

**APPLICATION OF REAL OPTIONS IN CAPITAL BUDGETING: A SURVEY  
OF OIL COMPANIES IN KENYA**

**BY**

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**A MANAGEMENT RESEARCH PROJECT SUBMITTED IN PARTIAL  
FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF  
BUSINESS ADMINISTRATION (MBA) DEGREE, SCHOOL OF BUSINESS,  
UNIVERSITY OF NAIROBI**

**OCTOBER, 2010**

## **DECLARATION**

### **STUDENT**

I, the undersigned, declare that this research project is my original work and that it has not been presented in any other university or institution for academic credit.

SIGNED

DATE

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This research project has been submitted for examination with my approval as university supervisor.

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## **ACKNOWLEDGEMENT**

First and foremost is my gratitude to the Almighty God for the gift of life, resources, a sound mind and everything else that enabled me go through the course.

The support and understanding of family; husband, son and daughter was immeasurable. Their understanding especially on the week-ends while I was away for classes and CATs was a great source of inspiration.

My thanks go to all my course instructors during the entire course and especially my Supervisor Mrs Winnie Nyamute, your hard work and dedication was not in vain.

Special tribute goes to my mother, sisters and brothers and my entire extended family for their moral and material support. My late dad, you went away when I was still doing this course, the Almighty rest your soul in peace.

My gratitude also goes to my close friends for their immeasurable support and understanding when I not available to participate in social undertakings. My colleagues who have in one way or another helped me and for those that we have worked closely together, Regina, Ken, Carol and others, may the Almighty bless you abundantly.

There are many more who contributed in one form or another during the course. I cannot name each and everyone here but I could not make it without you.

To all of you, I say, God bless you.

## **DEDICATION**

To my loving family,

My husband, son and daughter,

My loving father, late Silvano Ndiga and Mother, Felista Igoki

My sisters and brothers and entire family,

May God bless you mightly.

## **ABSTRACT**

Many academics and practicing managers recognize that the net present value (NPV) rule and other discounted cash flow (DCF) approaches to capital budgeting are inadequate in that they cannot properly capture management's flexibility to adapt and revise later decisions in response to unexpected market developments. Real options approach to capital budgeting has the potential to conceptualize and quantify the value of options from active management. It is on this background that this study was conducted to determine whether the use of real options had been adopted by Oil companies in Kenya. The oil industry was chosen because it was one of the few that had already adopted the use of real options as per studies conducted in other countries.

The study was conducted through the survey method of data collection. It was done through questionnaires administered to the one employee from each oil company. Such an employee would be dealing with capital budgeting. Out of 25 possible responses, only 17 were received giving a response rate of 68%.

The findings were that 82.35% of the companies used real options and 17.65% did not. Most of those that used real options did so because real options provided long term competitive advantage through better decision making. The study concluded oil companies do use real options in evaluating capital expenditure and that there was no correlation between the size of company and use of real options.

# TABLE OF CONTENTS

<b>DECLARATION.....</b>	<b>i</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>ii</b>
<b>DEDICATION.....</b>	<b>iii</b>
<b>ABSTRACT.....</b>	<b>iv</b>
<b>TABLE OF CONTENTS .....</b>	<b>v</b>
<b>LIST OF TABLES .....</b>	<b>vii</b>
<b>ABBREVIATIONS.....</b>	<b>viii</b>
<b>CHAPTER ONE .....</b>	<b>1</b>
1.0 INTRODUCTION.....	1
1.1 BACKGROUND OF THE STUDY .....	1
1.2 STATEMENT OF THE PROBLEM .....	7
1.3 OBJECTIVES OF THE STUDY.....	9
1.4 IMPORTANCE OF THE STUDY.....	9
<b>CHAPTER TWO .....</b>	<b>11</b>
2.0 LITERATURE REVIEW.....	11
2.1 INTRODUCTION.....	11
2.2 REVIEW OF THEORIES .....	11

2.3	EMPIRICAL EVIDENCE .....	17
2.4	CONCLUSION .....	25
<b>CHAPTER THREE .....</b>		<b>27</b>
3.0	RESEARCH METHODOLOGY .....	27
3.1	INTRODUCTION.....	27
3.2	RESEARCH DESIGN .....	27
3.3	POPULATION AND SAMPLE .....	27
3.4	DATA COLLECTION.....	28
3.5	DATA ANALYSIS .....	28
3.6	DATA RELIABILITY AND VALIDITY .....	29
<b>CHAPTER FOUR.....</b>		<b>31</b>
4.0	DATA PRESENTATION, ANALYSIS AND INTERPRETATION.....	31
4.1	INTRODUCTION.....	31
4.2	DATA ANALYSIS .....	31
4.3	SURVEY RESULTS .....	31
<b>CHAPTER FIVE .....</b>		<b>42</b>
5.0	SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....	42
<b>REFERENCES.....</b>		<b>48</b>
<b>APPENDICES.....</b>		<b>53</b>

## LIST OF TABLES

Table 1: Ranking of capital budging techniques.....	33
Table 2: Reasons for using real options.....	34
Table 3: Types of real options used .....	35
Table 4: Method of valuing real options.....	36
Table 5: Reasons for not using real options.....	37
Table 6: Types of capital expenditures .....	38
Table 7: Predictability of environment .....	39
Table 8: Correlation of use of real options to size .....	40
Table 9: Job titles of respondents.....	40



## ABBREVIATIONS

ARR	-	Accounting Rate of Return
AV	-	Abandonment Value
CEO	-	Chief Executive Officer
CFO	-	Chief Financial Officers
DCF	-	Discounted Cash-flows
FDI	-	Foreign Direct Investments
IRR	-	Internal Rate of Return
IT	-	Information Technology
MBA	-	Master of Business Administration Degree Holders
MIRR	-	Modified Internal Rate of Return
MIT	-	Massachusetts Institute of Technology
NPV	-	Net Present Value
NSE	-	Nairobi Stock Exchange
PBP	-	Payback Period
PV	-	Present Value
PVO	-	Present Value at Time Zero
S&P 500	-	Standards & Poor 500 index
SPSS	-	Statistical Package for Social Sciences
US	-	United States of America

# **CHAPTER ONE**

## **1.0 INTRODUCTION**

### **1.1 BACKGROUND OF THE STUDY**

Capital budgeting techniques used in business have been studied extensively by Kadondi (2002), Gitman and Forrester (1977), Graham and Harvey (2001), Block (2005), Brounen, de Jong and Koedijk (2004), Njiru (2008) among others. These studies reveal a trend towards a continuing increase in the use of more sophisticated capital budgeting techniques. However, the topic of real options is not covered or scores very poorly in terms of utilization. For instance in Graham and Harvey (2001) real options came 8<sup>th</sup> among a possible 12 methods used in capital budgeting in a study of 392 US firms. A similar study by Brounen et al (2004) on 313 European CFOs revealed real options coming 8<sup>th</sup> among 13 possible capital budgeting techniques, a result that confirmed the earlier study by Graham and Harvey (2001).

The capital budgeting decision is an important one since the firms' survival and profitability hinges on capital expenditures, especially the major ones (Pandey, 1995). Lynch (2001) looked at the tactics for improving the capital budgeting process to produce results, as a way of maximizing firm's contribution to shareholders' value. He argued that shareholders' value can be increased by improving the capital expenditures process for fixed assets with the caveat that an understanding of the process and a functioning continuous capital budgeting system were prerequisite to improvement activities.

A good capital budgeting system does more than just make accept-reject decisions on individual projects. It must tie into the firm's long range planning process-the process that decides what lines of business the firm concentrates in and sets out plans for financing, production and marketing etc. It must also tie into a procedure for measurement of performance (Brealey & Myers, 2007). Despite the increased usage of the more theoretically sound discounting techniques, several writers in both the UK and USA have claimed that companies are under investing because they misapply or misinterpret DCF techniques. For example Marsh, Barwise, Thomas and Wensley (1988) studied three UK organizations, observing that although all three companies used DCF techniques there were errors in the way it was applied (Drury & Tayles, 1997).

### **1.1.1 REAL OPTIONS: DEFINITION AND BACKGROUND**

In finance, **real options analysis** or **ROA** (not to be confused with return on assets) applies put option and call option valuation techniques to capital budgeting decisions. A **real option** itself is the right, but not the obligation, to undertake some business decision; typically the option to make, abandon, expand, or shrink a capital investment. For example, the opportunity to invest in the expansion of a firm's factory, or alternatively to sell the factory, is a real option (Wikipedia, n.d.). The term was coined by (Myers, 1977) to distinguish them from other financial options. According to him, the value of the firm is made of value of assets already in place and the present value of future growth opportunities:

$$V = V(A) + V(G)$$

Where  $V(A)$  = the market value of assets already in place,- and  
 $V(G)$  = the present value of future investment opportunities.

