree level qualifications. While there are no MBA and non-MBA masters qualified respondents, 6.3% indicated a PhD level qualification. The 18.8% that indicated other qualifications were all CA (SA) qualified respondents.

Decision makers were further asked to indicate their job title and the positions they held within the company. Figures 11, 12, 13, and 14 show the distribution of the decision makers profile with regard to age, level of qualification, job titles and the relevant years of experience in the field of capital investment and project appraisal.

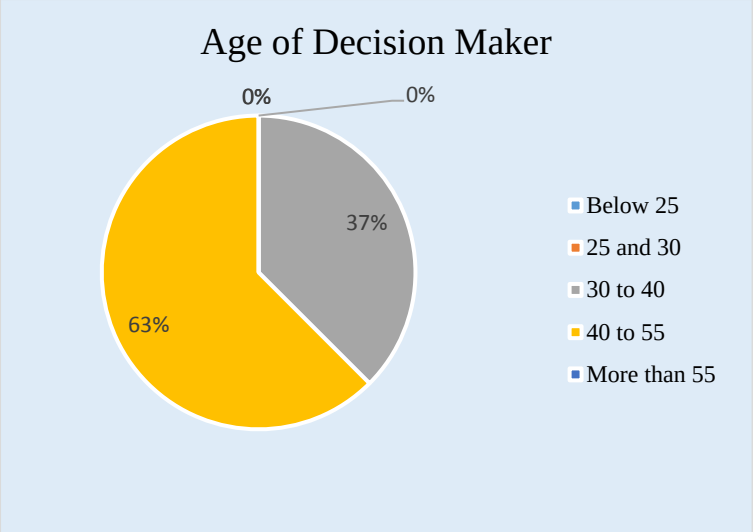


Figure 11: Age of the Decision Maker

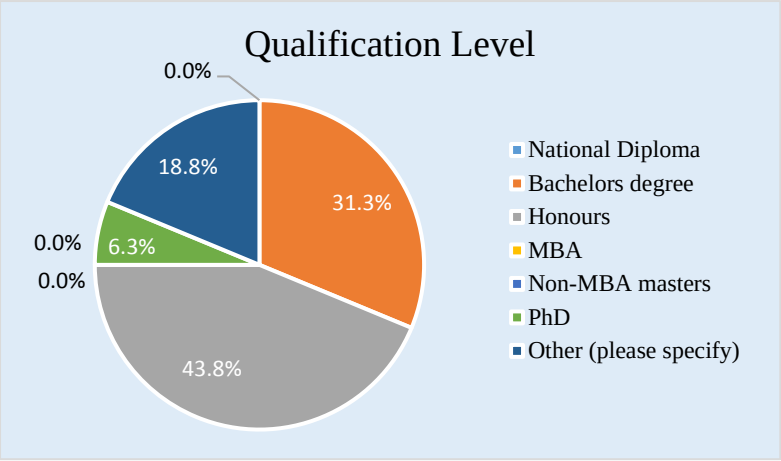


Figure 12: Level of Qualification for Decision Maker

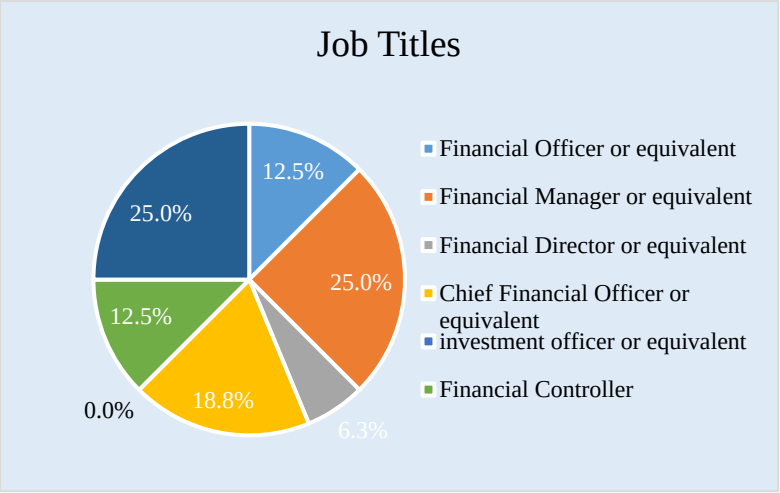


Figure 13: Job Titles for Decision Makers

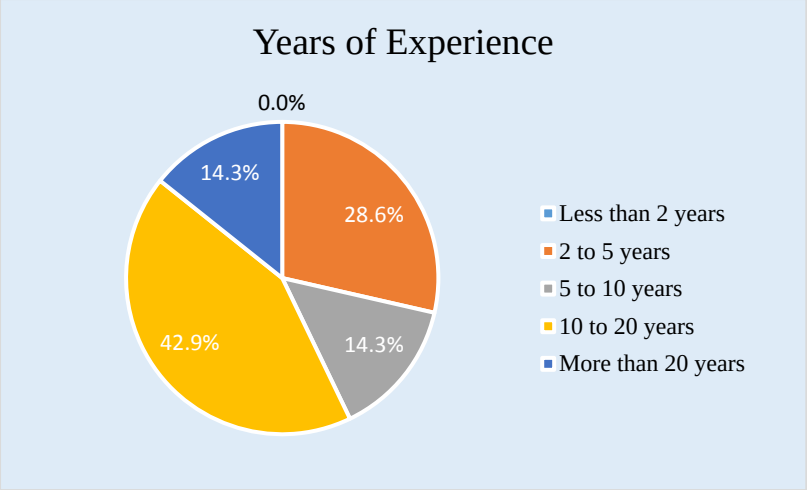


Figure 14: Experience of Decision Makers

4.5. Firm Performance

Two questions were asked in order to assess performance, based on financial indicators not economic/market indicators. While total assets of the company were questioned in order to establish the size of the company, it became an input in establishing company performance. Respondents were specifically asked to indicate the estimated annual average net income (Earnings after Interest