AN ANALYSIS OF THE USE OF DISCOUNTED CASH FLOW METHODS AND REAL OPTIONS TO VALUE FLEXIBILITY IN REAL ESTATE DEVELOPMENT PROJECTS.

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DECLARATION OF HONOUR

I, the undersigned, do hereby declare that this thesis is my own work and has not previously been submitted at any other university for a degree.

I have relied on opinions, thoughts and information from other sources, but irrevocably state that the original manuscript has not been plagiarised.

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Cape Town, 30 September 2007

ABSTRACT

Surveys of firms outside the property sector indicate the growth in the use of DCF methods such as the NPV and IRR methods to evaluate projects as compared to the use of such naïve methods as Payback and the Accounting rate of return. The growing convergence of theory and practice is indicated by the growing use of the NPV method. The objective of this study is to determine the capital budgeting methods used to evaluate real estate development projects and to compare the results of a survey with the results of other studies. Further, recent developments in capital budgeting theory, indicate that the investment valuation tools such as the Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period (PP), and the Accounting Rate of Return (ARR) may fail to recognize flexibilities in real estate development projects. As a consequence, the discounted cash flow methods (DCF) may systematically undervalue strategic or large-scale real estate development projects.

Two methods are introduced as an alternative to address the weaknesses of the DCF methods. Decision Tree Analysis (DTA) employs an approach to analyse flexibilities by creating a chain of possible options and allows alternative courses of action for management to adapt their initial strategies in order to capitalise on new opportunities or to minimise losses.

Real Option Analysis (ROA) introduces the theory of valuing financial derivates, in particular call options, and allows the staging of the development. These instruments further introduce a risk management aspect, as call options have a limited down side and an unlimited upside.

Each approach has advantages and shortcomings and should only be used in appropriate circumstances.

DTA is suited for the analysis of the project specific risks. ROA on the other hand, is a superior tool when dealing with uncertainty.

The thesis finds that that over 90% of all respondents are using a combination of NPV and IRR methods most often to evaluate development opportunities. Interestingly, 85% of all respondents are also using the payback period. Other methods used are the profitability index, residual value, free cash flow, economic value, and return on equity. Developers have adopted DCF methods such as NPV and IRR as the primary methods to evaluate projects rather than naïve methods such

as Payback and ARR, although these latter methods remain in use. The use of decision tree analysis and real option analysis is very limited.

Key words: **Real Estate Investment Analysis, Real Option Analysis, Property Development, Strategic Risk Management.**

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LIST OF ABBREVIATIONS

ATCF	: After Tax Cash Flow
DCF	: Discount Cash Flow Methods
DCR	: Debt Coverage Ratio
DTA	: Decision Tree Analysis
EAIT	: Earnings after Interest and Tax
EBIT	: Earnings before Interest and Tax
FV	: Future Value
H	: Hour
Ha	: Hectare
ICR	: Interest Coverage Ratio
IRR	: Internal Rate of Return
MAAR	: Minimum Acceptable Rate of Return
M^2	: Square Meter
M	: Meter
MIRR	: Modified Internal Rate of Return
NPV	: Net Present Value
%	: Percent
&	: And
PA	: Per Annum
PI	: Profitability Index
PV	: Present Value
ROA	: Real Options Analysis
ROE	: Return on Equity
ROI	: Return on Investment
ROCE	: Return on Capital Employed
R	: Rand
TPV	: Total Present Value
VAT	: Value Added Tax
WACC	: Weighted Average Cost of Capital

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CHAPTER I INTRODUCTION

1.0 Background to the Thesis

Economic analysis of investment potential is of decisive importance to the investor. This analysis is essential for the investor for the decision-making process and to evaluate investment alternatives within the frame work of investment objectives. In the context of this thesis, maximising shareholder value and minimising risk is the primary goal and represents the key focus of this thesis.

The principle of determining investment potential and performance on the basis of strict economic criteria, such as profitability index or net present value is not new.[1]

In the investment industry, general principles and techniques of measuring investment potential are well known as are the methods employed to analyse the value of the investment.

The methods of investment valuation range from simple accounting ratios to highly sophisticated and complex approaches such as the options pricing theory.

Although a variety of investment evaluation methods may be applied in the decision-making process, it is essential to ensure that the chosen method is appropriate for the problem in question.

The capacity of capital investments to satisfy the investment goals establishes the determining criteria in identifying critical factors directly influencing the investment evaluation process. These criteria are analysed according to their importance in the investment valuation process. These elements include the effects of tax, depreciation allowances, working capital requirements project size, optimal timing and the cost of financing to name a few, and demand further detailed investigation.

Real estate requires high capital expenditure to invest and to purchase for owner-occupation. In terms of real estate developments, the developer has to invest a considerable amount of capital to acquire land under uncertainty due potentially to departures in the current zoning, time-lags in supply and uncertainty in market prices. The nature of real estate development imposes considerable financial constraints and risks on the developer and few developers have unlimited equity capital or access to infinite funding sources. Therefore, it is necessary to evaluate the investment potential very carefully and accurately in order to provide accurate information for the decision-making process. The general decision criteria in capital

[1] Other techniques include internal rate of return (IRR), modified internal rate of return (MIRR), discounted payback, and accounting rate of return.

investment projects can be simply expressed as investing in projects with positive NPVs.

Apart from providing relevant data for evaluating probable investment performance, initial estimates are providing the base for decision-making.

Real estate development projects generate varying expenditures and income benefits at disparate intervals in time. The timing of these is significant in terms of both equity and debt finance requirements in order to fund the project. Project finance incurs debt servicing cash flows, which consists of bond repayments and interest expenses.

It is difficult to secure long-term funding facilities and often debt finance requirements involve certain obligations like pre-selling or pre-letting to a break-even point in order to obtain commercial finance for working capital requirements and to commence construction. Projects or phases not fully let or sold at contract completion stage will limit the finance available for investing and will not achieve the investment criteria of the investor.

Further, this results in generally higher interest rates as a result of higher credit default risk involved in highly geared projects.[2]

Rational investment decisions must therefore incorporate considerations of both the amount and timing of capital expenditure. Rationalisation of construction processes is permanently exploited to minimise standing time and time delays in the construction process in order to optimise the requirements for working capital. For example, the phasing of large-scale real estate development projects or in case of a residential developer a plot and plan strategy may significantly decrease the working capital requirements.

Carefully formulated projections of the operating cash flow over the anticipated holding period are essential for an accurate valuation of real estate development projects. The after tax cash flow (ATCF) available after payment of all expenses (operating expenses and bond repayments) including debt coverage and interest coverage are of primary concern to the investor and the lender.

In order to minimise risk and maintain flexibility the developer can pursue a staged or phased project using an option approach which allows the developer to follow an optimal decision path.

[2] High risk is adjusted by an appropriate premium for risk in the valuation. This method leads to a large discount rate and a lower value of the project.

The term "*real options*" was first introduced by Stewart Myers in 1977. It referred to the application of the option pricing theory to the valuation of a non-financial or real asset in particular paying attention to the sequence of stages in capital investments and the resulting managerial flexibility.

The real estate market is generally characterised by its heterogeneous and immobile nature of products, by product segmentation in various sub-markets and high market entry barriers for new players in an imperfect market. Companies, such as property development companies, must compete with each other under uncertain market conditions and have to periodically invest into large capital projects with enormous time lags in supply. These large capital projects have a series of options that should be incorporated into the capital budgeting process. The failure to recognise the existence of these options may lead to sub-optimal investments and under-investment which may lead to the failure of the firm to compete in the market place.

In particular, using a standard discounted cash flow analysis may result a bias in favour of large scale capital investments as opposed to a series of smaller incremental investments.

The purpose of this thesis is to undertake a survey of current practices in relation to investment analysis and to critically analyse the use of options in real estate development projects by employing a practical model to evaluate whether option strategies enhance shareholder value by providing management with flexibility to alter initial operating strategies and can minimise risk.[3, 4]

It is argued that no valuation method previously available offers such flexibility in valuing the number of options available when one analyses a project in which to productively invest the capital of the company.

For this reason, the traditional DCF approaches such as NPV and IRR may systematically undervalue (strategic) capital investments with valuable options. The thesis will further evaluate whether the use of options has the potential to quantify the value of options from active management and strategic interventions.

[3] Options in real estate development are equal to call options.

[4] Financial derivatives, if used properly, can be employed as risk management tool.

1.1 Research Objectives

For the purpose of this thesis the following research objectives have been formulated.

Research Objectives:

The following objectives were formulated:

1) ***The real estate sector employs DCF methods such as IRR and NPV rather than naïve methods such as Payback and the Accounting rate of return to evaluate projects.***
2) ***Firms in the real estate sector use the weighted average cost of capital (WACC) to discount project cash flows.***
3) ***Firms use real options to value the flexibilities inherent in real estate development projects.***

The above research objectives will be determined by undertaking a survey of current practices and establishing a financial model using the real option theory to identify the value of flexibility. The criterion of the project decision is ENPV>NPV.

1.2 Methodology

The research has been undertaken in four phases as detailed in figure 1 below:

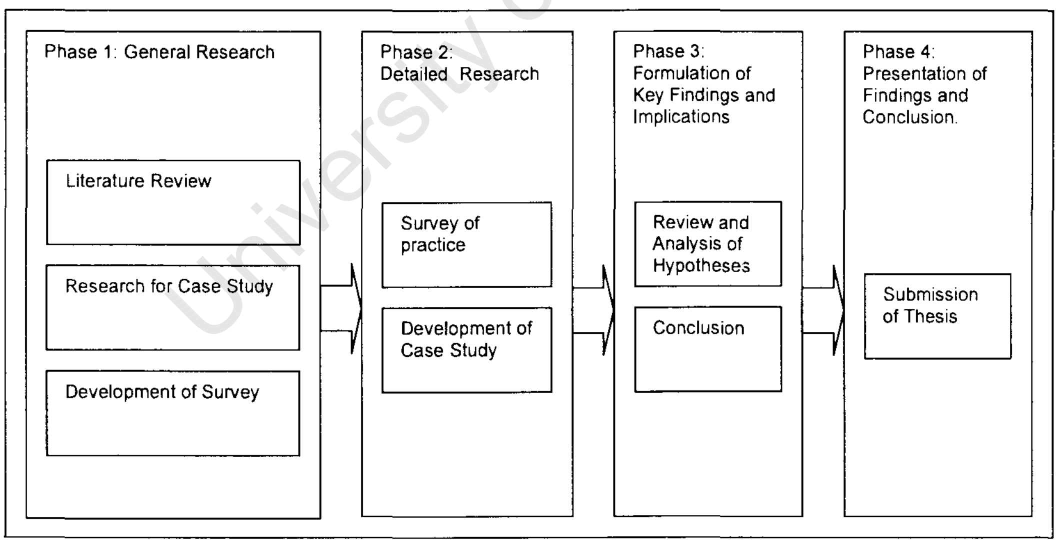

Figure 1: Detailed Phases of the Research.

Explained in more detailed below is the methodology used by the Author in respect of compiling this thesis.

1.2.1 Phase 1 General Research

Phase 1 is focused on understanding the principles involved in option pricing theory and its applicability in real estate development.

The following has been taken into consideration in order to achieve the research findings:

- Review of literature: The review of literature has been carried out in the libraries of the University of Cape Town and the University of Stellenbosch.
- Research for the case study: In order to compute the investment potential two types of valuation methods are employed in this thesis, which reflect the presence of flexibility. The traditional NPV is adopted to compute the project value without flexibility. On the other hand, the real option approach is used for valuing the project with flexibility, in which the firm can delay investment in the project.
- Development of a survey questionnaire: In order to obtain industry insight, an industry survey was necessary in order to obtain information from primary sources.

The findings of this literature review were used to establish a financial model to test the research objectives. This financial model was used in the case study to test the formulated research objections.

1.2.2 Phase 2 Detailed Research

Phase 2 undertook a detailed research aimed to provide market relevant information for the case study employed in this thesis.

This phase comprises the undertaking of different aspects of primary research as follows:

- Industry survey:

  The industry survey is aimed at analysing the usage of investment analysis tools employed by property professionals.

Phase 2 is mainly focused on primary sources. The collection of relevant market information was undertaken by nature of interviews and issuing standard questionnaires to property professionals in South Africa. The design of the questionnaires was based on information provided by Messner, et al. (1977, p. 56-66), Saunders, et al. (2003, p. 280-308) and Oppenheim (1966, p. 24-40).

The findings are formulated in chapter 7 and have been used for the case study used in this thesis.

1.2.3 Phase 3 Formulation of key findings and implications

- Review and analysis of information obtained.
- Conclusion.

1.2.4 Phase 4 Presentation of findings

- Submission of thesis.

1.3 Research Objectives

The primary objective of this thesis is to contrast DCF techniques and other capital budgeting methods with option valuation in the context of strategic capital budgeting decisions in real estate development.

Real estate development can be categorised as:

1) involving large initial capital investments (acquisition and working capital);
2) generating some sunk costs which might not be recovered if the project is abandoned (irreversibility);
3) providing a degree of uncertainty in market prices and subsequently in returns (risk and uncertainty);
4) having significant time-lags between investing and realisation of return (supply); and
5) requiring optimal timing in market entry and time to completion (option to defer).

The fundamental question is what strategy to pursue and what capital budgeting or investment analysis tool to use in order to evaluate such a highly uncertain investment, but highly profitable if successful and to illustrate embedded value in a formal way to shareholders and lenders.

The following main objectives for this thesis have been identified:

- Understand the current strengths and weaknesses of the property development process;
- Undertake a survey questionnaire of current capital budgeting practices in the real estate development sector
- Develop a practical model;
- Investigate the use and application of options in real estate development in South Africa by undertaking a survey;
- Investigate and evaluate methods for evaluating a large-scale real estate development project;
- Investigate strategies on how to enhance shareholder value and how to minimise risk in large-scale real estate development projects.

1.4 Limitations

Although the thesis represents a detailed investigation into economic techniques applied in assessing the investment potential of large-scale real estate development projects, the extensive nature of the topic asks for a comprehensive evaluation of the topic in its entirety and therefore certain limitations will apply.

A limitation arises from the sample of respondents. Although a number of professional organisations are in existence, and access to the member directories were granted, the population of property developers is not limited to members of professional associations

A further limitation applies to the quality of the responses and size of the sample in order to have a representative sample of the South African real estate industry.

Although the Black-Scholes methodology is employed to value real options in practice, (see Ooi (2006), Geltner (1989)), the model is subject to assumptions which may not apply in a real estate development environment.

1.5 Structure of this Thesis

The thesis is structured as follows:

As an introduction to this thesis, ***chapter 1*** explains the background to this thesis. Furthermore, the chapter outlines the research methodology and introduces the research process of the thesis. It also defines the hypotheses formulated for this thesis which shall be tested. This chapter defines the primary research objectives and also points out key limitations of this thesis.

Chapter 2 deals with literature review.

Chapter 3 provides an in-depth analysis of the real estate development process.

Chapter 4 deals with DCF techniques in real estate development project valuation.

Chapter 5 introduces the decision tree analysis and real option analysis approach to valuation of real estate development projects.

Chapter 6 will deal with a case study.

Chapter 7 summarizes and critically analyses the findings of the industry survey.

Finally, ***chapter 8*** summarizes the facts and findings obtained during the research process and offers recommendations based on the outcome of the research.

Figure 2 illustrates the structure of this thesis in relation to a real estate development project and shall assist the reader to understand the key stages of this thesis.

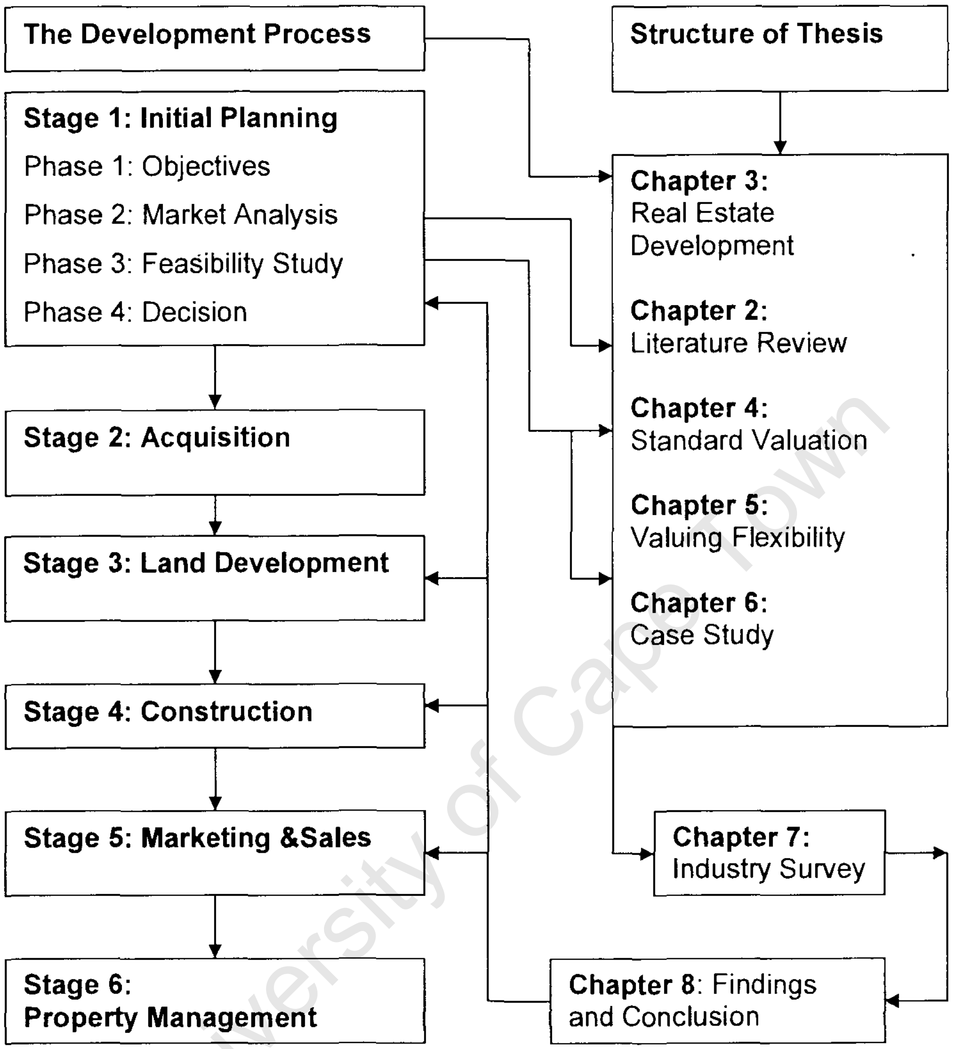

Figure 2: Schematic Illustration of Structural Framework of this Thesis.

CHAPTER II LITERATURE REVIEW

DCF techniques and other methods such as Payback and Accounting rate of return are commonly used to evaluate investment projects. Two distinct categories such as static (also refer to as traditional or non-discounting) and dynamic (conventional) methods emerge from the measures of investment worth. Static methods such as the payback method and the accounting rate of return ignore the time value of money.

Although there is a general acceptance of utilising discounted methods in preference to static methods by industrial companies, controversy remains with respect of disadvantages of these methods. In some instances, static methods seem to be more accurate and applicable. Lumby (1981) points out that the some traditional methods seem to have certain merits, when comparing to certain discounted methods. These techniques are useful in times of uncertainty and long-term projections as the future is uncertain. Therefore it is better to recoup the initial capital outlay as early as possible. As most of the investment appraisals consist of forecasts and estimates, it certainly will be of advantage for the investor to recoup his investment as quickly as possible.

Pike and Neale (2003) and Greer and Farrell (1988) for instance, refer to various investment analysis concepts such as the NPV and the IRR method, payback method, profitability index, and the accounting rate of return, from other disciplines and relate them to a property investment analysis framework. In South Africa there is limited empirical evidence of the methods used to evaluate real estate development projects. This study will evaluate current practices in relation to studies such as Pike and Neale (2003) and will determine whether DCF methods such as NPV and IRR are employed in preference to such naïve methods as payback and the accounting rate of return,

However, studies also have identified certain weaknesses and problems in utilising the traditional discounting procedures for capital budgeting. The weaknesses of the discounting methods are time extensions for capital sources, different sizes of projects, and the timing of cash flows. The short-comings of DCF techniques have been identified by Ross (1995), Luehrman (1997), Trigeorgis (1993). These studies concur that the usage of real options methodology, which is an alternative valuation tool based on the concept of financial derivates, may overcome many of the limitations associated with the DCF techniques (Dixit and Pindyck (1994)).

Common problems with DCF techniques include conceptual weakness, erroneous application, forecasting errors, difficulty in evaluating strategic and large-scale investments, and a systematic undervaluation of future growth opportunities, in particular in relation to long-term projects.

Above all, implicit assumptions are made by management based on the pre-defined strategy concerning cash flows. Referring to forecasting errors and inflexibility, it is usually assumed that the project will operate at an average or pre-determined pace until the end of its useful life. It implies further that any capital investment, once made, is partially or completely irreversible (see Dixit (1991), Pindyck (1991)) for many years. It assumes that management has no flexibility to alter its initial operating or investment strategy in order to capitalise on future opportunities or reduce potential losses.

Lucius (2001) provides a good overview of real options embedded in real estate development projects. He outlines the various types of real options available and discusses problems in practical application. He concludes that there is enormous amount of research required to investigate practical application and models.

In terms of land options, Brown and Achour (1983) was one of the earliest works that studied the pricing of land options. In their paper they define land options as the *"options to purchase real property"*. They suggest there is close similarity between call options for real property and call options for common stock. In fact, they conclude that land options are nothing other than call options on real estate. Further, they investigate if the Black-Scholes model can be applied to price/value land options as well. They conclude that there is a similarity between the pricing of land options and common stock call options. Although the option pricing model of Black-Scholes can not be perfectly employed, it provides a somewhat close approximation to pricing of land options (See Ooi (2006), Geltner (1989)).

The paper of Mc Donald and Siegel (1986) was one of the earliest works that studied the optimal timing of investment in an irreversible project. In their approach, it is assumed that cost and value of the project follow continuous time stochastic processes[5]. They investigate the fundamental problem of optimal investment under uncertainty, (that means under competition and price uncertainty), and proved that the timing options increase in value if uncertainty increases. The investment rule derived from traditional net present value methods is insufficient when values and expenses of projects are not deterministic. The firm will invest only when the benefits of calling the option and undertaking the project exceeds the costs of holding the option and deferring the project (See Sing (2001)).

Titman (1985) employs a simple binomial tree method to illustrate why deferring a development may be a feasible option when the price is uncertain.

Paxson (2005) determines an optimal investment strategy for current or prospective property owners that should provide the expected future profits (rent times occupancy times units available), and current profits relative to threshold trigger profits for a variety of alternative states and actions. These decision alternatives include remaining idle, building and operating properties, expanding, contracting, suspending, reverting to normal service or reduced service capacity, or abandoning.

The studies conducted by Trigeorgis (1991, 1993a, b), developed a valuation model which incorporates options embedded in an investment project in order to capture its full value.