The usual interpretation is that a positive value of  $V(G)$  reflects future investments which are expected to yield a rate of return in excess of the opportunity cost of capital. However, since the firm may choose not to pursue future investment opportunities,  $V(G)$  is best regarded as the present value of the firm's options to make future investments. The basic distinction being drawn here is between assets whose ultimate value depends on further, discretionary investment by the firm, and assets whose ultimate value does not depend on such investment.

There are different types of real options. These present various flexibilities to management when making investment decisions. The **abandonment option** gives management the option to stop use of the assets and realizing the salvage value. The **Flexibility option** allows management to alter output or input mixes in response to changing conditions. **Entry and exit** is the option to exit an investment activity and re-enter as conditions become more favourable. **Right to defer** is the option of delaying an investment outlay until such a time that the investment is more profitable. **Staged investment** on the other hand allows managers to make investment outlays in successive stages with the right to abandon the project as more information becomes available.

**Growth option** allows increase of the capacity of an existing product line, to expand into new geographical markets or to capitalize on an investment by taking on follow-up projects.

Real Options potentially offer a more efficient way for managers to allocate their firm's capital and maximize shareholder value by leveraging uncertainty and limiting downside risk (Arnold & Shockley, 2003). The presence of real options can make an investment worth more than its conventional DCF value. In their research, Van Putten and Macmillan (2004), Trigeorgis (2005) and others have stressed the importance of treating real options as a component of expanded net present value rather than as a stand-alone approach. The NPV is determined and the value of the real option is added. It is thus possible to have a project that has a negative NPV but a positive total project value because of the presence of the real options. Unlike DCF techniques, real options enable firms to cope with high levels of uncertainty about the upside potential or downside risk of an investment and allow for high levels of flexibility (Baker, Dutta, & Saadi, 2005).

Since the term "real options" was coined, the subject has generated much interest among some finance academics and practitioners (Baker, Dutta, & Saadi, 2005). However the same hype has not been witnessed in the way firms evaluate their investment decisions. Only a handful of firms in the USA and UK adopt this approach. Increasingly, managers in industries characterized by large capital investments and considerable uncertainty and flexibility such as mining, oil and gas, aerospace, pharmaceutical and biotechnology, are

contemplating the use of real options (Baker, Dutta, & Saadi, 2005).

Real options recognize that managers can obtain valuable information after the acceptance of a project and therefore give them the flexibility of incorporating this information in the project. Informed actions can make a critical difference to the overall value of a project. Considering the current economic uncertainties, it is clear that companies that recognize option values and build a degree of flexibility into their investments are likely to be at a significant advantage in the future, relative to companies that fail to take account of options in the design and evaluation of the capital projects.

Survey evidence suggests that most companies have been slow to adopt real options. Out of 392 CFOs surveyed by Graham and Harvey (2001), real options rank 8<sup>th</sup> among 12 capital budgeting techniques considered in their study with almost 27% of the respondents indicating they use the technique always or almost always. Brounen et al. (2004), in a study of 313 CFOs in Europe, had similar results to those of Graham and Harvey (2001), with real options ranking 8<sup>th</sup> at 29.3% of the CFOs using real options always or almost always.

The oil industry is touted as being one of the users of real options in investment evaluation in most studies, Block (2007), Brounen et al (2004) and others. However, in Kenya, there does not seem to be any literature on the utilization of real options despite the presence of the major brands like Royal Dutch Shell, Chevron, and until recently BP

and Mobil. It is in the backdrop of this and the slow takeup of real options as a method of evaluationg investment project that this survey was conducted.

### **1.1.2 THE OIL INDUSTRY IN KENYA**

According to the Petroleum Institute of East Africa (PIEA) website, the main players in the Kenyan oil industry consisted of 9 main player, and 16 smaller registered players who engage in limited oil marketing activities. PIEA was the professional body that governed the industry at the time of the study. It dealt mainly with training and professional education. It was launched on 8th July 1999 in response to a recognized need in the Industry. In the few years before the study, and particularly following liberalization of the Kenyan Petroleum Sector in October 1994, it had increasingly been felt by the Industry's players that the oil industry lacked an organized body which could liaise with the Ministry over Industry policy issues and jointly articulate the Industry's concerns. As the Industry moved from self-regulating to an open and aggressively competitive sector, it became increasingly obvious to all players, including Government, that a level playing field with rules governing all areas of business for all players is essential to safeguard all interests including those of the public.

Total industry volumes in 2009 were 4.1million cubic metres (m<sup>3</sup>) compared to 3.66million in 2008. The volumes have been going up steadily 2.6million in 2003 to 4.105million, a growth of about 58%. However, this growth in volumes has not reflected

in the profitability of most of the oil companies and margins have dwindled to the extent of some of the companies pulling out of some parts of the country and some exiting the market altogether. The situation at the time is what motivated this study with a view to understanding if the industry was incorporating options to abandon, change strategy or better still timing the market in the face of so much unprecedented competition. The study limited itself to senior and junior corporate members of the PIEA.

## **1.2 STATEMENT OF THE PROBLEM**

The valuation of real options (such as to defer, expand, contract, abandon, switch, or otherwise alter a capital investment), by providing a means to properly account for managerial flexibility and strategic considerations, has revolutionized corporate investment decision making.

A corporation's value creation and competitive position are critically determined by resource allocation and the proper evaluation of investment alternatives. At the international level, American companies have been steadily losing their competitive position relative to their Japanese and German counterparts, despite their use of more "powerful" quantitative techniques such as discounted cash flow (DCF) analysis, in recent decades (Trigeorgis, 1995).

Growing numbers of practicing managers and academics are becoming convinced that the standard approaches to corporate resource allocation have failed because they



cannot properly capture managerial flexibility to adapt and revise later decisions in response to unexpected market developments. In a constantly changing and always uncertain world marketplace, managerial operating flexibility and strategic adaptability have become vital in order to successfully capitalize on favourable future investment opportunities and limit losses from adverse market developments. The field of capital budgeting admittedly remained stagnant for several decades until recent developments in real options provided the tools and unlocked the possibilities to revolutionize the field. The insights and techniques derived from option pricing are capable of quantifying the elusive elements of managerial operating flexibility and strategic interactions, which have thus far been ignored or underestimated by conventional net present value (NPV) and other quantitative approaches.

Studies conducted outside Kenya (Brounen et al (2004); Block (2007)) reported the oil industry as one of the few that have adapted real options in capital budgeting. The Kenyan studies conducted on capital budgeting had failed to capture the use of real options. Owing to the limited research on the subject in Kenya's organisations, the study therefore sought to find out what capital budgeting techniques Oil Companies used and whether the companies incorporated real options in their methods of choice. The study sought to fill the knowledge gap existing on the area of capital budgeting and real options at the time; the question being whether management flexibilities were incorporated at the investment appraisal stage and if not what difference made if they were considered as options at the planning stage.

### **1.3 OBJECTIVES OF THE STUDY**

The study was guided by the following objectives: -

1. To determine if the oil companies in Kenya had adopted real options in capital budgeting.
2. To find out reasons for non-use of real options with a view to understanding limitations of application and if being applied, evaluate the impact it had in the corporate setting.

### **1.4 IMPORTANCE OF THE STUDY**

#### **Oil industry**

The study is invaluable to the oil companies' management in that it provides an insight into the various approaches towards capital budgeting process and how real options can be used to incorporate future uncertainties.

#### **The shareholders**

The study provides insights into better methods of maximizing shareholder value through better investment analysis. By not employing the most optimum methods of investment analysis, management is not able to determine the most viable investment opportunities and this may in turn erode shareholder value. Incorporating flexibility in investment analysis also gives an opportunity to amend the project as more information becomes

available or as conditions in the market change.

### **Academicians**

The study contributes to the available literature on the subject of real options. Given the limited number of local studies done on this subject, this study provides invaluable insight for academicians into oil industry specific issues on capital budgeting and more so on the use of real options and reasons if any, for not adopting this very useful tool in investment appraisal.

### **Strategists**

An area of immense importance that benefits from the study is that of competition and strategy. Sustainable competitive advantages resulting from patents, proprietary technologies, ownership of valuable natural resources, managerial capital, reputation or brand name, scale and market power, empower companies with valuable options to grow through future profitable investments and to more effectively respond to unexpected adversity (Brennan & Schwartz, 1985).

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

This chapter summarizes the information from other researchers who have carried out their research in the same field of study. The specific areas covered here are historical development, techniques used, capital budgeting process, real options in capital budgeting and capital budgeting for small and large organizations.