and Tax) under the performance part of the questionnaire. Together with the total assets question in determining the size of the company, a perceived return on asset range was established for the companies. Figure 15 shows the average net income for the companies with 42.9% having a net average income of over R1billion and 28.6% indicated a net income of less than R50 million.

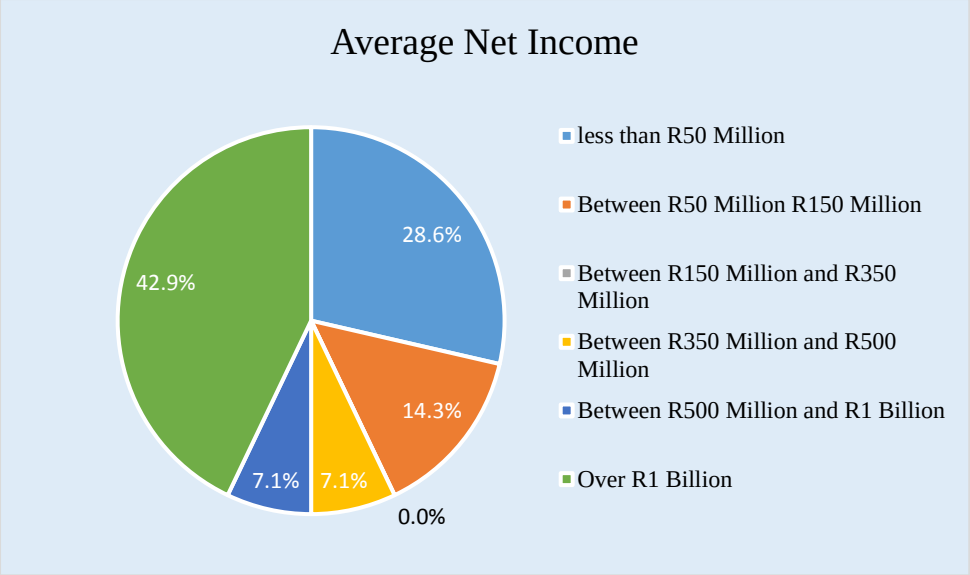


Figure 15: Average Annual Net Income

Average Sales Growth Rate (SGR)

Respondents were further asked to indicate the change in sales between the periods of 2010 to 2014. Although there is no specific reason for the time range, it is a reasonable time to see value created by capital projects that could have been commissioned in 2010 for example. Change of sales over a period of time is also a good enough measure of the value capital investments could have created (Axelsson et al., 2003). A total of 50% of the companies indicated a change in turnover of over 15%, with 50% of these companies indicating on the comments that their actual change was over 20%. 21.5% indicated a change of turnover between 5% and 10%, while 14.3% indicated a change of turnover of less than 0% and 7.1% indicated a change of between 10% and 15%. Figure 16 displays the results of the change in turnover.

