A Critical Examination of Valuation Methods for Vacant Land in High Income Residential Neighbourhoods in Nairobi, Kenya

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A thesis submitted in partial fulfillment for the requirement of the degree of Master of Arts in Housing Administration in the Department of Land Development at the University of Nairobi, Kenya

November, 1992

DECLARATION

I, MAUREEN NANCY AMBOKA WAMEYO, do hereby declare that this thesis is my original work and has not been presented for a degree in any other university.

MAUREEN NANCY AMBOKA WAMEYO

This thesis has been submitted for examination with our approval as supervisors

DR STEPHEN KITUUKA

MRS CATHERINE KARIUKI

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ABSTRACT

The need to examine critically the methods being used to value vacant land in Nairobi, Kenya arose upon observation that these methods were often subjective and inequitable. The objective of this examination was twofold:

1. To investigate the adequacy of existing approaches to estimating land value

2. To offer an improved and more efficient methodology for calculating land values.

In investigating the adequacy of existing approaches to assessing land value, estimated land values for vacant plots and sale values for the same plots were compared. To meet the second objective, regression analysis was carried out and proposed as a better method of estimating the value of land. Land value was regressed against distance to the CBD, the existence of a flood area on the plot, plattage, distance to the nearest shopping centre and tenure. Fifty-one (51) plots in high income residential neighbourhoods that had been assessed and sold were identified. For each of these, the independent variables-distance to the CBD (kms), existence of flood area on the plot, plattage, distance to the nearest shopping centre (kms) and tenure, were recorded.

The volume of empirical evidence compiled upon regressing land values against the independent variables listed supported the view that regression analysis would be a better method of assessing the value of land in high income residential neighbourhoods.

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ACKNOWLEDGEMENTS

I am greatly indebted to all my friends, relatives, lecturers, supervisors and the staff at the Nairobi City Commission and the Ministry of Lands and Housing.

Each of these has so graciously helped, encouraged and comforted me in my endeavour to make this work a success. I pray that the God of peace himself would preserve them without blame and equip them with every good thing.

DEDICATION

To God the Father

CHAPTER ONE

ASSESSMENT OF LAND VALUES

Introduction

The problems of predicting land value are a worldwide phenomenon. They have been experienced in the urban areas of both developed and developing countries in varying degrees. The major outcry is that most land in these areas is developed therefore making it difficult to separate the value of that land from that of improvements on it (Downing, 1979,101).

Valuers, as if to agree with this theory, have found it increasingly difficult to effect this separation. They feel that the degree of imagination that requires them to value built-up land as if it were covered with natural growth is beyond them (Gitonga, 1979b,44).

In spite of this misgiving, land values for both built-up and vacant land have been calculated in various countries with varying degrees of success. This study in critically examining the methods used therein attempts to determine whether these methods are adequate or whether there is need to develop other modes of assessment or improve on existing ones.

Problem Statement

The term value means different things to different people. However, from an economist's point of view it expresses either the utility of some particular object or the power of purchasing other goods which the possession of the object conveys.

> The one may be called 'value in use'
> the other 'value in exchange'.
>
> (Smith, 1977, 1002)

This value, and particularly that of interests in urban land, results almost entirely from the interactions and exchange activities of interest holders. It may be assessed for purposes of effecting transfer of ownership, financing and credit, just compensation in condemnation proceedings, preparation of rental schedules and lease procedures and for feasibility studies. To local authorities adopting the system of land taxation, land values must be known for rating purposes.

Conventionally land value is considered to be the original and indestructible value of land before improvement but ideally including the potential value when developed (Hicks, 1970, 9). In it is included value attached to;

(a) the clearing of land by the removal or thinning out of timber, scrub or other vegetable growth,

(b) the picking up and removal of stone,

(c) the improvement of soil fertility or the structure of the soil,

(d) the restoration or improvement of land surface by excavation, filling or levelling not being works of irrigation or conservation,

(e) the reclamation of land by draining or filling together with any retaining walls or other works appurtenant to the reclamation and

(f) underground drains.

(Herps, 1980, 107)

In practice there are many approaches to ascertaining this value. However, valuers in Kenya have tended to adopt two approaches, namely:-

1. the Market-Data approach and
2. the Residual method.

The Market-Data Approach

The Market-Data approach to an estimate of value is a process of comparing market data, that is, prices asked by owners and offers made by prospective purchasers or tenants willing to buy or lease land. This approach is also called the direct sales comparison approach, in short the Comparative approach (AIREA, 1979,273). At the onset of valuation the approach makes three assumptions:

(i) that there is a market for a particular property;

(ii) that both buyer and seller are fully informed as to the property and the state of the market for that type of property;

(iii) that the property would be exposed in the open market for a reasonable period of time.

(Mugo, 1987, 33)

Having made these assumptions, land is compared to other land in the neighbourhood using sale values as the unit of comparison. Vacant plots of land within the neighbourhood that have been sold are investigated and the amount of money for which they were sold noted. Having investigated a reasonable number of plots and determined their sale values, the assessor establishes through averaging, the comparative front foot or square foot value of the typical plot (Back, 1979, 39).

Although this approach appears simple, it is subject to several complications in application. Firstly, the Comparative approach assumes that there will be two or more similar pieces of land which can be satisfactorily compared. Two pieces of land, however, are rarely similar thus hindering comparison. Heterogeneity in size, location, nature of the subsoils and topography among others means that different factors affect different parcels of land. For comparison to be accurate the degree to which each of the different factors affects land must be documented and comparisons made depending on these degrees. In the Market-Data approach this does not occur and comparisons are more accurately generalizations.

Secondly, in high population density residential areas it is difficult to find vacant land which has recently been sold and its sale value can be used for comparison. In instances where vacant land can be identified, the trend is that this land is rarely sold or exchanged for monetary value. In most cases it comprises land set aside by developers as recreational space or land for community facilities. As a result there exists in these residential areas little evidence of land transaction. Sale values of land which can be used for assessing the value of other land through comparison are therefore minimal. Where the Market-Data approach is to be used in such areas, guesswork and subjective thinking is resorted to by those concerned.

In other instances comparables may be found but because sales do not take place under a free market atmosphere resultant sale values do not form adequate comparables. In a free market environment it is assumed that there are both willing buyers and willing sellers in the market, that is. that none is brought into the market under compulsion. It is also assumed that the price at which a commodity will be sold will be set exclusively by the forces of supply and demand independent of any external influences such as government intervention. There is also expected to be a scenario of perfect knowledge where information about sales is available to all interested parties. Where such is the case economists argue that the prices set by supply and demand forces reflect the true price and hence the value of land. In reality, however, the operation of such markets is hindered by factors which propagate either forced or biased sales. There is rarely perfect (free and adequate) information about vacant lots available to interested buyers in the market. Plots instead tend to change hands among relatives or specific groups of people. This is aggravated by the fact that the availability of a parcel of land is made known by word of mouth to a particular group of people with the aim of keeping that land within the group.

In other instances the government may require that land be sold to it so that it can be used for the good of the public as a whole. However, in many such cases land is sold against the will of the owner, thus violating the principle of a willing buyer and a willing seller in the free market economy. Where land is sold in situations of bankruptcy the same is the case. The sale is somewhat forced and the owner tends to take what he is given whether fair or not.

Thirdly, the ever changing market conditions inhibit the accuracy of the Comparative approach. For example, land being sold during a depression cannot be satisfactorily compared with land sold during a boom period. A case in point is the coffee boom period of 1977. During this period land values escalated considerably with increasing demand for land. This demand was created by the increased returns from the then very lucrative coffee business. In the current period of instability following the introduction of multiparty politics, land values have declined significantly (Field survey, 1992).

The success of the Market-Data approach is also dependant upon the honesty of buyers and sellers. When interviewed these must be willing and able to give the true price at which land was bought or sold. In certain instances, however, although many transactions in land may be identified, property owners are not willing to give the true price at which they bought or sold land. Consequently, land prices are either highly understated or overstated rendering them useless as comparables.

Because the competence of the Market-Data approach is largely dependant on the acquisition of accurate sales data, it has been suggested that offering prices of sellers be used as an alternative when this data is not available. However, offering prices usually have limited validity as market data because a seller can offer a property at any price no matter how unrealistic (AIREA, 1973, 136).

A counter argument is that instead of using the offering price, the quotations of buyers should be used. These however, may tend to be biased particularly where the seller is desperate to sell.

In view of these weaknesses it is not unrealistic to argue that the Comparative approach is inadequate as far as the accurate assessment of land value is concerned. Quigley (1978), correctly contends that this method of comparing can be totally misleading and can only be used as a rough guide.

The Residual Method

The Residual method is an extension or technique of the Investment approach to value. In this approach the net income of a site improved to its highest and best use is estimated and capitalized to give an indication of its value. This capitalized value is referred to as the proceeds from the sale. From this value the cost of constructing the development is deducted and the surplus taken as an indication of land value.

The premise behind this calculation is that the price which a purchaser can pay for land is the surplus after he has met out of the proceeds from the sale of the finished development, the cost of construction on the land and finance and an allowance for profits. The proceeds from the sale or the anticipated money to be realized from the development is estimated through comparison. The profit rate is targeted with due regard being given to the nature of the development and allied risks, the competition in the market, the period of development and the developers general optimism about the development.

The success of the Residual method is tied to the acquisition of accurate analysis of income data on investment property. In Kenya there is a lack of properly maintained information systems for land administration purposes. This means that acquiring the information required in carrying out Residual analysis is both expensive and time consuming. Many valuers resort to subjective estimations thus hampering the degree of accuracy obtainable by them. As a result,

> .....jurisdictions which enjoy acceptably accurate assessments represent a minority.
>
> (Back, 1970, 47)

Nevertheless, some valuers do use the Residual method in assessing the value of land. These valuers must of necessity take a lot of care since alternate assumptions in the model produce considerable differences in the value of land. For example, alternate assumptions in the highest and best use of a given plot of land may produce significant variations in the residual net income imputable to that land.

In residential zones, assumptions about the highest and best use can be very varied. This is particularly so in high income residential neighbourhoods where owners may not be developing for commercial purposes but rather for personal occupation. This implies that they build that which suits them rather than what seems to be the most profitable or acceptable way of using the land.

In certain cases the projected cost of the development may exceed the expected proceeds from the sale, consequently the surplus found after deducting the cost of the development from the proceeds would be either zero or negative seeming to indicate that land has no value.

Because of these shortcomings the Residual method is best applied when assumptions of the highest and best use are at a minimum such as in assessing land value in single storey structure residential neighbourhoods. It therefore becomes evident that the Residual method cannot be used effectively in Nairobi's high income residential areas where the trend is towards constructing maisonettes and other double storeyed structures.

It appears also that the Residual approach can only be used to ascertain the value of income generating properties (that is to say, the value of land on which housing for rental purposes has been constructed). It gives no provision for valuations for non-profit estates.