#### **2.2 REVIEW OF THEORIES**

##### **2.2.1 IRVING FISHER'S THEORY OF INTEREST RATES**

Fisher (1930) advanced the *Theory of Interest* in which he postulated that NPV is the key part in theory of optimal resource allocation. Fisher called interest “an index of a community’s preference for a dollar of present income over a dollar of future income.” He labelled his theory of interest the “impatience and opportunity” theory. Interest rates, Fisher postulated, result from the interaction of two forces: the “time preference” people have for capital now and the investment opportunity principle (that income invested now will yield greater income in the future). The interest rate, or what is called cost of Capital, forms the basis of the Internal Rate of Return (IRR) defined as the discount rate that will equate the present value of future cash flows to the resources employed now.

Fisher (1930) defined capital as any asset that produces a flow of income over time. A

flow of income is distinct from the stock of capital that generated it, although the two are linked by the interest rate. Specifically, wrote Fisher, the value of capital is the present value of the flow of (net) income that the asset generates.

During the 1930s through to the 1950s, large non-owner managed firms put in place capital budgeting control systems that identified planned capital investments going forward. The size of non financial investments and the number of non owner managed firms increased during the industrial revolution. These simultaneous changes created fertile ground for use of more sophisticated evaluation techniques and for the capital budgeting processes in use today (Chapman & Hopwood, 2007).

During the 1950s, practicing financial controllers began to network with each other, with consultants and with academicians to develop models for capital budgeting (Chapman & Hopwood, 2007). Dean (1951), in his book *Capital Budgeting*, advanced the implementation of Discounted Cashflows (DCF) methodology in its current form.

Managers are required to maximize return on investment at a given level of risk. However capital budgeting models only consider the return on investment. As a result, managers don't usually have all the information to make the right decisions as far as risk is concerned. To address this flaw, Hertz (1964) provided a discussion on how computer simulation can be used to provide managers with a measure of risk on a capital Investment Project.

The internal rate of return (IRR) and the net present value (NPV) have long been the

accepted capital budgeting measures preferred by corporate management and financial theorists, respectively. Notwithstanding impressive advances in the theory of finance over the past 2 decades, practical procedures for capital budgeting have evolved only slowly. The standard technique, which has remained unchanged in essentials since it was originally proposed Dean (1951), derives from a simple adaptation of the Fisher (1907) model of valuation under certainty: under this technique, expected cash flows from an investment project are discounted at a rate deemed appropriate to their risk, and the resulting present value is compared with the cost of the project. This standard textbook technique reflects modern theoretical developments only insofar as estimates of the discount rate may be obtained from crude application of single period asset pricing theory. The inadequacy of this approach to capital budgeting is widely acknowledged, although not widely discussed (Brennan & Schwartz, 1985).

### **2.2.2 OPTION PRICING THEORY**

Option pricing theory, developed by Black, Scholes and Merton (1973) and Cox and Ross (1976) introduced the concept of pricing securities by arbitrage methods. Since the option is valued relative to the underlying asset (and can in principle be replicated synthetically), it has the same value in the actual world as in a risk-neutral environment. The expected value of the option at maturity, under the risk-neutral probability distribution, can then be discounted at the risk-free rate to obtain the current value of the option. If the market is complete the risk-neutral distribution is unique and can be obtained simply by replacing the actual (true) expected rate of return on the underlying

asset by the risk-free rate of return.

### **2.2.3 REAL OPTIONS THEORY**

Real options revolution arose in part as a response to the dissatisfaction of corporate practitioners, strategists, and some academics with traditional capital budgeting techniques. Well before the development of real options, corporate managers and strategists were grappling intuitively with the elusive elements of managerial operating flexibility and strategic interactions (Schwartz & Trigeorgis, 2000).

To differentiate the options on real assets from the financial options traded in the market, Myers coined the term “real options” that has been widely accepted in academic and industry world. Myers (1977) first observed that future investment by corporations is discretionary, and thus is analogous to a financial option, where an investor holds a claim to buy or sell an underlying financial asset at a potentially favourable price, and has the right to make this trade only if it will in fact be profitable. He used the term “real options” to emphasize that investment opportunities are (or involve) options on real assets, as opposed to financial assets.

Since the derivation of the first quantitative models by Black, Scholes and Merton (1973) on valuation of options, several seminal papers gave a boost to the real options literature by focusing on valuing quantitatively a variety of real options, although each option was typically analyzed in isolation. The option to defer or initiate investment has been

examined by Paddock, Siegel and Smith, (1988) in valuing offshore petroleum leases. Majd & Pindyck (1987) valued the option to delay sequential construction for projects that take time to build. The option to temporarily shut down and restart operations was analyzed by Brennan and Schwartz (1985) and Macdonald and Siegel (1986).

In their paper, Robichek and Van Horne (1967) examined the importance of abandonment value to capital budgeting, analyzed how it can affect a project's expected return and risk and proposed a framework for dealing with abandonment value. They developed a simulation method for incorporating the effects of abandonment into information provided for investment decision. They noted that routine consideration of the abandonment option reduces the potential for down side movement in value. Using the option-pricing they have shown that an asset payoff is bonded from below when the abandonment option is explicitly considered. Their approach emphasizes the reduction of the potential losses as opposed to risk and the increase in firm value implied by the abandonment option is more obvious. According to them, the abandonment value is the value of the abandonment option and its worth should be included in the calculation of the present value of the future cash inflows. The calculations of the present value at time zero (PVO), provide the market valuation at such a point in time. As time passes, conditions, either endogenous or exogenous to the firm, will change the present value of an asset. Thus the present value of future cash flows of the same asset will be different at any given point in time. The question of whether to abandon and the decision process of the optimal timing of abandonment have been considered. They suggest that a policy of



abandoning an asset one period after abandonment value becomes greater than the present value ( $AV > PV$ ) would benefit the firm.

They considered investment in a mine when mothballing can occur by incurring maintenance cost and costless abandonment of the mine is possible. They found that it is optimal to close the mine only when the output price has fallen considerably below production cost, and conversely, it's not optimal to re-open a mothballed mine even when the output price rises, well above the production costs. Thus, there is a range of value of output prices over which it is optimal to produce. This phenomenon, that is a consequence of the interaction of sunk costs and uncertainty, is referred to in economic literature as hysteresis.

On their part, Myers and Majd (1990) calculated the value of the option to permanently abandon a project for its salvage value. They showed that, other things held constant, the value of the abandonment option increases with salvage value (the exercise price), project volatility, and project life (maturity) while it decreases with project value, as predicted by put-option pricing theory.

The advantages of viewing investment opportunities as options are twofold. First, there are several well-known insights about options that provide us with new perspectives when evaluating investment opportunities, such as the fact that options may become more valuable if the volatility of the underlying asset increases. Second, analytic techniques have been developed for valuing options that are superior to using a standard DCF approach. These techniques result in better evaluation of corporate investments with

embedded options, and more accurate valuation of the securities of corporations that have such projects.

### **2.3 EMPIRICAL EVIDENCE**

Graham and Harvey (2001) sought to find out how chief finance officers (CFOs) make capital budgeting decisions and identify areas where theory and practice are consistent. They asked CFOs to rate how frequently they used different capital budgeting techniques on a scale. The sample consisted of 4440 US firms. The survey was conducted by way of questionnaires sent by mail and fax. A total of 392 CFOs responded to the survey. They reported results by summarizing the percentage of CFOs who said that they always or almost always used a particular capital budgeting evaluation technique.

The study found that NPV and IRR were the most frequently used capital budgeting techniques, 74.9% of CFOs always or almost always used NPV, 75.7% almost or always used IRR while 56.9% of CFOs used hurdle rate. They also found out that companies that pay dividends were significantly more likely to use NPV and IRR than firms that do not pay dividends regardless of firm size. Public companies were found to be more likely to use NPV and IRR than private companies. Other than NPV, IRR and the hurdle rate, the payback period was the most frequently used capital budgeting technique (56.7% always or almost used use this technique). This was found surprising because finance textbooks have lamented shortcomings of payback criterion for decades. The choice of evaluation technique was found to be linked to firm size and executive characteristics. They also observed that payback period method is used by less sophisticated, older managers

without MBAs. Real options came a measly 8<sup>th</sup> among 12 techniques.

In their work, Holmén and Pramborg (2009) investigated Swedish firms' use of capital budgeting techniques for foreign direct investments (FDI). Questionnaires were sent to the CFOs of the Swedish firms that had responded to a survey from the Swedish central bank (Riksbanken) in the spring of 2003, regarding how much FDI the firm had invested as of December 2002. A total of 497 firms met the criteria and 200 responded.