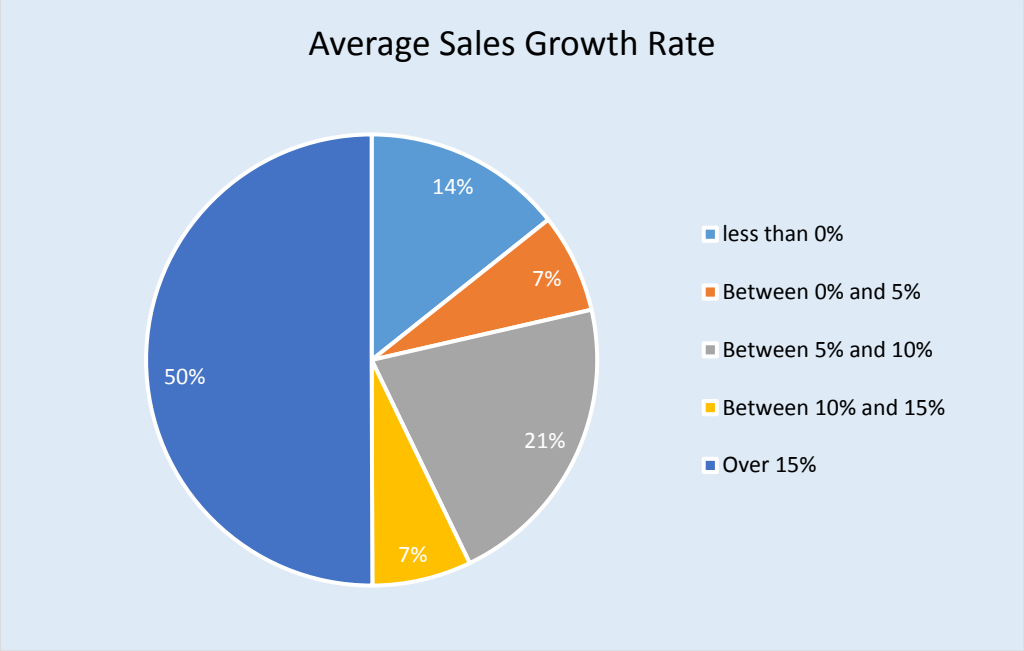


Figure 16: Average Sales Growth Rate

5. Empirical Analysis

5.1. Regression Results

The model described in equation 4 sought to explain the variations of company performance by the variations in the capital budgeting sophistication, size of the company and the capital intensity of the company. At this stage, it is important to note the omission of all the industry level variables, used in similar studies (Klammer, 1973; Farragher et al., 2001) due to the fact that only one industry in this study is under review.

In order to the test hypothesis H_4, the dependent variable (ROA) was regressed against the specific variables of size, capital budgeting sophistication, risk analysis sophistication and capital intensity in a multiple regression model. The results of the regression are tabulated below in table 11, with the coefficients of the variables, standard errors, t-ratios and the p-values for the model described by equation 10.

Equation 10:

$$ROA_j = b_0 + b_1 TA_j + b_2 CapS_j - b_3 CapI_j + \mu$$

where:

ROA; is the operating rate of return

TA_j; size of the company j denoted by total assets

$CapS_j$; Capital budgeting sophistication

$CapI_j$; Capital intensity of company j

μ; Error term.

Dependent variable: ROA

Table 11: Estimated Variables Coefficients for Regression Model

Independent variables	Coefficient	Std. Error	t-ratio	p-value	Significance
Const	0,13	0,13	0,99	0,33	
TA	0,21	0,09	2,31	0,03	**
CapS	−0,01	0,03	-0,39	0,71	
CapInt	−0,01	0,00	-3,72	0,00	***

*Significant at 90% confidence level; **statistically significant at 95%; *** highly statistically significant at 99%

Table 12: Regression results for model estimation

Mean dependent var	0,06	S.D. dependent var	0,13
Sum squared resid	0,08	S.E. of regression	0,08
R-squared	0,68	Adjusted R-squared	0,61
F(3, 12)	8,84	P-value(F)	0,00
Log-likelihood	18,96	Akaike criterion	−29,92
Schwarz criterion	−26,83	Hannan-Quinn	−29,77

Evaluating the variables separately from the results, take note of the signs of the coefficients for the different variables, while size and capital intensity had their expected signs from the hypothesis, and theory, capital sophistication have an unexpected sign. The result shows a positive relation of size to performance and a negative relation to both capital budgeting sophistication and capital intensity. From the theory of capital budgeting and the framework established in chapter 2 of this study, it was expected that capital budgeting sophistication would positively affect performance, where the higher level of sophistication would yield better firm performance.