Valuers in Nairobi have tended to ignore the use of the Residual method in assessing land value arguing that the method is tedious and time consuming (Gitonga, 1988, 62). This means that the Comparative approach is the most popular land value assessment tool. However, in view of its inherent weaknesses there is need to investigate the possibility of providing a more accurate land value assessment method which can be used competently by valuers both in the private and public sectors. According to Gitonga (1979),

> ....what has transpired in Kenya where land and buildings are supposed to be assessed and their values entered separately ... has been to derate buildings rather than a scientific attempt in separating the two values.
>
> (Gitonga, 1979 a, 13)

One of the techniques needing investigation with a view to improving the work of the appraiser and reducing subjective judgement is regression analysis. In regression it is assumed that a dependent variable (in our case land value) is related to one or more variables. The technique attempts to measure the degree of association between the variables and uses this association to explain the behaviour of the dependent variable.

Regression analysis as applied to the assessment of land value assumes that land values are affected by political, social and economic factors.

> The value is created, maintained, modified or destroyed by the interplay of social ideals and standards, economic adjustments and changes, political or government regulations, physical and natural forces.
>
> (AIREA 1973, 1)

The onus is therefore upon the researcher to establish the extent to which each of these factors influences land value and hence develop a model for predicting the same.

Hypothesis

The current approaches to assessing land value in Nairobi lack a scientific basis as they rely on subjective judgements and assumptions about the future which are often inconsistent and inequitable.

Research Objectives

1. To investigate the adequacy of the existing approaches to estimating land value.
2. To offer an improved more efficient methodology for calculating land values.

Research Methodology

This research was carried out using both primary and secondary data. Secondary data was acquired through the review of related literature from various libraries. Primary data was collected during field work and used in data analysis. The research procedure followed comprised four general steps, namely:-

i. Determining the variables that influence land value
ii. Data collection
iii. Comparing predicted values of land and sale values of the same
iv. Regression analysis.

Determining the variables that influence land value

Land value theories and researches on the same set forth the various factors which influence land value as well as real property characteristics in general. They argue that the market value of real property is dependent upon social, economic and political and physical or natural resources. This research proposed that for high income residential areas in particular, the following were the factors which influenced land value.

1. Tenure
2. Plot ratio
3. Ground coverage
4. Distance to the CBD
5. Distance to the nearest recreational facility
6. Distance to the nearest unconforming use
7. Distance to the nearest shopping centre
8. Distance to the nearest police post
9. Existence of flood area on the plot
10. Area of site
11. Slope
12. Nature of the subsoils
13. Shape of site
14. Frontage
15. Available water facilities
16. Available sanitary facilities
17. Telephone facilities
18. Political factors
19. Plattage
20. Time

Data Collection

In the earlier part of this chapter it was suggested that disparities occur between estimated values of vacant land as proposed by land valuers and actual sale values recorded when transactions in land take place. The hypothesis further affirmed that this disparity was as a result of the inadequacies of the various methods used in the appraisal process. The first part of the data collection therefore was to document the estimated values and sale values of various land parcels.

Since it was not possible to ascertain beforehand the number of such cases in the market, as many cases as possible were identified and analyzed. Four property management and valuation firms were chosen for this purpose: These were:

i) Lloyd Masika Limited

ii) Bageine Karanja and Mbuu Limited

iii) Tysons Limited

iv) Milligan and Company Limited.

In each of these firms questionnaires were administered to valuers and estate managers. These were asked to identify plots which had been valued and sold within the firm. The assessed values and the sale values of these plots were then entered on the questionnaires together with other details including the year of assessment, the year of sale and the land registration number of the plot.

The four listed companies were chosen because each of them has both an active sale and valuations department. It was therefore possible to find assessed values and sale value of a particular plot in the same firm.

They were also chosen on the understanding that being the four largest propert management firms in Nairobi and having very active valuation and estate agenc departments, they would facilitate easy, accurate, speedy and convenient data collection.

Fifteen questionnaires were administered to each of these firms. From each firm plo valued and sold between 1980 and 1992 were identified and analyzed. If more questionnair were needed, these were administered accordingly.

Information not available from the valuation firms was collected from the Nairo City Commission and the Ministry of Lands and Housing. This included information c distances from various points, shapes and sizes of plots and tenure characteristics.

Measurement of distances

Distances were measured from maps provided by both the City Commission and t Ministry of Lands and Housing. A central point from which all distances were measure was identified. This was taken to be the Hilton Bus-stop. The bus-stop was chosen becau of its centrality to the whole town and also because of it being a point of maximu pedestrian and vehicle traffic. From this point distances were measured along publ transport routes to various areas. Where there were no public transport routes, the shorte most convenient routes by motor vehicle were used. In the case of two or more publ transport routes to one area, the shortest of the routes was taken. Straight line distanc were used where distance to the nearest unconforming use was being ascertained.

Comparing predicted and sale values

One of the arguments of this project is that because of weaknesses inherent in the widely used Comparative approach to value, assessed values often differ significantly from the true market values of various lots. In order to investigate this argument both assessed values and the sale values were collected for all the plots under investigation. These were divided into two samples, "a" and "b", where "a" contained assessed values and "b" sales values. The means of these were compared using the "t" test.

The "t" statistic is an index showing the difference between sample means. It is derived using the following formula;

$$t = \frac{\text{difference between means}}{\text{standard error of difference}}$$

$$= \frac{\bar{a} - b}{\sqrt{\left(\frac{S_a}{n_a}\right)^2 + \left(\frac{S_b}{n_b}\right)^2}}$$

Where:

a represents the mean of sample a

b represents the mean of sample b

n_a represents the sample size of sample a

n_b represents the sample size of sample b

s_a represents the standard deviation of sample a and

s_b represents the standard deviation of sample b.

Regression analysis

The data collected for this purpose was coded and systematically analysed using both descriptive and inferential statistics. With descriptive analysis the mean, mode, the maximum and 'minimum values and the frequency distributions of the variables were computed. The findings were presented in an explanatory format with certain results being explained using tables.

In the second stage of analysis inferential statistics were resorted to. Initially simple regression was done with each variable being regressed independently against land value. With each equation the co-efficient of determination (r^2), the adjusted r^2 and the correlation co-efficient (r) were computed. The purpose of this simple regression was twofold:-

(i) To establish the degree and strength of association between the dependent variable and each of the independent variables.

(ii) To give a general indication of how much of the changes in land value are explained by each independent variable.

Multiple regression analysis was then carried out to establish the effect of all the independent variables working together on land value. The regression equation proposed took the form,

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \dots b_nx_n$$

where,

Y is taken as the dependent variable

a the intercept

b_1 - b_n the partial correlation co-efficients and

x_1 - x_n as the independent variables.

The intercept, "a" represents the value of land when all the independent variables (x_1 - x_n) are zero. Each partial correlation co-efficient on the other hand gives an indication of the changes in Y (dependent variable) for every unit change in X (independent variable) with all other variables being held constant.

> Thus b_1 estimates the change in Y per unit change in X_1 when all other Xs' remain constant.
> (Ndwigah, 1988, 11)

The multiple regression analysis also yielded other statistics including the F ratio, the standard deviation, the co-efficient of multiple determination R^2, the adjusted R^2 and the multiple correlation co-efficient (R). In the final part of data analysis stepwise multiple regression was carried out with the aim of determining the most significant variables to the assessment of land value.

Stepwise linear multiple regression is an automatic data processing technique which helps in determining the most important independent variables as far as explaining changes in the dependent variable is concerned. This procedure is carried out with the understanding that not all the proposed independent variables contribute significantly to changes in the dependent variable. A stepwise multiple regression will therefore determine the group of variables which yields the maximum value of R^2.

In the first step of this process the most important of the independent variables is picked. The dependent variable is then regressed against this variable and a regression model constructed. At the second step, the second most significant variable is picked and a second regression model constructed with land value being regressed against the two variables (the one picked in the first step and the one picked in the second step). Any improvement to the value of R^2 if any is calculated.

> This process of adding variables continues so that with the addition of more variables those which are statistically unimportant are eliminated.
>
> (Syagga, 1985, 66)

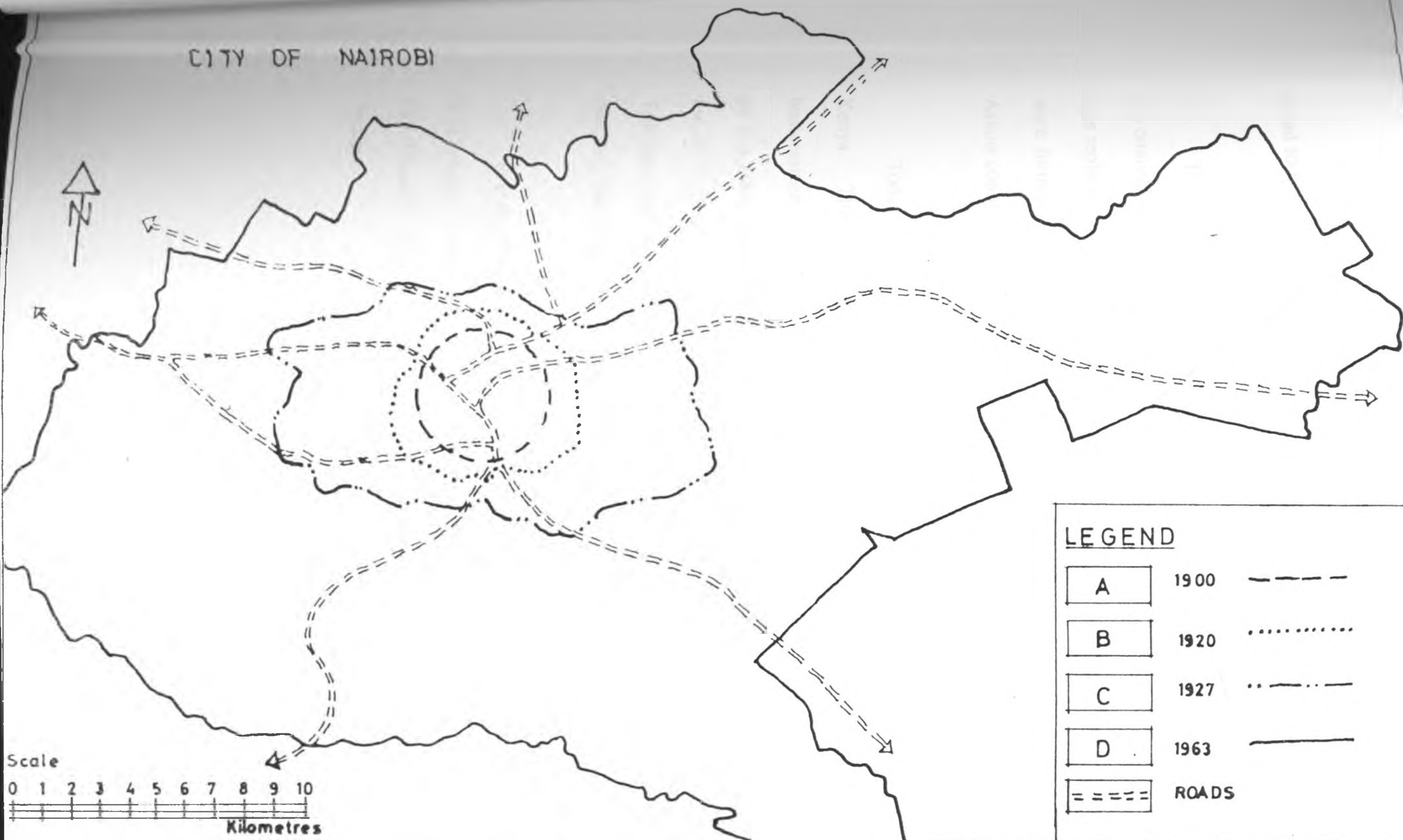
Studv Area

The data used in the analysis procedure discussed in the preceding section was based on land value assessments for vacant land in Nairobi's high income residential neighbourhoods. The name Nairobi was derived from a Maasai word 'Enkara Nairobi' which means a stream of cold waters (Ndwigah, 1988, 13). Prior to its establishment as a railway encampment in 1899, Nairobi was an area of subsistence farming occupied by the Kikuyu, Kamba and Maasai ethnic groups. During this period land was held communally by the clan who inherited it from their male ancestors.