They surveyed to what extent firms actually use pre-investment strategies to manage political risks. They focused the analysis on whether firms were more likely to use the Payback method instead of the theoretically correct NPV method when the risk of expropriation was perceived to be high.

They concluded that in the presence of political risks, managers are reluctant to rely on the traditional NPV method and suggest this is due to the fact that they find it difficult to take such risks into account. This is consistent with managers being bounded rational decision makers, using simple rules of thumb when the deliberation cost is high. Further, the results are consistent with the notion that the rules of thumb are adjusted to proxy optimal decision as far as possible.

Grinstein and Tolkowsky (2004) carried out a Survey to determine the role of the board of directors in capital budgeting process. The study was carried out in the United States of America. The sample consisted of "S&P 500" firms and covered the period from 1995 to 2000. Their final sample consisted of 2,262 firms after excluding financial institutions

due to their special governance regulations and requirements and a further 292 firms for whose proxy statement information was not obtained.

They used several financial and governance variables to characterize what determines the establishment of the capital budgeting committees which included firm size, board structure and the ratio of number of independent directors to total number of directors. They used both univariate and multivariate data analysis methods in their survey. The findings were that 17% of the boards of directors of the sampled firms disclosed that they establish committees that have a capital budgeting role. The study revealed that boards of directors have four main roles in capital budgeting. These roles include reviewing of; annual budgets, large capital expenditure requests, merger and acquisition proposals and performance of approved projects. They found that committees that review budgets and capital expenditure requests perform a monitoring role which is consistent with existing theories. They also found that boards are more likely to establish special committees to perform these tasks where the auditing costs are low and when the overinvestment problem is severe. Some committees have an advisory role in capital budgeting process. The main finding of the study was that boards of directors have a dual role in capital budgeting process, that is the disciplinary role and the advisory role.

Pradeep and Quesada (2008), in a study on the use of capital budgeting techniques in businesses in the Western Cape Province of South Africa, investigated a number of variables and associations relating to capital budgeting practices. The sample consisted of 600 firms but only 211 interviews were conducted successfully giving a response rate of

35%. A descriptive approach to the research finding was adopted. Chi-square test technique was used to measure association between variables. Data analysis was carried out using SPSS software.

The results revealed that payback period followed by NPV appear to be the most used method across the different sizes and sectors of businesses. 39% of respondents used Payback period technique while 36% used NPV. 28% of respondents used internal rate of return and profitability index. 22% of respondents used accounting rate of return (ARR) while 10% did not use any capital budgeting technique. The study also revealed that 64% of the business surveyed used only one method of capital budgeting while 32% used between two and three different techniques to evaluate capital budgeting decisions. The more complicated methods such as NPV and IRR were favoured by large businesses compared to small businesses.

The study did not incorporate use of real options and therefore did not draw any conclusions on their use.

Gervais (2009) surveyed the literature on the effects of behavioural biases on capital budgeting. A large body of the psychology literature finds that people tend to be overconfident and overly optimistic. Because of self-selection, firm managers tend to be even more affected by these biases than the general population. Indeed, the literature finds that biased managers overinvest their firm's free cash flows, initiate too many mergers, start more firms and more novel projects, and tend to stick with unprofitable investment policies longer. Corrective measures to reduce the effects of the

managers' biases include learning, inflated discount rates, and contractual incentives, but their effectiveness in curbing overinvestment appears to be limited.

Block (2005) carried out a study on the use of capital budgeting procedures between industries. He stated that while it is easy to state that the use of capital budgeting analysis has become more sophisticated over the decades, the question remains as to whether different industries have followed the same pattern. He conducted a survey comprising of three hundred and two (202) *Fortune* 1000 companies and organized them along industry lines. Chi-square independence of classification tests indicated that a null hypothesis of no significant relationship between industry classification and capital budgeting procedures could be rejected in a number of decision-making areas including goal setting, rates of return, and portfolio considerations.

Uddin and Chowdhury (2009) sought to find out whether the capital budgeting theory of large business is well applicable for the small businesses or not. They suggested that if it is not, then further development of theory becomes necessary. They found that there is no well accepted standard definition of small business in the literature that can be used to create the basis of applying the theory of capital budgeting. It is possible to say that the theory of capital budgeting, which is constructed under assumptions related to large incorporated businesses, is not fully applicable for small businesses. Moreover, market determined discount rate is not possible to find since the market for small business's capital is not liquid, which does not allow thinking about separation of investment and financing decision. Also, the effect of agency conflict, when it is present, on the

investment decision, is different for small businesses because of lack of separating ownership and control. They found that the reasons for the inapplicability were lack of knowledge, cost of hiring outside consultants, low priority of planning, size and availability of capital, size and availability of investment opportunities, tendency of high reliance on easy techniques like payback period, short operating history, credit constraints, difficulties in quantifying future cash flow, and limited discretionary alternatives for investments.

Block (2007) sought to find out if real options are actually used in the real world. He used the Fortune 1000 as the initial database of study. Out of 279 respondents, 40 indicated that they used real options in their capital budgeting. Out of the 40, 18 indicated major utilization, 13 used real options as a supplemental tool and 9 used it to shadow other capital budgeting techniques. 239 out of the 279 respondents indicated they did not use real options in capital budgeting. Main reasons given for non-use were lack of top management support, discounted cash flow being a proven method and therefore preferred, real options require a high degree of sophistication and that real options tend to encourage excessive risk-taking.

In their work, Triantis and Borison (2001) found that users of real options tended to come from certain industries. They found that users of real options came primarily from technology (13), Energy (11), utilities (6) and the rest from other similar segments of the economy where sophisticated analysis is the norm.

Brounen et al (2004) found that real options were rarely used. In a study of 313

firms drawn from UK, Netherlands, Germany and France, they found that real options ranked 8<sup>th</sup> from a list of 13 possible capital budgeting techniques. This study confirmed the results of a study carried out by Graham and Harvey (2001) on American companies in which study real options ranked 8<sup>th</sup> among 12 possible capital budgeting techniques.

In a study of Canadian firms, Bennouna et al (2010) found a similar low usage of real options. They conducted a study of 88 Canadian firms out of which 94.2% were found to use NPV, 87.7% used IRR, 78.5% still used payback period, 8% used real options and 17 out of the total number did not respond. This result concurs with previous ones carried out in the US and Europe.

In her study, Kadondi (2002) carried out a survey on capital budgeting techniques used by companies listed at Nairobi Stock Exchange (NSE). The objectives were to document the capital budgeting techniques used in investment appraisal by corporations in Kenya, to determine whether the techniques used conform to theory and practices of organizations in developed countries and to determine how firms and CEO characteristics influence the use of a particular technique.

She intended to conduct the study on 54 Companies listed at the NSE but the analysis included only 43 Companies whose annual reports and accounts were available. Of these, only 28 Companies responded of which 50% were small companies and 50% large companies. The findings of the study were that 31% of the companies used Payback Period method, 27% use NPV while 23% uses IRR. According 71% of respondents, their companies considered capital budgeting process a strategy for achieving



competitive edge advantage. Another finding of the study was that small companies use IRR and Payback Methods while large Companies with high net profit margins use NPV, IRR and Payback Period methods. This study is consistent with the survey done by Graham and Harvey (2001) who found that large firms favoured the sophisticated techniques of capital budgeting while the smaller firms favoured the traditional methods of payback and ARR.

Njiru (2008) wanted to identify the most commonly used capital investment appraisal technique by commercial parastatals and determine the factors that influence the choice of capital investment appraisal technique used. His study covered all commercial parastatals with headquarters in Nairobi and was for the period of 5 years between 2003 and 2008. The analysis revealed that on average, the annual size of capital budget is 1.4% of the total asset base of the organizations studied. This implies a low intensive capital investment during the study period (2003-2008). The study also found that all the parastatals had a capital investment policy. The results showed that incorporating risk, determination of the appropriate discount rate and incorporating inflation in the capital investment analysis were the three main challenges that parastatals faced in the capital investment appraisal process.

According to the study, the three main capital investment appraisal techniques used by commercial parastatals are IRR (65%), NPV (25%) and pay-back period technique (10%). The amount of funds required for the capital investment, size of the organization, government policy and industrial practices are the main factors that influence the choice

of the capital investment appraisal technique. Further the study found that 75% of the respondents preferred discounted cashflow (DCF), 10% non-discounted cashflow (DCF) technique whereas 15% did not respond.

Oyaro (2009) studied the capital budgeting techniques for insurance companies in Kenya. Her study reviewed that the DCF methods were preferred to the simpler methods like IRR, ARR and Payback period. This is still consistent with other studies conducted by Kadondi (2002) and Njiru (2008).