The term "*real options*" was first introduced by Stewart Myers in 1977 (Myers, 1977). It referred to the application of option pricing theory to the valuation of a non-financial or real assets in particular paying attention to the sequence of stages in capital investments and the resulting managerial flexibility.

The classical models which value real options of initiating investment are Samuelson (1965), McDonald and Siegel (1986), Majd and Pindyck (1987), Pindyck (1988) or temporarily suspending a project, McDonald and Siegel (1985). The seminal papers for evaluating operating and entry/exit options in entities with fixed capacity include Brennan and Schwartz (1985) and Dixit (1989). The models employed make explicit use of no-arbitrage arguments, and a replicating portfolio to provide the inputs into standard financial option pricing models.

Luehrman (1998a) refers to a business strategy as a series of options rather than a series of single cash flows. He provides a framework that bridges the gap between theory and practical application in real life capital investment projects. The framework provided by Luehrman is based on a simple application and produces a quantitative output for the decision maker.

Estimating the volatility of the underlying asset is one of the most important problems in real options analysis. Most capital projects contain multiple sources of uncertainty, and historical data does not exist or is not easily accessible. Further problems with real options analysis are limited tradability, illiquidity, and high transaction costs.

Although developments in the theory of real options analysis has led to advances in the evaluation of unconventional capital projects, its practical application to real life capital projects is subject to limitations.

[5]Stochastic processes refer to the dynamics of events unfolding with the course of time. Stochastic is a Greek name for random.

CHAPTER III REAL ESTATE DEVELOPMENT

3.0 Introduction

Real estate development is characterised by high fixed costs, long decision cycles, high working capital requirements, enormous time-lags in supply, and is exposed to significant demand, and supply, and price uncertainty over time.

Miles, et al. (2000, p. 4) define real estate development as:

"Development is an idea that comes to fruition when consumers-tenants or owner-occupants -acquire and use the bricks and mortar (space) put in place by the development team. Land, labour, capital management and entrepreneurship are needed to transform an idea into reality. Value is created by providing usable space over time with associated services."

The real estate market is generally characterised by its heterogeneous and immobile nature of products, by product segmentation in various sub-markets and high market entry barriers for new players.

Horne (1978, p.12) identified *"the controllable and uncontrollable elements surrounding property"*.

These elements are as follows:

(1) Controllable factors

- Location;
- Type and quality;
- Price, rent and costs;
- Timing and promotions.

(2) Uncontrollable factors

- World economic situation;
- National socio-political factors;
- Government legislation;
- Legal factors;
- Town planning and local building legislation;
- Short-term and long-term business confidence;
- Financial position and size of company at a fixed point in time;
- National economic factors.

Figure 3 illustrates how these factors interact in the market place. The developer can influence (control) certain factors before initiating a development. These factors are the location of the site, the type of property to be developed (demanded), the optimal timing when entering the market, construction costs and more importantly, the land price.

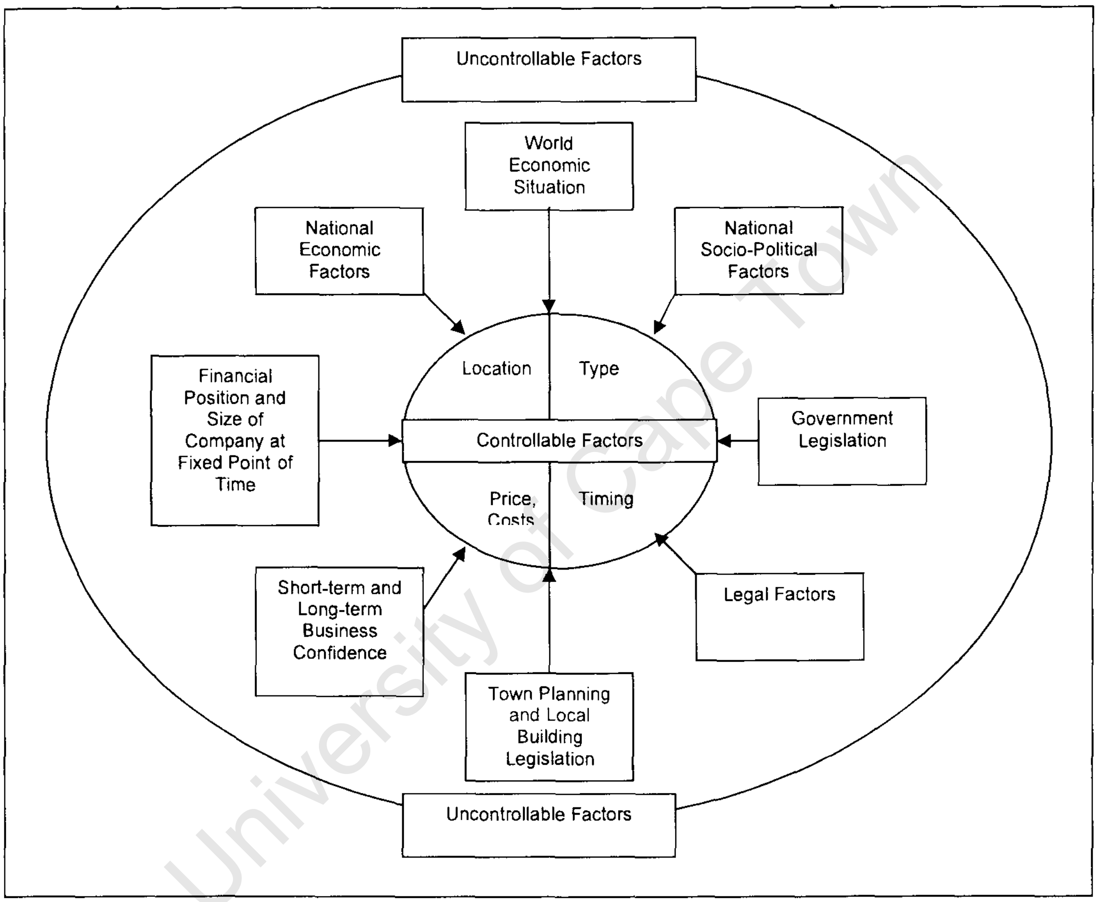

Figure 3: Controllable and Uncontrollable Factors in the Building Environment.

3.1 The Developer

The developer can operate as investor developer or trader developer.

Harvard (2002, p.15) describes a trader developer as follows:

"Here the developer acts as the ultimate entrepreneur developer, in the project for the short-term return only. The roles taken by the developer trader are similar to the developer investor except that the former is also seeking a long-term owner for the freehold of the scheme, i.e. they look to sell on the completed development as a completed investment."

This type of developer is largely concerned with producing properties, selling them and realising a profit. Figure 4 and 5 show the schematic explanation of this route for property developers.

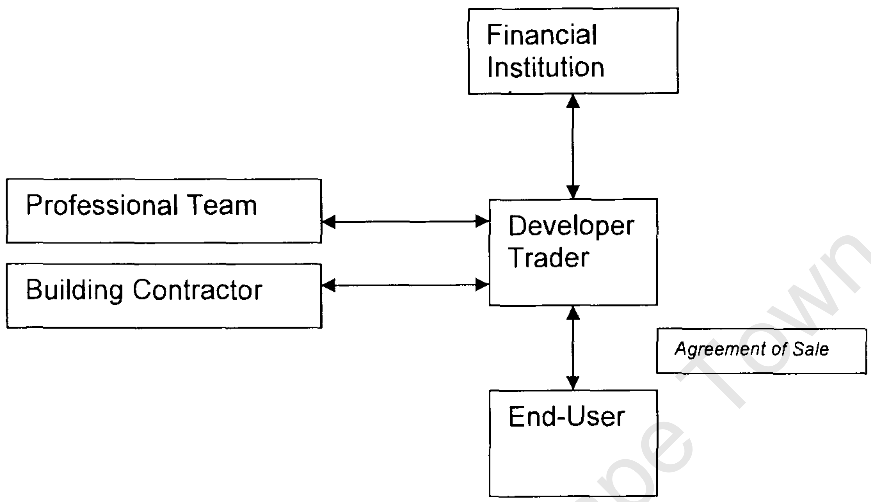

Figure 4: Schematic Explanation of the Developer Trader.

Harvard (2002, p.14) defines an investor developer as:

"the developer seeks to retain the long-term beneficial ownership of the building, i.e. they are building to invest and are termed developer investors."

This type of developer is focused on producing property for investment purposes and managing a portfolio. This option of the development route can be shown as in figure 5 below.

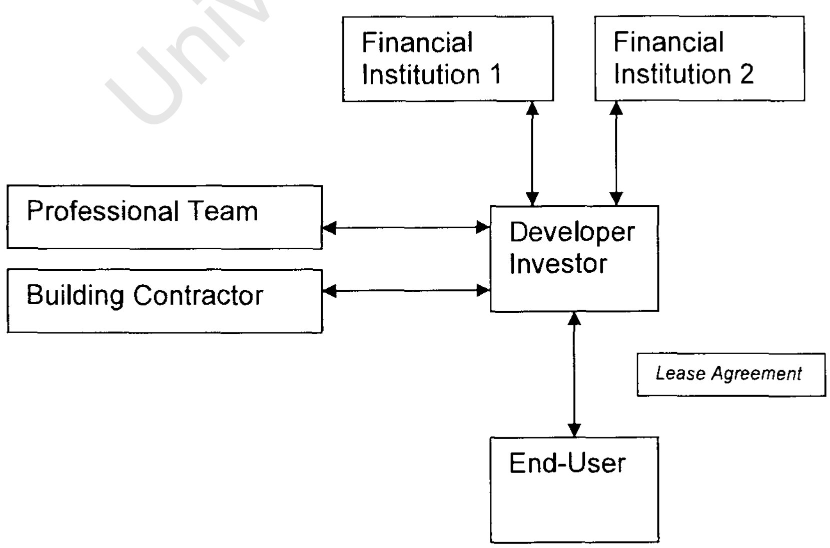

Figure 5: Schematic Explanation of the Developer Investor.

3.2 A Model for the Development Process

The development process is usually divided into several key stages and represents the value chain in real estate development.

Developers follow a sequence of steps from the moment they identify a need or discover a suitable site to the stage were the physical construction process is completed.

Barrett and Blair (1987, p. 6) refer to a five stage model of the traditional development process which is as follows:

Stage 1: Initial planning of the project

Phase 1: The formulation of the developer's objectives

Phase 2: Conducting of a market analysis

Phase 3: Preparation of a financial feasibility study

Phase 4: Decision-making process

Stage 2: Acquiring the land

Stage 3: Developing the land

Stage 4: Construction of improvements

Stage 5: Marketing and selling/leasing

Stage 6: Property management

The development process represents the value chain in real estate. Developers and investors might speculate on by simply buying and holding vacant land, or add value by rezoning land and selling the product, or rezone, subdivide and service land and sell land to either end users or pursue an investment strategy. There are various facets of property development with different risk and return profiles.

3.3 Key Stages in the Development Process

For the purpose of this thesis the model provided by Barrett and Blair (1987, p. 6) shall be discussed in more detail below.

Stage 1-Initial planning

The initial planning stage will be initiated by an idea that the developer has for a specific site. According to Graaskamp (1970, p. 13) the initial planning process can originate from three primary sources, which are:

(1) An idea in search of the site (as per figure 6);

(2) A site in search of an idea (as per figure 7);

(3) An investor looking for means of involvement in (1) or (2).

Messner, et al. (1984, p. 17-18) provide the following flow charts to describe the process of analysis as follows:

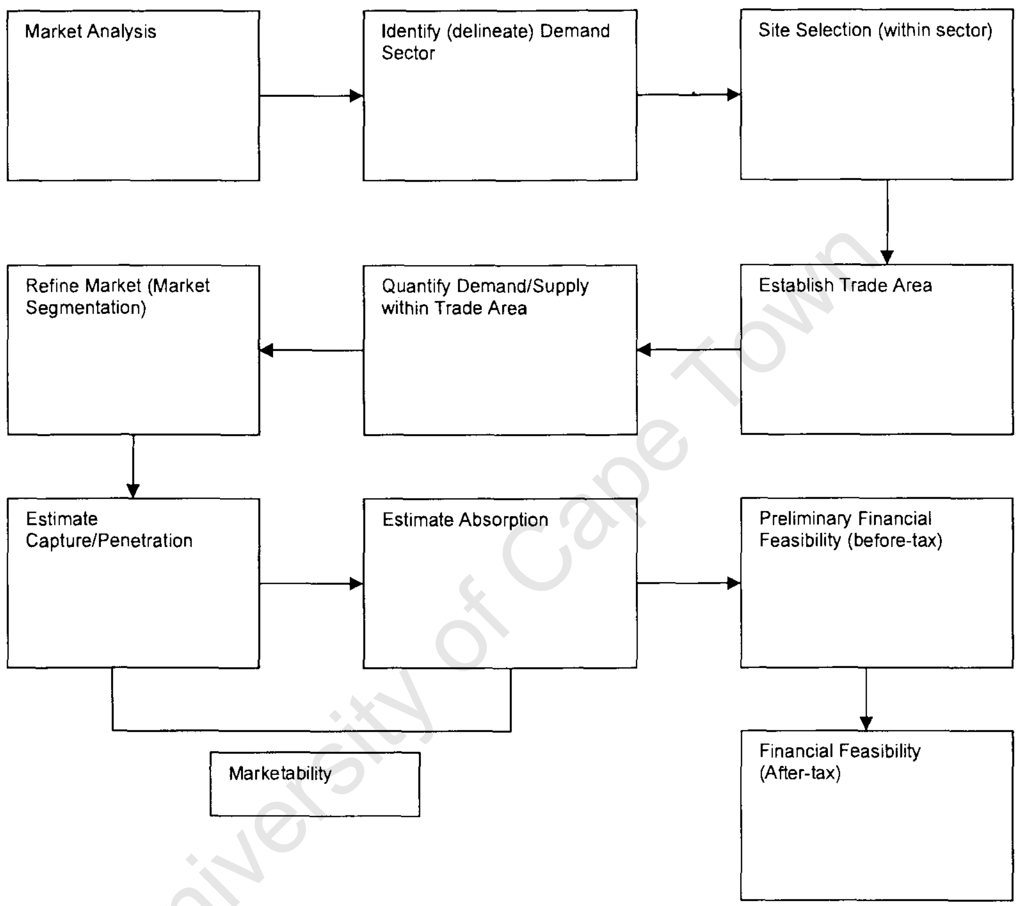

Figure 6: Use Known/Site to be Determined.

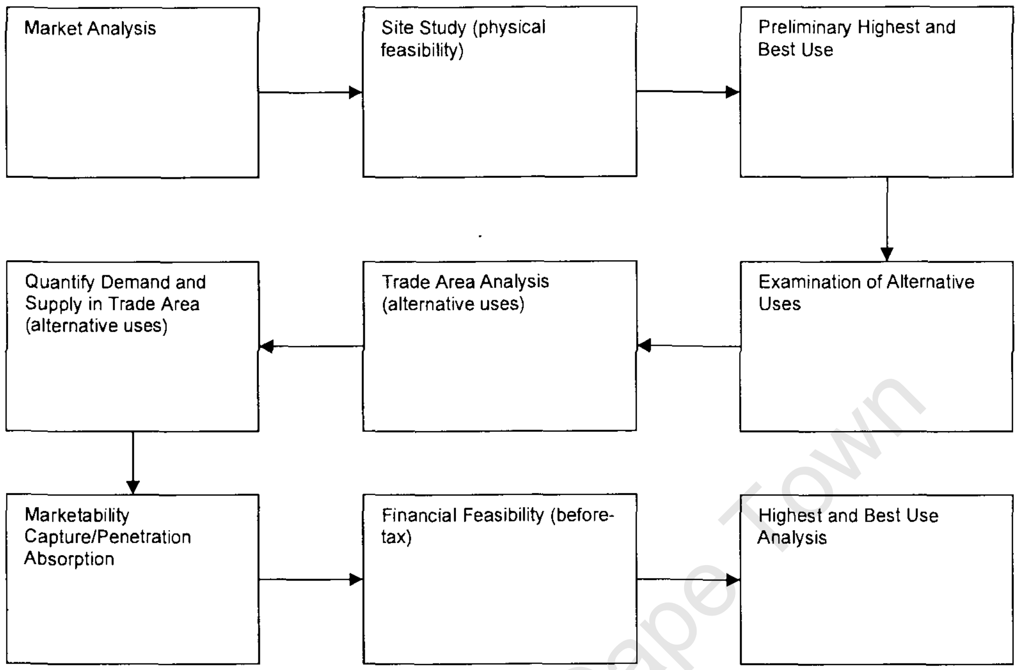

Figure 7: Site Known/Use to Be Determined.

In addition, this stage contains certain sub-phases which are:

- The formulation of objectives;
- Conducting of a market analysis;
- Preparation of a financial feasibility study;
- Decision-making process.

Stage 1- Phase 1: The formulation of the objectives

The first step according to Barrett and Blair (1982, p. 8) is to define the developers goals and objectives, which are of great importance for the feasibility process.

Stage 1- Phase 2: Conducting a market analysis

After developing a workable concept and identifying the goals and objectives, the developer has to analyse the market dynamics of the target market.

Messner, et al. (1984, p. 13-14) refer to a break down of analysis as shown in figure 8.

Market Study

A study of market variables which influence the supply of and the demand for real estate. (This is the broadest possible form of analysis and it encompasses all other types of demand-oriented real estate studies.)

Marketability Study

A narrowly defined study to determine the conditions under which a specific property can be sold. The key conclusions relate to both price and time required to sell.

A Feasibility Study

A study to determine the probability that a specific real estate proposal will meet the objectives of the developer and/or investor.

Highest and Best Use Study

A study to determine that use among other possible and legal alternative uses which results in the higher land value for specific site.

Figure 8: Framework of Analysis.

DeLisle and Sa-Aadu (1994, p. 261) confirm the view of Messner, et al. and refer to two key problems in market research.

The first problem is the present-future problem. This specific problem refers to forecasting the future income for a specific property. Analysts still use present or historic market information to evaluate the future potential of a property using a comparative market approach.

The second key problem according to DeLisle and Sa-Aadu (1994, p. 261) was identified as being the macro-micro problem. This specific problem deals with the market information available. Most market-related information is for the whole economy or for key markets, but this information can not be used for a specific property in a specific sub-market.

These two key problems of market research can relate to a four square model as shown in figure 9 below.

	Present	Future
Macro (Market)	Current &historical: Supply by segment Demand characteristics Preferences Income Household types Absorption & vacancies	Market forecasts: Supply by segment Demand Employment growth Population growth Space needs Absorption & vacancies
Micro (individual properties)	Subject property and comparables: Unit size and quality Demand characteristics Preferences Income Type of tenant household Absorption & vacancies	Future performance of subject property: Demand characteristics Preferences Income Type of tenant household Absorption & vacancies

Figure 9: Four Square Model of Market Research.

According to the discussion above, the goal of a market study is to reach the lower right square, future micro, which describes the future performance of the subject property.

Stage 1- Phase 3: Preparation of a financial feasibility study

In this section the analysis of the financial viability is examined. Graaskamp (1970, p. 4) defines:

"A real estate project is "feasible" when the real estate analyst determines that there is a reasonable likelihood of satisfying explicit objectives when a selected course of action is tested for a fit to a context of specific constraints and limited resources."

The definition provided by Graaskamp implies that implicit assumptions are made by management based on the pre-defined strategy concerning cash flows. It is usually assumed that the project will operate at an average or pre-determined pace until the end of its useful life and management has no flexibility to alter its initial operating or investment strategy in order to capitalise on future opportunities or reduce potential losses.

Stage 1- Phase 4: Decision-making process

After finalising the project feasibility the developer arrives at a stage where he has to make a decision whether the proposed project will be considered as feasible.

As real estate investment decisions do not differ from general investment decisions, the decision criteria can be expressed as NPV=>0. Initial estimates are providing the base for decision-making. Figure 10 illustrates the decision framework for capital projects.

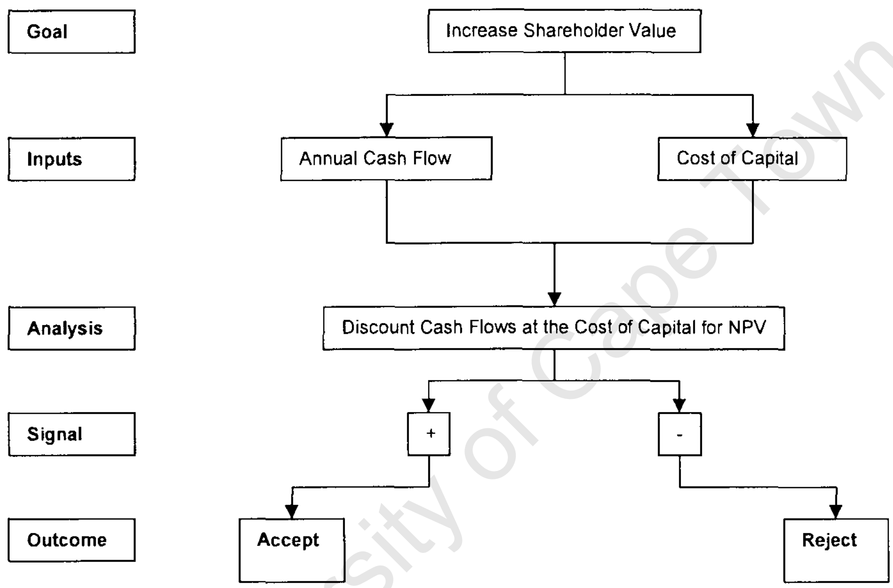

Figure 10: NPV Decision Framework for Projects.

As illustrated in figure 10, a capital project is only worth undertaking if the NPV is positive and shareholder value is increased. However, despite the simplicity of the standard project valuation, the shareholder wealth framework for a firm is much more complex and involves various decisions and strategies. Figure 11 illustrates the framework of shareholder analysis for a firm. Combining business, financing and investment strategies will lead to the operating cash flow of the firm and its cost of capital, which in turn will determine if shareholder wealth is increased. Factors such capital structure and taxation play a significant role in property development. Although, investment and financing decisions are independent from each other they can have a significant impact on the firm ability to acquire new capital projects.