After the arrival of the Kenya Uganda railway land was compulsorily acquired in the town and a railway station constructed. It was during this period that pioneers began settling in Nairobi especially near Kabete and Westlands. The white fathers, an order of the French Catholic fathers settled on the present James Gichuru Road (St. Austins Road). They acquired Lavington and Bernard Estate for their mission. Many settlers preferred the hilly parts of the town to the north and northwest. It was in these areas that they built for themselves large comfortable houses on very large plots. In 1900 the Nairobi Municipal Council was established. Its municipal committee was dissolved in 1919 and a municipal corporation instituted. The actual shaping of the municipality, however, took place between 1920 and 1939. This municipality was defined to include Muthaiga, Eastleigh, the residential estates of Westlands, Marlborough, Upper Parklands, Upper Hill, Kilimani, Thompson Estate and St. Austins Mission. The southern part of the city extended as far as Ngong Road.

Racial segregation existed within the city's boundaries with white settlers occupying the west of the town and the indigenous people the east. Parklands became a predominantly Asian neighbourhood. Relatively poor Indians settled in Ngara and Pangani.

During this period (1920-1939) indigenous people began to migrate to Nairobi in search of commercial and political opportunities. These were not catered for by the government and therefore began putting up unauthorised villages along the town's periphery. Some of those who were lucky to have found jobs settled in Pumwani. In 1929, the Nairobi Municipal Council began building rental housing for their African subordinate staff. This included an old carrier corps camp now known as Kariokor Estate, Shauri Moyo and Makongeni. All these estates were to the southeast of Pumwani.



Source: Dept of Urban and Regional Planning, U.o.N.

FIGURE 1.1 BOUNDARY EXTENSION

After the second world war the municipal council financed Woodley Estate on Ngong Road to house European speculators coming into the city from Europe and South Africa.

This pattern of racial segregation of residential neighbourhoods was condemned with the coming of independence in 1963. It was however not eliminated completely, but instead was replaced by a new type of segregation - Economic segregation. Generally areas which were formally occupied by Europeans were now occupied by economically able persons. Asians continued to dominate Parklands, Pangani and certain parts of Ngara.

Today Nairobi is still the centre of commercial, political and social activities in Kenya. This importance has created a high demand for residence in the town by businessmen, tourists and unemployed citizens among others. The resultant pressure created by this mass of people on existing infrastructural facilities, essential services and land has forced the City Commission to extend its boundaries on several occasions (See Figure 1.1). Together with boundary extension the local authority has severally reorganized land use, planning and development regulations.

In spite of this repeated alteration of development control measures, high demand for land created by increased population has resulted in rapid increase in land values within the city (Ondiege, 1989, i). Valuers have been responsible for monitoring and documenting this increase.

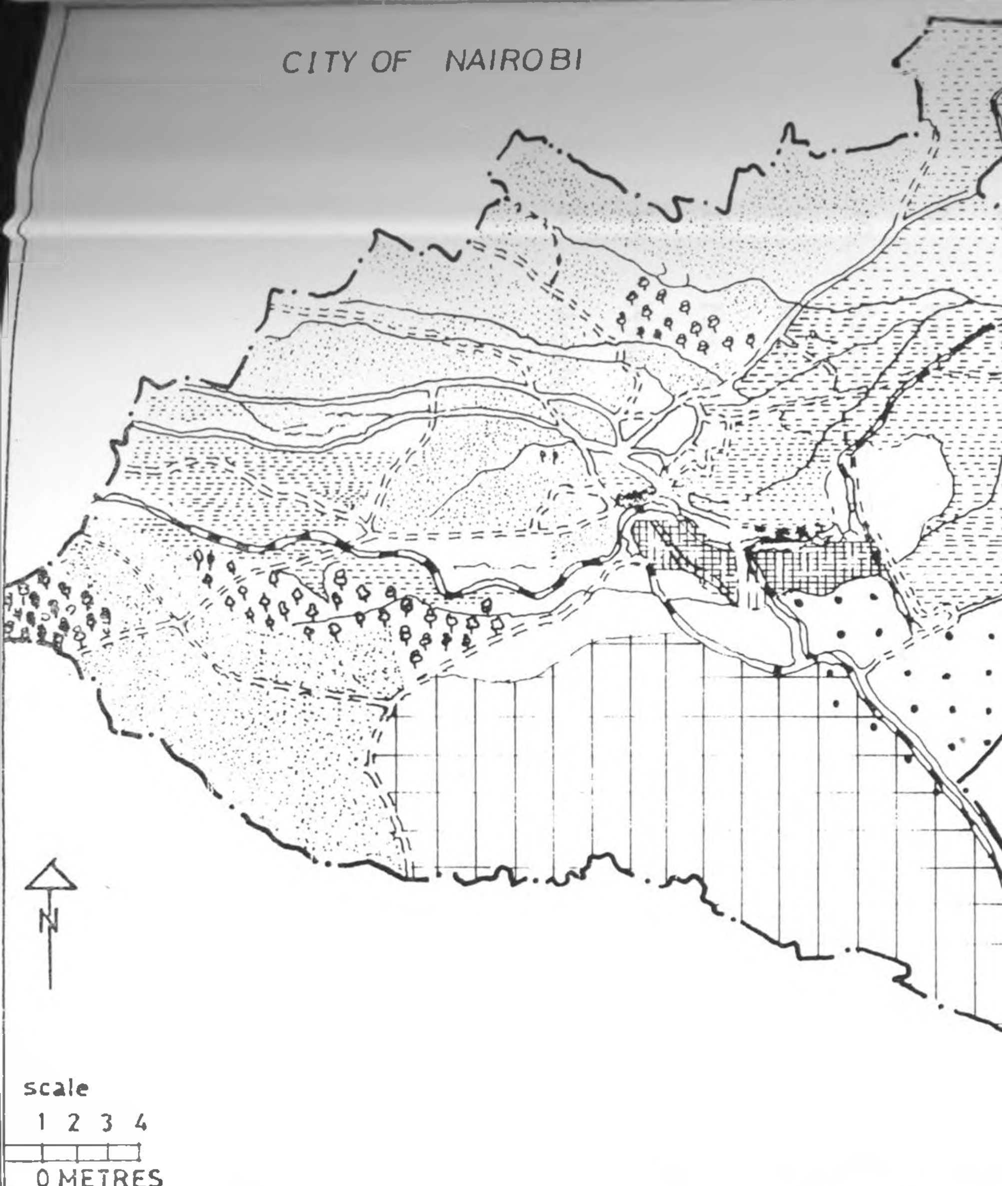
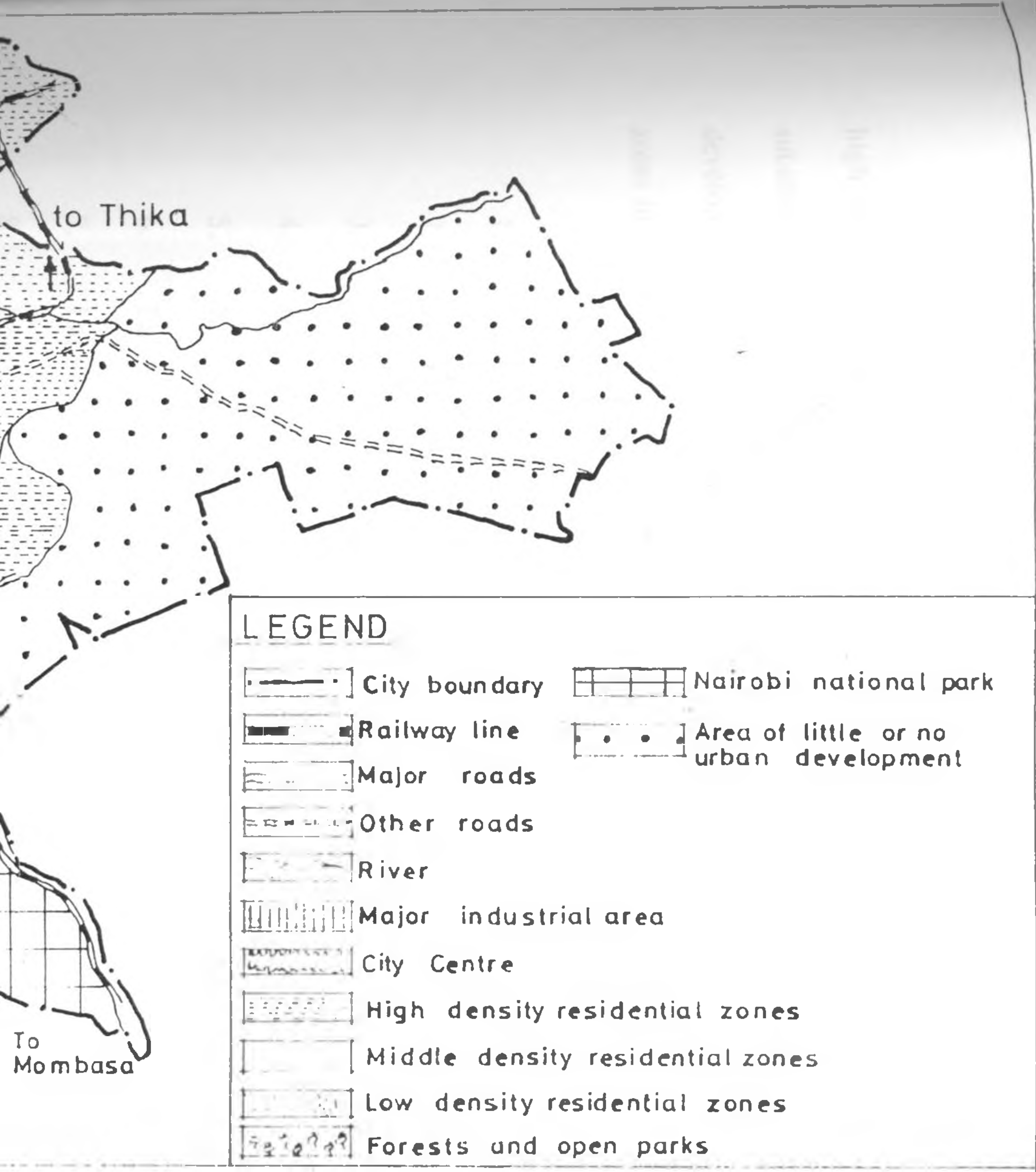


FIGURE 1.2 RESIDENTIAL ZONES



Source Dept of Urban and Regional Planning, U.O.N.