## **2.4 CONCLUSION**

Most corporate investment opportunities involve a sequence of managerial decisions over time. Each decision is made based on information available at the time, but also should take into consideration future decisions under a range of scenarios. A research and development (R&D) project in a pharmaceutical company, for instance, requires periodic investment to be sustained. Whether additional investment will be made at a particular stage depends on the outcome of scientific research to date, updated information on the potential size of the market for the drug, and consideration of the flexibility to accelerate, ramp down or even cancel the project at a future date (Triantis A. , 2003).

Most of the studies above concluded that DCF techniques had become the most popular techniques in making capital budgeting decisions. Nevertheless, rule of thumb techniques continued to enjoy substantial use. In the decade or so before this study real options had been growing in importance but the use has been very rare. A lot of academic literature

developed and studies carried out to confirm the application of the theory in real life. Most of the studies conducted indicated a very low uptake of real options in real practice. At the time of this study, no study had been conducted on the application of real options in Kenya. This was not surprising given the complexities involved in valuation of real options. However, given that the same was being applied in other regions of the world, there was need to conduct research as to the awareness and usage of real options as a tool of incorporating uncertainties in capital budgeting decisions. Thus this study was conducted to help understand the reasons as to the slow uptake if any and also contribute to the growing literature on the subject.

## **CHAPTER THREE**

### **3.0 RESEARCH METHODOLOGY**

#### **3.1 INTRODUCTION**

This chapter comprises of the research design, description of data collection instruments, description of data analysis procedures and data reliability and validity.

#### **3.2 RESEARCH DESIGN**

The study used the survey method conducted on all the Oil Companies in Kenya that were members of the Petroleum Institute of East Africa. An exploratory survey was used in carrying out this study. According to Cooper and Schindler (2003), exploratory design aims at determining the ‘why’ phenomena. The survey method was preferred for this type of study as it enables the sampling of different characteristics exhibited by the members of the defined population.

#### **3.3 POPULATION AND SAMPLE**

The population of interest of this study covered the oil companies who were members of the Petroleum Institute of East Africa at the time. According to the website there were 25 corporate members divided into 9 Senior Corporate Members and 16 junior corporate members. The population consisted of 25 Chief Finance Officers (CFOs) or their equivalents, each representing the 25 oil companies.

### **3.4 DATA COLLECTION**

The research drew its data from primary sources using structured questionnaire. Self-administered drop and pick questionnaires were distributed among sampled employees.

The study being a survey meant that one (1) employee was selected from each of the 25 oil companies and administered with the questionnaire. The staff included were finance managers, heads of finance or their equivalent and those directly involved in capital expenditure. Structured questions were used as the main data collection instrument. The questionnaires employed both open and close-ended questions. The close-ended questions provided more structured responses to facilitate tangible recommendations. The open-ended questions provided additional information that may not have been captured in the close-ended questions.

Secondary data sources were employed through the use of previous documents or materials to supplement the data received from questionnaires.

### **3.5 DATA ANALYSIS**

Before processing the responses, the completed questionnaires were edited for completeness and consistency. Data was captured and analyzed using Statistical Package for the Social Sciences (SPSS). The data was then coded to enable the responses to be grouped into various categories. Descriptive statistics were used to summarize the data. These include percentages and frequencies. Tables and other graphical presentations as

appropriate were used to present the data collected for ease of understanding and analysis.

In determining the factors, the study used factor analysis method. The factors were tested in the questionnaire using like scale. This is the most frequently used variation of the summated rating scale. Summated scales consist of statements that express either a favourable or unfavourable attitude towards an object of interest. Each response was given a numerical score to reflect its degree of attitudinal favourableness and the scores was totalled to measure respondents' attitude (Cooper & Schindler, 2003).

### **3.6 DATA RELIABILITY AND VALIDITY**

The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable. Kirk and Miller (1986) identify three types of reliability referred to in quantitative research, which relate to: (1) the degree to which a measurement, given repeatedly, remains the same (2) the stability of a measurement over time; and (3) the similarity of measurements within a given time period. Charles (1995) adheres to the notions that consistency with which questionnaire items are answered or individual's scores remain relatively the same can be determined through the test-retest method at two different times. One way to address the issue of reliability is to use the Cronbach's alpha which correlates performance on each item with overall score .The results will be numbered as the questionnaires are sent out and then grouped into two groups to

measure the score for each group. From the two groups, the results will be evaluated for internal consistency. Due to time constraints while undertaking the study it will be difficult to repeat the questionnaires to determine repeatability of the study, however, some of the questions in the questionnaires will be repeated with slight changes in the wording to evaluate the repeatability of the study.

Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. Wainer and Braun (1988) describe the validity in quantitative research as “construct validity”. The construct is the initial concept, notion, question or hypothesis that determines which data is to be gathered and how it is to be gathered.

## **CHAPTER FOUR**

### **4.0 DATA PRESENTATION, ANALYSIS AND INTERPRETATION**

#### **4.1 INTRODUCTION**

This chapter presents the findings of the data collected through the use of questionnaires. It covers data analysis and findings. The information is presented and discussed in relation to the objectives and research questions investigated in this study.

#### **4.2 DATA ANALYSIS**

The data was analyzed using frequencies and percentages. Frequencies and percentages were used to analyse the general information. The 4-point and 6-point rating scales were used for different questions. The 4-point scale ranged from Never (1) to Always (4) to measure the extent of application of variable being measured and None (1) to High (4) in questions where the respondent was asking to state reasons. The 6-point scale ranged from Never Predictable to Always predictable in a question where the respondents were asked to rate how predictable their market was. The 6-point was also used in a question where the respondents needed to rate how often they obtained certain information from the capital budgeting system. This ranged from Never (1) and Very Often (6).

#### **4.3 SURVEY RESULTS**

The survey used drop and pick method of data collection through a questionnaire containing 22 questions. 18 of the questions were to gauge application of real options



and the other 4 to collect data on the characteristics of the companies responding to the questionnaire. It is important to note that the researcher had no way of verifying whether the responses given coincided with actions but had no reason to believe otherwise.

Seventeen (17) out of a possible 25 questionnaires were received giving a response rate of 68%. This is higher than that obtained by Block (2007) at 27.1%.

#### **4.3.2 USE OF REAL OPTIONS**

In response to the question “Does your company use real options in making capital budgeting decisions?” the results show that 17.65% respondents answered “No” and 82.35% responded “Yes”. Thus, 14 of the 17 survey respondents use real options. Although Block, (2007) had a 14.3% result on the use of real options, he studied Fortune 1000 firms from all sectors and not just the oil industry.

This result was not surprising given that the oil industry (Energy) was touted as one of the few using real options. Out of the 40 users of real options in Block, (2007) study, 37 represented: technology (13), energy (11), utilities (6), health care (4) and manufacturing (3). The result is therefore in line with these earlier findings.

#### **4.3.3 RANKING OF CAPITAL BUDGETING TECHNIQUES**

To gauge the relative popularity of real options compared with other capital budgeting techniques, the researcher asked the respondents how frequently their firms used each of seven methods when deciding which projects or acquisitions to pursue on a four-point

scale, from 1 = never to 4 = always. As Table I shows, the respondents ranked Profitability Index, Payback Period and Real Options as their three most frequently used capital budgeting techniques. IRR came 4<sup>th</sup> with a mean score of 3.06 and Net Present Value came 4<sup>th</sup> with a mean of 2.94, same as the Accounting Rate of Return. MIRR came last with a mean score of 2.06.

**Table 1: Ranking of capital budging techniques**

	Frequency					Mean
	n	Never(1)	Almost Never(2)	Almost Always(3)	Always (4)	
Real Options	17	1	2	7	7	3.18
Net Present	17	1	2	11	3	2.94
IRR	17	1	1	11	4	3.06
MIRR	17	5	6	6	0	2.06
Profitability	17	1	1	6	9	3.35
Payback	17	0	3	5	9	3.35
Accounting	17	1	3	9	4	2.94

Source: Research data

#### **4.3.4 WHY THE COMPANIES USE REAL OPTIONS**

To find out the reasons why those companies that use real options do so, the researcher asked the respondents to indicate the importance of each of six reasons. The researcher used a 4-scale ranking with None =1, Some =2, Moderate = 3 and High =4. As Table 2

shows the reason with the highest importance is that real options provide long term competitive edge through better decision making, followed by the fact that real options provide an analytical tool to deal with uncertainty. The reasons with the lowest importance are that real options complement traditional capital budgeting techniques and that they provide a way of thinking about uncertainty and its effects on valuation over time. The results are as shown in table 2 below:

**Table 2: Reasons for using real options**

	Frequency					Mean
	N	None	Some	Moderate	High	
Incorporate Managerial Flexibility into the analysis	14	0	1	8	5	3.29
Complements Traditional CB techniques	14	0	5	4	5	3.00
Provides Long term competitive through better decision making	14	0	0	4	10	3.71
Provides an analytical tool to deal with uncertainty	14	0	1	7	6	3.36
Provides a way of thinking about uncertainty and its effects on valuation over time	14	0	3	8	3	3.00
Provides a management tool to help form the Strategic vision	14	0	0	10	4	3.29

Source: Research Data

#### 4.3.5 TYPES OF REAL OPTIONS USED

The researcher sought to know what types of real options were in use by those that

indicated they used real options. Respondents were asked to indicate how frequently their company used each of six (6) real options commonly discussed in finance literature: flexibility, entry and exit, right to defer, staged investment and growth options. The three most used options were flexibility, growth and right to defer (Mean = 3.57, 3.50, 3.29) in that order. Entry and exit and staged investment were used equally frequently with mean of 3.21. Abandonment was the least used option with a mean score of 2.79.