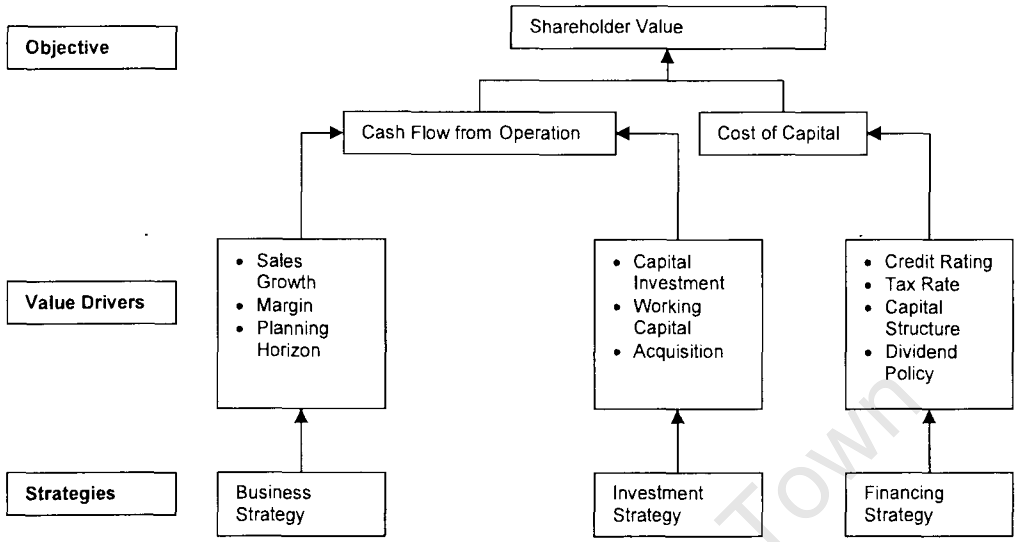

Figure 11: Framework of Shareholder Value Analysis for Firm.

The decision maker's main function in the decision making process is therefore to ensure that the investment analysis reflects realistic assumptions in terms of project feasibility, comply with working capital policies, retain the optimal capital structure, maintain flexibility, minimise risk, and increase shareholder value.

Stage 2- Land acquisition

Reaching this stage, the acquisition and selection of a suitable site becomes a very important factor in the development process. The selection of land is one of the most important decisions in the development process. Factors such as location, usage rights, physical characteristics and price will influence the value of the property and the marketability of the completed product quite considerably. Location is one of the controllable factors as identified by Horne. A fundamental characteristic of property is its fixed location. If the developer purchases the site, this will have an impact in the marketability of the property once it has been finish.

After identifying a suitable site, the developer has to secure the site. Usually, developers acquire a project directly by acquiring the project or structuring the transaction.

In order to reduce their capital outlay and subsequent risks, developers may take a land option on a project before committing substantial funds in acquiring the project (see Brown (1983) and Ooi (2006)).

Pursuing such an acquisition strategy would:

1) reduce initial capital investments (acquisition, transaction cost and working capital);
2) limit sunk costs and make the project fairly reversible if the project is abandoned;
3) provide a hedge against unfavourable market trends by limiting the loss to the option premium; and
4) enable the optimal timing of the investment (defer or wait).

Once the site is identified as suitable, the developer will purchase the site and become the beneficial owner of the land.

Stage 3- Land development

Reaching this stage means that the developer has purchased the site and an extensive urban planning process will take place. This is usually a very time-consuming process and the developer has to make various decisions in terms land use, density, and services. Once these decisions are made they are literally irreversible since land has been rezoned, sub-divided and developed. However, a number of option strategies at this disposal:

1) stage the investment (to avoid high working capital requirement);
2) develop the site in phases;
3) wait for the optimal timing of the development or phase (defer and act on new information or changes in demand);
4) expand by increasing the density or by buying more land to develop; or
5) exit by selling the fully serviced plots to either home builders or end-users.

After finishing civil servicing the previously agricultural land is transformed into fully serviced plots and the next stage in the development process is reached.

Stage 4- Building development

This stage represents the last major section where the developer can cut costs and reduce losses to maintain or increase his profitability. Rationalisation of construction processes is permanently exploited to minimise standing time and time delays in the construction process in order to optimise the requirements for working capital. The building stage represents the most capital intensive stage in the whole development process. There are numerous developers who prefer to not to be a contractor due to high working capital requirements, additional liability in terms of construction guarantees and warranties.

In the case of a residential developer a plot and plan strategy may decrease significantly the working capital requirements and allows the developer enormous operational gearing. It is difficult to secure long-term funding facilities for smaller property developers and often these finance requirements involve certain obligations which are difficult to meet.

In particular, smaller residential developers pursue this strategy. It has the advantage that the developer can operate with minimal working capital requirements as he pre-sells each unit or a development to a break-even point. Once sold, the end user becomes the registered owner of the land and signs a standard construction agreement with the developer for the building. The developer draws according to completion milestones from the mortgage with the financing bank of the end-user. In addition, the developer has aligned the payment of his creditors with draws against the building loan, leaving him with the optimal working capital cycle.

On the other hand, bigger property developers might pursue a turnkey strategy. Here the strategy is simple. Based on higher volumes and economies of scale, bigger developers are able to pre-finance the construction and deliver a finished product to the client. Although, their investor or lender requires usually pre-sales of the development to a break-even point, the development is financed by the developer. The advantages are the faster and easier implementation. The biggest disadvantage is the additional assumed financial risk by the developer and higher interest which has to be added into the selling price.

Stage 5- Marketing and sales

Another important stage in the development process is marketing and sales of the finished products. This is a critical stage in the development process whereas the development will either succeed or fail. Although, in theory there is a clear separation of these two stages in reality these stages are implemented at the same time. In most instances, the developer usually tries to pre-sell or pre-let-off to get a first indication if his development is a success or if it will fail. In some cases, as some developers have several projects in pipeline and long construction periods tied up in working capital cycles, developers are generally prohibited from undertaking several projects simultaneously.

The paper by Lai, et al (2004) investigates risk and return characteristics of sale before completion for both developers and buyers. They found that buyers have a call option on the purchase of a unit in case of a presale contract. A presale contract gives the buyer the right to buy a property at an agreed payment schedule. They pay the option premium in form of a deposit and then have the option to exercise the option or let it expire. The developer on the other hand is writing a call option. The uncertainty about the future demand can be also reduced because projects can be pre-sold or pre-let at the time close of making investment decisions.

Stage 6- Property management

Efficient and effective property management often explains why two similar buildings perform differently. Management systems of controlling maintenance and security are most important and should be considered at an early stage in the development process as they affect the economic performance of a building in the future.

Well planned buildings are efficient and keep the running expenses down to a minimum and ensure a better cost–benefit relationship and make the building more attractive in terms of profitability and return.

CHAPTER IV DCF TECHNIQUES IN REAL ESTATE DEVELOPMENT

4.0 Introduction

An overwhelming majority of literature refers to DCF analysis as the method of choice to evaluate investment potential. Investment valuation means evaluating the income-potential of assets such as real estate, plant and equipment, or capital investments.

Pike and Neale (2003, p. 95,158) and Greer and Farrell (1988, p. 275) for instance, refer to various investment analysis concepts such as the NPV and the IRR method, payback method and the accounting rate of return, from other disciplines and relate them to a property investment analysis framework.

Lumby (1981, p. 12) points out that the some traditional methods seem to have merit, when compared to DCF methods. These techniques can be useful in times of uncertainty, and particularly to evaluate long-term projections as the future is uncertain. Therefore it is better to recoup the initial capital outlay as early as possible. As most of the investment appraisals consist of forecasts and estimates, it certainly will be of advantage for the investor to recoup his investment as quickly as possible.

Warren (2000, p. 86-94) details three methods for calculating the rate of return on property investments while Lumby (1981, p. 33-41) provides a well stated and in-depth study of the NPV and IRR applied to real estate investments.

Lumby (1981, p. 61) identifies the NPV method as the most reliable and preferred method for investment analysis and his work outlines a very detailed practical example for applying NPV to investment evaluations.

Although the integration of timing represents an enhanced feature of discounting future values it does not guarantee their effective function under all circumstances.

A review of the literature associated with capital investment analysis reveals that discounted methods are preferred relative to traditional measures of investment worth (Pike and Neale, 2003) (Lumby, 1981).

4.1 Discounted Cash Flow in Real Estate Development Projects

Real estate development projects generate complex cash flows and therefore appropriate investment evaluation methods are required.

Greer and Farrell (1988, p. 282) define five major factors:

- Anticipated stream of net cash flow to the investor;
- Expected timing of cash receipts;
- Degree of certainty of expectations;
- Returns from alternative investment opportunities;
- Investor attitudes towards risk.

Greer and Farrell further state that investment benefits must be adjusted for scope, quality and timing.

However, a definitive understanding of the NPV method is more complex. The concept of the net present value technique is based on the principle of maximising the investor's wealth. The investor's wealth consists of both current funds and the present value of all rights to future income. Investing in an investment opportunity means to sacrifice current funds for the right to earn future income which exceeds the initial capital outlay plus a cost of capital, so that the investor's wealth is increased. Conversely, if the initial capital outlay exceeds the present value of the right to future income then the investor's wealth will decline and the investment is not viable.

This method is commonly known as the net present value method or net benefit method or net present worth method. The NPV approach represents a direct utilisation of the present value concept, whereby all future costs and benefits are discounted to present values. The NPV technique, determines the net difference between the present value amounts attached to all costs and benefits.

Lumby (1981, p. 33) describes the net present value method as:

"The NPV investment appraisal method works on the simple but fundamental principle that an investment is worth undertaking only if the money got out of the investment is at least equal to, if not greater than, the money put in."

If the NPV of the total cash flow equals or exceeds zero, the project is regarded as being economically viable and should be accepted. Conversely, if the NPV is less than zero, the project is not considered as economically viable in terms of the hurdle rate and should be rejected.

The hurdle rate is equated to the cost of foregoing investment opportunities and typically reflects the required return selected by the investor. It is important to understand that the hurdle rate may represent a number of rates. These include overdraft rates, cost of capital, weighted average cost of capital, and average rate of return. These are determined according to the individual objectives of an investor, however, it can be said that the investor seeks to exceed the hurdle rate in order to maximise value.

Despite the complexities concerning the conceptual philosophy underpinning the NPV method, the calculation procedure is relatively simple. The equation representing the formula for arriving at the NPV is described below:

$$NPV = \sum_{t=1}^{n} \left[\frac{[I_t - E_t]}{[(1+i)^t]} \right] - C_0$$

Where

I_t = Actual value of income in period t

E_t = Actual value of expenditure in period t

T = A discounting period

N = Total number of discounting periods

I = The discount rate (hurdle rate)

C_0 = Initial capital costs

The NPV is depending of a number of variables. These factors are as follows:

- Initial capital investment;
- Future cash inflows;
- Timing of future cash inflows;
- Duration of investment;
- Cost of capital (discount rate)

These sections comprise the main discounting methods such as the net present value (NPV) and the internal rate of return (IRR).

The key difference between the main discounting methods namely the NPV method and the IRR method is that:

- The NPV approach assumes that all intermediate cash flows are reinvested at the company's cost of capital, whereas,
- The IRR approach assumes reinvestment at the IRR.

4.2 The Discount Rate

The choice of a discount rate is critical when selecting between investment alternatives. A project is regarded as economically viable in the sense that it yields a return in excess of the hurdle rate.

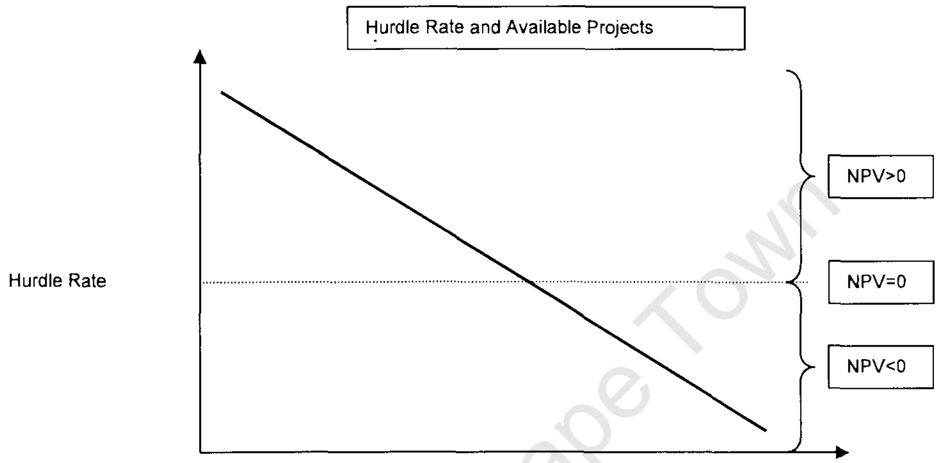

Figure 12: Hurdle Rate and Available Projects.

As illustrated in figure 12 above, the developer should accept any project that exceeds the hurdle rate in order to increase shareholder wealth.

Pike and Neale (2003, p. 390) and Greer and Farrell (1988, p. 292) refer to three factors to consider when selecting an appropriate discount rate.

Firstly, there is the risk free rate. This approach assumes that there is no premium for associated risk since the firm prices risk in its cash flows. However, while the risk of default may be zero, there still remains the opportunity cost.

Secondly, there is the risk-adjusted rate, which considers a minimum acceptable rate of return on the investment and adds a risk premium for associated risk.

Thirdly, a firm may use the weighted average cost of capital (WACC) as a minimum acceptable rate of return. Using this approach permits a direct comparison between investment opportunities of the same risk category. Furthermore, it eliminates comparison problems which could arise if anticipated cash flows differ vastly in amount or timing.

A project with high risk is adjusted by an appropriate premium for risk in the valuation. This method leads to a large discount rate and a lower value of the project.

DCF methods such as NPV and IRR are preferable to such methods as Payback and Accounting rate of return. The Payback method does not measure the return beyond the payback period. The Accounting rate of return is dependent on accounting policies and both the payback and the ARR do not consider the time value of money. Yet, DCF methods are subject to certain limitations.

4.3 Limitations of DCF Techniques

The DCF techniques work exceptionally well for the valuation of smaller more simple projects. However, the use of DCF techniques may be limited for large-scale real estate development projects, due to the flexibility in making consequential decisions, which are not valued under the DCF methods.

Simply demanding a higher return to compensate for higher risk leads to a systematic undervaluation of the project. The limitations of the DCF techniques originate from their fundamental assumptions. According to Copeland and Keenan (1998a) DCF techniques assume passive management of the investments and ignore that managers actively manage projects and may deviate from their initial operating strategy to adapt to new information. The traditional DCF methods ignore flexibility in managerial decision-making.

The failure or success of any project depends on the strategic use of embedded options. Limitation of the DCF techniques could be overcome through tree decision analysis, where multiple scenarios or options are included.

shortcomings of the traditional DCF analysis. It is possible to estimate probabilities and payoffs based on past data and experience. In the real world, the application of DTA is much more complex and involves numerous variables. This tool still involves a degree of subjectivity since the decision-maker must estimate the probabilities and discount rate, which are the most single important input assumptions.

5.2 Real Options Analysis

The real options approach is an extension of financial options theory applied to real assets. Real Options offer two strong advantages compared to the traditional DCF methods. Firstly, it recognizes the inherent uncertainty and flexibility of large-scale or multi-staged capital investments. Secondly, it establishes a link between strategic decisions and managerial flexibility.

5.2.1 Basis of Real Option Valuation

The basis for real option valuation derives from that of financial option valuation. A call option gives the buyer of the option the right to buy the underlying asset at a pre-determined price, at any time on or before the expiration date. The buyer pays a price for this right called the option premium. If, at expiration of the option, the value of the underlying assets is worth less than the exercise price, the option will not be exercised and becomes worthless. If on the other hand, the value of the underlying asset exceeds the exercise price, then the option is exercised- the buyer of the stock buys the underlying asset at the exercise price and the difference between asset value and the exercise price comprises the gross profit of the investment. The net profit on the investment is the difference between gross profit and the price paid for the call option originally.

A payoff diagram illustrates the payoff on an option at expiration date. For a call option, the net payoff is negative (and equal to the price paid for the call) if the value of the underlying asset is less than its exercise price. If however, the price of the underlying asset exceeds the exercise price, the gross payoff is the difference between the gross payoff and the cost of the call option.

There are two main types of call options- namely an American and European option. A primary distinction between American and European options is that American options can be exercised at any time prior to expiry. On the other hand European options can be exercised only at expiration date. The possibility of early exercise makes American options more valuable than European options. In addition, based on the early exercise possibility, American options are more difficult to value. In most instances, the time premium associated with the remaining life of the option and transaction costs make early exercise sub-optimal. In this instance, it would be more advisable to sell the option rather than exercising the option.

5.2.2 Real Option Valuation

Most capital investment projects that involve a sequential decision-making process have options embedded in them. Not recognizing the value of these options, could lead to underinvestment since decision-makers are likely to miss future investment opportunities with great potential returns.

The most important feature of real options analysis is that it can be used in conjunction with the conventional DCF methods. Mun (2002) suggested the concept of expanded NPV (ENPV), which is a combination of the option value embedded in the project and the NPV of the project.

It is assumed that a project requires an initial investment of X and will generate the present value (PV) of the expected cash flows computed as S. The NPV of this project is the difference between the S and X. This can be expressed as follows:

$NPV = S - X$

The option value can be calculated as follows:

$Option\ Value = Benefits - Cost$

The ENPV can be calculated as follows:

$ENPV = NPV + Option\ Value$

He further concludes, that when a project is deterministic, in other words without flexibilities, the option value would then be simply zero.

As in the DCF techniques, in real option analysis, cash flow, timing and risk still matter.

1. Cash flows: cash flows generated by the project and the initial investment.
2. Timing: The timing of the cash flows and the time to expiry.
3. Risk: The risk of the project and business risks.

According to Copeland and Keenan (1998a) option pricing models must contain at least 6 variables, which include information about cash flow, timing, and risk.

The value of a call option is determined by a number of key variables relating to the underlying asset. Listed below are the key value drivers for options:

1. ***Current value of underlying asset:*** Options are assets that derive value from an underlying asset. Changes in the market value of the underlying asset will affect the option value on that asset. Since call options secure

the right to buy the underlying asset at a pre-determined price, an increase in value of the asset will increase the option value.

2. ***Volatility in the market value of the underlying asset:*** The buyer of a call option acquires the right to buy an underlying asset at a fixed price. The higher the volatility (uncertainty) in market values, the greater the value of the option. While it may appear strange that an increase in uncertainty should increase the option value, options have the potential to earn significant returns from large price movement with relatively little risk of financial loss (not more than cost of option).
3. ***Dividends paid on the underlying asset:*** The value of the underlying asset can be expected to decrease if dividend payments (with land options agricultural rent) are made on the asset during the life of the call option. Hence, the option value on the underlying asset is a decreasing function of the size of the expected dividend (rent) payments.
4. ***Exercise price of call options:*** A key characteristic used to describe a call option is the exercise price. In this instance, the holder of a call option acquires the right to buy an asset at a pre-determined price, the option value will decrease if the exercise price increases.
5. ***Time to expiration on call option:*** Option value increases significantly as the time to expiration increases (extends). The reason for this characteristic is that the longer the time to expiration the more time is at hand for the underlying asset to appreciate in value. In addition, the present value of the exercise price decreases as the life of the option increases, thus increasing the value of the call option.
6. ***Risk-free interest rate and time to expiry:*** A higher interest rate will reduce the present value of the exercise price, thereby increasing the value of a call option, since the buyer of an option pays a premium for the call option in advance, and an opportunity cost exists. This opportunity cost will depend on the level of interest rates and the time to expiry on the call option.

Real options are useful when comparing to other methods, because they clearly define value drivers in projects with options embedded in them. Based on the variables in financial options, variables of real options can be used in a way to maximize the potential value of the options and the project.

Using variables typical to financial options as the basis, Copeland and Keenan (1998b) identifies major variables that can strategically improve option value in a project. Table 1 below, compares the variables of a financial option to the variables of a real option.

Comparison Financial Options vs. Real Options			
	Financial Option		Real Option
r_{RF} =	Risk-free interest rate	=	Risk-free interest rate
t =	Time until the option expires	=	Time until the option expires
X =	Exercise price	=	Cost to implement the project
P =	Current price of the underlying stock	=	Current value of the project
s^2 =	Variance of the stock's rate of return	=	Variance of the project's rate of return

Table 1: Comparison Financial Options vs. Real Options.

5.2.3 Types of Real Options

A number of studies have identified the types of real options that can be found in capital projects (see Lucius (2001), Trigeorigis (1993)).

There are many types of options in capital projects that are widely recognized and implemented:

Strategic Options in Capital Budgeting		
Option	Description	Examples in real estate developments
Defer	To defer development to wait for more favourable market conditions.	Wait with construction until investment is viable.
Expand or contract	To increase or decrease the scale of the project in response to demand and supply situation.	Buying or selling land for development to react to demand and supply situation.
Abandon	To discontinue (exit) a project and liquidate the asset base.	Discontinuing a real estate development due to unfavourable market conditions.
Stage investment	To develop projects in stages allows flexibility.	Phasing of large-scale development projects.
Switch inputs or outputs	To change the mix of inputs or outputs in response to changes market prices or supply situation.	Build apartment block instead of single family homes. Use concrete blocks instead of bricks.
Grow	To expand the scope of activities to capitalise on new opportunities.	Diversifying income by adding additional services or developments.

Table 2: Strategic Options in Capital Budgeting.

5.2.4 The Black-Scholes Option Pricing Model Theory

The model by Black and Scholes (1973) was designed to value European options, which were dividend protected. They combined the main factors of option value to develop a model in option pricing. Although the model is based on complex mathematical equations, it enjoys practical application. They established the value of an option by constructing a replicating portfolio of traded securities and debt. This provided a complete hedge, and since the hedged position has no other source of uncertainty other than the movement of the underlying asset price, the risk free rate can be employed as discount rate.

The Black-Scholes option pricing formula of a call option is as follows:

$$C = SN(d_1) - EN(d_2)e^{-tk}$$

In the formula, *S* is the current market price for a security, whereas *E* is the exercise price to the option, r_f is the continuously compounded risk-free rate, *t* is the number of years to expiry, *e* is the natural log. When this number is raised to a power equal to the product of $-r_f$, we convert it to the discount factor that discounts the exercise price to a present value using continuous discounting. The exercise price multiplied by e^{-tk} is the present value of the exercise price.

The numbers d_1 and d_2 are calculated as follows:

$$d_1 = \frac{\ln(S/E) + tk}{\sigma t^{1/2}} + \frac{\sigma t^{1/2}}{2}$$

$$d_2 = d_1 - \sigma t^{1/2}$$

$N(d)$ is the value of the cumulative distribution function for a standardised normal random variable and e^{-tk} is the present value of the exercise price continuously discounted.

The Black-Scholes option pricing formula has limitations as it does not take into account early exercise or the payment of dividends both of which have an impact on option value. Merton (1973) extended the Black-Scholes option pricing formula by introducing additional variables to deal with early exercise dividend payments. However, since in most instances real estate development projects do not pay dividends and the developer cannot exercise his options prior to rezoning or sub-division approval, options valued in this thesis are deemed to be European call options. However, other assumptions such as tradability may impact on the valuation of real estate developments.

CHAPTER V VALUING FLEXIBILITY IN REAL ESTATE DEVELOPMENT

5.0 Introduction

In a traditional capital budgeting analysis, a project should be accepted if the return exceeds the hurdle rate. Further, the NPV rule implies a "now or never" proposition, which means if the project yields a positive NPV it requires full commitment right away regardless how events may unfold. For example, a firm may able to defer investment until more information becomes available. DCF methods assume management's passive commitment to a certain pre-defined strategy and operate continuously at base scale until the end of the projects pre-specified life.