This research in investigating the methods used therein concerns itself only with the high income residential areas of Nairobi. These were chosen because there is in them substantial evidence of transaction in vacant land. There is therefore the opportunity of developing and testing predictor models which can then be modified and applied to built-up areas in other zones. The specific residential areas investigated are:-

1. Garden Estate
2. Gigiri
3. Karen
4. Kileleshwa
5. Kitusuru
6. Lavington
7. Langata
8. Loresho
9. Ridgeways
10. Riverside Drive
11. Runda
12. New Muthaiga
13. Nyari
14. Westlands

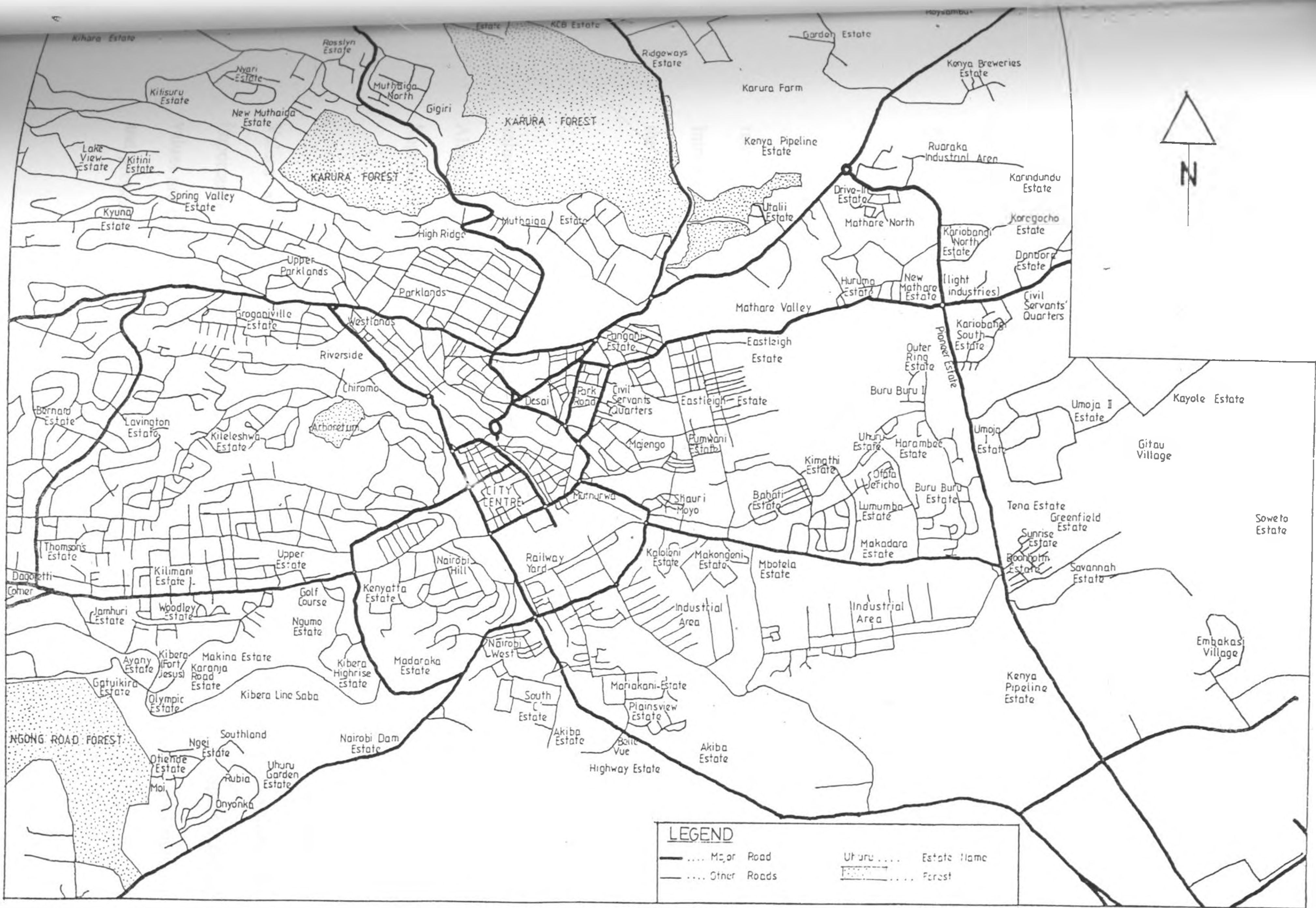


FIGURE 1.3 GREATER NAIROBI

Scale 1 56,000
Source Tourist Maps Kenya Ltd 1990

Scope of Research

This study aims at analysing the methods used in assessing the value of land in high income residential areas in Nairobi. These are the Market-Data approach and the Residual approach. It also outlines the factors which are considered important in determining land value and investigates the extent of contribution of each of these to this value. The end result of this investigation is to show how all variables found important can be integrated into one model which can then be adopted as a method of assessing high income residential values.

Organization of Thesis

This work is divided into four main parts. The first part, Chapter One outlines the reasons why the undertaking of this research was found necessary. This is done in the introduction and problem statement. The objectives of the research are also stated along with the methods to be used to achieve these objectives.

The second chapter comprises the conceptual framework behind determining land values and discussions on several methods of assessing land value. They include the Allocation method, Discounted Cash Flow analysis, the Comparative approach and Multiple Regression.

The third chapter which is titled "A Comparative Study and Analysis of Assessed Values and Sale Values in High Income Residential Neighbourhoods", explains the importance of each piece of information collected. In the first part of this chapter assessed values are compared to market values. In the second part, regression analysis is carried out and proposed as a better method of assessing land value.

The final chapter of this work is the Conclusions and Recommendations chapter. It discusses the main findings of the research, gives recommendations and suggests areas that need further research.

CHAPTER TWO

THE CONCEPTUAL FRAMEWORK BEHIND DETERMINING LAND VALUE

Preview

The prices of land value are influenced by economic and political factors each having different influences on different parcels of land.

The first part of this chapter looks at the theories which purport to explain how these affect land value. The second part discusses the various methods that have been developed (based on the findings of the theories) to ascertain land values particularly in urban areas.

Theories of Land Value

The term land value is in many cases considered synonymous with the term land rent. However a more detailed investigation will show that ideally land value is a capitalization of land rent. Most approaches to value use this rent as a starting point to explain land value. These fall in three main categories.

(i) Neo-classical approaches to value

(ii) The Marxist approach

(iii) The Land Development Process approach

Neo-classical Economic Land Rent Theory

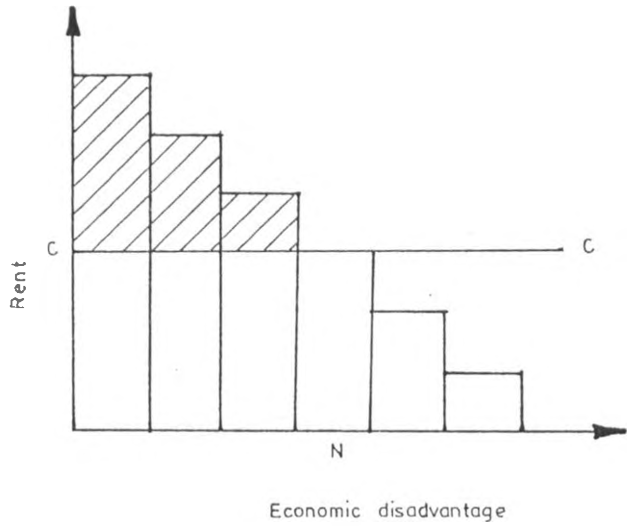
Neo-classical economic land rent theories contend that land values are dependent upon the economics of supply and demand, inflation trends and changes in real incomes, population growth, the availability and cost of credit and the role of institutions. These values will as a result remain dependent upon decisions of investors in the property market, changing only when the desires of the investors and market conditions change. Some of the earliest works under this category are those of David Ricardo and Von Thunen.

David Ricardo (1772-1823) defined rent as a payment for the original and indestructible power of the soil. This rent accrued to the land not because of the efforts of land owners but rather because of the niggardliness of nature and excess demand for factors of production. These factors of production were not demanded for themselves but rather for the goods they produced; hence land was not demanded for itself but rather for the support it provides to mans activities.

Ricardo argued that with an increasing scramble for land due to increased population and other factors, land that was not previously considered economically viable is brought into investment. This increases the cost of production and hence goods produced on it are sold at higher prices. Since all the entrepreneurs are assumed to be rational, even the owner of the advantaged piece of land increases his product prices creating uniformity in the market. In so doing he receives an unearned benefit. In any given economy this trend continues until the extensive margin of production is reached and it becomes uneconomical to bring more land into production (See fig. 2.1).

Figure 2.1

Unearned Increment from Several Parcels of Land



Source: Prepared by author

Figure 2.1 is a representation of parcels of land arranged in a descending order of economic advantage (for example, distance from the market place, soil fertility). The line CC represents the cost of factors of production. The Nth piece of land just manages to meet the cost of factors of production. (What it produces just manages to pay for these factors and hence their is no surplus rent after factors of production have been paid for in the various farming enterprises). It is this surplus that is translated to represent unearned increment. It is generated as a result of the relationship between advantaged and less advantaged parcels of land. The valuer or assessor attempts to document it or 'treat' it in order to represent value. In drawing up this theory Ricardo understood that value did not come to land only due to its quality and productivity but also due to its relative position with regard to the market place.

Von Thunen (1783-1850), like Ricardo, attempted to explain land value in an economy of agricultural activities. Von Thunen contended that farmers would tend to locate near the market place. They did this in an attempt to reduce on cost incurred during transportation of both purchases and produce. The competition among farmers for location in close proximity to the market place meant that only the highest bidder would possess the land. The amount a farmer would be willing to pay would depend on his production technology and how much he paid for this combination, and the amount he expected as profit. The surplus after these two were catered for represented what a farmer would be willing to pay for a given parcel of land.

> It therefore followed that people with the highest financial surpluses from their agricultural enterprises could afford to bid highest, so that they ended up occupying land nearest the market.
>
> (King'oriah, 1987, 124)

Financial surpluses reflected economic rent and hence value. As one moved further off from the markets, he would pay less for land due to the increased incidence of transport costs and consequently less financial surplus. According to Von Thunen, who had assumed a landscape of uniform fertility, this decline in financial surplus would be gradual being interrupted only by natural factors such as rivers, or differences in modes of production. It is from this model of Von Thunen's that Land economists draw the assumption that land values decrease with distance from the CBD.

Von Thunen's and Ricardo's works indicate that the value of land is dependent upon the forces of supply and demand. They however, assume that these operate in a perfect market situation. This is one of the greatest weakness of the neo-classical approaches.

In reality markets are rarely perfect and efficient being hampered by the imperfect knowledge of buyers and sellers, the uniqueness of each piece of land, the small number of properties on the market at any given time, the unwillingness of some owners to sell despite the potential monetary gain, the high cost of transactions, the monopolistic nature of land ownership, and government policy (Balchin and Kieve, 1985).