However, the capital budgeting sophistication variable carried a low t-ratio of -0.39 and a corresponding p-value of 0.71, which is highly insignificant. This finding is consistent with similar empirical studies (Farragher et al., 2001; Klammer, 1973), but in contradiction with other studies on smaller firms (Peel & Bridge, 1998; Olawale et al., 2010) and capital budgeting theory.

Size of the firm, as measured by the total assets, carries the expected sign; highlighting the positive relation to firm performance. Furthermore, the t-ratio suggests a significant positive relation of company size to capital budgeting exists. Similar studies have consistently reported a positive significant relation of size to the firm performance (Klammer, 1973; Pike, 1984; Farragher et al., 2001). However, other studies have reported no relation of size to performance, except when size is measured by sales volumes, and only at industry level (Copon et al., 1990).

Capital intensity carries the expected sign, confirming the expected negative relation to performance. High capital intensive companies require a lot of capital to produce the mineral resources. While mining and manufacturing industries are classified as high capital intensive industries, on a firm level where only mining companies are considered, that issue is standardised and adjusted for (Pike, 1984; Farragher et al., 2001). While all the capital budgeting sophistication variables proved to be insignificant, size and capital intensity variations, significantly explained the variations in performance.

Up to now, the variables were analysed separately by looking at their individual relation to the performance measure as calculated by ROA. While it is understood that variables could be non-significant in explaining relationship when regressed individually, the solution is to seek for the combined effects of all key independent variables to the dependent variable (Brooks, 2014). It is for this reason that a step-wise multiple regression analysis was conducted to determine which of these variables affect performance significantly and to establish the correct variable combination by analysing the R^2 (Farragher et al., 2001).

The combined results of the regression are displayed in table 12. The main purpose of the regression was to estimate the best line that fits the data with some level of error. One good measure of how well the regression fits the data is by looking at R-squared. R-squared is defined as the goodness of fit, that is, how well the regression best describe the data (Brooks, 2014).

It has values from 0; which indicate that none of the relation of the variables as defined the linear regression is weak and 1 which indicates that all the variables' data lie exactly on the straight line (Brooks, 2014). Although there is no prescribed good value for R-squared, the rule of thumb is that for cross-section data a good value is 0.15 or greater, and for time series data a good value is 0.8 and greater (Brooks, 2014).

An estimated R-squared of 0,688536 indicates that there exists a strong relation between the independent variables and the dependent variables in the estimated regression. From this value of R-squared alone, the positive effect of size, negative effect of capital sophistication and capital intensity to the company performance is strong, and well described in the model derived in equation 10.

Equation 10: Company performance and capital budgeting in South African Mines

$$\mathrm{ROA\,j} = 0.13 + 0.21\mathrm{TAj} - 0.01\mathrm{CapSj} - 0.009\mathrm{CapIj}$$

The negative relation of capital budgeting to performance in this study could be attributed to some extent by the method utilised in scoring the level of capital budgeting sophistication of the companies. While similar studies have used different methods of scoring the level of sophistication, the results were consistently negative and insignificant as well (Axelsson, 2003; Farragher et al., 2001).

Equation 11:

$$ROA_j = b_0 + b_1\,TA_j + b_2\,RAS_j - b_3\,CapI_j + \mu$$

where:

ROA; is the operating rate of return

TAj; size of the company j denoted by total assets

RASj; Risk Analysis sophistication

CapIj; Capital intensity of company j

μ; Error term.

Table 13: Regression results for performance and risk analysis sophistication

Variable	Coefficient	Std. Error	t-ratio	p-value	
const	−0,03	0,06	-0,44	0,67	
TA	0,12	0,09	1,31	0,21	
CapInt	−0,01	0,00	-4,17	0,00	***
RAS	0,04	0,02	1,87	0,08	*

Mean dependent var	0,06	S.D. dependent var	0,14
Sum squared resid	0,07	S.E. of regression	0,08
R-squared	0,76	Adjusted R-squared	0,69
F(3, 12)	12,38	P-value(F)	0,00
Log-likelihood	20,91	Akaike criterion	−33,82
Schwarz criterion	−30,73	Hannan-Quinn	−33,67

Another important part of the study focused on the risk analysis techniques, while it was concluded from the results in chapter 4 that the mining companies do not use the sophisticated risk analysis techniques, with 71% always using sensitivity analysis. In a similar way that the capital budgeting was scored, risk analysis was also scored and the results were used in a multiple regression. By replacing the capital budgeting sophistication variable with the risk analysis variable, the model in equation 11 yielded the results as in table 13. The signs of the

coefficients are consistent with earlier results and show a positive sign for the risk analysis technique. Results indicated that a company that uses the most sophisticated risk analysis techniques would perform better than those who do not., a finding consistent with theory, however marginally significant with the low t-stats, and p-value of 0, 085.