However, a business strategy consists of a series of options rather than a single cash flow and management will proactively manage investments by changing strategies in response to changing market conditions.

DCF methods are inadequate as they do not account for flexibility to adapt or revise initial operating decisions in response to changing or unexpected market developments. The NPV rule does not recognize such value.

In this section, we will introduce and analyse decision tree analysis and real option analysis.

5.1 Decision Tree Analysis

Decision tree analysis (DTA) is considered a more sophisticated method incorporating the DCF method, where multiple scenarios (options) are included in the analysis. It was first introduced by J. Margee in 1964 and remained an important valuation tool for capital investment decisions.

Real estate development projects involve sequential decision-making. In the case of multi-phase real estate development projects, DTA can be even more useful. DTA shows strategic future paths to a decision-maker and can be applied when future outcomes are uncertain. Decision-makers are able, by employing DTA, to react when new market information emerges and adapt their strategies accordingly.

DTA is based on the concept of expected returns, which form the basis of the traditional DCF analysis. The expected return of an asset is a probability-weighted average of its return in all future scenarios. The main concept of DTA is to show potential decision paths to decision-makers, enabling active management of the project. DTA includes the value of flexibility by laying out the structure and all the scenarios of a project in a tree form. These benefits can be used to overcome

CHAPTER VI Case Study: Option Pricing for Real Estate Development

6.0 Introduction

In traditional investment analysis, a project or new investment should be accepted only if the project exceeds the cost of capital resulting in a positive NPV. In this chapter, we will analyse a residential housing development[6] by using a traditional discounted cash flow analysis and analyse three options that are embedded in real estate development projects. The first is the option to delay a project, especially when the firm has exclusive rights to the projects. In addition, the company has acquired an option on the vacant land for R250,000 and hence has the exclusivity to develop this particular project. Further, it is expected that the company will operate for the next 3 years without serious competition due to market entry barriers. The second option is the option to expand the project by replicating the initial project. In this case study, the company has been able to acquire a second option on vacant land adjacent to the original project for the same amount consisting of an additional 750 opportunities for development, which it will pursue if the expected future cash flows exceed a set target. The third option is the option to abandon a project by exiting the investment if the expected cash flows do not materialize.

6.1 Discounted Cash Flow Analysis

A company has the opportunity to invest into a new project in the affordable housing market. All the company has at this stage is the development idea and an identified potential site for a plot and plan development. If the findings of the feasibility study are promising, the company will invest into the project at a cost of R65,742,250 acquiring 750 opportunities which the company intends to develop over a period of 3 years. Based on current projections, if the development is successful in the market, the company expects to generate an annual net cash flow of R32,810,733. To fund the planned construction the company needs to invest a further R11,172,317 in working capital in Year 0. The firm's cost of capital is 16%. The corporate tax rate is 29%. Using the cost of capital as discount rate, we obtain the following NPV for the project:

NPV of project	R-2,141,143
IRR of project	14.31%

[6] This thesis attempts to expand the application of real option analysis in real estate development to the valuation of large-scale developments case-studying the Bardale Village Development in Cape Town.

Although this project has a negative NPV and should be rejected right away, the biggest source of uncertainty on this particular project is variance in selling price/unit. While the current market studies indicate that the average selling price/unit in this target market is at R310,000 excluding VAT, the study also indicates a possibility that based on the current imbalance of demand and supply in the particular sub-market the potential selling prices could grow faster and higher than expected to R425,000 excluding VAT. Therefore, by rejecting the development considerable value might be lost.

In fact, a simulation of the project's cash flows yields a standard deviation of 32.47% in the present value of the cash flows with an expected value of R74,773,424.

Based on this uncertainty, the developer may chose to delay the project.

6.2 Valuing the Option to Delay a Project

It is assumed that a project requires an initial investment of *K* and the present value (PV) of the expected cash flows computed is *S*. The NPV of this project is the difference between the *S* and *K*.

$$NPV = S - K$$

For simplicity, we ignore the impact of working capital requirements and taxation in this calculation. We assumed that the firm has exclusive rights for the project for the next 3 years, and that the present value of the expected future cash flows may change due to the uncertainty in the selling price/unit. Thus, the project may have a positive or even negative NPV, but it might turn out to be an even better investment, if the firm waits.

To value the option to delay this project, we first define the inputs to the Black-Scholes option pricing model:

Value of underlying asset (S)	R65,703,399
Exercise price (K)	R76,914,567
Variance in underlying asset value (σ)	32.47%
Time to expiration (t)	3 years
The 10 year risk free rate (r_f)	10%.

The value of the option can be calculated as follows:

$$C = R65{,}703{,}399 * 0.7035 - R76{,}914{,}567 * 0.4889^{(-0.10)(3)} = R18{,}367{,}720$$

The option value can be added on to the net present value of the project to arrive at the total value of the project.

NPV of project[7]	R-698,659
Value of option to delay	R18,367,720
Total value of project	R17,669,061

The company should consider delaying the project, even though the NPV of the project is negative and should be rejected straight away, as the value of the option delay is of much greater value than the NPV.

6.3 Valuing the Option to Grow a Project

The company is considering replicating the initial project by exercising its option to buy additional land adjacent to the initial project. However, the company will only implement the repeated project if demand is high and it can achieve the highest selling price/unit. The exercise price is R88,451,752, which is 15% higher than the initial cost for the original project, and will only be undertaken only if the present value of the expected cash flows exceeds R100,000,000. Currently the present value of the expected cash flow of the initial project is only R74,773,424.

If it were not, the company could have implemented the entire project immediately. The company does still not know much about the likely demand and the selling price per unit, and there is still considerable uncertainty making it viable to stage the investment.

The value of the option to expand can now be estimated, by defining the inputs to the Black-Scholes option pricing model as follows:

Value of underlying asset (S)	R65,223,564
Exercise price (K)	R88,451,752
Variance in underlying asset value (σ)	32.40%
Time to expiration (t)	3 years
The 10 year risk free rate (r_f)	10%.

The value of the option can be calculated as follows:

$$C = R65{,}223{,}564 * 0.6073 - R88{,}451{,}752 * 0.3863^{(-0.10)(3)} = R14{,}296{,}921$$

The option value can be added on to the net present value of the original project under consideration.

NPV of initial project	R-698,659
Value of option to expand	R14,296,921
Total value of project	R13,598,263

[7] In the option model, for simplicity the NPV was not adjusted for working capital and taxation.

The company should consider implementing the initial project first, even though the NPV of replicated project is negative. However, at the implementation of the initial project, the selling price/unit is highly uncertain and it is not clear at this stage if the project will yield the desired cash flows making it more viable to stage the development.

6.4 Valuing the Option to Abandon a Project

The final option to consider here is the option to abandon a project when its expected cash flows do not materialize. This option can also be illustrated using decision tree analysis. The decision tree analysis typically works only for multi-stage projects and it requires estimation on probabilities for each stage of the project. The option pricing model on the other hand provides a more formal approach of estimating the abandonment value of an option.

The value of the abandonment option can be estimated by estimating the inputs variables of a put option:

Value of underlying asset (S)	R65,703,369
Exercise price (K)	R76,914,567
Variance in underlying asset value (σ)	32.47%
Time to expiration (t)	3 years
The 10 year risk free rate (r_f)	10%.

The value of the put option can be calculated as follows:

$$C = R65{,}703{,}369 * 0.7035 - R76{,}914{,}567 * 0.4889^{(-0.10)(3)} = R18{,}367{,}720$$

$$P = (R18{,}367{,}720 - 65{,}703{,}369) + R76{,}914{,}567^{(-0.10)(3)} = R9{,}644{,}063$$

The option value can be added on to the net present value of the original project under consideration.

NPV of project	R-698,659
Value of option to abandon	R9,644,063
Total value of project	R8,945,404

If the expected NPV of the project is higher than the value of the abandonment option, then the project should be continued. If the abandonment value is higher, than the developer should not proceed with the development and exit his investment.

CHAPTER VII INDUSTRY SURVEY

7.0 Introduction

This thesis consists of original findings concerning how developers make investment decisions about optimal timing and risk management tools. It examines the real estate development processes of property developers-specifically what factors influence investment decisions, how potential development opportunities are valued and what methods are being used to undertake the valuations.

7.1 Research Overview

The data was gathered by contacting 252 property professionals, in particular decision-makers and their advisors, concerning their experience in property development practices in South Africa. The survey was administered in July and August 2007. Various professional bodies in South Africa namely the Royal Institute of Chartered Surveyors, the Association of Construction Project Managers, and the Master Builder's Association in the Western Cape were the sources for the population of property professionals identified as being part or the driver of the property industry in South Africa.

Source	Population
Royal Institute of Chartered Surveyors	111
Association of Construction Project Managers	30
Master Builder's Association (Western Cape)	29
Master Builder's Association (Gauteng)	50
Yellow Pages	32
Total Population	252

Table 3 : Break Down of Population for Survey.

Usable questionnaires were completed by 36 of the 252 property professionals contacted resulting in a response rate of 14.2%.

Although, this is a relatively low response rate, the results are in line with other survey results of listed companies being 15-25%. Also, the entities surveyed are unlisted and mainly small and medium sized enterprises and are usually owner-managed hence a lower response rate to questionnaires.

7.2 Context

While there is considerable literature concerning decision tree analysis and real options analysis in general, much is less is known about its use in evaluation practices for real estate development projects in South Africa.

The research explores current real estate development practices at a time when investors and property developers enjoy a largely positive investment environment. It extends the literature of real estate development practices by providing detail and specific information on the valuation practices that property professionals employ, both in terms of the overall importance and their evolving acceptance.

7.3 Survey Focus

In this research, factors influencing property development as well as the valuation tools and techniques employed by South African property professionals are considered. These property professionals comprise a group of role players in various aspects of property development that is concerned with maximising shareholder wealth and managing risk.

7.4 Survey Results

The questions produced quantitative data. The results from the quantitative analysis give a general overview in the analysis.

The quantitative data is principally an opinion put into a numeric presentation model, this would be responsive direct, yes or no questions or ranking in terms relevance or importance or frequency in a questionnaire or during an interview.

The questionnaire (see annexure A) was broken down into 6 sections and will be analysed below.

7.4.1 Section One: Background and Contact Details

In this section, respondents were asked a series of questions about their educational background and professional membership. Illustrated in figure 1 is the level of education of respondents interviewed. 24 of 36 or 68,57% of respondents have an postgraduate qualification, 9 out of 36 or 25.71% have undergraduate qualification and 2 of 36 or 5.71% have a secondary qualification as their highest level of education as shown in figure 15.

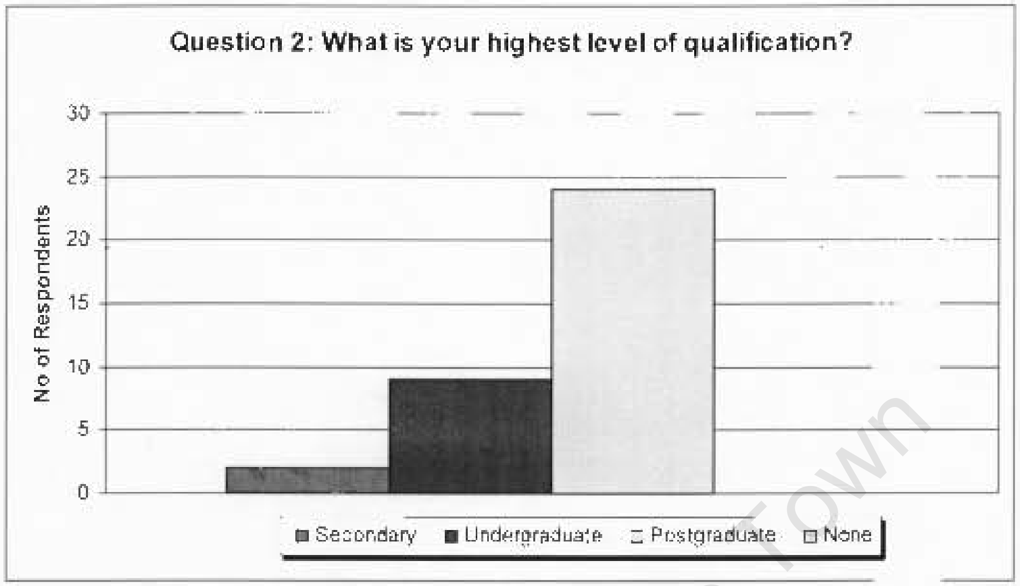

Figure 15. Level of Education of Respondents.

Figure 16 below shows the breakdown of respondents by professional membership. 13 of 36 or 37.14% of respondents were members of the Royal Institute of Chartered Surveyors followed by others (7 of 36).

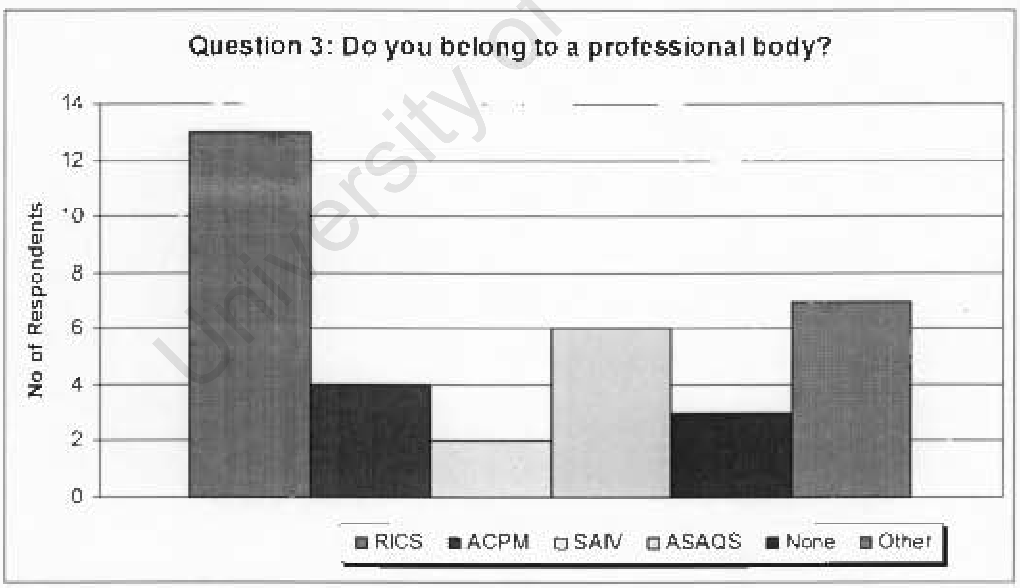

Figure 16. Breakdown of Respondents by Professional Membership.

7.4.2 Section Two: Classification of Company

In this section, respondents were asked a series of questions about their company. Of the 36 responses, 22 identified themselves as being directly involved in property development and investment, 10 identified themselves quantity surveyors, 2 identified themselves as project managers, 2 identified themselves as consultants.

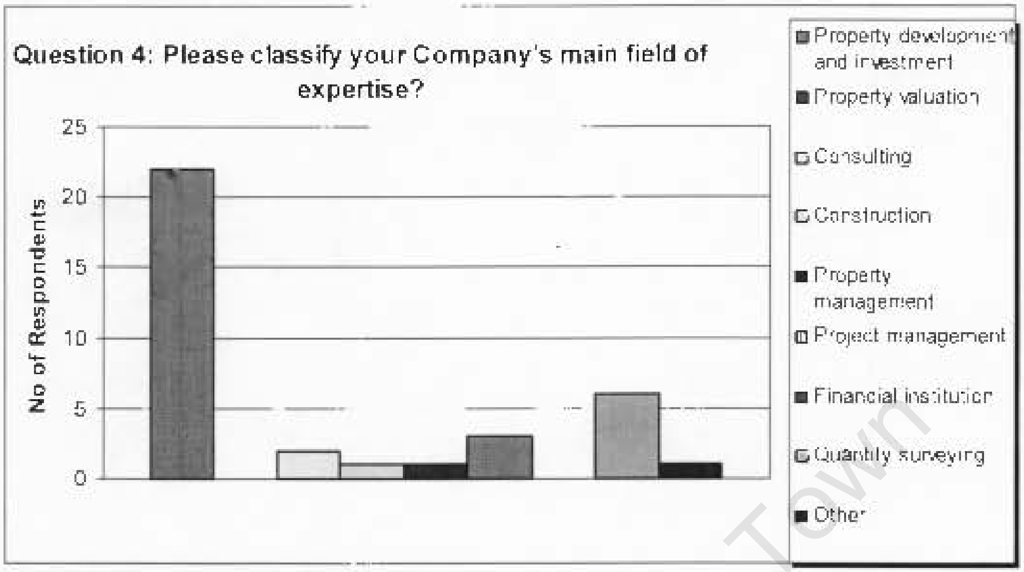

Figure 17. Breakdown by Classification of Company.

Incorporated in the questionnaire was a sub-survey specifically to identify operating strategies of property developers in South Africa. A sub-group of 22 respondents were identified.

In question 4A, respondents who are working for a company working in the field of property development and investment were asked to classify their company as either developer trader or developer investor or both. 9 of 22 or 40.91% of respondents identified their companies as developer traders whereas 6 of 36 or 27.27% of respondents identified their companies as developer investor, and 7 of 22 or 31.82% of respondents identified their company as being both

In question 4B, respondents were asked what type of property their company develops. 11 of 22 or 50% of respondents replied that there company is a developing both residential and commercial property, 7 of 22 respondents develop commercial property only and 4 of 36 respondents specialise on residential property development.

In question 4C, respondents were asked to select the operating strategy their company is pursuing when developing property. 10 of 22 respondents name the turnkey strategy, 4 of 22 respondents solely operate on a plot & plan strategy and 8 of 22 respondents identified that they use both. Interestingly, those that are developing residential property classified themselves as developer trader.

In question 4D, respondents who identified the plot & plan strategy as their operating strategy were asked to give reasons for using this strategy. 8 of 22 respondents stated that all reasons given are valid.

In question 5, respondents were asked if they work for a private or public company. 31 of 36 or 86.11% of respondents work for a private company. Only 4 of 36 respondents work for a listed company.

In question 5A, respondents who are working for a private company were asked if the shareholders of the private company are South African or foreign. 24 of 36 or 66.67% of respondents replied their companies are owned by South African citizens, 7 of 36 respondents replied their companies are owned by both South African citizen and foreign nationals, and a 5 of 36 respondents replied that their company is fully owned by foreign nationals.

In question 5B respondents who work for a private company were asked what type of legal entity their company is. It was found that 27 of 36 or 75% of respondents replied that the legal entity employed is a company, 6 of 36 are close corporations, and 3 of 36 are partnerships.

In question 5C, respondents who work for a listed company were asked on which stock exchange their company is listed. 4 of 4 are listed in South Africa on the Johannesburg Stock Exchange and one is also listed on a foreign Stock Exchange.

In question 6 and 7 respondents were asked about the size of their company by on the basis of the number of employees and annual turnover. Please refer to figure 18 and 19 respectively.

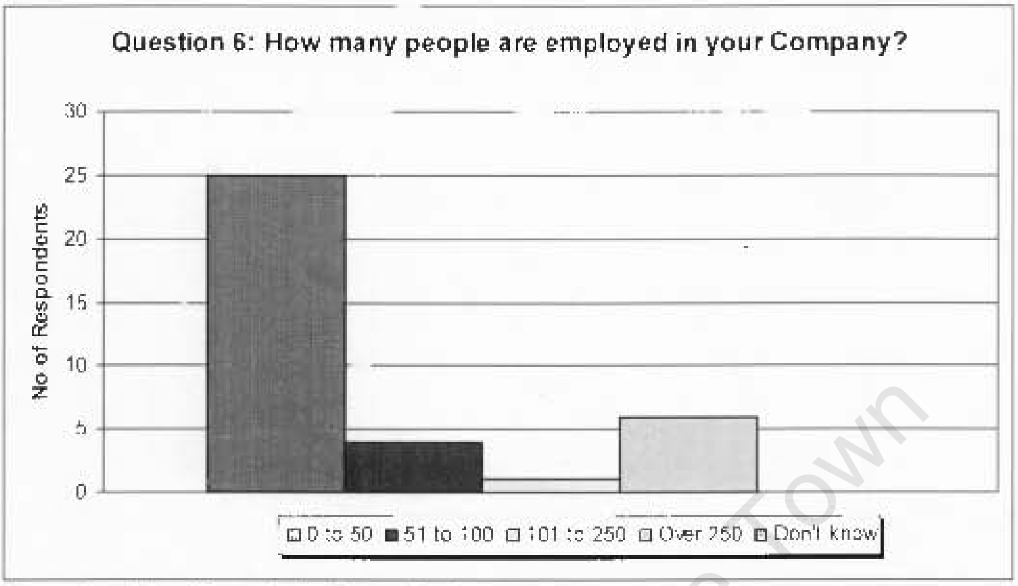

Figure 18: Breakdown of Companies by Number of Employees

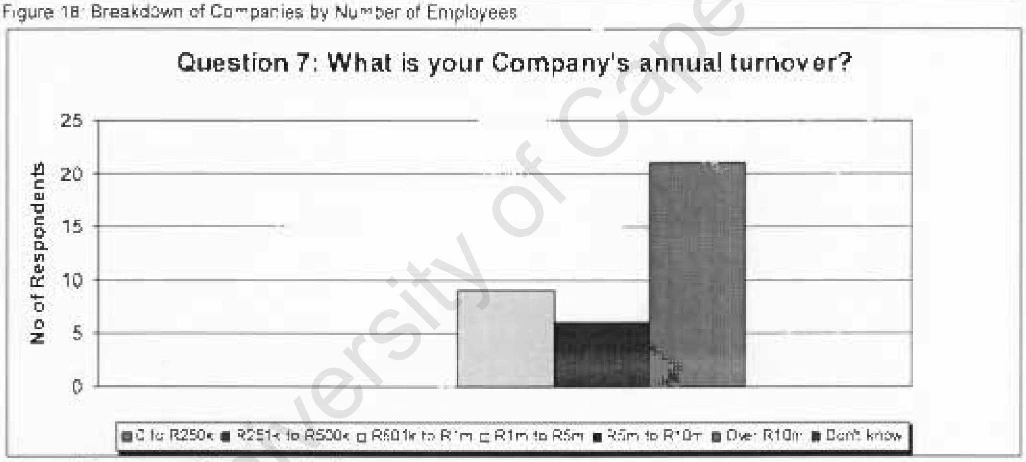

Figure 19: Breakdown of Companies by Annual Turnover.

In question 8, respondents were asked to name the value of the biggest real estate development project undertaken by the firm. Figure 20 shows that 7 of 36 respondents have worked on projects of more than R1bn in value. 6 of 36 respondents worked on projects of R500m to R1bn providing a good indication for this research in terms of valuation methods used to value such projects.