In spite of this short-coming, neo-classical theories have been used to explain land values in several African cities including Accra, Lagos and Nairobi.

Accra

In a study done in Accra, Asabere (1981) using data on approved property transactions of the Bank of Housing and Construction plus sales by real estate brokers, showed that land values tended to decrease with distance from the city centre. They also tended to increase away from the sea in high income residential zones and near major roads.

Value was also found to be influenced by the availability of services, the size of the plot and political intervention.

Bobo's study done earlier in 1977 contended that land values increased in general terms with distance from the central business district (CBD). This of course differs from Asabere's findings (1981) which indicated a decline in land value with distance from the CBD. The two however agreed on incidences of high land values in high income residential areas relative to other residential areas and a positive relationship between land value and the presence of infrastructural facilities.

Nairobi

Kimani (1970), using valuation roll data noted that land values while at their peak in Central Nairobi and areas with extensive corporate and Asian ownership, decreased by varying degrees towards the periphery. Yahya (1990) doing a similar analysis noted that land prices and values were dependant upon not only location but also zoning (and therefore density) and also the quality of services.

Lusaka

Van den Berg's study (1984) of Lusaka's urban fringe indicated that there was a decline in the value of land as one moved from the city centre. Using data for 3900 transactions in undeveloped land, Van den Berg (1984) however cautioned that this decline was not systematic. It was modified in some areas by accessibility, topography, attractiveness and prestige of various zones and proximity to squatter or traditional villages.

Lagos

Studies done in Lagos, by Sada (1972) and Okpala (1978) indicated that the structure of land values did not follow the principles laid down by neo-classical theorists. They found land rent did not vary proportionally with distance from the CBD.

> They attributed this partly to the city's topography and also to the incapability of the assumptions of the traditional models to cater for a city with three forms of land ownership.
>
> (Rakodi, 1991, 4)

In the traditional models it is assumed that land is owned similarly by all inhabitants. These have the right to do as they wish with the land being steered only by the profit motive.

Marxist Land Rent Theory

Marxist land rent theories view land value not merely as the capitalization of rent but also as revealing social relationships between agents such as landowners and tenants or owners and developers (Ball et al, 1985). This emphasis on social agents means that land value must reflect the impact of the investment characteristics of land owners tradition and beliefs, racial discrimination and education levels of residents and local inhabitants.

> Although Marxist theory has been used extensively in the explanation of underdevelopment and the nature of the state at the national level in Africa, it has been little used in investigations of urban development and the urban local state.
>
> (Rakodi, 1991, 5)

Attempts to explain land value in Africa using the marxist approach have been minimal. However, there have been attempts towards this end in the western world. The use of the Hedonic Approach is one such attempt.

The Hedonic approach to value lays an emphasis on social factors which have a bearing on value. It estimates the benefits obtained from environmental amenities such as parklands, pollution free air and freedom from noise (McMillan et al, 1980, 315). In estimating this, the degree of environmental amenity is related to property value through the use of hedonic regressions. Unfortunately these regressions cannot be used singularly to ascertain land values as they reflect behaviour of only one determinant of the same. The regressions attempt to predict the reactions of investors in the presence or absence of public goods. Hedonically estimated prices are therefore best used as inputs into a second stage regression designed to estimate value.

Land Development Process Theories

The body of work contained here-in arose because of the dissatisfaction of land economists in the neo-classical and marxist approaches to value. In spite of the dissatisfaction, land development process theories draw from both the neo-classical and marxist works.

> Land development process theories represent,... an attempt to understand the land development process.... by focussing on the behaviour of actors in that process, their calculations of risk and reward and their strategies for assembling the physical, financial and other resources needed.
>
> (Rakodi, 1991, 6)

Following this statement it is not absurd to suggest that land values will be dependant upon prevailing economic conditions and political regimes as well as other factors including infrastructural facilities and government policies. Although not much research has been done on this approach, it is ideally the best approach to value. It summarizes land value determinants to include alongside economic conditions and political regimes, lot size, time, accessibility, the presence of infrastructural facilities and other capital improvements, relative position, development potential and plattage, demand and public control. The following section discusses those factors that are important to residential land value assessment.

Tenure

There are generally two forms of private land ownership, freehold ownership and leasehold ownership. A freehold title conveys to a land owner ownership of land for an indefinite period of time. The land owner as a result has extensive powers of controlling and manipulating development on that land. A leasehold title to land on the other hand, conveys to the land owner exclusive occupation of land for a fixed or definite period of time (Abbot, 1987,496).

Ideally land with a freehold title is more valuable than land with a leasehold title. This is because the freeholder having his land indefinitely may do with it as he wishes (subject to various legal considerations). Within the leasehold category however, land values will vary depending on the number of years remaining on the lease. These remaining years are important as they determine how one can use land and how much profit he is likely to receive. If, for example, the number of years remaining on a lease cannot allow an entrepreneur to recoup profits from proposed development, the purchase of the land in question is not considered worthwhile.

Plot ratio and Ground coverage

All land within the jurisdiction of any local authority is governed by certain regulations which control development. These include zoning, plot ratio and ground coverage among others. We shall discuss these only in relation to residential areas.

Residential zones are mainly divided into three; high income residential zones, middle income residential zones and low income residential zones. Different factors influence the land values in the different zones. Two such factors are the ground coverage and the plot ratio. These determine the amount of development that can take place on a particular plot. Ideally a higher ground coverage and a higher plot ratio means more development and therefore more value.

<u>Distance</u>

Land value represents the capitalized cost of transport from one location to another. In an attempt to reduce this cost, man locates as near as possible to his necessities. The person looking for a convenient place of habitation will therefore consider as important the distance from his house to the CBD, the nearest shopping centre and social amenities. He will also have in mind the distance to the nearest unconforming use and the nearest police post. The CBD represents the centre of economic, social and political activities in the urban area. Every urban dweller visits this centre frequently for one reason or another.

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Because of its importance, the CBD is heavily developed having a high marginal productivity of land. This marginal productivity decreases as one moves away from the centre due to the decreasing density of settlement. Those locations near the CBD therefore, offer higher marginal products and command higher values.

Although it may be argued that the impact of distance to the CBD on land value has been diluted by the mushrooming business concerns in the city suburbs, political, social and administrative functions remaining therein still make it important. They continue to draw people to the CBD and maintain its importance within the urban area as a whole.

The mushrooming shopping centres have had the important impact of diversifying the shopping trends of various urban dwellers. Shopping can now be done conveniently without incurring the many problems associated with shopping in the CBD (lack of parking space, congested stores, traffic jams, pick-pocketing and theft). Thus residential areas within close proximity to shopping concerns would be more favourable than those further off.

Social amenities represent man's need and desire for comfort. Although there are many indications of social amenities, outdoor recreational facilities are perhaps the ones most widely spoken of. These include clubs, tennis courts, football pitches, horse racing tracks, golf courses, open areas and parks.

The outdoor recreation movement had its origins in the urban areas of the industrial and manufacturing centres. Due to long working hours, recreation during the week was minimal causing individuals to seek group recreation outdoor on rest days. For each individual the recreation experience included among other things considerations on the cost of the journey to and from the recreation site (Miles et al, 1977, 3).

In order to facilitate easier recreation man would locate as near as possible to the recreation site. The same is true today. This high demand for sites in close proximity to recreation centres therefore, increases there value.

Unconforming uses are generally avoided because of the different inconveniences associated with them. It is not the mere presence of a non-conforming use that reduces land value, rather it is the externalities associated with the unconforming use that have great impact on adjacent land values (Holland, 1970, 104). Four types of non-conforming uses being particularly important to residential areas are the city boundary, national parks, slum areas, river valleys and various forms of unkept vacant lands being used as hideouts by robbers.

Squatter settlements are often found along city boundaries. The people dwelling therein are often feared for various reasons. Some people allude that they are generally criminals who unleash unnerving injustices on their neighbours especially if those neighbours belong to a different economic class.

National parks are avoided because of the constant threat of damage to individuals and property posed by escaping animals.

Urban areas have become notorious for their high levels of criminal activities. As a result inhabitants therein have adopted various self protection measures including complex alarm signals, burglar proofing and employment of security guards. They also rely on the services of the police force who are called in when criminal activities are identified. ***Ceteris paribus***, the arrival of police officers to the aid of the people in the home under distress depends on how far that home is from the police post. Proximity to the police post is therefore important to the location of residences.

Flood Area on Plot

Entrepreneurs have to use as much land as possible for development (due regard being given to planning rules and regulations). However, if a certain portion of the land to be developed is subject to flooding, the entrepreneur can only make use of the non-flood section. This would ideally reduce the amount of profit or expected benefit to the land owner.

Area of Site

It is obvious that land prices will vary with size. Any rational person will sell his land for a unit price therefore making profit as the number of units increases. This however, will only be true under the assumption that the land being sold is subject to a certain degree of uniformity. For example, one unit of land, say one acre, in a commercial area may be much more expensive than one unit of land in a residential area. The assumption that land value increases with lot size may therefore not hold true where the land being compared is heterogenous. Nevertheless in instances of homogeneity it holds true.

> Urban land economists have implicitly hypothesized that land value initially increases at an increasing rate and the increases at a decreasing rate as lot size or area increases.
>
> (Colwell et al, 1978, 514)

Topography

Although topography refers to the general physical characteristics of land, this study translates it to relate to slope alone. Slope refers to the inclined position of a piece of land either upward or downward. This inclination determines the ease with which a site can be developed. Steep slopes are generally more difficult to develop requiring various degrees of terracing and infilling. If not carefully manipulated, structures built on them could collapse easily with sliding or any form of disturbance. Plots with gentle slopes being easier to develop are consequently more appealing to developers.

Nature of the Subsoils

The subsoils of a particular plot determine the type of support that a plot can provide to proposed development. Poor underground support hinders the development of heavy sealed edifices particularly high rise structures. Heavy compact soils on the other hand inhibit the use of various forms of sewerage facilities and inhibit the construction of adequate foundations. As a result care must be taken when such soils are identified.

Within residential areas, plots with stable, firm and easily workable soils are more valuable than plots with solid compact, shrinkable soils. A good example of the disparities in value due to differences in subsoil characteristics can be found in Nairobi's Runda Estate. In this estate three types of soil can be identified - black cotton soil, red soil and mixed soil. Red soil plots are the most valuable and black cotton soil plots the least valuable (see Table 2.1).

Table 2.1

Particulars of Plots on Sale - Runda

Tenure	Area (m^2)	Soil Type	Price (KShs)
Leasehold (99yrs)	2023.45	Black Cotton	500,000
Leasehold (99yrs)	2023.45	Red	800,000
Leasehold (99yrs)	2023.45	Mixed	700,000

Source : Lloyd Masika Limited, 1992.

Infrastructural Facilities

Infrastructural facilities are important because not only do they facilitate relatively easier development, but they also ensure relatively comfortable habitation. There will therefore emerge large price differentials between land without infrastructural facilities and serviced land (Peterson, 1991, 6). This observation was made in Santacious, Bolivia where land with access to paved streets, flooding, protection and rudimentary waste water removal systems sold at ten to fifteen times the price of comparatively located land without services (Peterson, 1991, 6).