5.2. Step-wise Regression Results

To test the reliability and validity of the model established, a step-wise regression analysis was undertaken in three steps. The omission and the inclusion of other variables in the model should still maintain similar results if the model is robust and plausible. This step is important in confirming the validity of the model, and to establish which of the independent variables defines the dependent variable more (Farragher et al., 2001. The results of the analysis are tabulated in table 14.

Table 14: Step-wise Regression Results

Variable	Step 1	Step 2	Step 3	Step 4
Constant	0,03	0,26	0,13	0,014
TA (P-Value)	0,28 0,05*	0,25 0,07*	0,22 0,03**	0,12 0,23
CapS (P-Value)		-0,06 0,22	-0,01 0,71	-0,01 0,92
CapInt (P-Value)			-0,01 0,00***	-0,01 0,00***
RAS (P-Value)				0,04 0,11
R-Square	0,24	0,32	0,69	0,76
Adj R-square	0,19	0,23	0,61	0,67

The first column of the results is the independent variable, from constant, total assets to the risk analysis sophistication. From step 1 only, only the size variable is added to the model and all the other variables are omitted, the result for this variable is constant with the result of the model described. Highlighted is the positive significant relation of size to corporate performance. Step 2 includes the addition of the capital budgeting sophistication variable, together with the size variable. The results continue to be consistent with the model, with the negative and insignificant relation of capital budgeting and further confirmation of the positive and significant relationship of size to corporate performance.

Further inclusion of variables yields consistent results, as evident in step 3 of the step-wise regression. With the inclusion of capital intensity to size and capital sophistication, these variables maintained their expected signs and significance. A negative and highly significant relation of capital intensity to company performance is further highlighted. The final step includes the risk analysis sophistication variable, where the signs of all other variables are maintained, and the positive, insignificant relation of risk analysis sophistication to company performance is evident.

Overall, the model is robust as by adding or omitting variables, none of these variables changed signs and significance, except for the last step where the inclusion of the RAS variable resulted in size TA not being significant. Observing the R2 and the adjusted R2 in the bottom lines of the table of results by adding a variable, the goodness of fit increases. Based on these results, there is high confidence that the conclusions can be drawn from the results of this model regarding the performance of mining companies and capital budgeting sophistication.

6. Conclusion

The main objective of the study was to investigate the capital budgeting practices used in the mining industry and their impact on corporate performance. The study focused on two parts of the main objective, researching capital budgeting practices in evaluating investments in the mining industry, using a survey questionnaire and an empirical analysis of the effect on corporate performance by developing a regression model.

A survey research method was used for this study where the sample was carefully selected to include all the major role players in the South African mining industry; with all the Chamber of Mines member companies selected. Together, all the mining companies included in the sample contributed more than 90% of the mineral production in the country in 2014.

Out of the 55 Chamber of Mine members, 35 companies were listed on the JSE. A total response rate of 29.1% was achieved for this study compared to an 18.88% average in similar studies. The descriptive statistics suggest that 69% of the companies that responded to the survey had total assets in excess of R10 billion, 25% had total assets in excess of R1 billion but less than R10 billion and 6% had total assets of less than R500 million. Therefore, the conclusions of this study may be more suited to large South African mining companies.

The Discounted Cash Flow method is highly utilised in capital decisions with 83.3% of the companies always using NPV, 61.5% always using IRR as opposed to the 58.3% which always use PBP. Most of the companies also indicated the multiple use of the techniques, and the reliance on the DFC method in making the final decisions. And thus, H_1 was rejected, with 83.3% and 61.5% of the respondents always using the DCF methods of NPV and IRR.

Furthermore, the findings show the presence of different capital budgeting techniques for different size investments. For investments of less than R50 million, companies indicated that they always used PBP 78% of the time as opposed to NPV and IRR which were both used 56%

of the time. For investments of more than R50 million but less than R100 million, the companies indicated they equally use the NPV, IRR and PBP.