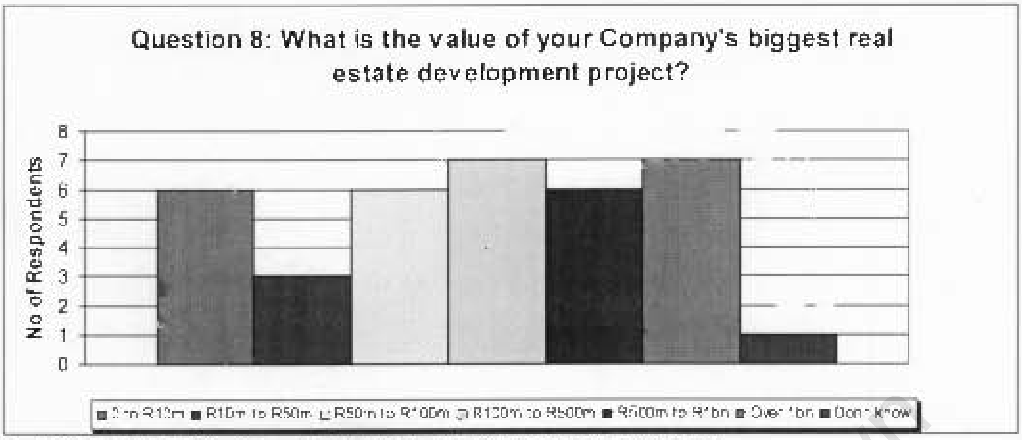

Figure 20. Breakdown of Companies biggest Real Estate Development Project by Value.

7.4.3 Section Three: Factors influencing Property Development

A particular objective of this research was to determine how important factors in property development are and how they are affecting investment decisions in real estate development. These factors are market factors, property characteristics, economic factors, and financial factors. Respondents were asked to rank in importance factors influencing decisions and activity in property development.

In question 9, respondents were asked to rank market factors in importance.

Question 9	Very important	Fairly important	Neither important nor unimportant	Not very important	Not at all important	Don't know	Mean	Total responses
1. Rentals for comparable properties	21	12	2	0	1	0	2	36
2. Vacancy rates and trends	14	14	5	2	1	0	2	36
3. Rental rates and trends	17	16	2	0	1	0	2	36
4. Lease terms on competing properties	5	15	15	1	0	0	2	36
5. Your firm's market experience	14	14	6	2	0	0	2	36
6. Sales prices of comparable properties	17	19	0	0	0	0	2	36
7. Competition	8	19	7	2	0	0	2	36
8. Limited land availability	23	10	2	1	0	0	1	36
9. Zoning and planning control	24	8	4	0	0	0	1	36
10. New construction methods	7	11	10	4	4	0	3	36
11. Time of market entry	21	12	1	2	0	0	2	36
12. Time to completion	13	11	5	1	0	0	2	36

Figure 21. Influence of Market Factors in Property Development

As illustrated in figure 21, 24 of 36 respondents identified zoning and planning control as the most important factor followed by limited land availability with 23 of 36. Further, 21 of 36 respondents identified rentals for comparable properties as well as time of market entry as equally important market factors. 19 of 36 respondents ranked competition as fairly important.

In question 10, respondents were asked to rank property characteristics in importance. As illustrated in figure 22, 33 of 36 respondents ranked location as the most important property characteristic.

Question 10	Very important	Fairly important	Neither important nor unimportant	Not very important	Not at all important	Don't know	Mean	Total responses
1. Location	33	3	0	0	0	0	1	36
2. Building condition	12	16	6	2	0	0	2	36
3. Land use	17	19	0	0	0	0	2	36
4. Access to public transport	6	17	9	4	0	0	2	36
5. Access to major highways	7	20	6	3	0	0	2	36
6. Design and architecture	8	22	6	0	0	0	2	36
7. Competitive position in market	16	13	6	1	0	0	2	36
8. Redevelopment potential	7	16	10	3	0	0	2	36
9. Infrastructure	19	12	5	0	0	0	2	36
10. Future growth potential	14	18	1	2	1	0	2	36
11. Size of property	6	11	13	5	1	0	3	36

Figure 22: Property Characteristics Influencing Property Development.

In question 11, respondents were asked to rank financial factors in importance. As illustrated in figure 11, 31 of 36 respondents ranked projected future income as the most important financial factor followed by capital growth with 23 of the respondents ranking this factor as very important.

Question 11	Very important	Fairly important	Neither important nor unimportant	Not very important	Not at all important	Don't know	Mean	Total responses
1. Projected future income	31	5	0	0	0	0	1	36
2. Debt coverage ratio	16	16	2	1	1	0	2	36
3. Pre-leasing or pre-selling	11	19	6	0	0	0	2	36
4. Loan-to-value ratio	12	17	4	2	1	0	2	36
5. Capitalization rate	15	18	3	0	0	0	2	36
6. Cash-on cash return	9	16	7	2	1	1	2	36
7. Price per sqm	15	13	7	1	0	0	2	36
8. Break-even point	12	16	8	0	0	0	2	36
9. Internal rate of return	19	10	6	0	1	0	2	36
10. Net present value	14	10	10	1	1	0	2	36
11. Resale value	14	18	3	0	1	0	2	36
12. Income yield	22	13	1	0	0	0	1	36
13. Capital growth	23	11	1	1	0	0	1	36
14. Shareholder value	14	14	5	1	1	1	2	36
15. Net profit	17	17	2	0	0	0	2	36
16. Working capital	14	18	4	0	0	0	2	36
17. Interest cover ratio	8	11	4	3	0	0	2	36
18. Return of equity	20	12	4	0	0	0	2	36
19. Risk free rate	8	16	7	2	1	2	2	36
20. Interest rate	18	11	4	3	3	0	2	36

Figure 23: Financial Factors Influencing Property Development.

In question 12, respondents were asked to rank economic factors in importance. As illustrated in figure 24, 31 of 36 respondents ranked demand as the most important economic factor followed by 23 of 36 who ranked supply as the second most important factor. Interestingly, 13 of 36 respondents found that Government interference is neither important nor unimportant in light of Government policies demanding a mixed use development in terms of income groups.

Question 12	Very important	Fairly important	Neither important nor unimportant	Not very important	Not at all important	Don't know	Mean	Total responses
1. Demand	31	5	0	0	0	0	1	36
2. Supply	23	12	1	0	0	0	1	36
3. Capital availability	14	15	5	0	1	1	2	36
4. Overall economic outlook	7	19	8	2	0	0	2	36
5. National real estate market	5	21	7	2	1	0	2	36
6. Inflation	7	17	9	3	0	0	2	36
7. Government interference	10	10	13	3	0	0	2	36
8. Macroeconomic policy	7	20	7	1	1	0	2	36
9.Availability of credit	11	17	5	2	1	0	2	36

Figure 24: Economic Factors Influencing Property Development.

7.4.4 Section Four: Economic Outlook and Business Confidence

Respondents were asked in question 13 and 14 how confident they are regarding the economic outlook for the next 5 to 10 years. In addition, they were asked in question 15 if their company is investing more, less or about the same in new projects than they did 2 years ago.

As illustrated in figure 25, 17 of 36 or 47.22% of respondents felt very confident. Interestingly, it seems rather surprising that the majority of 18 of 35 or 52.78% of respondents felt only fairly confident for the next 5 years in light of South Africa hosting the World Cup in 2010 and the increased Government expenditure on housing and infrastructure. However, no respondent indicated a lack of confidence over the next five years.

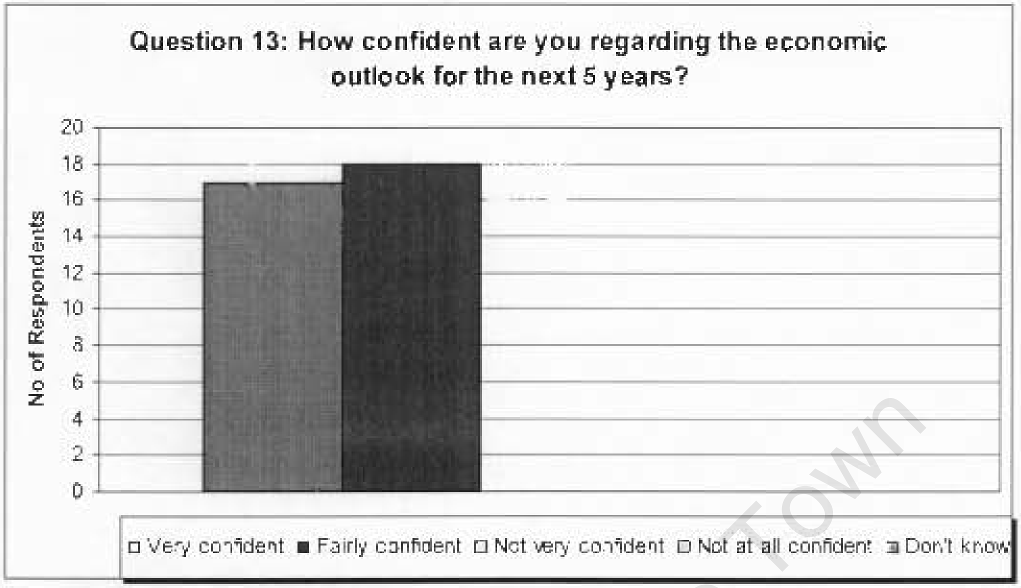

Figure 25. Confidence in Economic Outlook for the next 5 Years

Figure 26 shows that confidence levels are shifted with only 4 of 36 respondents feeling very confident over the next 10 years. The majority (28 of 36) of respondents felt only fairly confident for that period expressing market and political uncertainty. 3 of 36 respondents are not very confident and 1 of 36 respondents expressed no confidence at all.

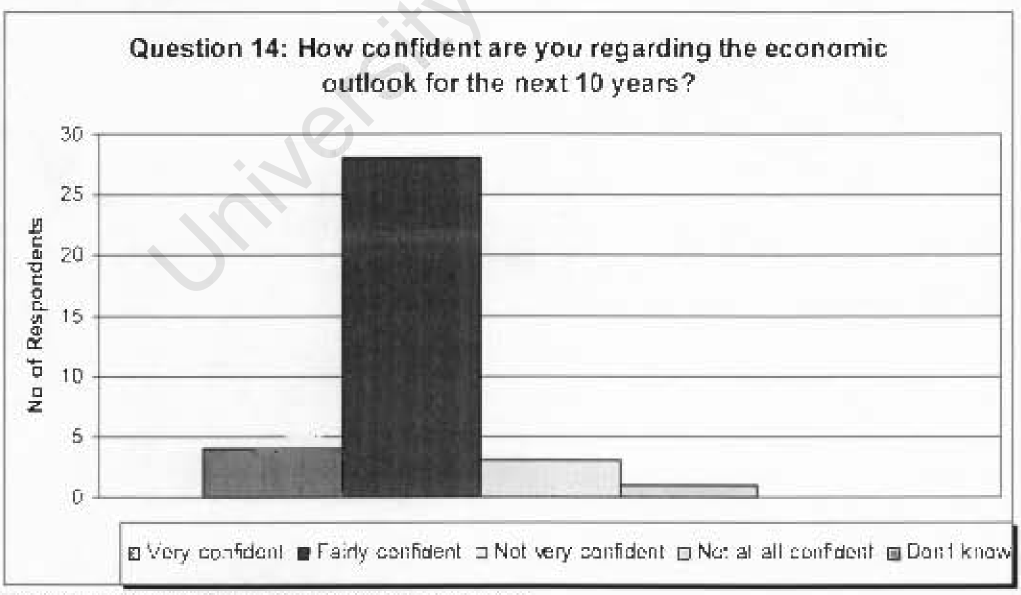

Figure 26: Confidence in Economic Outlook for the next 10 years.

In question 15, respondents were asked about the level of investment. 28 of 36 respondents indicated that they are investing more than they did 2 years ago and so confirming their confidence in the current economic situation. None of the respondents replied that they were investing less. The survey indicated that 6 of 36 respondents are investing about the same as in prior years.

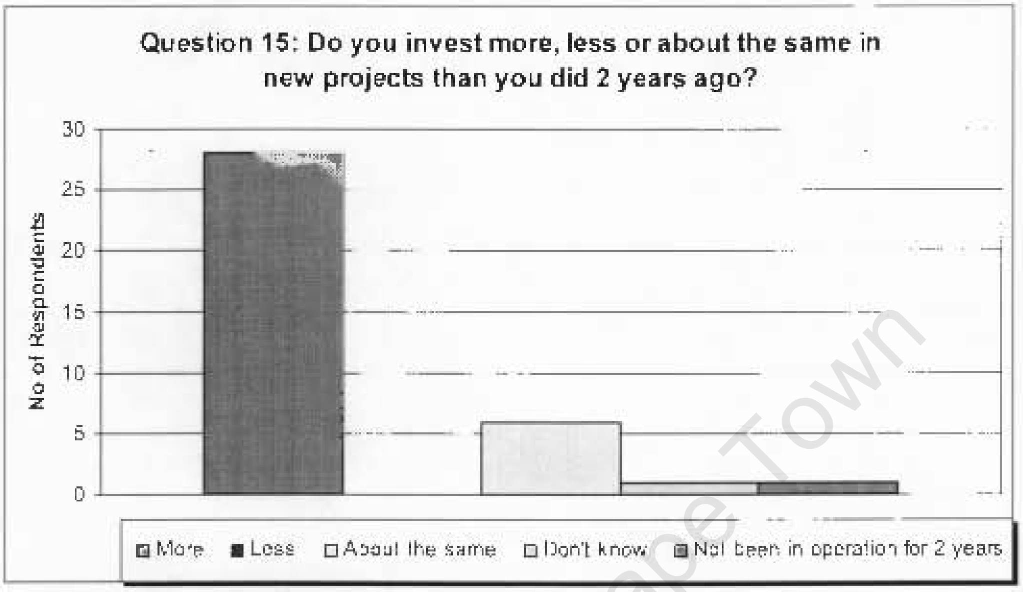

Figure 27: Level of Investment Activity In New Projects

7.4.5 Section Five: Evaluation Techniques used in Property Development

In this section, respondents were asked about the importance and the use of evaluation techniques in property development.

In question 16, respondents were asked which evaluation methods they use and how often they use them when valuing real estate development projects. The survey found that 17 of 36 respondents ranked the internal rate of return as the most often used method, 10 of 36 respondents ranked the net present value method as the second most used method followed by the return on equity with 10 of 36 respondents. It was found that 18 of 36 respondents do not use the decision tree analysis at all, 15 of 36 are not using economic value added, and 14 of 36 are not using real options analysis. A survey by Gilbert (2003) of capital budgeting practices employed by South African manufacturing firms found interesting shifts in valuation practices in South Africa. Ryan (2002, cited in Correia, et al (2003)) conducted a survey of Fortune 1000 companies on their capital budgeting practices.

The results of both studies are compared in table 4 against the results of this study.

Methods	RSA	USA	Survey Results
Payback	85%	44%	86%
ROI	77%	N/A	75%
ARR	23%	33%	78%
NPV	74%	75%	94%
IRR	67%	72%	92%

Table 4: Comparison of Valuation Methods used by Sector.

The results of the survey done in this thesis for the property sector are generally consistent with those of the manufacturing sector with an increasing use of the NPV and IRR methods. Surprisingly, the payback period and the accounting rate of return have been consistently in use. Property development firms tend to make a greater use of NPV as well as the accounting rates of return. This is consistent with firms using a number of methods to evaluate projects.

Question 16	Always	Very often	Often	Not very often	Not at all	Don't know	Mean	Total responses
1. Net present value	10	5	9	10	2	0	3	36
2. Internal rate of return	17	4	7	5	2	1	2	36
3. Accounting rate of return	7	4	6	12	5	2	3	36
4. Payback method	7	6	5	8	4	1	3	36
5. Profitability index	3	7	5	9	11	1	4	36
6. Discounted payback	2	4	4	15	10	1	4	36
7. Economic value added	4	2	4	9	15	2	4	36
8. Real options analysis	2	2	1	12	14	5	4	36
9. Decision tree analysis	0	3	2	10	18	3	4	36
10. Residual value	4	9	7	7	7	2	3	36
11. Free cash flow	4	7	8	5	8	2	3	36
12. Return on equity	10	5	7	10	6	3	3	36

Figure 28: Use and Frequency of Use of Evaluation Methods in Property Development.

Figure 28 indicates that the IRR method is the most important method used by developers in evaluating projects. There are disadvantages with using the IRR method relating to the reinvestment assumption.

In question 17, respondents were asked if they use more than one evaluation technique when evaluating development opportunities. As shown in figure 29, 28 of 36 respondents are using more than one evaluation technique.

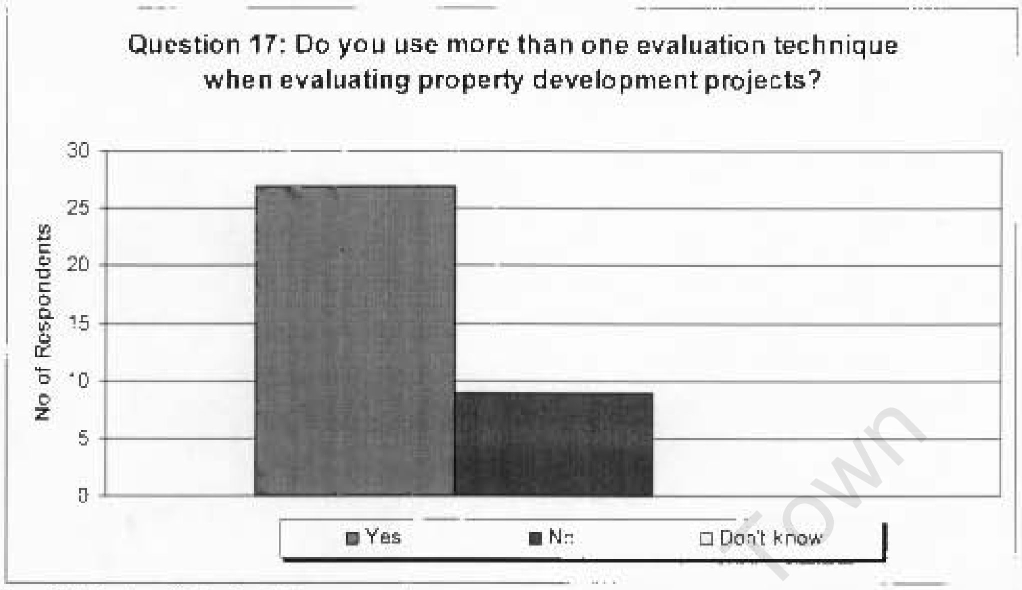

Figure 29. Number of Evaluation Techniques used.

In question 17A, respondents were asked which evaluation methods they use together when valuing real estate development projects. 16 of 30 respondents ranked the net present value and internal rate of return combination as the most often used when valuing a development opportunity, 10 of 30 respondents ranked the net present value, internal rate of return, accounting rate of return, and pay back period as the second most used combination followed by the internal rate of return and accounting rate of return combination with 4 of 30.

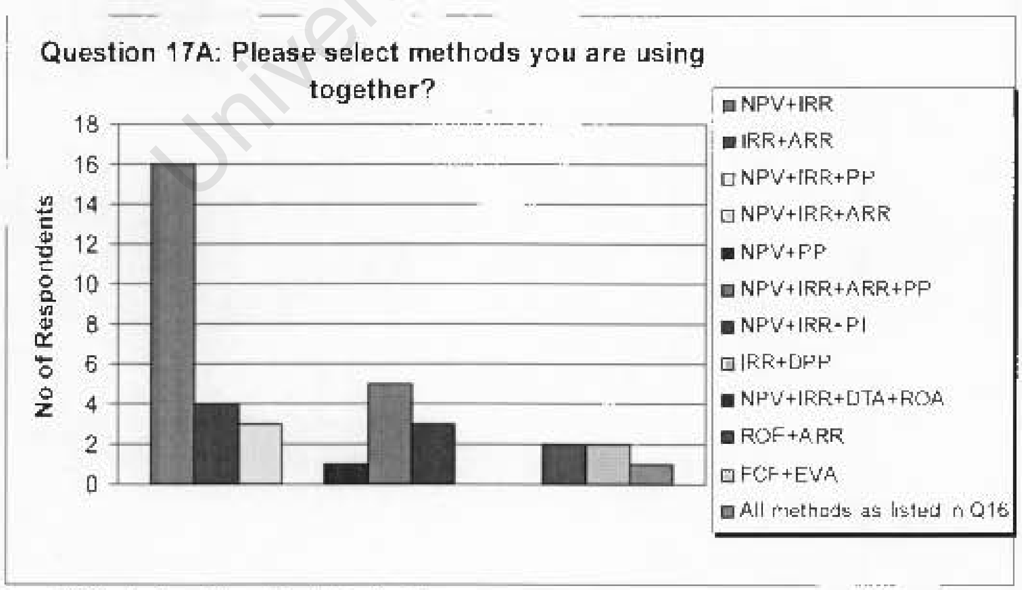

Figure 30: Combination of Use of Evaluation Techniques

In question 18, respondents were asked if they have experienced any difficulties over the last year finding acceptable projects to invest in. 18 of 36 or 50% of respondents replied that they have not experienced any difficulties in finding acceptable projects whereas 16 of 36 or 44.44% respondents replied with yes they have experienced difficulties finding acceptable projects.

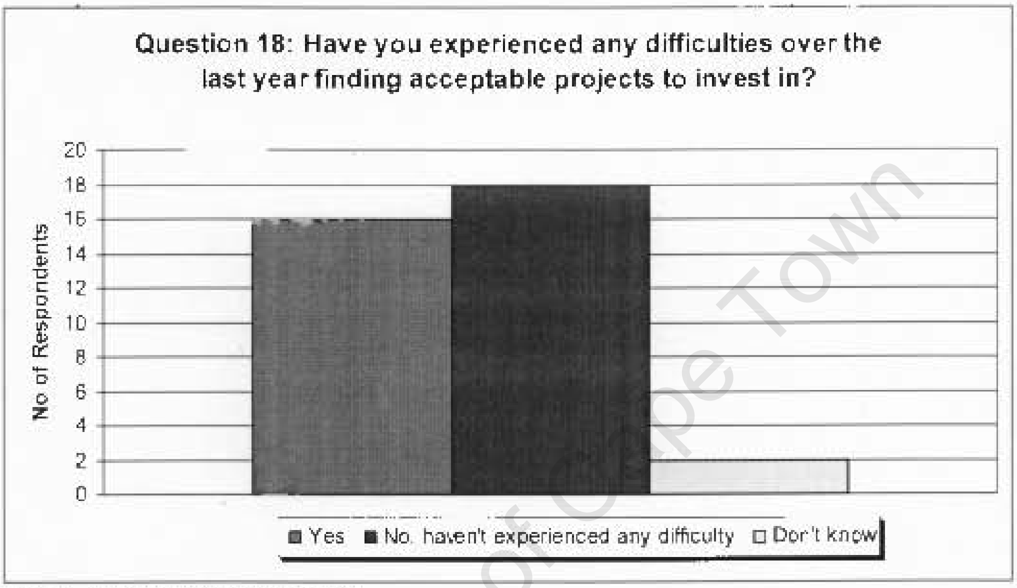

Figure 31. Availability of Acceptable Projects.