Time

Land values appreciate over time. Residential land value today would therefore be expected to be more valuable than residential land value ten years ago. Time can also be viewed in terms of convenience and accessibility. If an area can be reached in the least possible time then it tends to have a value advantage. According to Waldo (1974)

> ... the time value of commuting should
> appear as a positive increment.
>
> (Waldo, 1974, 196)

Political Factors

The property market is very volatile being affected considerably by changes in the political atmosphere. The political situation in a country is an indication of its stability. During a stable period the market is very active following increased interest in real property investment. However, during the unstable political period demand for real property decreases pushing prices down with it.

Two kinds of political factors can therefore be identified - those that speak of a stable political atmosphere and those that speak of an unstable political atmosphere. Political factors speaking of instability would include things like civil wars, tribal clashes and 'coup de tats'. During this time/period investment in the property market is expected to be minimal speaking of decreased demand and consequently reduced prices. However, when significant political events occur (for example, the OAU Summit, 1980) the country is seen as being stable allowing for free participation in the real property market.

Plattage

Plattage may be defined as the additional value which is obtained by dividing a lot into two or more smaller lots before sale or development. The value of the sum of the parts is expected to be greater than the value of the whole before it was subdivided. A plot with a higher plattage potential would be expected to be more valuable than one with a lower plattage potential.

Methods of Assessment

The methods of assessing land value which will be discussed in this chapter are the following:-

i) The Allocation method

ii) The Market-Data approach

iii) Discounted Cash Flow analysis

iv) Multiple Regression analysis

The Allocation Method

This method of site value assessment is based on the contention that there is a proportional relationship between the value attributed to the land and that attributed to improvement on the same property. This proportion or ratio varies from one site to another depending on age, condition, physical structure and character and economic stability of the improvement. In its application the method assumes that ;

i) There is a reasonably active property market within the area under investigation and as a result adequate sales data is available.

ii) Properties within the area differ widely according to age and condition.

iii) Competently ascertained current replacement cost data is available.

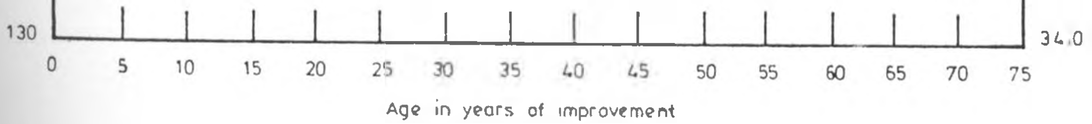
For the purpose of illustration let us assume that the Allocation method is to be used to determine the land value in a region with a conglomeration of single family residential properties. The properties possess to highly equal degrees the amenities and drawbacks, attendant upon location and urban environment. Given this situation, the first step is to compute the percentage ratio of replacement cost to the selling price of each of the sold properties.

$$RC/SP \times 100 \qquad ......(i)$$

Where:

RC is the replacement cost and

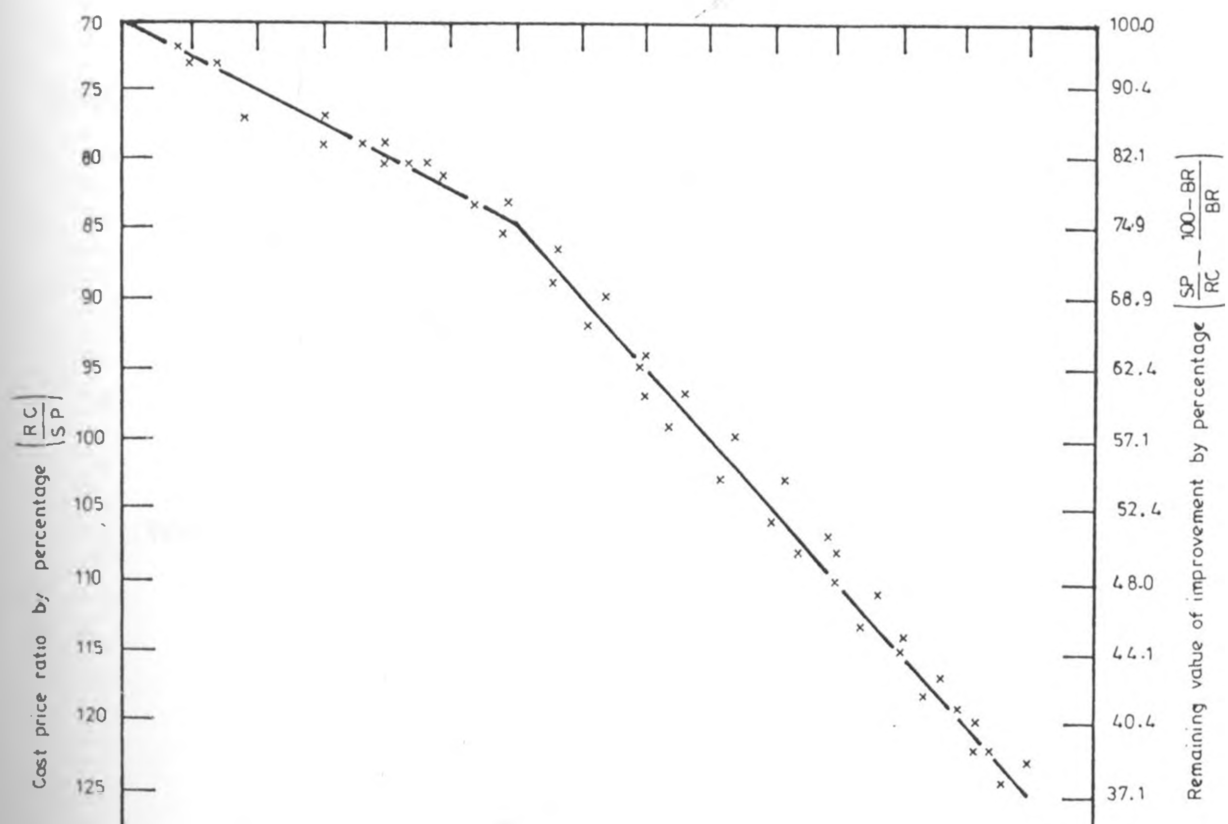
SP is the selling price.



Source: Back, 1970, 44

Figure 2.2

Ratios of Replacement Cost to Selling Price



The ratios are then plotted on a graph. The line of best fit resultant from the plotting becomes the means by which depreciation rates are computed. This happens when the line is translated by re-plotting into a remaining value declination or depreciation curve.

The remaining value of the improvement reflects the structure values of concerned properties and is derived using the following formula.

$$RVI = \left(\frac{SP}{RC} \right) - \left(\frac{100 - BR}{BR} \right)$$

.....(ii)

Where:

RVI is the remaining value of improvement

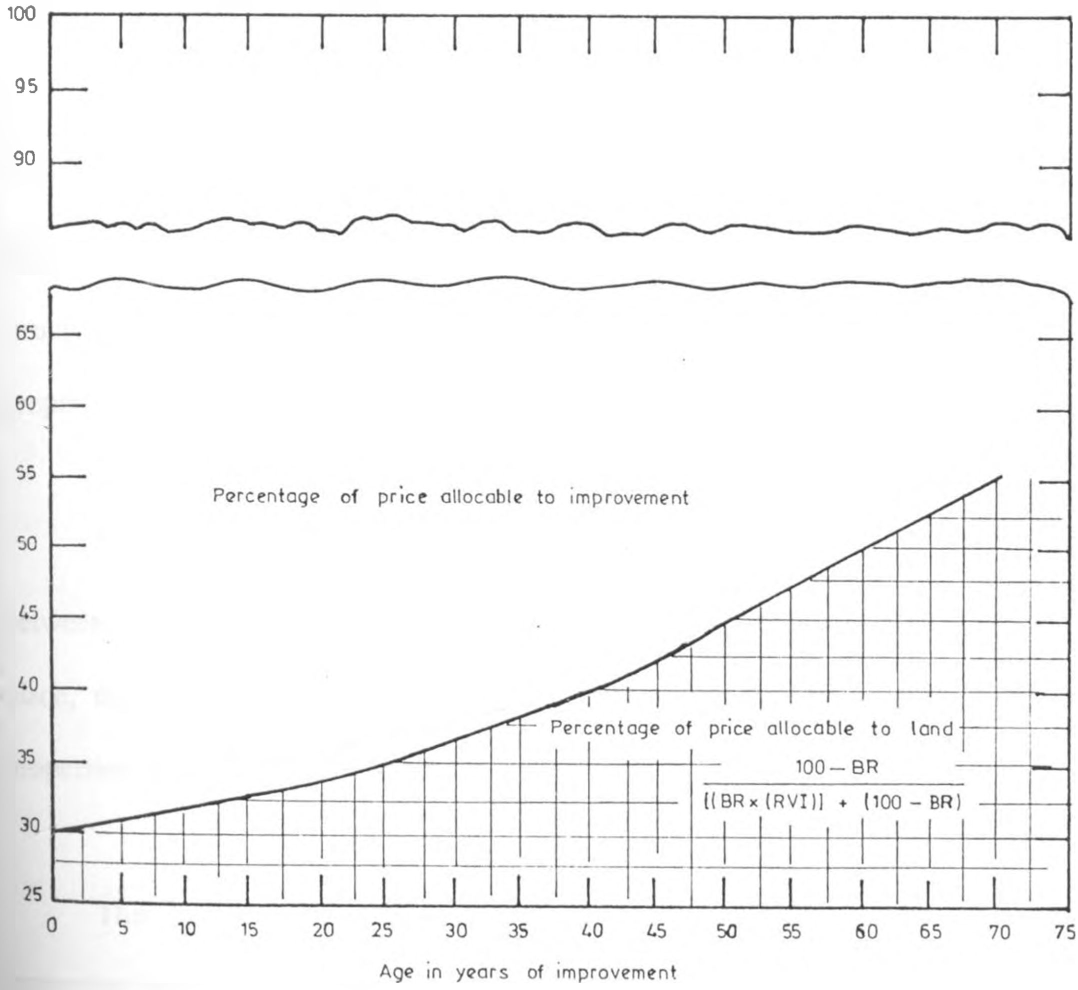
SP is the selling price

RC is the replacement cost

BR is the basic relationship of replacement cost at age 0 in years (new) to selling price of property (in this example, 75, as shown in Figure 2.2.)

Figure 2.3

Percentage of Selling Price Allocable to Land and Improvements



Source: Back, 1970, 45

The second stage of the Allocation method is to determine the percentage allocation of the selling price to land. This is done using the following formula;

Percentage of price allocable to land

$$\frac{100 - BR}{BR * RVI} + \{100 - BR\}$$

.........(iii)

Once the percentage of price allocable to land is ascertained, that allocable to improvement can also be computed by simple arithmetics. The value of the land and structures can then be computed by multiplying the percentages with the actual price of each property.

The end result of the Allocation method is to document the degree of relationship between land values and structure values for given properties. Once this documentation takes place, the separation of land and improvement values can be effected given the age of properties being considered and their selling price.