**Table 3: Types of real options used**

	Mean	Mode	Standard Deviation	Count
<i>Abandonment</i>	2.79	4	1.25	14
<i>Flexibility</i>	3.57	4	0.51	14
<i>Entry and Exit</i>	3.21	4	1.12	14
<i>Right to defer</i>	3.29	4	0.91	14
<i>Staged Investment</i>	3.21	3	0.70	14
<i>Growth</i>	3.50	4	0.94	14

Source: Research Data

#### **4.3.6 METHOD OF VALUING REAL OPTIONS**

In order to determine what methods the respondents used to value real options, the researcher asked them to indicate the extent the company used each of 4 possible methods of valuation: binomial lattices, risk adjusted decision trees, Monte Carlo simulation and Black-Scholes option pricing model. These choices were previously used by Triantis and Borison, (2001). The respondents were asked to indicate how often the

respective method was used on a scale of Never =1, Almost Never =2, Almost Always = 3 and Always =4. The results showed that risk-adjusted decision trees and Monte Carlo simulation were the two most popular methods at mean scores of 2.87 and 2.38 respectively. Black-Scholes option pricing model and binomial lattices were the least popular among the respondents with a mean of 1.50 and 1.77 respectively. The results are tabulated in Table 4 below.

**Table 4: Method of valuing real options**

	N	Mean	Mode	Standard Deviation
<i>Binomial Lattices</i>	14	1.50	1	0.94
<i>Risk-adjusted Decision trees</i>	13	3.00	3	0.91
<i>Monte Carlo simulation</i>	12	2.50	2	1.09
<i>Black-scholes</i>	12	1.83	1	0.83

Source: Research Data

#### **4.3.7 REASONS FOR NOT USING REAL OPTIONS**

To understand reasons behind non-use of real options, the researcher included a question asking those that did not use real options to indicate the importance of each of 8 reasons on a scale None=1, Some =2, Moderate =3 and High =4. The dominant reason for not using real options is lack of applicability to specific business (mean = 3.33), followed by the fact that real options valuation requires unrealistic assumptions at a mean of 3.00. The least important reason according to the results is that real options do not help managers

make better decisions. This result is surprising, given that real options are meant to be an improvement to the traditional capital budgeting techniques. It is possible that the non-users of real options responding to this questionnaire were not aware of real options and their application to capital budgeting. The results are presented in Table 5 below.

**Table 5: Reasons for not using real options**

	Count	Mean	Mode	Standard Deviation
<i>Lack of expertise or knowledge</i>	3	2.33	2	0.58
<i>Lack of applicability to our business</i>	3	3.33	3	0.58
<i>Too complex to apply in practice</i>	3	2.33	2	0.58
<i>Difficulty in estimating inputs</i>	3	2.33	3	1.15
<i>Requires unrealistic assumptions</i>	3	3.00	N/A	1.00
<i>Does not help managers make better decisions</i>	3	1.33	1	0.58
<i>Limited Support real world applicability</i>	3	1.67	1	1.15
<i>Requires many internal resources</i>	3	2.33	N/A	1.53

Source: Research data

#### **4.3.8 TYPES OF CAPITAL EXPENDITURES**

To gain insight into the kind of capital expenditures incurred by the respondent companies, the researcher included a question requiring them to indicate the proportion of the total capital expenditures made in the last 5 years, classified into replacement, expansion of existing operations or new operations. Most of the respondent companies engaged in expansion of existing operations with a mean of 53% of total capital expenditures, followed by new projects at a mean of 36%. Most of the responding

companies engaged very little in replacement projects.

**Table 6: Types of capital expenditures**

	Count	Mean	Mode	Standard Deviation
<i>Replacement</i>	17	10%	0%	9%
<i>Expansion - existing</i>	17	53%	40%	15%
<i>Expansion - New</i>	17	36%	30%	15%

Source: Research data

#### **4.3.9 PREDICTABILITY OF THE ENVIRONMENT**

To gain more insight into the kind of environment the respondents operated in the researcher asked them to rate how predictable their companies' environment was. The researcher used a scale of 6 ranging from Never predictable=1 and Always predictable =6. A score of 1 or 2 meant the environment was very unpredictable, a score of 3 or 4 meant the environment was moderately predictable and a score of 5 or 6 meant the environment was very predictable. They were expected to score various environmental issues, including supplier actions, competition, macro-economic factors like inflation and government regulations. The question was meant to help the researcher understand the level of uncertainty in the market in which the companies operated. The results showed that supplier actions, customer preferences and technology were relatively predicable.

Competitor actions, government regulations and trade union actions were relatively unpredictable.

**Table 7: Predictability of environment**

	Count	Mean	Mode	Standard Deviation
<i>Supplier Action</i>	17	4.53	5	0.94
<i>Competitor Action</i>	17	4.82	4	1.01
<i>Customer Preferences</i>	17	5.12	5	0.78
<i>Capital Market behavior</i>	17	4.88	6	1.36
<i>Government regulations</i>	17	3.88	3	1.32
<i>Trade Unions Actions</i>	17	3.24	3	1.20
<i>Technology</i>	17	4.82	5	0.88

Source: Research data

#### **4.3.10 CHARACTERISTICS OF THE RESPONDENT COMPANIES**

The researcher included some questions to give an indication of the characteristics of the responding companies. Most of the companies freely gave the indicative numbers of staff in the organization but were reluctant to give information on their net assets and sales revenue. Due to this, the researcher could only use the number of staff to give an indication of the size of company. Other data on net assets and sales revenues could not be compared and was therefore ignored.



To test for correlation between the size of the company (represented by the number of employees) and use of real options, the researcher did a correlation analysis. There seemed to be very slight negative correlation but the correlation coefficient was tending towards zero (-0.16). The researcher concluded there was no correlation between the size of company and use of real options. The result is shown in Table 8.

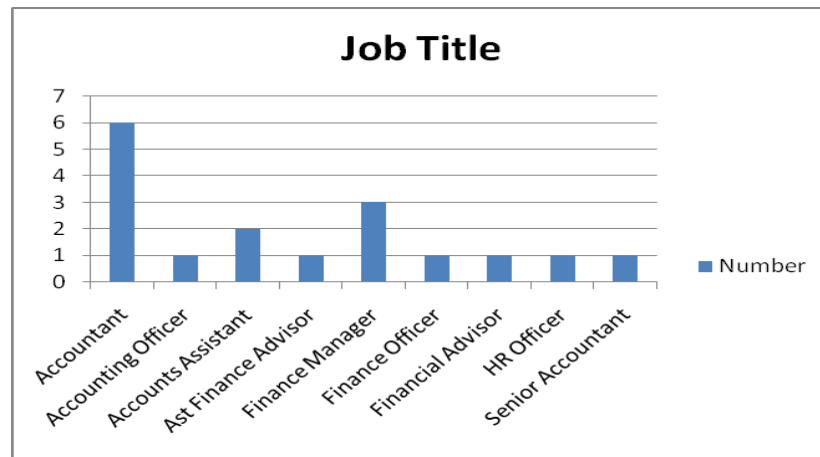
**Table 8: Correlation of use of real options to size**

	<i>Use RO?</i>	<i>No. of Employees</i>
Use RO?	1.00	
No. of Employees	(0.16)	1.00

Source: Research data

To gauge the level of staff involved in capital budgeting, the researcher included a question asking the respondents to indicate their job titles. The result is presented in the chart below:

**Table 9: Job titles of respondents**



Source: Research data

The most common titles were accountant, accounts assistant and finance manager. The researcher did not have a way of verifying whether the use of the different titles could be a way of referring to the same position in different companies. It is possible that different companies used different titles for a similar position or one doing a similar job.