In question 19, respondents were asked about their level of accuracy. 10 of 36 respondents replied that their valuations are fairly accurate meaning a variance of less than 10% between the result of a valuation and its market value, 8 of 36 respondents replied that their valuations are very accurate meaning a variance of less than 5% between result of valuation and market value.

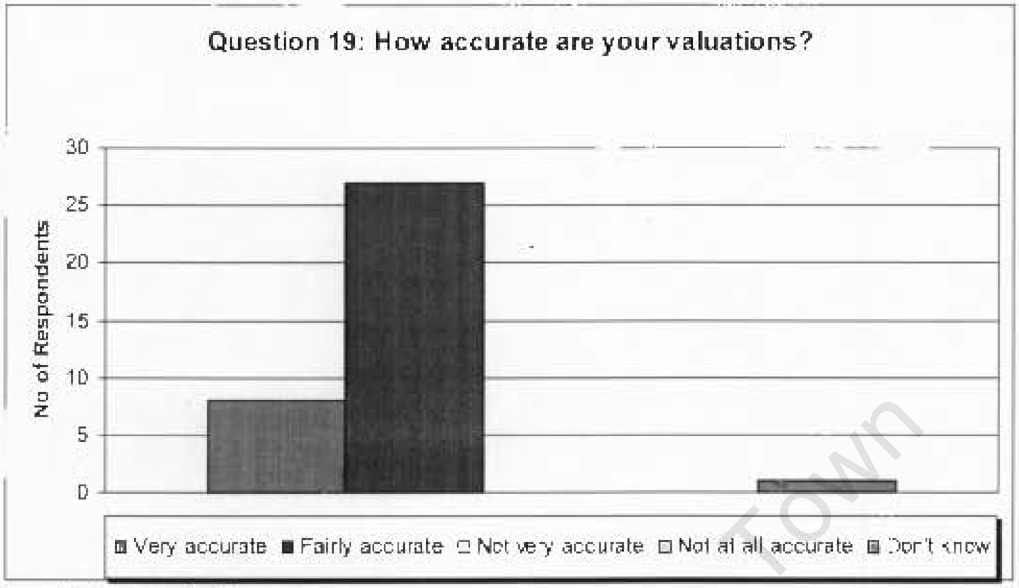

Figure 32: Accuracy of Valuations

In question 20, respondents were asked if they think that having a superior method or tool to evaluate projects would give them a competitive advantage. 15 of 36 respondents answered with a "yes", 7 of 36 respondents answered with a "no", and a surprisingly 13 of 36 respondents answered with a "maybe".

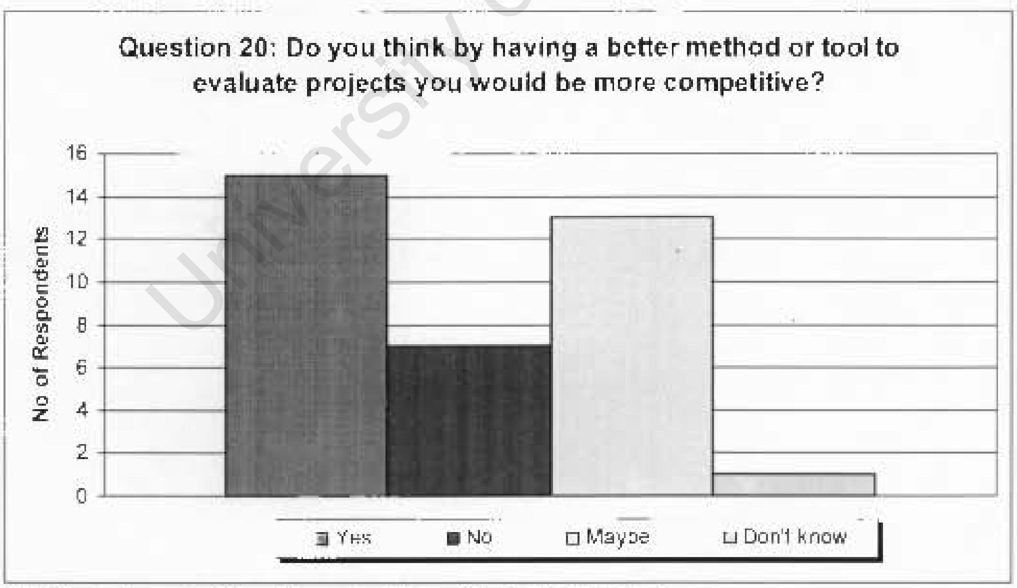

Figure 33: Improvement of Competitiveness by Using a Better Evaluation Method

In question 21 and 22, respondents were asked how familiar they are with real option analysis and decision tree analysis. In question 21, 19 of 36 respondents replied that they are not familiar at all with real option analysis.

In question 22, however, 5 of 36 respondents indicated that they are fairly familiar with decision tree analysis and 15 of 36 respondents replied that they not familiar with decision tree analysis. Refer to figure 34 and 35 respectively.

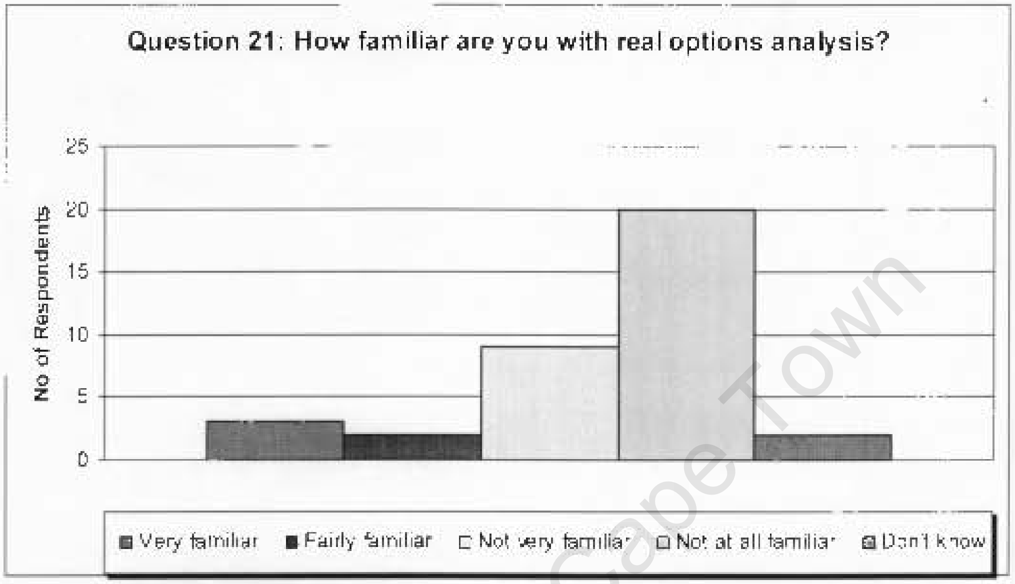

Figure 34: Familiarity with Real Options Analysis.

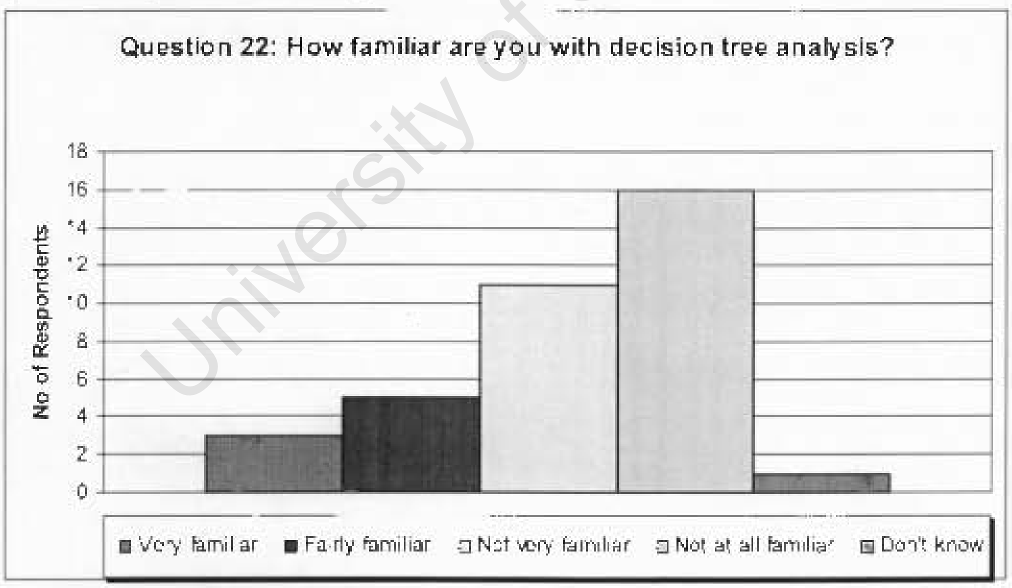

Figure 35: Familiarity with Decision Tree Analysis

In question 23, respondents were asked how they deal with uncertainty in valuation. The majority or 17 of 36 respondents employ a sensitivity analysis approach. Only 5 of 36 respondents use a scenario analysis approach. Rather surprisingly, 8 of 36 respondents use probabilities to deal with uncertainty in valuation models. None of the respondents uses explicitly Monte Carlo Simulation. However, 4 of 36 respondents are using all methods to deal with uncertainty.

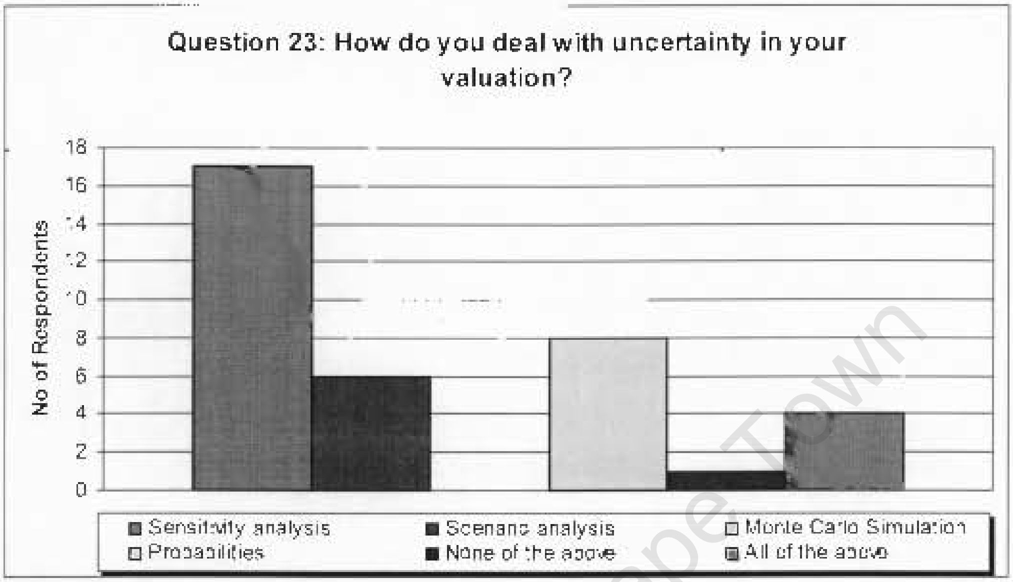

Figure 36: Methods to Deal with Uncertainty in Valuations.

In question 24, respondents were asked how they choose the discount rate when valuing real estate development projects. The majority of 20 of 36 or 55.56% of respondents replied the rate of return required by shareholders. 7 of 36 respondents do not know.

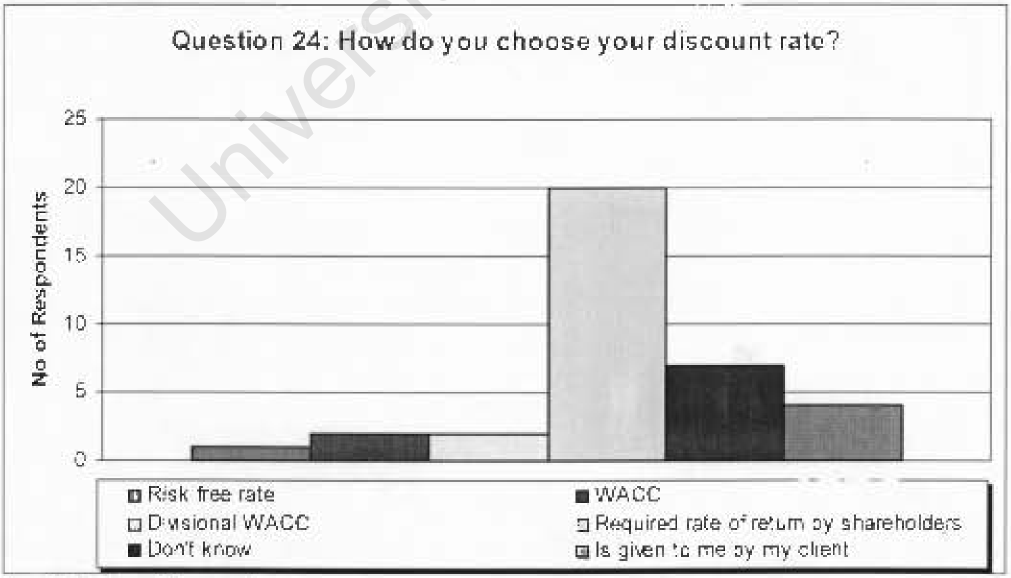

Figure 37: Choice of Discount Rate

In question 25, respondents were asked about their minimum rate of return for real estate development projects. 19 of 36 respondents replied that their minimum rate of return is between 10 to 15%. 9 of 36 respondents replied they require a rate or return between 15 to 20%. 4 of 36 respondents require a hurdle rate of more than 25%. 2 of 36 respondents require a hurdle rate of over 30%.

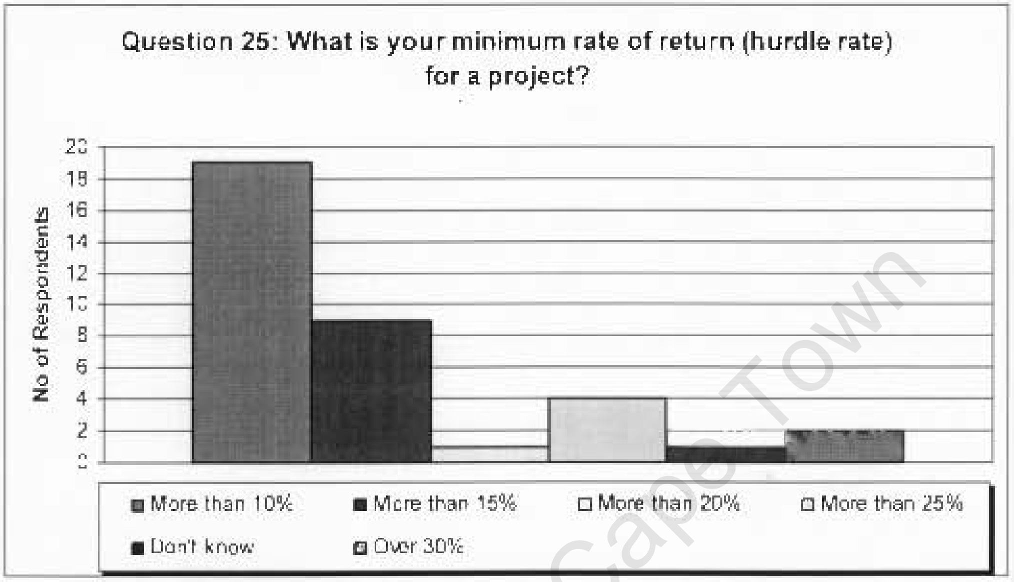

Figure 38: Minimum Hurdle Rate for a Project

In question 26, respondents were asked if they are performing a post-audit after completing real estate development projects. An overwhelming majority of 27 of 36 or 75% of respondents do perform a post-audit.

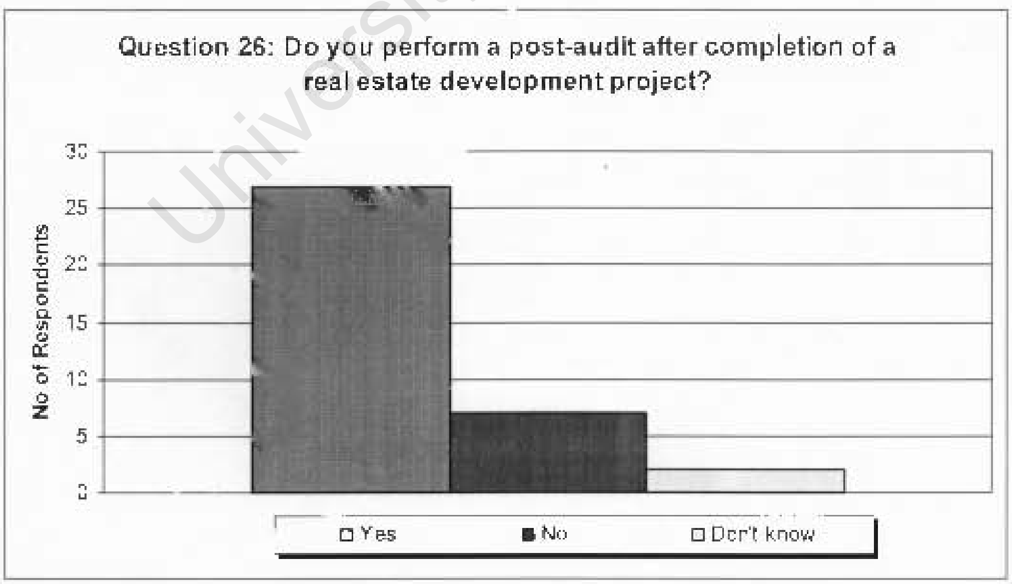

Figure 39: Performance of Post-Audit after Completion of a Project.

A survey conducted by Coltman (1995, cited in Correia, et al (2003)) indicated that 87.5% of firms did undertake post-audits after completing capital investment projects. In contrast, 75% of all respondents are performing post-audits after completing a property development project.

In question 27, respondents were asked to rank different options in real estate development projects in terms of relevance. Figure 40 below illustrates, that 14 of 36 respondents felt the option to grow has the highest relevance, 21 of 36 respondents felt that the option to expand is only relevant. 15 of 36 respondents felt that the option to defer has only some relevance.

Question 27	Highly relevant	Relevant	Has some relevance	Has minimal relevance	Has no relevance	Don't know	Mean	Total responses
1. Option to grow	14	14	5	1	2	2	2	36
2. Option to expand	7	21	5	1	1	1	2	36
3. Option to abandon	3	15	12	2	1	3	3	36
4. Option to defer	1	13	15	3	1	3	3	36
5. Option to switch inputs or outputs	1	15	9	3	2	6	3	36
6. Staging of investment	8	14	7	2	1	4	3	36

Figure 40: Relevance of Options in Property Development.

7.4.6 Section Six: Risk Management in Property Development

In this section, respondents were asked about relevant risk and risk management tools employed in real estate development projects.

Figure 41 below shows the results for question 28. Here respondents were asked to rank risks in relevance. An overwhelming majority of 29 of 36 respondents identified cash flow risk as the most relevant risk in real estate development projects. 15 of 36 respondents identified market risk and skills and material shortage as the second most relevant risk in real estate development.

Question 28	Highly relevant	Relevant	Has some relevance	Has minimal relevance	Has no relevance	Don't know	Mean	Total responses
1. Liquidity risk	14	18	3	0	0	1	2	36
2. Cash flow risk	29	6	1	0	0	0	1	36
3. Control risk	7	21	3	2	1	2	2	36
4. Credit risk	9	22	3	2	1	0	2	36
5. Business risk	9	20	7	0	0	0	2	36
6. Market risk	15	16	5	0	0	0	2	36
7. Project risk	9	20	5	0	1	1	2	36
8. Unsystematic risk	0	10	15	4	1	6	3	36
9. Country risk	1	16	10	5	3	1	3	36
10. Currency risk	2	12	15	5	2	0	3	36
11. Skills & material shortage	15	13	7	1	0	0	2	36

Figure 41: Relevant Risks in Property Development.

In question 29, respondents were asked if they know the difference between uncertainty and risk. An overwhelming majority of 30 of 36 respondents stated yes.

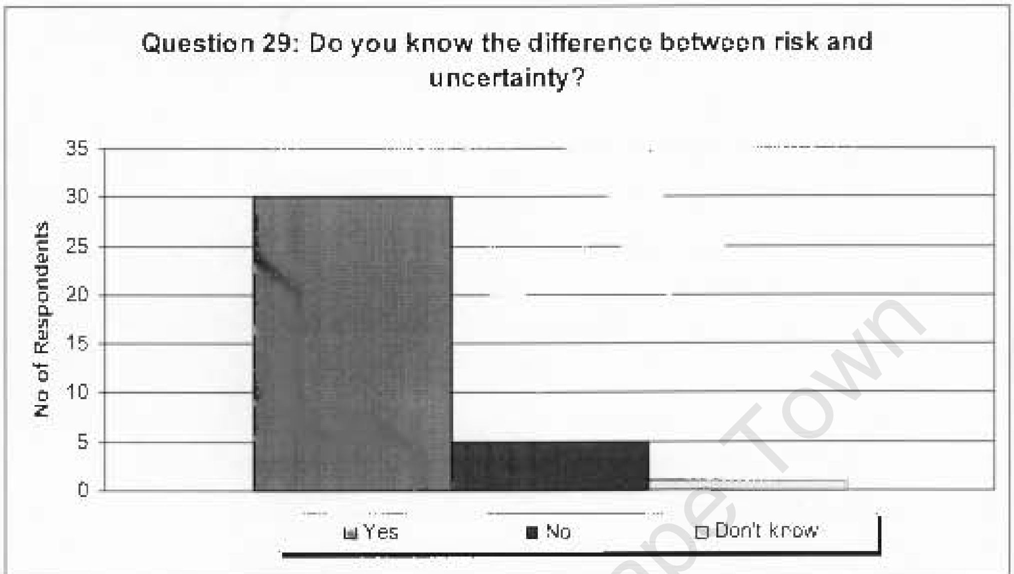

Figure 42 Difference between Risk and Uncertainty.

In question 30, respondents were asked how often they use selected tools to manage risks in property development. 19 of 36 respondents ranked active management as a tool which is always used to manage risk in real estate development.

Question 30	Always	Very often	Often	Not very often	Not at all	Don't know	Mean	Total responses
1 Insurance	18	6	3	5	3	0	2	36
2 Guarantees	17	10	6	2	1	0	2	36
3 Financial derivatives	1	2	3	10	19	1	4	36
4 Securitization	0	1	4	12	14	5	5	36
5 Phasing of development	5	13	12	4	2	0	3	36
6 Staging of investment	2	7	11	11	3	2	3	36
7 Active management	19	7	7	1	2	0	2	36
8 Pre-selling or pre-letting	12	10	6	5	2	0	2	35
9 Limited liability	8	11	6	5	4	1	3	35

Figure 43. Use and Frequency of Use of Risk Management Tools in Property Development

CHAPTER VIII Conclusions and Recommendations for Further Research

8.0 Introduction

This chapter concludes this thesis and sets out the findings of this research. The recommendations are at an overall level, specifying broad directions for further research rather than detailed advice.