This method is based on the assumption that similarities occur in each group of properties in terms of design and physical structure. Although this may be true for certain residential estates and blocks of flats, it may not be true for areas where each individual builds his house according to his tastes and preferences. The method also relies heavily on the accurate representation of sales data within a perfect market economy and accurate replacement cost data. Where this is not available again the assessment may be rendered incompetent.

In general the method involves a great deal of computation thus relying heavily on the availability of both fiscal resources and professional capabilities. This computation even becomes more burdensome when one realises that new graphs and percentages need to be developed for each group of similar properties. It is especially painful if all this is to be done to assess only one property in a whole block - (generally valuers are required to value single properties at a given time. Rarely are they required to value a whole block of properties together). If a valuer had instructions to value a whole block of residential properties then probably he would consider it worth the while using the allocation method as his assessment tool.

It is also apparent from this discussion that in the Allocation method the structure/improvement value is calculated first before a value can be placed on land. This means that the method can only be used to determine the value of built up assets. In cases of vacant residential land, the method cannot be used for assessment.

In spite of these observations the Allocation method is a reasonably accurate and equitable and therefore highly competent method of estimating land value. It not only makes assessment accurate and equitable, but also helps in acquiring and monitoring a large bank of land appraisal data essential to valuation practice in general. In Nairobi however, valuers have not resorted to the use of this method. Although it may be argued that this could be due to a lack of awareness about the same, I would tend to think that this is due to the weaknesses and complexes of the method as explained herein.

The Market or Comparative Approach

In this method values of land are deduced or inferred from known values through systematic comparison. The assessor compares (weighs and relates) sales data to the land being appraised and sets a value to it through extrapolation.

> If there are numerous current sales of vacant lots that are accurately representative of all categories - location, zoned use, productibility and physical characteristics, the assessors problems associated with the land valuation task become simply procedural and ministerial in nature.
>
> (Back, 1970, 41)

However, in cases where these are not available comparison becomes difficult.

Assuming that enough data is available for systematic comparison the assessor produces through various statistical procedures, curves, tables, data and equations which will aid in comparison. Depth curves describing the actual attitudes of market participants are developed and equations derived from actual market responses to lot configuration, corner location, site, size and street frontage inferred.

These curves, tables and equations, enable the assessor to extract unit values (front metre or square metre, front foot or square foot) of the plots that have been sold. These unit values are then recorded on land value maps to discover the proper extent of the viability of those rates within an area or along a fronting street.

This method although simpler and more direct than the Allocation method also relies on sales data. This sales data must be on vacant land alone. This becomes difficult to compile since in most urban areas, there is a minimum number of vacant sites meaning that comparative data is equally scarce. However, Back (1970) argues that if this is the case, then direct market evidence of the value of land may be supplemented by benchmark site values that represent validly allocated portions of selling prices on competently appraised values of improved real property parcels (Back, 1970, 42).

Most valuers when using the Comparative approach, however, do not go through the necessary procedure of developing the various important curves, tables and equations. Instead they resort to averaging sales values in an attempt to ascertain the value of a unit of land (field survey, 1992). The problem with this approach is that averaging sales as a means of determining market value could result in either overvaluing or undervaluing. This method of assessing is therefore unsound. A proposed alternative to averaging is that the valuer repeatedly makes examinations of relevant sales and circumstances under which these are made in order to determine the most adequate comparable to the parcel of land subject to valuation. This is a tedious task especially in the case of repetitive valuations. As a short cut method it has been argued that market values be reduced to unit values or benchmarks or valuation stations representing the typical square foot value of a typical parcel of land in a given area.

Discounted Cash Flow Analysis

Discounted Cash Flow (DCF) techniques have been used for many purposes including for establishing the present capital value of a project at a given rate of return. They are also important in establishing the true earning rate of a project with a given capital value. It is however, in the interest of this study to investigate how these techniques are applied not only to projects in general but also to the valuation of land.

According to Quigley,

> The principles of discounted cash flow in analysing risks are further stages of sophistication in obtaining a greater degree of accuracy in the decision making process (i.e. in determining what can be paid for broad acres).
>
> (Quigley, 1978, 262)

DCF analysis as used in land valuation assumes that land will be developed to its highest and best use. When the development has been conceptualized all development costs and sales are targeted and placed on a cash flow leaving out in the first instance any reference to the initial purchase of land. The cash flow is then discounted to give the present value of the residual at a particular rate of return. Commonly the rate of return adopted is the rate of interest payable on money to be borrowed for investment in the scheme representing the cost of capital (Brutton et al, 1989, 188).

Other rates used include the rate of return required by the investor or the rate of return he could earn on the money on an alternative investment where money could be invested if the scheme is not to proceed. This could also be referred to as the opportunity rate.

To illustrate the use of Discounted Cash Flow (DCF) techniques in valuing residential land, let us assume that a given residential property can be constructed in six months at a cost of KShs 50,000.00. It can then be sold at a cost of KShs 55,000.00.

Table 2.2

Projected Cash Flow for Proposed Residential Development

MONTH	COSTS	SALES	NET CASH FLOW (MONTHLY)	CUMULATIVE
0	-10000		-10000	-10000
1	-10000		-10000	-20000
2	-10000		-10000	-30000
3	-10000	+10000	0	-30000
4	-10000	+10000	0	-30000
5		+15000	15000	-15000
6		+20000	20000	5000
TOTAL	-50000	55000	5000	5000

Source: Quigley, 1978, 266

Table 2.2 represents the projected cash flow for the residential development before discounting. The total derived from the net cash flow or the cumulative cash flow is interpreted to represent land value (KShs 5000.00). It is therefore the contention of DCF analysis that the value of land is the surplus after all other costs have been met. In this computation the opportunity cost of capital has not been taken into consideration.

If this same cash flow were to be discounted at say a thirty (30) percent rate of return the value of land would change significantly (See Table 2.3).

Table 2.3

Projected Cash Flow for a Proposed Residential Development at a Thirty (30) Percent Rate of Return

MONTH	NET CASH FLOW (KShs)	PV $1 at 30%	$P_r = 1/(1+R)^n$
0	-10000	1	-10000
1	-10000	0.9784	- 9784
2	-10000	0.9572	- 9572
3	0	0.9365	0
4	0	0.9163	0
5	15000	0.8965	13447.5
6	20000	0.8770	17540
TOTAL	5000		1631.5

Source : Prepared by author

Table 2.3 indicates that the value of the land when assessed at a thirty (30) percent rate of return increases by a total sum of KShs 1631.50 to KShs 6631.50.

$$5000 + 1631.50 = 6631.50$$

The value increases because at a 30 percent rate of return the developer can afford to pay more money for land as returns are expected to be quite lucrative.

According to the DCF approach therefore land values are dependant on the cash flow of various projects and will vary when these cash flows vary. The method also suggests that land value is dependant upon the rate of return expected from a given project.

In the discussed example it is assumed that before development begins (in the zero month) the developer will have to part with KShs 10,000 being payment for different types of fees and the land. The figure attached to land is however, arbitrary. A second alternative would be instead of adding this arbitrary figure to the cash flow, to ignore it completely and to discount the cash flow using the known amounts (see Table 2.4). At a thirty percent rate of return the value of land (reflected as the total present value of the cash flow) still comes to KShs 6631.50.

Propagators of the DCF approach argue that this method is advantageous because it quantifies the actual cash flow expected for the project being assessed at each point in time and defers this at an interest rate related to the opportunity cost of money. In this respect it is better than traditional methods which look at cash flows as one figure (a lumpsum) disregarding the expectations of future growth.

Table 2.4

Projected Cash Flow for a Proposed Residential Development (Excluding an Arbitrary Figure for Land Value in the Cash Flow)

MONTH	COSTS (Kshs)	SALES	NET MONTHLY CASH FLOW	Pv $1 at 30% $p_v=1/(1+R)^n$	PV in (KShs)
0	- 5000		- 5000	1	- 5000
1	-10000		-10000	0.9784	- 9784
2	-10000		-10000	0.9572	- 9572
3	-10000	10000	0	0.9365	0
4	-10000	10000	0	0.9163	0
5		15000	15000	0.8965	13477.5
6		20000	20000	0.8770	17540
TOTAL	-45000	55000	10000		6631.5

Source : Prepared by author

As far as land valuation is concerned this can hardly be considered as an advantage since the land assessor is not concerned with the accuracy of cash flow but rather with accurate assessment of land value. In actual fact the DCF approach just like the Residual method in chapter one is subjective as it depends mostly upon assumption about the future. To project cash flows for projects can often be deceiving as future trends can scarcely be predicted. It is not possible to estimate especially sales, since economic situations vary significantly over times and are very volatile. The concept of the rate of return is also very subjective since each developer will expect a different rate depending on his understanding of the market. The method thus becomes extremely unreliable since even a very small change in the expected rate of return could alter the predicted land value significantly.

In view of these weaknesses the DCF technique has not been used widely to assess land value in Kenya (Gitonga, 1988). Some valuers have been discouraged not only by its weaknesses but also by its length. They say that the method is long and tedious involving numerous references to valuation tables and equally numerous calculations. The traditional methods are on comparison quicker to apply to many problems. The formidable amount of table reading and key bashing necessary in DCF analysis poses a high risk of error. It has also been argued that where DCF analysis is applied to freehold properties the perpetual nature of the freehold property investment implies an infinitely long cash flow projection. This in turn creates problems with both computation and projection. DCF analysis is therefore not ideal as a method of assessing residential land value.

Multiple Regression Analysis

So far this chapter has attempted to discuss various methods that valuers have developed to be used as tools in assessing land value. Two of these methods, the Allocation method and the Comparative approach are extensions of the Market-Data approach discussed in chapter one. Discounted Cash Flow (DCF) analysis is a brother to the Residual method discussed in the same chapter. These methods are not being widely used in Kenya probably due to weaknesses inherent in them (field survey, 1992). This section discusses another method, Multiple Regression analysis and investigates how it has been used in residential land valuation in various parts of the world. Although this method may be considered as an advancement of the Comparative approach, I am of the opinion that it is more superior as it documents systematically the effect of various factors on land value. In so doing it helps determine the most important variables in assessing land value and improves the assessor's job considerably. Discussed here-in are the works of various scholars including Downing (1970), Mills (1970), Yeates (1966), and Berry (1970).