## **CHAPTER FIVE**

### **5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 INTRODUCTION**

This chapter discusses the findings of the research and draws conclusions from the major findings. The main objective of the study was to determine whether oil companies in Kenya applied real options in capital budgeting. The primary data was collected using a questionnaire that was administered through “drop and pick” method to the respective respondents. A total of 17 questionnaires from a possible 25 were received back from the respondents.

#### **5.2 SUMMARY OF FINDINGS AND CONCLUSIONS**

The results indicate that most of the oil companies use real options as part of capital budgeting. Triantis and Borison, (2001) found that there were tendencies among those using real options to come from certain industries. The energy sector, in which oil companies in Kenya fall, is one such industry. Block, 2007 found that from among the 40 companies that used real options, 11 came from the energy sector among others. Given this scenario, the result of this study therefore is consistent with these findings as the study targeted oil companies.

The results show that real options is one the four most popular capital budgeting techniques together with profitability index, IRR and payback period. The results are almost similar to those obtained by Baker, et al (2005) with the exception that the

responding managers in their study ranked net present value (NPV), internal rate of return (IRR), and payback as their three most frequently used capital budgeting techniques.

The results reveal that the most important reasons why oil companies in Kenya use real options are that they provide long term competitive edge through better decision making and that they provide an analytical tool to deal with uncertainty. According to Amran and Kulatilaka, (1999), the real options approach creates links between project level analyses of strategic investments and the corporate strategic vision. This is however contrary to the findings of Baker, et al (2005). In their research, the reason that real options provide long term competitive edge through better decision making came last among the six reasons given. They argued that the option to delay investment accrues some benefits.

According to the results, the fact that real options complement traditional methods is not as important. This is inconsistent with Van Putten and Macmillan (2004), Trigeorgis, (1995) and others whose research stressed the importance of treating real options as a component of expanded NPV rather than a stand-alone approach.

The results indicate that the most used real options are flexibility, growth and right to defer with abandonment being the least used. The results are consistent with those of Baker, et al (2005). According to their study, in decreasing order of usage, the percentage of respondents indicating that their firms use these options was growth (85%), right to defer (80%) and flexibility (77%).

According to the results, non-users of real options indicate that the two most

important reasons for non-use are lack of applicability to business and that real options require unrealistic assumptions. In practice, real options valuation is not easy because it requires a high degree of mathematical sophistication. Also, users need to have a healthy respect for the difficulties and limitations of analyzing real options. Thus, concerns about such issues as estimating inputs, requiring unrealistic assumptions, and needing many internal resources are important.

The results show that the oil industry operates in a relatively predictable environment in terms of customer preferences, capital market activities, and technology and supplier action. The result also indicate that there is no correlation between the size of the company (using by the number of staff as proxy) and whether or not the company used real options in capital budgeting.

The study concluded that oil companies in Kenya do use real options in evaluating capital expenditure and that real options ranked among the most popular capital budgeting techniques applied by these companies. The study also concluded that there was no correlation between the size of company and use of real options. Most of those that used real options did so because real options provided long term competitive advantage through better decision making. The most used real options were flexibility, growth and right to defer. Those that did not use real option did not do so because they felt that real options required unrealistic inputs and that that they had little applicability to their companies.

### **5.3 LIMITATIONS OF THE STUDY**

Several aspects of this research place limitations on the outcomes and may bias the results. First, non-response bias is potentially an issue with surveys. Because confidential information was sought, identifying respondents and firms was avoided in order to maximize response rate. However, it is still possible that information provided on the size of the firm may be misleading.

Second, the research was limited to a small population of 25 oil companies based on the PIEA database. This database may or may not be exhaustive.

Third, the study relied on a traditional survey method. This did have the advantage of facilitating comparison with previous studies that relied on a similar method, but a more novel approach could have been used.

Forth, the focus of this study was on selected aspects of capital budgeting. Successful use of real options is one of the many decisive factors leading to successful capital investment. Other capital budgeting phases (for example, generating investment ideas) are important.

Finally, this study, and much of the capital budgeting literature, assumes that managers make rational decisions, carefully using logical, proven techniques. It may well be that other dynamics are at play. The vast literature on more general managerial decision

making demonstrates that this may be the case and that many decisions in a complex, fast paced environment are made on intuitive and pragmatic grounds.

#### **5.4 SUGGESTIONS FOR FURTHER STUDY**

The researcher suggested that future research be done on the application of real options in other industries probably on those companies listed on the Nairobi Stock Exchange. This will enable full comparison with other studies done in USA, Australia, Europe and Canada for instance Graham and Harvey, (2001); Brounen et al, (2004) and others.

Another suggested future study would be to study other aspects of capital budgeting incorporating other phases for instance how capital budgeting ideas are generated and determination of hurdle rates. This will enable comparison with for instance the study conducted by Graham and Harvey, (2001) in the USA and Brounen et al, (2004) in Europe.

The researcher also suggested that a study be carried out using other methods of data collection. This could incorporate interviewing the respondents face to face. This could eliminate non-response bias and could help determine the extent to which real options are actually being used.

The researcher also suggested that other studies focusing mainly on industries cited in Block, (2007) namely technology, utilities, healthcare and manufacturing. In the study, these industries are said to be the few that adopted early use of real options. This will

help determine whether the same applies in Kenya.

Finally, the researcher suggested that a study be carried out in Kenya on the effects of behavioral biases on capital budgeting. A large body of the psychology literature finds that people tend to be overconfident and overly optimistic. Because of self-selection, firm managers tend to be even more affected by these biases than the general population. Gervais, (2009) found that biased managers overinvest their firm's free cash flows, initiate too many mergers, start more firms and more novel projects, and tend to stick with unprofitable investment policies longer. A study of this type will help determine whether such biases do exist in relation to application of real options in Kenya.



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## APPENDICES

## APPENDIX I

### LETTER OF INTRODUCTION



**UNIVERSITY OF NAIROBI**  
**SCHOOL OF BUSINESS**

**MBA PROGRAM - LOWER KABETE CAMPUS**

Telephone: 020-2059162  
Telegrams: "Varsity", Nairobi  
Telex: 22095 Varsity

P.O. Box 30197  
Nairobi, Kenya

DATE: 15th September 2010

#### TO WHOM IT MAY CONCERN

The bearer of this letter ... MARY MUKWANJERU MUTHOMI


Registration No: D61/70059/2009

is a Master of Business Administration (MBA) student of the University of Nairobi.

He/she is required to submit as part of his/her coursework assessment a research project report on a management problem. We would like the students to do their projects on real problems affecting firms in Kenya. We would, therefore, appreciate if you assist him/her by allowing him/her to collect data in your organization for the research.

The results of the report will be used solely for academic purposes and a copy of the same will be availed to the interviewed organizations on request.

Thank you.

  
**UNIVERSITY OF NAIROBI**  
**SCHOOL OF BUSINESS**  
**MBA OFFICE**  
**P.O. Box 30197**  
**NAIROBI**  
**DR. W.N. IRAKI**  
**CO-ORDINATOR, MBA PROGRAM**

## APPENDIX II

### QUESTIONNAIRE

#### A: Capital budgeting methods

1. Does your company use real options in making capital budgeting decisions?

- Yes  
 No

2. Please indicate how frequently your company employs the following evaluation techniques when deciding which investment projects to pursue? *(Please tick one square per line)*

	Never	Almost Never	Almost always	Always
	1	2	3	4
Real Options	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Net Present Value	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internal rate of return (IRR)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Modified IRR (MIRR)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Profitability index	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Payback period	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Accounting rate of return*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (Please specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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\*Average earnings return on assets

3. What are the main reasons why your company employs real options as a method of capital investment appraisal? Please indicate the level of importance of the reasons given below. *(Please tick one square per line)*

	None	Some	Moderate	High
	1	2	3	4
Incorporate managerial flexibility				



into the analysis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Complements traditional capital budgeting techniques	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provides a long-term competitive through better decision making	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provides an analytical tool to deal with uncertainty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provides a way of thinking about uncertainty and its effects on valuation over time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provides a management tool to help form the strategic vision	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. What kind of real options does your company use? Please indicate how frequently your company uses the following real options:

	Never	Almost Never	Almost always	Always
	1	2	3	4
<b>Abandonment-</b> ( <i>stop and realize salvage value of investment</i> )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Flexibility</b> ( <i>alter input/output mixes in response to changing conditions</i> )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Entry and Exit</b> ( <i>exit an investment and re-enter as conditions improve</i> )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Right to defer</b> ( <i>delay investment until it is more profitable</i> )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Staged investment</b> ( <i>make investments in successive stages with right to abandon as more information becomes available</i> )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Growth</b> ( <i>increase capacity of an existing product line, expand into new areas etc</i> )	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. Please indicate which method(s) among the following that your company uses to value real options