For investments of more than R100 million, the results are consistent with the results of the overall use of capital budgeting techniques, with NPV and IRR being the superior techniques over the PBP technique. This finding results in rejecting hypothesis H_3: Size of capital investment **does not** affect the capital budgeting technique used (size does not matter in terms of which capital technique is used).

The riskiness and the level of importance of the capital budgeting process steps were consistent for the final step, of project control, audit and review; all companies indicated that it is the least risky and the least important. The most important stage in the capital budgeting process is the cash flow estimation, and project implementation was deemed the most risky due to the high probability of project overrun on budget and on schedule. Sensitivity analysis is still the preferred method of risk analysis, although there is an improvement in the use of real option analysis as compared to similar studies (Hall, 2001; 2010; Maroyi & Van de Poll, 2012).

Responding to H_2: South African Mining companies **do not** use Quantitative risk measures in capital budgeting (Use of qualitative risk measures in capital budgeting). Where none of the respondents indicated the use of non-formal technique and 71% indicated, they always used sensitivity analysis. Hence H_2 is rejected.

An important part of the study included the empirical analysis of the effect of capital budgeting on company performance. Company performance, as defined by the operating rate of return, is calculated by return on assets. Controlling variables of size, and capital intensity were regressed together with the capital sophistication variable. Findings were consistent with similar studies, but in contradiction with capital budgeting theory. These findings therefore result in the

rejection of the hypothesis $H_{4:}$ Companies that utilise the sophisticated capital budgeting techniques **have superior** corporate performance than those who do not.

The results further highlighted the negative, insignificant relation of capital budgeting sophistication to company performance, consistent with similar studies (Klammer, 1973; Farragher et al., 2001; Pike 1984). However, these findings are in contradiction with capital budgeting theory and other studies on smaller firms (Peel & Bridge, 1998; Olawale et al., 2010), where a positive relation between capital budgeting sophistication and company performance was evident in the results.

Capital investments are selected if they add value to the company and this is the principle of capital budgeting; however, the selection of a good investment alone does not ascertain superior performance, a conclusion that can be drawn from this study. Further highlighting the conclusion from Klammer (1973), that by merely employing the sophisticated techniques of capital budgeting does not mean that value is added to the company and to shareholders (Klammer, 1973). Managers need to consistently make good decisions, in terms of the investments they choose and continuous monitoring of the investment in order to maximise wealth and create value for the company and shareholders.

Limitations and Further Studies

Although the results of the empirical analysis are consistent with similar studies, and the reliability of the model estimated was validated by the robustness tests, further studies are required to re-affirm these results for South African companies. Although this subject is not new, there is not enough research, especially looking at capital budgeting impacts on performance in South Africa.

The major limitation for this model is the very small sample size from which the model was estimated. Due to time constraints for this study and the low response rate to the survey, only

16 companies' data in the same industry could be analysed, minimising the error involved in adjusting for different industries, however, limiting the generalisation to all other industries.

Furthermore, different performance measures, other than ROA, could be employed to calibrate performance. Moreover, our study does not consider volatility of the company as a controlling variable in modeling this relationship. Further studies can incorporate this variable/factor. Such studies will increase the body of knowledge on the relationship between capital budgeting and company performance in South Africa.

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Appendices

Appendix I: Survey Questionnaire

Part A: Size of Company and Capital Budget

1. Please specify the year of incorporation * of your company.

2. Please specify the total Assets the company holds?

Less than R500 Million
Between R500 Million and R1 Billion
Between R1 Billion and R5 Billion
Between R5 Billion and R10 Billion
More than R10 Billion

3. What is the estimated annual turnover of the company?

Less than R200 Million
Between R200 Million and R500 Million
Between R500 Million and R1 Billion
Between R1 Billion and R5 Billion
More than R5 Billion

*** 4. What is the annual capital budget allocation?**

Less than R50 Million
Between R50 Million and R100 Million
Between R100 Million and R300 million
Between R300 million and R500 Million
More than R500 Million

***5. What projects are regarded as capital projects within your company based on the initial investment (outlay)?**

Less than R20 Million
Between R20 Million and R50 Million
Between R50 Million and R100 Million
Between R100 Million and R200 Million
More than R200 Million

Part B: Capital Budgeting Technique

6. What techniques does your company use for project appraisal

	1 (never)	2	3	4	5 (Always)
Net Present Value(NPV)	☐	☐	☐	☐	☐
Internal Rate of Return(IRR)	☐	☐	☐	☐	☐
Payback Period (PBP)	☐	☐	☐	☐	☐
Discounted Payback Period(DPB)	☐	☐	☐	☐	☐
Profitability Index(PI)	☐	☐	☐	☐	☐
Accounting Rate of Return(ARR)	☐	☐	☐	☐	☐
Adjusted Internal Rate of Return (AIRR)	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐
No formal Technique	☐	☐	☐	☐	☐