8.1 Findings

Based on the research undertaken the following key findings are evident:

(1) 67% of respondents identified zoning and planning control as important market factors, followed by limited land availability and time of market entry.

(2) 91.7% of respondents identified location as the most important property characteristic.

(3) 86.1% of respondents identified projected future income as the most important financial factor.

(4) 86.1% of respondents identified demand as the most important economic factor in property development.

(5) 47.2% of respondents are using the IRR method always. Decision tree analysis and real options analysis on the other hand are the least use methods when evaluating projects.

(6) 77.8% of respondents use more than one evaluation method to evaluate real estate development projects. The most frequent combination is the NPV and IRR method.

(7) 72.2% of respondents said that their valuations are fairly accurate with less than 10% between valuation results and market value.

(8) The majority of respondents are not familiar with decision tree analysis or real options analysis at all.

(9) 47.2% of respondents employ a sensitivity analysis to deal with uncertainty. Only 13.9% of respondents use a scenario analysis approach.

(10) 55.6% of respondents are using the required rate of return by shareholders as the discount rate.

(11) 52.8% of respondents identified their minimum discount rate between 10 to 15%.

(12) 75% of respondents perform post-audit after completing a project recording experiences and historical data for future reference.

(13) 38.9% of respondents ranked the option to grow as highly relevant option in property development. 58.3% of respondents ranked the option to expand as relevant.

(14) 80.6% of respondents ranked cash flow risk as highly relevant for property development.

(15) 52.8% of respondents ranked active management as the most effective risk management tool.

8.2 Conclusions on Research Objectives

The research was undertaken to determine the following research objectives:

1) ***The real estate sector employs DCF methods such as IRR and NPV rather than naïve methods such as Payback and the Accounting rate of return to evaluate projects.***

   The results of the survey show that over 90% of all respondents are using a combination of NPV and IRR methods most often to evaluate development opportunities. Interestingly, 85% of all respondents are also using the payback period. Other methods used are the profitability index, residual value, free cash flow, economic value, and return on equity. Developers have adopted DCF methods such as NPV and IRR as the primary methods to evaluate projects rather than naïve methods such as Payback and ARR, although these latter methods remain in use. The use of decision tree analysis and real option analysis is very limited and demands further detailed research.

2) ***Firms in the real estate sector use the weighted average cost of capital (WACC) to discount project cash flows.***

   The survey found that the discount rate used is between 10 and 15%. The survey indicated that developers use a return required by shareholders. It perhaps indicates the use of a cost of equity, WACC approach or the pre-tax cost of debt. However, interviews indicate the use of pre-tax cost of debt is used as a benchmark to compare to the after-tax return. Consequences of such an approach are a systematic overvaluation of project value and an incorrect adjustment for risk. This issue raises scope for further research.

3) ***Firms use real options to value the flexibilities inherent in real estate development projects.***

The survey found that 19 of 36 respondents quoted active management as the most effective risk management tool in property development. Other risk management tools used are insurance, i.e. all contractors use risk insurance for construction-related risk during the building period and performance guarantees by the principal contractors. Financial derivatives such as forward or future contracts to fix construction prices are not used at all in the industry probably due to the complex nature and limited tradability.

In terms of real option theory, phasing of developments and staging of investments are being used only by a few respondents.

12 of 36 respondents are using pre-selling or pre-letting of projects as a risk management tool. Generally, pre-selling or pre-letting is used by developers to test the market. If sufficient pre-sales have been achieved, the developer then exercises the option and commences the property development project.

8.3 A Viewpoint

In real life companies pursue business strategies set by management to achieve targets. Companies may take on projects, because they allow them either to take on other projects and grow their market share or to enter into other markets in the future. In such instances, the initial project can be regarded as an option allowing the company to take on other projects or expand the initial project. Such business strategies consist of a series of options rather than a single cash flow and management will proactively manage investments by changing initial strategies to capitalise on further opportunities or to limited potential losses.

The NPV rule implies a "now or never" proposition, which means the project, if acceptable, requires full commitment right away regardless of how events may unfold. In general, DCF methods assume management's passive commitment to a certain pre-defined strategy and to operate continuously at base scale until the end of the projects pre-specified life.

DCF methods are inadequate as they do not account for flexibility to adapt or revise initial operating decisions in response to changing or unexpected market developments. The NPV rule does not recognize such value.

The fundamental question is what valuation tool to use in order to evaluate highly uncertain investment, but highly profitable if successful and to illustrate embedded value in a formal way to shareholders and lenders.

There are two fundamental conclusions from this thesis: firstly, there is value in options embedded in capital investment projects and management can unlock such value by recognizing such options embedded in a capital investment. Secondly, by recognizing such options the company gains a competitive advantage.

The value of the option to delay derives not from the expected future cash flows generated by the investment, but from the uncertainty in market prices and the time to expiry. The greater the uncertainty in market prices and the longer the time to expiry, the greater is the option value to delay the investment.

The value of the option to expand derives not from the expected future cash flows generated by the second investment, but from the excess returns generated by the initial project. The greater the potential for excess returns on the subsequent investment, the greater is the option value in the initial investment. The potential for earning excess returns is linked to the exclusivity or the competitive advantage of the initial investment.

In a competitive market place, excess returns attract competition and drives out excess returns. The more sustainable the competitive advantages are, the greater will be the value of the options embedded in the investment. In this case study, we assumed that the developer would acquire an option on vacant land consisting of 750 opportunities in the initial project and acquire a further option on vacant land for another 750 opportunities should the expected future cash flows exceed the initial expectations. In this instance, the supply of available land to develop is limited in a particular sub-market and has been bought by one developer. Competitors anticipating entering this market need to overcome market entry barriers by first acquiring a suitable piece of land, decide on the highest and best use, rezone, and then finally service the land. This would imply that it might take competitors up 24 months to enter the market before they would be able to compete.

The value of the option to abandon derives not from the expected future cash flows generated by the investment, but from the uncertainty and liquidation or abandonment value. The greater the uncertainty in market prices and the abandonment value, the greater is the option value to abandon the investment.

While it is quite obvious that options are embedded in many real estate development projects, there are several problems associated with the use of option pricing models to value these options.

First, the underlying asset, which is the sum of present values of the project's cash flow, is not traded, making it difficult to estimate its market value and its variance. It could be argued that the value can be estimated from the expected cash flows and the discount rate applied to the project. However, assigning probabilities to cash flows and determining the WACC leaves scope for errors and subjectivity by management. The variance is more difficult to determine, since the developer has to estimate the variance in project value over time. The variance in the present value of expected cash flows from projects can be estimated in 2 ways:

1. The firm might have had similar projects in the past, and the variance in cash flows from those projects can be used to determine the variance.
2. Probabilities can be assigned to various market scenarios, cash flows estimated under each scenario and the variance estimated across present value of expected future cash flows.

In addition, the behaviour of prices in the real estate market does not follow the price path assumed in option pricing models. The assumption that prices follow a diffusion process may not apply and the assumption that variance in project value remains unchanged over time, may not hold.

A further problem is the time to expiry, which the company has to develop the project. Unlike in our example, in which the firm has exclusive rights to the project for 3 years due to a time lag in supply and not legal rights as in a master license agreement for a franchise agreement.

A company may have significant advantages over its competitors by owning a strategically located piece of land hence creating an artificial monopoly by means of the size and location of the development, which may in turn provide the company with exclusive rights to this project for a long-time. Such rights are not legal restrictions but represent market entry barriers and could erode faster than expected by increased competition and changing market conditions.

In such cases the estimated project life is only an estimate and highly uncertain in itself.

In conclusion, the key value drivers of option values are the variances in expected future cash flows and the time to expiry. As in many investments, the acquiring firm believes that the investment will give the firm a competitive advantage over its competitors. When entering into new investment, firms have the option to invest in stages or delay the project until it yields the desired returns. While pursuing such a strategy may reduce the potential downside, it also may at the same time limit the potential upside. Taking investment in stages may allow competitors to enter the market and capture greater market share. It may also lead to higher unit costs, since the firm does not take full advantage of economies of scale leaving it vulnerable to competition.

Given reasonable characterization of conditions and uncertainties in the real estate markets and in property development, the real options approach provides a way to determine the optimal decision path and optimal timing when to implement a project for management.

Not all investments possess embedded options and not all embedded options are valuable. While the argument that most investments have embedded options is true, there is a danger that management will use this argument to justify poor investment decisions to shareholders and lenders.

References

Adair, A. and Lucius, D. (2002), ***What are real options in real estate development***, Briefings in Real Estate Finance, Volume 2, No.1, pp. 89-90.

Amin, K. and Capozza, D.R. (1993), ***Sequential Development***, Journal of Urban Economics, Volume 34, pp. 142-158.

Barrett, G. Vincent, Blair, John P. 1982, ***How to conduct and analyze real estate market and feasibility studies***, First edition, Van Nostrand, New York.

Black, F. and Schwartz, E.S. (1973), ***The Pricing Of Options and Corporate Liabilities***, Journal of Political Economy, Volume 81, pp. 637-654.

Brennan, M.J. and Schwartz, E.S. (1985), ***Evaluating Natural Resource Investments,*** Journal of Business, Volume 58, pp. 135-157.

Brown, R.L. and Achour, D. (1984), ***The Pricing of Land Options***, Urban Studies, Volume 21, pp. 371-323.

Byrne, P. (1995), *Fuzzy Analysis,* ***A Vague Way of Dealing with Uncertainty in Real Estate Analysis?,*** Journal of Property Valuation and Investment, 13:3, pp.22-41.

Capozza, D.R. and Helsley, R.W. (1989), ***The Fundamentals of Land Prices and Urban Growth***, Journal of Urban Economics, Volume 26, pp. 295-306.

Capozza, D.R. and Helsley, R.W. (1990), ***The Stochastic City***, Journal of Urban Economics, Volume 28, pp. 187-203.

Capozza, D.R. and Li, Y. (2001), ***Residential Investment and Interest Rates: An Empirical Test of Land Development as a Real Option***, Real Estate Economics, Volume 29, pp. 503-519.

Capozza, D.R. and Sick, G. (1991), ***Valuing Long-Term Leases: The Option to Redevelop***, Journal of Real Estate Finance and Economics, Volume 4, pp. 209-223.

Capozza, D.R. and Sick, G. (1994), ***The Risk Structure of Land Markets,*** Journal of Urban Economics, Volume 35, pp. 297-319.

Constantinides, G. M. (1978), ***Market Risk Adjustment in Project Valuation***, Journal of Finance, Volume 33, May 1978, pp. 603-616.

Copeland, T. and Antikarov, V. (2001), ***Real Options: A Practioner's Guide***, TEXERE, New York.

Copeland, T. E. and Keenan, P. T. (1998a), ***How Much Is Flexibility Worth?***, The McKinsey Quarterly, No. 3, McKinsey & Company, New York.

Copeland, T. E. and Keenan, P.T. (1998b), ***Making Real Options Real***, The McKinsey Quarterly, No. 3, McKinsey & Company, New York.

Correia, C., Flynn, D., Uliana, E. & Wormald, M. (2003), ***Financial Management,*** Fifth Edition, Juta & Co, Ltd, Cape Town, p. 5-5 to 5-23.

Cox, J.C. and Ross, S.A. (1976), ***The Valuation of Options for Alternative Stochastic Processes***, Journal of Financial Economics, Volume 3, No. 1-2, pp. 145-166.

DeLisle, James R., Sa-Aadu, J. 1994, ***Appraisal, market analysis, and public policy in real estate: essays in honor of James A. Graaskamp***, First edition, Kluwer Academic Publishers, Boston, p. 20.

Dixit, A.K. and Pindyck, R.S. (1994), ***Investment under Uncertainty***, Princeton University Press.

French, N. and Gabrielli, L. (2004), ***The Uncertainty of Valuation, Journal of Property Investment and Finance***, 22:6.

French, N. and Gabrielli, L. (2005), ***Discounted Cash Flow: Accounting for Uncertainty***, Journal of Property Investment and Finance, Vol. 23, No.1, pp. 76-89.

Froot, K. and Scharfstein, D. and Stein, J. (1994), ***A Framework for Risk Management,*** November-December, pp.91-102.

Gilbert , E. (2005), ***Capital Budgeting: A Case Study Analysis of the Role of Formal Evaluation Techniques in the Decision Making Process***, SAJAR, Volume 19, No.1, pp. 19-36.

Graaskamp, J. A. (1970), ***A guide to feasibility analysis***, First edition, Society of Real Estate Appraisers Inc., Chicago.

Graham, J.R. and Harvey, C.R. (2001), ***The Theory and Practice of Corporate Finance: Evidence from the Field***, Journal of Financial Economics, Volume 29(60), pp. 187-243.

Geltner, D. (1989), ***On the Use of the Financial Option Price Model to Value and Explain Vacant Urban Land***, AREUEA Journal, Volume 17 No. 2.

Greer, G. E., Farrell, M. D. (1988), ***Investment analysis for real estate decisions***, Second edition, Longman Financial Services Publishing, New York, p. 400.

Grenadier, S.R. (1995a), ***Valuing Lease Contracts: A Real Options Approach***, Journal of Financial Economics, Volume 38, pp. 297-331.

Grenadier, S.R. (1995b), ***The Persistence of Real Estate Cycles***, Journal of Real Estate Finance and Economics, Volume 10, pp. 95-119.

Grenadier, S.R. (1995c), ***Flexibility and Tenant Mix in Real Estate Projects***, Journal of Urban Economics, Volume 36, pp. 357-378.

Grenadier, S.R. (1996), ***The Strategic Exercise of Options: Development Cascades and Overbuilding in Real Estate Markets***, Journal of Finance, Volume 51, No.5, pp. 1653-1679.

Grenadier, S.R. (2001), ***Equilibrium with Time-to-build: A Real Options Approach in Project Flexibility, Agency and Competition***, Oxford, Oxford University Press, pp. 275-296.

Harvard, T. (2002), ***Contemporary Property Development***, First edition, RIBA Enterprises Ltd, London, p. 15.

Herath, H.S.B. and Park, C.S. (2002), ***Multi-Stage Capital Investment Opportunities as Compound Real Options***, The Engineering Economist, Volume 47, pp. 1-27.

Hertz, D.B (1964), ***Risk Analysis in Capital Investment***; London, Harvard Business Review, Jan/Feb p.64.

Hirshleifer, D. (1993), ***Managerial Reputation and Corporate Investment Decisions***, Financial Management, Volume 22(2), pp.145-160.

Horne, L.G. (1978), ***Marketing property in South Africa***, First edition, McGraw-Hill Company (Pty) Limited, Johannesburg.

Ingersoll, J.E., Jr and Ross, S.A. (1992), ***Waiting to Invest: Investment and Uncertainty***, Journal of Business, Volume 65, March, pp. 1-29.

Lai, R.N.; Wang, K.; Zhou, Y. (2004), ***Sale before Completion of Development: Pricing and Strategy***, Volume 32/2, pp. 329-357.

Leslie, K.J. and Michaels, M.P. (1993), ***The Real Power of Real Options***, The McKinsey Quarterly, No. 3, McKinsey & Company, New York.

Lucius, D. (2001), ***Real Options in Real Estate Development***, Journal of Property Investment and Finance, Vol. 19, No. 1, pp. 73-78.

Luehrman, T. A. (1998a), ***Investment Opportunities as Real Options: Getting Started on the Numbers***, Harvard Business Review, July-August, pp. 3-15.

Luehrman, T. A. (1998b), ***Strategy as a Portfolio of Real Options,*** Harvard Business Review, September-October, pp. 89-99.

Lumby, Stephen (1981), ***Investment appraisal and related decisions***, First edition, Thomas Nelson and Sons Ltd, Nairobi, p. 12.

MacFarlene, J. (1995), ***The Use of Simulation in Property Investment Analysis***, Journal of Property Valuation Investment, 13:4, p. 25-38.

Margee, J. (1964), ***How to Use Decision Tree in Capital Investment***, Harvard Business Review, Volume 42, pp. 79-69.

Majd, S. and Pindyck, R.S. (1987), ***Time to build, Option Value, and Investment Decisions***, Journal of Financial Economics, Volume 18, March, pp. 7-28.

McDonald, R. and Siegel, D. (1986), ***The Value of Waiting to Invest***, Quarterly Journal of Economics, Volume 101, No. 4, pp. 707-727.

McDonald, R. L. and Siegel, D.R. (1985), ***Investment and the Valuation of Firms when There is an Option to Shut Down***, International Economic Review, Volume 26, No. 2, June, pp. 341-349.

Merton, R.C. (1973), ***Theory of Rational Option Pricing***, Bell Journal of Economics and Management Science, Volume 4, pp. 144-183.

Messner, S. D., Boyce, B. N., Trimble, H. G. & Ward, R. L. (1984), ***Analyzing real estate opportunities: market and feasibility studies***, Fourth edition, Realtors National Marketing Institute, Chicago, p. 5.

Miles, M. E., Berens, G., Weiss, M. A. (2000), ***Real estate development: principles and process***, Third edition, ULI-the Urban Land Institute, Washington, D.C, p. 6.

Mun, J. (2002) ***Real Options Analysis: Tools and Techniques for Valuing Strategic Investments and Decisions***, John Wiley & Sons, NJ.

Myers, S. (1977), ***Determinants of Corporate Borrowing***, Journal of Financial Economics, Volume 5, November, pp. 147-175.

Oemke, J. (2000), ***Anomalies in Net Present Value Calculations***, Economic Letters, Volume 67, pp.349-351.

Oppenheim, A.N.1966, ***Questionnaire design and attitude measurement***, First edition, Basic Books, INC., New York, p. 24-40.

Patel, K. and Paxson, D. (1998); ***Real Options Based Approach to Valuation of Property Development and Investment***, Property Research Digest, February, pp. 1-11.

Paxson, D.A. (2004), ***Multiple State Property Options***, Journal of Real Estate Finance and Economics.

Pike, R. (1996), ***A Longitudinal Survey on Capital Budgeting Practices***, Journal of Business Finance and Accounting, Volume 23(1), pp. 79-92.

Pindyck, R. (1991), ***Irreversibility, Uncertainty and Investment***, Journal of Economic Literature, Volume 29, No. 3, pp. 1110-1148.

Ross, S.A. (1995), ***Uses, Abuses, and Alternatives to the Net Present Value Rule***, Financial Management, Volume 24, No.3, pp. 96-102.

Saunders, M., Lewis, P., Thornhill, A. (2003), ***Research methods for business students,*** Third edition, Pearson Education Limited, Harlow, p. 280-308.

Sing, T.F. (2001), ***Optimal Timing of Real Estate Development under Uncertainty***, Journal of Property Investment and Finance, Volume 19, pp. 53-72.

Smith, J.E. and Nau, R.F. (1995), ***Valuing Risky Projects: Option Pricing Theory and Decision Analysis***, Management Science, Volume 41, No. 5, May, pp. 795-816.

Trigeorgis, L. (1993), ***The Nature of Option Interactions and the Valuation of Investments with Multiple Real Options***, Journal of Financial and Quantitative Analysis, Volume 28, pp. 1-20.

Trigeorgis, L. (1995), ***Real Options in Capital Investments***, Models, Strategies and Applications, Praeger, Westport, Conn, First Edition.

Trigeorgis, L. (1998), ***Real Options: Managerial Flexibility and Strategy in Resource Allocation***, The MIT Press, Cambridge, MA.

Trigeorgis, L. and Mason, S.P. (1987), ***Valuing Managerial Flexibility***, Midland Corporate Finance Journal, Volume 5, No. 1, pp.14-21.

Williams, J. (1991), ***Real Estate Development as an Option***, Journal of Real Estate Finance and Economics, Volume 4, pp. 191-208.

Williams, J. (1993), ***Equilibrium and Options on Real Assets***, Review of Financial Studies, Volume 6, pp. 825-850.

Annexure A-Questionnaire

Objective of Survey

This survey forms part of my master thesis as a partial requirement to obtain my master degree in commerce at the University of Cape Town.

Investigator

Name: **Michael Bauer**

Contact No: **083 255 4442**

Email: **Michael@ihpc.co.za**

What is the purpose of the thesis?

The thesis will focus on advanced valuation techniques in evaluating flexibilities of management in large-scale real estate development projects. The approach is to analyse flexibilities by creating a chain of possible options and allow alternative course of action for management to adapt their initial strategies in order to capitalise on new opportunities or to minimise losses.

The thesis focuses more on practical application rather than mathematical theory.

Confidentiality

A statistical analysis will be performed on the data collected. Confidentiality is guaranteed.

SECTION ONE: BACKGROUND AND CONTACT DETAILS

Q1 **What is your name and contact details?**

Company Name: ______________________

Your Name: ______________________

Your Position: ______________________

Your Contact No: ______________________

Your Email address: ______________________

Q2 **What is your highest level of qualification?** SINGLE CODE ONLY

Secondary	1
Undergraduate	2
Postgraduate	3
None	4

Q3 **Do you belong to a professional body?** SINGLE CODE ONLY

Royal Institute of Chartered Surveyors	1
Association of Construction Project Managers	2
South African Institute of Valuers	3
The Association of South African Quantity Surveyors	4
Other	5
None	6

SECTION TWO: CLASSIFICATION OF COMPANY

Q4 Please classify your Company's main field of expertise? SINGLE CODE ONLY

Property development and investment	1	GO TO Q4A	
Property valuation	2	GO TO Q5	
Consulting	3	GO TO Q5	
Construction	4	GO TO Q5	
Property management	5	GO TO Q5	
Project management	6	GO TO Q5	
Financial institution	7	GO TO Q5	
Quantity surveying	8	GO TO Q5	
Other	9		( )

Q4A Are you a ....? SINGLE CODE ONLY

Developer trader	1	
Developer investor	2	
Both	3	
Don't know	4	( )

Q4B What type of property does your Company develop? SINGLE CODE ONLY

Residential	1	GO TO Q4C	
Commercial (includes office, retail, and industrial)	2	GO TO Q5	
Both	3		
None	4		( )

Q4C If your Company is developing residential property, which strategy does your Company pursue? SINGLE CODE ONLY

Plot & plan	1	GO TO Q4D	
Turnkey	2	GO TO Q5	
Both	3		( )

Q4D Why is your Company pursuing a plot & plan strategy? SINGLE CODE ONLY

Limited risk	1	
No working capital required	2	
No transaction costs	3	
Increase operational leverage	4	
Less resources required	5	
Low working capital requirement	6	
Risk transfer	7	
Don't know	8	
All of the above	9	
None of the above	10	( )

Q5 **Is your Company privately owned or listed on a stock exchange?** SINGLE CODE ONLY

Private	1	GO TO Q5A
Public	2	GO TO Q5C
Both	3	

( )

Q5A **If your Company is a private company, are the shareholders....?** SINGLE CODE ONLY

South African	1	GO TO 5B
Foreign	2	
Both	3	

( )

Q5B **What type of legal entity is your Company?** SINGLE CODE ONLY

Close Corporation	1
Partnership	2
Company	3
Trust	4

( )

Q5C **If your Company is listed on a stock exchange, where is it listed?** SINGLE CODE ONLY

In South Africa	1
Outside South Africa	2
Not listed	3

( )

Q6 **How many people are employed in your Company?** SINGLE CODE ONLY

0 to 50	1
51 to 100	2
101 to 250	3
Over 250	4
Don't know	5

( )

Q7 **What is your Company's annual turnover?** SINGLE CODE ONLY

0 to R250k	1
R251k to R500k	2
R501k to R1m	3
R1m to R5m	4
R5m to R10m	5
Over R10m	6
Don't know	7

( )

Q8 **What is the value is your Company's biggest real estate development project?** SINGLE CODE ONLY

0 to R10m	1
R10m to 50m	2
R50m to R100m	3
R100m to R500m	4
R500m to R1bn	5
Over R1bn	6
Don't know	7

( )

SECTION THREE: FACTORS INFLUENCING PROPERTY DEVELOPMENT

Q9 How important do you think market factors are in property development?
SINGLE CODE FOR EACH.