	Never	Almost Never	Almost always	Always
	1	2	3	4
<b>Binomial lattices</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Risk-adjusted decision trees</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Monte Carlo simulation</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Black-Scholes option pricing model</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. If you answered “NO” to number (1), what are the main reasons for not using real options. Please indicate the importance of each of the following reasons: *(tick one square per line)*

	None 1	Some 2	Moderate 3	High 4
Lack of expertise or knowledge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of applicability to our business	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Too complex to apply in practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Difficulty in estimating inputs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Requires unrealistic assumptions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does not help managers make better decisions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Limited support for real-world applicability of real options models	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Requires many internal resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Any other (please specify) \_\_\_\_\_

7. When computing the Internal Rate of Return (IRR) or Net Present Value (NPV), does your firm use: *(Please tick one square only)*
- Cash flows
- Accounting Income
8. In Computing the Internal Rate of Return (IRR) or Net Present Value (NPV), do you deduct interest and other financing costs from revenue to arrive at cash flows?
- Yes                       No
9. Which of the following approaches is used in your company to determine the minimum acceptable rate of return (discount rate) to evaluate proposed capital investments? *(Please tick one square only)*
- Weighted average cost of capital (WACC)
- Cost of debt
- An arbitrarily chosen figure is used
- Another rate *(Please specify)*, pp. \_\_\_\_\_
10. If the Weighted Average Cost of Capital (WACC) is used, the weights are defined by: *(Please tick one square only)*
- Book values derived from the balance sheet
- Current Market Values
- Target Values (Long term targets)
11. Do you have different rates of return that are required for different divisions, subsidiaries or projects of the firm?
- Yes                       No
12. Which method does your firm use to incorporate risk in capital budgeting decisions? *(tick one square per line)*
- |                                   | Never                    | Almost<br>never          | Almost<br>always         | Always                   |
|-----------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                                   | 1                        | 2                        | 3                        | 4                        |
| Risk-adjusted discount rate       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Certainty equivalent approach (*) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Other ( Please specify), pp.      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

\_\_\_\_\_  
 (\*) Certainty equivalent approach: Every cash inflow that is not known with certainty is scaled down, and the riskier the flow, the lower the certainty equivalent value.

13. Please estimate the average proportion of the total capital expenditures your firm made in the last five years that should be classified within these three investment categories:

Replacement Projects: \_\_\_\_\_ %  
 Expansion Projects – Existing Operations: \_\_\_\_\_ %  
 Expansion Projects – New Operations: \_\_\_\_\_ %  
 Total: 100 %

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

Yes                       No

15. Does your firm possess a capital investment manual (written capital investment guidelines)?

Yes                       No

16. Does your company conduct post-audits of major capital expenditures?

Yes                       No

17. Please tick one square in each line indicating the degree of uncertainty or predictability in your company’s environment:

	<i>Never predictable</i>				<i>Always predictable</i>	
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
Action of suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Action of competitors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Customer preferences and tastes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Behaviour of financial/capital markets	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Related governmental regulations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Action of trade unions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rate of related technological changes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

18. How often is the following investment project-related financial data for capital investment decisions obtained from your company’s capital budgeting information systems (\*)? Please tick one box in each line.

	<i>Never</i>	<i>Very Little</i>	<i>Little</i>	<i>Some</i>	<i>Often</i>	<i>Very Often</i>
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
Project expected cash outflows	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Project expected cash inflows	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cost of Capital and required returns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Project expected economic life	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Macroeconomics (e.g. inflation rates)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Post-audit review	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(\*) Capital Budgeting information system is defined as an organized collection, storage, and presentation system of data and other knowledge for capital investment decision making. Example of capital budgeting information system includes executive information systems (EIS), decision support systems (DSS), and spreadsheet software (For example, Excel or Lotus 1-2-3).

**B: Other information**

19. Your job title? \_\_\_\_\_

20. What is your firm’s approximate number of employees? \_\_\_\_\_

21. What is your firm’s approximate net assets (\*) amount? \$\_\_\_\_\_

(\*) Defined as the value of fixed assets after depreciation

22. What is firm’s approximate sales revenue? \$\_\_\_\_\_

### APPENDIX III

#### LIST OF OIL COMPANIES IN KENYA (MEMBERS OF PIEA)

##### Senior Corporate Members

	POST OFFICE NO.	TELEPHONE	FAX
HASHI ENERGY LTD	P.O. Box 10795-00100, NAIROBI	2215088	2216800
HASS PETROLEUM LTD	P.O. Box 76337, 00508 NAIROBI	2711586/7/8	2711598
KENOLKOBIL LTD	P.O. Box 30322, NAIROBI	249333/2755000	2230967
KENYA PETROLEUM REFINERIES LIMITED	P.O. Box 90401, MOMBASA	041 3433511/582	041 2220619
KENYA PIPELINE COMPANY	P.O. Box 73442, 00200, NAIROBI	6532244	6530384
KENYA SHELL LIMITED	P.O. Box 43561, NAIROBI	3205555	343581
LIBYA OIL KENYA LIMITED	P.O. Box 64900, NAIROBI	3767842/3622000	221881/3767575
NATIONAL OIL CORPORATION OF KENYA	P.O. Box 58567 - 00200 NAIROBI	6952000	6952400
TOTAL KENYA LIMITED	P.O. Box 30736, NAIROBI	2897000/3668000	3668397/6

##### Junior Corporate Members

ADDAX KENYA LIMITED	P.O. Box 12403-00100, NAIROBI	2738023	2738026
BAKRI INTERNATIONAL ENERGY CO. (K) LTD	P.O. BOX 19095 - 00501, NAIROBI	2730003/8/9	2738555
BOC GASES	P.O. Box 18010, NAIROBI	6944000	6944001
DALBIT PETROLEUM LTD	P.O. Box 1931,00200, NAIROBI	4347433/53	4347439
ENGEN KENYA LIMITED	P.O. Box 10278, 00100, NAIROBI	2729195/2724414	2715209
GALANA OIL KENYA LIMITED	P.O. Box 62603, NAIROBI	4934000/3593774	2714610
GAPCO KENYA LIMITED	P.O. Box 40908-00100, NAIROBI	2219515	2229448
GLOBAL PETROLEUM LIMITED	P.O. Box 30621-00100, NAIROBI	8563252-4	8562130
GULF ENERGY LIMITED	P.O. Box 61872,00200, NAIROBI	2729030/29	2729031
HUNKAR TRADING CO.LTD	P.O. BOX 64445 - 00619, NAIROBI	557443	556781
INTOIL LIMITED	P.O. BOX 70701 - 00400, NAIROBI	343943	2210320
JADE PETROLEUM LTD	P.O. Box 34725-00100, NAIROBI	2104740/1	2104742
MGS INTERNATIONAL (K) LIMITED	P.O. BOX 27696 - 00506, NAIROBI	550250 / 7730101	550701
PETRO OIL KENYA	P.O. Box 10633 - 00100, NAIROBI	3742010/ 3743139	3742009
RIVA PETROLEUM DEALERS LTD	P.O. BOX 16299 - 20100, NAIROBI	051 221534/5/6	051 2214525
TROJAN INTERNATIONAL LTD	P.O. BOX 10339-00100, NAIROBI	2217848	2217849

## Associate Members

BURHANI ENGINEERS LTD	P.O. Box 21111 - 00505, NAIROBI	3871237	3872140
CHEMIGAS LIMITED	P.O. Box 6487-00300, NAIROBI	554210/530501	650164/553439
CYKA FUEL MART	P.O. Box 18047 - 00500, NAIROBI	557172/652558	553067
KENYA BUREAU OF STANDARDS	P.O. Box 54974, NAIROBI	6948000	604031
NORKEN LIMITED	P.O. Box 9882 - 00100, NAIROBI	343140/249067	248900
PAN AFRICAN PETROLEUM LTD	P.O. Box 78050-00547, NAIROBI	020 3592883	554599
PETROLEUM INDUSTRIAL SERVICES	P.O. Box 76529, 00508 NAIROBI	650806/7, 3541924	550060
PREMIER AGENCIES	P.O. Box 44432, NAIROBI	4442809/4450544/5	4441820
PRICEWATERHOUSECOOPERS LIMITED	P.O. Box 43963 - 00100, NAIROBI	2855000	2855001
PRIMEFUELS KENYA LIMITED	P.O. Box 17578, NAIROBI	228807/229187	230070
SGS KENYA LIMITED	P.O. Box 72118, NAIROBI	2733693/2733699	2733664
TRIPAC CHEMICAL INDUSTRIES	P.O. Box 48876-00100, NAIROBI	553720	537442