Please supply reasons for the selections above

7. Please specify what technique is used for the specified capital projecs

	Net Present Value	Internal Rate of Return	Payback period	Discounted payback period	Profitability index	Accounting rate of return	Adjusted internal rate of return	Other	None
less than R50 Mil	☐	☐	☐	☐	☐	☐	☐	☐	☐
Between R50 Mil and R100 Mil	☐	☐	☐	☐	☐	☐	☐	☐	☐
Between R100 Mil and R150 Mil	☐	☐	☐	☐	☐	☐	☐	☐	☐
Between R150 Mil and R300 Mil	☐	☐	☐	☐	☐	☐	☐	☐	☐
More than R300 Mil	☐	☐	☐	☐	☐	☐	☐	☐	☐

Please supply validation for the selections above

Part C: Risk Analysis Techniques

8. Please specify the IMPORTANCE of these capital budgeting processes by ranking 1(least important) to 5 (most important)

	1(least important)	2	3	4	5 (most important)
Projects Identification and definition	○	○	○	○	○
Cash flow estimation	○	○	○	○	○
Financial analysis and project selection	○	○	○	○	○
Project implementation	○	○	○	○	○
Project control, post audit and review	○	○	○	○	○

Supply reason the ranking above

9. Please specify the LEVEL OF RISK on these capital budgeting processes by ranking 1(least risky) to 5 (most risky)

	1(least risky)	2	3	4	5 (most risky)
Projects Identification and definition	○	○	○	○	○
Cash flow estimation	○	○	○	○	○
Financial analysis and project selection	○	○	○	○	○
Project implementation	○	○	○	○	○
Project control, post audit and review	○	○	○	○	○

Supply reason the ranking above

10. Please specify the risk analysis technique used by your company

	1 (Never)	2	3	4	5 (Always)
Sensitivity analysis	○	○	○	○	○
Monte Carlo simulations	○	○	○	○	○
Scenario testing and analysis	○	○	○	○	○
Risk-adjusted rate of return	○	○	○	○	○
Real options analysis	○	○	○	○	○
Risk Adjusted cash flow	○	○	○	○	○
Other(specify)	○	○	○	○	○
No formal technique	○	○	○	○	○

Please supply reason for above selection

Part D: Firm Performance

11. Please specify your company's average annual net income (earning after interest and tax, EAIT)

Less than R50 Million

Between R50 Million R150 Million

Between R150 Million and R350 Million

Between R350 Million and R500 Million

Between R500 Million and R1 Billion

Over R1 Billion

12. Please specify the average change in turnover over the past 5 years (2010-2014)

Less than 0%

Between 0% and 5%

Between 5% and 10%

Between 10% and 15%

Over 15%

Part E: Decision Maker's Profile This part of the survey reflects on the individual taking the survey.

13. Please specify * your age group

Below 25

25 and 30

30 to 40

40 to 55

More than 55

*** 14. Please specify your qualification level**

National Diploma

Bachelor's degree

Honours

MBA

Non-MBA masters

PhD

Other (please specify)