		Very important	Fairly important	Neither important nor unimportant	Not very important	Not at all important	Don't Know	Official use
1)	Rentals for comparable properties	1	2	3	4	5	6	( )
2)	Vacancy rates and trends	1	2	3	4	5	6	( )
3)	Rental rates and trends	1	2	3	4	5	6	( )
4)	Lease terms on competing properties	1	2	3	4	5	6	( )
5)	Your firm's market experience	1	2	3	4	5	6	( )
6)	Sales prices of comparable properties	1	2	3	4	5	6	( )
7)	Competition	1	2	3	4	5	6	( )
8)	Limited land availability	1	2	3	4	5	6	( )
9)	Zoning and Planning control	1	2	3	4	5	6	( )
10)	New construction methods	1	2	3	4	5	6	( )
11)	Time of market entry	1	2	3	4	5	6	( )
12)	Time to completion	1	2	3	4	5	6	( )

Q10 How important do you think property characteristics are in property development?
SINGLE CODE FOR EACH.

		Very important	Fairly important	Neither important nor unimportant	Not very important	Not at all important	Don't Know	Official use
1)	Location	1	2	3	4	5	6	( )
2)	Building condition	1	2	3	4	5	6	( )
3)	Land use	1	2	3	4	5	6	( )
4)	Access to public transport	1	2	3	4	5	6	( )
5)	Access to major highways	1	2	3	4	5	6	( )
6)	Design and architecture	1	2	3	4	5	6	( )
7)	Competitive position in market	1	2	3	4	5	6	( )
8)	Redevelopment potential	1	2	3	4	5	6	( )
9)	Infrastructure	1	2	3	4	5	6	( )
10)	Future growth potential	1	2	3	4	5	6	( )
11)	Size of property	1	2	3	4	5	6	( )

Q11 **How important do you think financial factors are in property development?**
SINGLE CODE FOR EACH.

		Very important	Fairly important	Neither important nor unimportant	Not very important	Not at all important	Don't Know	Official use
1)	***Project future income***	1	2	3	4	5	6	( )
2)	***Debt coverage ratio***	1	2	3	4	5	6	( )
3)	***Pre-leasing or pre-selling***	1	2	3	4	5	6	( )
4)	***Loan-to-value ratio***	1	2	3	4	5	6	( )
5)	***Capitalization rate***	1	2	3	4	5	6	( )
6)	***Cash-on-cash return***	1	2	3	4	5	6	( )
7)	***Price per m²***	1	2	3	4	5	6	( )
8)	***Break-even point***	1	2	3	4	5	6	( )
9)	***Internal rate of return***	1	2	3	4	5	6	( )
10)	***Net present value***	1	2	3	4	5	6	( )
11)	***Resale value***	1	2	3	4	5	6	( )
12)	***Income yield***	1	2	3	4	5	6	( )
13)	***Capital growth***	1	2	3	4	5	6	( )
14)	***Shareholder value***	1	2	3	4	5	6	( )
15)	***Net profit***	1	2	3	4	5	6	( )
16)	***Working capital***	1	2	3	4	5	6	( )
17)	***Interest cover ratio***	1	2	3	4	5	6	( )
18)	***Return on equity***	1	2	3	4	5	6	( )
19)	***Risk free rate***	1	2	3	4	5	6	( )
20)	***Interest rate***	1	2	3	4	5	6	( )

Q12 **How important do you think economic factors are in property development?**
SINGLE CODE ONLY FOR EACH.

		Very important	Fairly important	Neither important nor unimportant	Not very important	Not at all important	Don't Know	Official use
1)	***Demand***	1	2	3	4	5	6	( )
2)	***Supply***	1	2	3	4	5	6	( )
3)	***Capital availability***	1	2	3	4	5	6	( )
4)	***Overall economic conditions and outlook***	1	2	3	4	5	6	( )
5)	***National real estate market***	1	2	3	4	5	6	( )
6)	***Inflation***	1	2	3	4	5	6	( )
7)	***Government interference***	1	2	3	4	5	6	( )
8)	***Macroeconomic policy***	1	2	3	4	5	6	( )
9)	***Availability of credit***	1	2	3	4	5	6	( )

SECTION FOUR: ECONOMIC OUTLOOK AND BUSINESS CONFIDENCE

Q13 How confident are you regarding the economic outlook for the next 5 years? SINGLE CODE ONLY

Very confident	1
Fairly confident	2
Not very confident	3
Not at all confident	4
Don't know	5

( )

Q14 How confident are you regarding the economic outlook for the next 10 years? SINGLE CODE ONLY

Very confident	1
Fairly confident	2
Not very confident	3
Not at all confident	4
Don't know	5

( )

Q15 Do you invest more, less or about the same in new projects than you did 2 years ago? SINGLE CODE ONLY

More	1
Less	2
About same	3
Don't know	4
Not been in operation for 2 years	5

( )

SECTION FIVE: EVALUATION TECHNIQUES USED IN PROPERTY DEVELOPMENT

Q16 Which evaluation methods do you use, and how often do you use them to evaluate property development projects? SINGLE CODE FOR EACH.

		Always	Very often	Often	Not very often	Not at all	Don't know	Official use
1)	*Net present value*	1	2	3	4	5	6	( )
2)	*Internal rate of return*	1	2	3	4	5	6	( )
3)	*Accounting rate of return*	1	2	3	4	5	6	( )
4)	*Payback method*	1	2	3	4	5	6	( )
5)	*Profitability index*	1	2	3	4	5	6	( )
6)	*Discounted payback*	1	2	3	4	5	6	( )
7)	*Economic value added*	1	2	3	4	5	6	( )
8)	*Real options analysis*	1	2	3	4	5	6	( )
9)	*Decision tree analysis*	1	2	3	4	5	6	( )
10)	*Residual value*	1	2	3	4	5	6	( )
11)	*Free cash flow*	1	2	3	4	5	6	( )
12)	*Return on equity*	1	2	3	4	5	6	( )

Q17 **Do you use more than one evaluation technique when evaluating property development projects?** SINGLE CODE ONLY

Yes	1	GO TO Q17A
No	2	GO TO Q18
Don't know	3	( )

Q17A **Please select methods you are using?** MULTIPLE CODE OK

Net present value	1
Internal rate of return	2
Accounting rate of return	3
Payback method	4
Profitability index	5
Discounted payback	6
Economic value added	7
Real options analysis	8
Decision tree analysis	9
Residual value	10
Free cash flow	11
Other	12

( )

Q18 **Have you experienced any difficulties over the last year finding acceptable projects to invest in?** SINGLE CODE

Yes	1
No, haven't experienced any difficulty	2
Don't know	3

( )

Q19 **How accurate are your valuations?** SINGLE CODE ONLY

Very accurate	1	(LESS THAN 5% DIFFERENCE)
Fairly accurate	2	(LESS THAN 10% DIFFERENCE)
Not very accurate	3	(MORE THAN 20% DIFFERENCE)
Not at all accurate	4	(MORE THAN 30% DIFFERENCE)
Don't know	5	( )

Q20 **Do you think by having a better method or tool to evaluate projects you would be more competitive?** SINGLE CODE ONLY

Yes	1
No	2
Maybe	3
Don't know	4

( )

Q21 **How familiar are you with real options analysis?** SINGLE CODE ONLY

Very familiar	1
Fairly familiar	2
Not very familiar	3
Not at all familiar	4
Don't know	5

( )

Q22 **How familiar are you with decision tree analysis?** SINGLE CODE ONLY

Very familiar	1	
Fairly familiar	2	
Not very familiar	3	
Not at all familiar	4	
Don't know	5	( )

Q23 **How do you deal with uncertainty in your valuation?** SINGLE CODE ONLY

Sensitivity analysis	1	
Scenario analysis	2	
Monte Carlo simulation	3	
Probabilities	4	
All of the above	5	
None of the above	6	( )

Q24 **How do you choose your discount rate?** SINGLE CODE ONLY

Risk free rate (10 year Government Bond)	1	
WAAC	2	
Divisional WAAC	3	
Required rate of return by shareholders	4	
Is given to me by my client	5	
Don't know	6	( )

Q25 **What is your minimum rate of return (or hurdle rate) for a project?** SINGLE CODE ONLY

More than 10%	1	
More than 15%	2	
More than 20%	3	
More than 25%	4	
Over 30%	5	
Don't know	6	( )

Q26 **Do you perform a post-audit after completion of a real estate development project?** SINGLE CODE ONLY

Yes	1	
No	2	
Don't know	3	( )

Q27 **How relevant do you think strategic options are in property development?** SINGLE CODE FOR EACH.

		Highly relevant	Relevant	Has some relevance	Has minimal relevance	Has no relevance	Don't know	Official use
1)	*Option to grow*	1	2	3	4	5	6	( )
2)	*Option to expand*	1	2	3	4	5	6	( )
3)	*Option to abandon*	1	2	3	4	5	6	( )
4)	*Option to defer*	1	2	3	4	5	6	( )
5)	*Option to switch inputs or outputs*	1	2	3	4	5	6	( )
6)	*Staging of investment*	1	2	3	4	5	6	( )

SECTION SIX RISK MANAGEMENT IN PROPERTY DEVELOPMENT

Q28 How relevant do you think risks are in property development? SINGLE CODE FOR EACH.

		Highly relevant	Relevant	Has some relevance	Has minimal relevance	Has no relevance	Don't know	Official use
1)	*Liquidity risk*	1	2	3	4	5	6	( )
2)	*Cash flow risk*	1	2	3	4	5	6	( )
3)	*Control risk*	1	2	3	4	5	6	( )
4)	*Credit risk*	1	2	3	4	5	6	( )
5)	*Business risk*	1	2	3	4	5	6	( )
5)	*Market risk*	1	2	3	4	5	6	( )
7)	*Project risk*	1	2	3	4	5	6	( )
8)	*Unsystematic risk*	1	2	3	4	5	6	( )
9)	*Country risk*	1	2	3	4	5	6	( )
10)	*Currency risk*	1	2	3	4	5	5	( )
11)	*Skills and material shortage*	1	2	3	4	5	6	( )

Q29 Do you know the difference between risk and uncertainty? SINGLE CODE ONLY

Yes	1	
No	2	
Don't know	3	( )

Q30 How often do you use the tools below to manage risks in property development? SINGLE CODE FOR EACH.

		Always	Very often	Often	Not very often	Not at all	Don't know	Official use
1)	*Insurance*	1	2	3	4	5	6	( )
2)	*Guarantees*	1	2	3	4	5	6	( )
3)	*Financial derivatives, i.e. options, futures, forwards, or swaps*	1	2	3	4	5	6	( )
4)	*Securitization*	1	2	3	4	5	6	( )
5)	*Phasing of development*	1	2	3	4	5	6	( )
6)	*Staging of investment*	1	2	3	4	5	6	( )
7)	*Active management*	1	2	3	4	5	6	( )
8)	*Pre-selling or pre-letting*	1	2	3	4	5	6	( )
9)	*Limited liability*	1	2	3	4	5	6	( )

Q31 Would you like a copy of the survey results? SINGLE CODE ONLY

Yes	1	
No	2	( )

This concludes the survey. Thank you very much for taking the time to help with this thesis.

Please fax or email your completed questionnaire to **021 9090 304** or Michael@ihpc.co.za.

Annexure B-Model Input Land Cost

Land Cost

Price per plot	R 100,000
No of plots	750
Total land costs	**R 75,000,000**
Transaction Cost in Land	
Legal fees	R 1,125,000
Professional Survey	R 0
Rates and Taxes	R 16,500
Vat on land only	R 10,500,000
Geotechnical report	R 0
Site prep	R 0
Sub-div costs	R 0
Building deposit and connections	R 0
Occupational interest	R 0
Grand total land costs	**R 76,242,250**

Annexure C- Model Input Construction Cost

Construction cost/unit	
Concrete to foundations	R 4,569
Plinth	R 2,837
Floorslab	R 4,988
Ground floor superstructure	R 15,360
Firstfloor superstructure	R 13,669
Concrete deck	R 7,662
Roofstructure	R 8,045
Roof covering	R 5,466
Doors	R 2,474
Ceilings (incld cretestone skim)	R 3,778
Screed to floors	R 2,088
Floor coverings	R 5,831
Wall tiling	R 1,563
Glazing	R 904
Internal plaster	R 6,714
External plaster	R 4,743
Internal painting	R 4,751
External painting	R 2,500
Rainwater goods	R 1,100
External sewer - one pipe system	R 2,559
Internal plumbing	R 6,751
Electrical	R 8,158
Extras	R 14,463
Sub-total	**R 130,972**
Professional fees	
Quantity Surveyer	R 250
Health and Safety	R 80
Engineer	R 750
Architect	R 650
Council Scrutiny Fees	R 907
Contingency	R 6,081
Eskom Fee	R 947
Council Connection Fee	R 1,945
Other	R 3,850
Environmental Consultant	R 80
Sub-total	**R 15,540**
Conveyancing fees	
Conceyancing registration fee	R 2,000
Postage & petties to Deed	R 80
Rates clearance certificate	R 35
Deeds office registration fee	R 300
Fee re sub-divisional clearances and General p	R 330
Sub-total	**R 2,745**
Sales and marketing	
Sales Commission	R 15,000
Marketing	R 2,000
Sub-total	**R 17,000**
Overheads	
Interim interest over construction period	R 2,500
Fixed cost	R 10,000
Sub- Total	**R 12,500**

Grand Total Construction Cost/Unit	**R 178,757**

Annexure D-Calculation of Selling Price

Calculation of selling price		
Grand total contruction cost/unit	R 178,757	
Grand total land cost/unit	R 100,000	
Profit	R 66,902	24%
Total	**R 345,659**	

Taxes		
VAT	R 48,392.23	14%
NHBRC levy	R 5,123	1.3%
Total selling price including NHBRC	**R 399,174**	

Benchmarks

Selling Price per sqm incl VAT	R 5,322
Contruction cost per sqm excl. VAT	R 2,383
Profit per sqm	R 892

Annexure E-Discounted Cash Flow Analysis

DCF Analysis Residential Housing Development

Cost (excl. VAT)	-R 65,742,250
Project Duration	3
Working capital	R 11,172,317
Tax rate	29%
Cost of capital	16%
Required rate of return	16%

	Selling price/unit	Units p.a.	Total sales p.a.
Exp. Sales p.a	310,000	250	R 77,500,000
Exp. Cost p.a	178,757	250	R 44,689,267

Cash flow	**Year 0**	**Year 1**	**Year 2**	**Year 3**
Net cash flows	-R 65,742,250	R 32,810,733	R 32,810,733	R 32,810,733
Working capital	-R 11,172,317			R 11,172,317
Tax	R 0	R 0	R 0	-R 9,480,085
Net cash flow	-R 76,914,567	R 32,810,733	R 32,810,733	R 34,502,965
Cumulative cash flow	-R 76,914,567	-R 44,103,834	-R 11,293,100	R 23,209,864

NPV	-R 2,141,143
IRR	14.31%
MIRR	14.91%

Annexure F-Sensitivity Analysis

Sensitivity analysis change in land cost/unit to NPV	
Land cost/unit	**NPV**
	-R 2,141,143
R 70,000	R 13,330,486
R 80,000	R 8,174,473
R 90,000	R 3,018,460
R 100,000	-R 2,141,143
R 120,000	-R 12,843,924
R 130,000	-R 18,195,315
R 140,000	-R 23,546,705
R 150,000	-R 28,930,154
R 160,000	-R 35,502,654
R 180,007	-R 48,652,254
R 180,000	-R 48,647,654
R 190,000	-R 55,220,154
R 200,000	-R 61,792,654

Sensitivity analysis change in selling price/sqm to NPV	
Price (excl. VAT)	**NPV**
	-R 2,141,143
R 200,000	-R 57,829,616
R 250,000	-R 29,755,997
R 300,000	-R 6,362,437
R 350,000	R 14,153,091
R 400,000	R 34,516,395
R 450,000	R 54,808,372
R 500,000	R 74,740,642
R 550,000	R 94,672,911
R 600,000	R 114,605,181
R 650,000	R 134,537,451
R 700,000	R 154,469,720
R 750,000	R 174,401,990
R 800,000	R 194,334,260

Sensitivity analysis change in construction cost/sqm to NPV	
Construction Cost	**NPV**
	-R 2,141,143
R 90,000	R 34,010,190
R 100,000	R 29,937,529
R 110,000	R 25,864,869
R 120,000	R 21,792,208
R 130,000	R 17,719,547
R 140,000	R 13,646,886
R 150,000	R 9,574,225
R 160,000	R 5,501,564
R 170,000	R 1,428,904
R 180,000	-R 2,665,822
R 190,000	-R 6,887,115
R 200,000	-R 11,108,409
R 210,000	-R 15,329,702

Annexure G-Option to Delay a Project

DCF Analysis

Option premium=	-R 250,000
Cost=	-R 76,914,567
WACC=	16%
Risk-free rate=	10%

Demand	Prob.	Expected Cash Flow	Prob. x (CF)
High	0.3	R 61,560,733	R 18,468,220
Average	0.4	R 32,810,733	R 13,124,293
Low	0.3	R 7,810,733	R 2,343,220
	1.0	Expected CF=	R 33,935,733.31

Year	1	2	3
Expected CF	R 33,935,733	R 33,935,733	R 33,935,733

NPV= -R 698,659

Value of a Call Option Using the Black-Scholes Model

			Base	Sensitivity Analysis: Worst	Best
r_{RF} =			10%	10%	10%
t =			3	3	3
X =			R 76,914,567	R 76,914,567	R 76,914,567
P =			R 65,703,368	R 65,703,368	R 65,703,369
s =			32.47%	5.00%	45.00%
d_1 =	$\frac{\{\ln(P/X) + [r_{RF} + s^2/2)]t\}}{(s\, t^{1/2})}$	=	0.5345	1.6882	0.5725
d_2 =	$d_1 - s\,(t^{1/2})$	=	-0.027[illegible]	1.6016	-0.2069
N(d1)=		=	0.7035	0.9543	0.7165
N(d2)=		=	0.48[illegible]	0.9454	0.4180
V =	$P[N(d1)] - Xe^{-r_{RF}t}[N(d2)]$	=	R 18,357,720	R [illegible]	R 23,257,4[illegible]

Total Value =	Value of Project + Value of option to delay		
Total Value =	-R 698,659	+	R 18,357,720
Total Value =	R 17,6[illegible]		

Annexure H-Option to Expand a Project

Option premium=	R -250,000
Cost=	-R 88,451,752
WACC=	16%
Risk-free rate =	10%

Valuation of Original Project

Cost		Future Cash Flows			NPV this	Prob.	Data for
Year 0	Prob.	1	2	3	Scenario	x NPV	Std Deviation
	30%	R 61,560,733	R 61,560,733	R 61,560,733	R 61,344,040	R 18,403,212	1,128,927,374,670,030.00
-R 76,914,567	40%	R 32,810,733	R 32,810,733	R 32,810,733	-R 3,225,284	-R 1,290,114	4,160,983,375,902.44
	30%	R 7,810,733	R 7,810,733	R 7,810,733	-R 59,372,523	-R 17,811,757	1,057,528,937,340,550.00
					Expected NPV =	-R 698,659	2,190,517,295,386,480.00
					Standard Deviation=	R 46,804,031	
					Coefficient of Variation =	-66.99	

NPV without growth option:

NPV = -R 698,659

Expected NPV is you simply repeat original project at time 3.

NPV =	NPV of project + PV of repeated project		
NPV =	NPV_1	+	$NPV_1 / (1+WACC)^3$
NPV =	-R 698,659	+	-R 447,601
NPV =	-R 1,146,259		

Value of a Call Option Using the Black-Scholes Model

			Base Case	Sensitivity Analysis Worst	Best
r_{RF} =			10%	10%	10%
t =			3	3	3
X =			R 88,451,752	R 88,451,752	R 88,451,752
P =			R 65,223,564	R 65,223,564	R 65,223,564
s =			32.40%	5.00%	45.00%
d_1 =	$\frac{\{\ln(P/X) + [r_{RF} + s^2/2]\}t\}}{(s\ t^{1/2})}$	=	0.2724	-0.0102	0.3838
d_2 =	$d_1 - s\ (t^{1/2})$	=	-0.2886	-0.0968	-0.3957
N(d1)=		=	0.6073	0.50	0.6494
N(d2)=		=	0.3863	0.46	0.3462
V =	$P[N(d1)] - Xe^{-r_{RF}t}[N(d2)]$	=	14,295,921	2,190,847	19,673,786

Total Value =	Value of Project + Value of growth option		
Total Value =	-R 698,659	+	R 14,295,921
Total Value =	R 13,596,263		

Annexure I-Option to Abandon a Project

DCF Analysis

Option premium=	R -250.000
Cost=	-R 76,914,567
WACC=	16%
Risk-free rate=	10%

Demand	Prob.	Expected Cash Flow	Prob. x (CF)
High	0.3	R 61,560,733	R 18,468,220
Average	0.4	R 32,810,733	R 13,124,293
Low	0.3	R 7,810,733	R 2,343,220
	1.0	Expected CF=	R 33,935,733.31

Year	1	2	3
Expected CF	R 33,935,733	R 33,935,733	R 33,935,733

NPV= -R 698,659

rRF =	10%		
t =	3		
X =	R 76,914,567		
P =	R 65,783,369		
s =	32.47%		
d_1 =	$\{ \ln(P/X) + [r_{RF} + s^2/2]\, t \} / (s\, t^{1/2})$	=	0.5345
d_2 =	$d_1 - s\,(t^{1/2})$	=	-0.0279
N(d1)=		=	0.7035
N(d2)=		=	0.4889
V =	$P[N(d_1)] - Xe^{-r_{RF}t}[N(d_2)]$	=	R 18,367,729
Put Value=	$V - P + Xe^{-r_{RF}t}$	=	R 9,644,063

Total Value =	Value of Project + Value of abandonment option		
Total Value =	-R 698,659	+	R 9,644,063
Total Value =	R 8,945,404		