*** 15. What position do you hold in your company?**

*** 16. How many years in the current and similar roles altogether?**

Less than 2 years

2 to 5 years

5 to 10 years

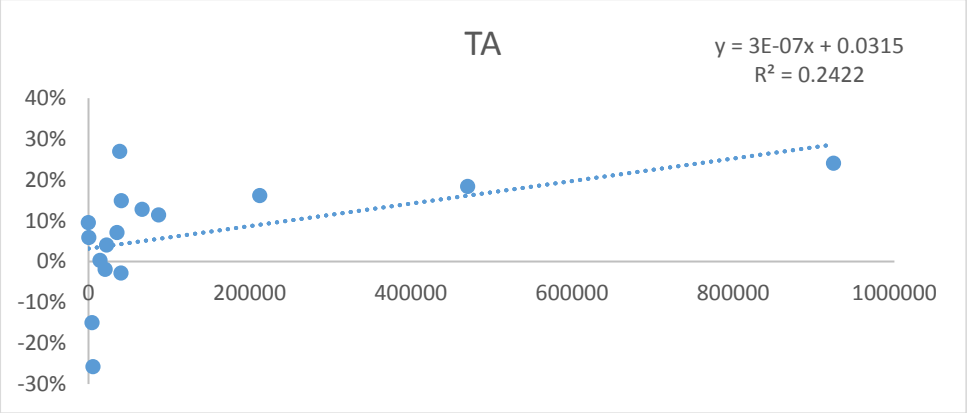
10 to 20 years

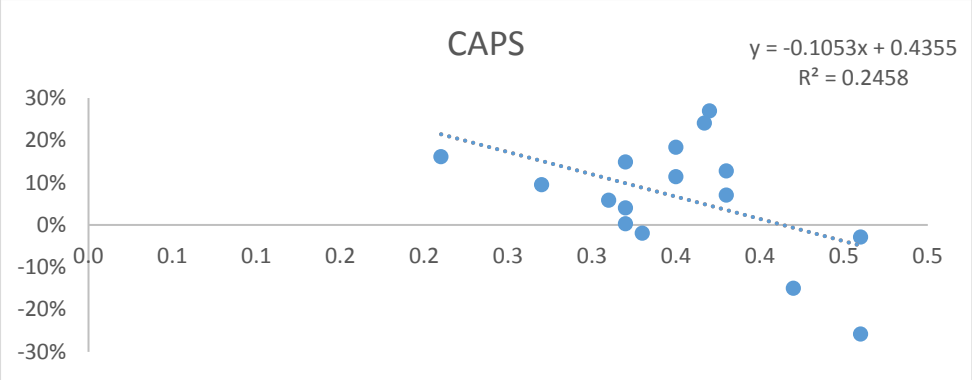
More than 20 years

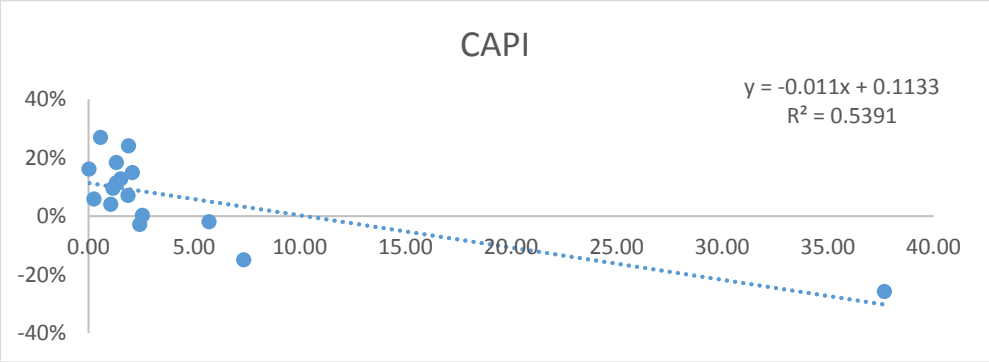
Appendix II: Assumptions of Linear Regression

Linearity of the variables

Scatter plots for the variables regressed together with the dependent variables and their corresponding R^2.







White's test for heteroscedasticity

The results of the Null hypothesis: heteroscedasticity not present are tabulated below.

Variable	coefficient
Const	−0,19
TA	−0,18
CapS	0,09
CapInt	0,04
Sq TA	0.00
X2_X3	0.14
X2_X4	-0.47
Sq_CapS	-0.00
X3_X4	-0.00
Sq_Capint	0.00

Unadjusted R-squared = 0,67

Test statistic: TR^2 = 10,657383,

P-value = P (Chi-square(9) > 10,657383) = 0,0899926. P-value is significant hence we do not reject null hypothesis of no heteroscedasticity.

Testing collinearity

Minimum possible value = 1.0; Values > 10.0 may indicate a collinearity problem

TA 1,028; CapS 1,381; CapInt 1,414

VIF(j) = 1/(1 - R(j)^2), where R(j) is the multiple correlation coefficient between variable j and the other independent variables.

1-norm = 1,1409885e+012

Determinant = 7,8194258e+016

Reciprocal condition number = 2,631147e-013

Correlation analysis Matrix for the independent variables tabulated below. Correlation coefficients, 5% critical value (two-tailed) = 0,4973 for n = 16

TA	CapS	CapInt	
1,0000	-0,04	-0,16	TA
	1,00	0,52	CapS
		1,00	CapInt

Normality tests results

Testing for the null hypothesis of normal distribution Chi-square(2) = 6,743 with p-value 0,03434, and the graphical distribution is plotted below.