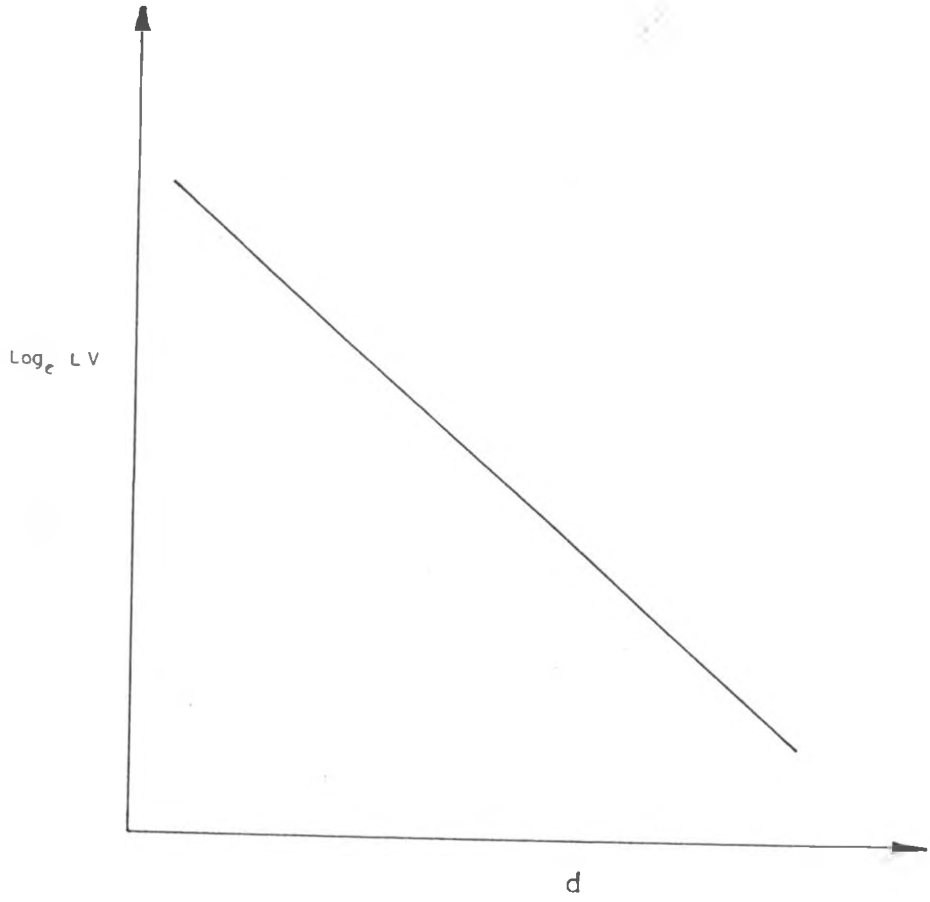
<u>Multiple Regression and Location Theory</u>

Multiple regression with regard to location theory can be viewed as an extension and statistical documenting of the neo-classical works of scholars such as David Ricardo and Von Thunen. One scholar who successfully attempted this documentation was Edward Mills (1970).

Mills was of the opinion that the values of land were a function of the location of a site within a given area. Rent was paid for the use or purchase of that site depending on how near it was to important points, for example, the market place. Land rent therefore was solely attributable to location. Rent attributable to location or location rent was ascertained with regard to transport costs.

Figure 2.4

A Model of Land Values and Population Densities



LEGEND

LV: Land Value

d : Distance from important point

Source: Mills, 1970, 298

It is assumed that since these costs increased with distance from a centrally located workplace or market place, residents in neighbourhoods near the workplace would spend less in money on transportation. The resultant saving made by them would accrue to the land owners and be reflected as land value. It follows then that with increasing distance from the workplace transport costs increased, individual savings made by residents decreased and land value declined. This trend is depicted in Figure 2.4. Based on the foregoing argument Mills developed the following model proposing that it be used as a land value assessment tool.

$$R(u) = R_0 e^{(-Au)}$$

Where:

R(u) is the land rent at a distance (u) from the city centre

R_o is a constant of integration interpreted as land rent at the city centre

e is the natural base of logarithms

A exponent, and

d is the distance from the city centre.

Mills tested his model in Chicago using land values estimated by Homer Hoyt for the years 1856, 1857, 1873, 1910 and 1928 and his own sample of land values for 1966. The results of his regression model are contained in Table 2.5. These indicate that initially there was a strong negative relationship between land value and distance from the city centre. As put by Berry et al (1970),

> ... the city experienced an increase in the land gradient and level of explanation afforded by distance .
>
> (Berry et al, 1970, 299)

Table 2.5

Mills' Land Value Regression for Chicago

YEAR	TYPE OF REGRESSION	CONSTANT	CO-EFFICIENT OF REGRESSION	R^2
1856	Linear	1016	-101.6	0.0503
	Log	5.799	-0.3986	0.7836
1857	Linear	6011	-575.1	0.1911
	Log	8.792	-0.4874	0.8597
1873	Linear	24920	-2333	0.2009
	Log	10.02	-0.3300	0.7066
1910	Linear	139800	-19220	0.1385
	Log	10.84	-0.3275	0.5867
1928	Linear	182400	-15590	0.1150
	Log	11.85	-0.2184	0.4985

Source : Berry et al, 1970, 300

This was due to rapid industrial growth experienced during the industrial revolution. Transport systems were not well developed during this period making it important to locate near the CBD or the centrally located work place. This would facilitate easier and cheaper transportation of both raw materials and finished goods. Between 1857 and 1873 technical innovations in transportation (the street car railway for commuters) led to a rapid decrease in the land value gradient. This continued between 1910 and 1928 with the advent of the automobile for workers and the truck for goods.

With this decline other factors came into play as influences of residential land value. Mills' model could not as a result be used to give an accurate indication of land value.

Although Mills successfully presented us with evidence that land values are influenced by location in relation to various important centres, he failed to bring to light the fact that land values are also influenced by many other factors. As a result as at 1928, his model could only account for 11.5 percent of the determinants of land value.

Multiple Regression and Amenity Rent

Yeates (1965) recognized the diminishing effect of distance on land value and proposed amenity rent as a better determinant and predictor of land value. He contended that in order to determine land value it was important to determine the factors influencing amenity rent and consequently value. According to Yeates these were distance to the CBD, distance to the nearest regional shopping centre, distance to the nearest recreation facility, (for Chicago, Lake Michigan), distance to the nearest elevated train or subway station, population density and the percentage of non-white population.

The Predictor Model

Yeates developed the following model as an assessment tool for residential land value

$$\text{Log } V_i = a + b_1 \log C_i + b_2 \log R_i + b_3 \log M_i + b_4 \log E_i$$
$$+ b_5 \log P_i + b_6 N_i + e$$

Where:

V_i : Frontfoot land value

C_i : Distance to the CBD

R_i : Distance to the nearest regional shopping centre

M_i : Distance to Lake Michigan

E_i : Distance to the nearest elevated train or subway station

P_i : Population density

N_i : Percentage of non-white population

e : Error

i : "ith" sampling point.

The findings from the subsequent regression are contained in Table 2.6.

Table 2.6

Yeates' Regression Results

Year	b^1	b^2	b^3	b^4	b^5	b^6	R^2
1910	-.837	-.038	-.450	-.248	+.105	+.005	77
1920	-.637	-.122	-.414	-.246	-.008	+.001	65
1930	-.268	-.156	-.367	-.214	+.039	-.003	37
1940	-.275	-.134	-.285	-.410	+.044	-.002	34
1950	-.268	-.080	-.227	-.152	-.016	-.002	24
1960	-.173	-.092	-.146	-.050	-.317	-.002	18

Source : Berry et al, 1970, 301

As with the Mills model, the explanatory power of this model declined over time as did the correlation co-efficients for distance. This can again be explained by the diminishing effect of distance on land value (four out of the six variables in the model are based on distance). Yeates found that only within 1.5 miles (2.41 kms) of the city centre were land values found to be strongly related to distance, towards the edge of the city land values actually increased with distance.

Although the work done by Yeates is more advanced than that done by Mills in that it incorporates more variables, the resultant model due to the weaknesses discussed became an ineffective tool to assessing residential land values.

Estimating Residential Land Value According to Downing

Downing(1970) was concerned with investigating residential land value in light of capital value theory. He contended that land values were a capitalization of land rent as received by the land owner.

$$LV = \frac{R}{I}$$

Where:

LV Represents the present worth of land (land value)

R Represents the annual net return to the land (land rent)

i Represents the interest rate.

This land rent was dependant on several factors including the accessibility of the lot being assessed to economic activities (P), amenities (A), the lots topography (T), its present and future use (U) and historical factors affecting utilization (H)

$$LV = f(P, A, T, U, H)$$

In developing his model, Downing investigated each of these variables individually and developed specific measures for them. As regards the accessibility to economic activities (P), Downing developed three measures,

(i) distance to the central business district (CBD)

(ii) distance to the nearest regional shopping centre

(iii) distance to the nearest public grade or junior high school.

He measured amenities in relation to the desirability and quality of the neighbourhood. These were visible through:-

(i) the percentage degree of deterioration and dilapidation

(ii) the degree of crowding

(iii) the presence of non-whites

(iv) the level of income

(v) location either north or south of the town.

The percentage degree of deterioration was ascertained by determining the number of poorly maintained houses in a given section (eg. in a given block or units). A high percentage of dwellings in a poorly maintained condition indicate a poorly maintained area and therefore reduced land value.

The accuracy of this assumption is, however, questionable. At a local context the condition of the improvements seems to have limited influence on land value. In certain slum areas in Nairobi for example, land values are still considerably high in spite of the poor quality of dwelling units.

Crowding is thought to have a negative effect on land value. Crowded areas are normally noisy, less orderly in appearance, have parking problems and uncontrollable crime rates. This reduces the demand for them and consequently value. Although this may have been true for Downing in certain areas in Nairobi, the assumption does "not hold water". In Eastleigh for example, crowding has come to be associated with high values. These areas have high unit values created by excessive demand for housing by refugees and other community emphasizing groups. However, in high income residential areas the assumption is expected to be true - there exists an inverse relationship between crowding and land value. Most residents in these areas opt for privacy rather than the communal accountability afforded in crowded residential areas.

Crowding can be measured in terms of the number of persons per given unit area or the number of persons per room. If this number is above that acceptable under existing laws, then the area under investigation is considered crowded. In Kenya the number of persons acceptable as inhabitants per room is 2.5 (5 persons per two rooms).

Downing incorporated in his model a variable related to racial discrimination. He expected that the presence of non-whites in a given area would make it less desirable. On the other hand the presence of whites in an area would considerably increase its land value.

This would have been true for Kenya during the colonial era when social discrimination was being encouraged. However, with independence racial segregation laws are nonexistent. It would perhaps be more correct to argue that zoning in terms of economic characteristics affects land values. The values in areas where high income groups reside could be considered as significantly different from those of low income group areas.

The level of education tends to be directly related to income. Within high income areas more people are educated per given dwelling unit or have greater opportunities for education. According to Downing (1970), therefore,

> it is expected that it would be desirable to live near highly educated and more affluent families. This would result in higher residential land values in areas where such people settle.
>
> (Downing, 1970, 107)

Topography as incorporated into the model refers to all the physical characteristics of a site which influence its desirability. These include the slope of the site, the geology of the soil and underlying strata. A gently sloping site, for example, is more desirable than a steep site which complicates construction and is subject to higher risks of sliding. Poor underground support on the other hand inhibits the construction of heavy and highrise structures even when planning laws allow for them. Poor soil also affects the laying of sanitary systems. Clay soil, for example, restricts or eliminates the use of septic tanks. Black cotton soil also hinders development.

Downing also included in his model variables related to historical factors and to the intensity of use. The term historical factors is understood to mean the employment of land in a way that is no longer suitable. It includes among other things the retention of old buildings as monuments or antiques or preservation of a certain land use as a cultural heritage.

Regarding the intensity of land-use Downing correctly assumed that land which facilitates a high intensity of development is demanded more and hence has a higher value than that allowing a lower intensity of development.

Downing tested his model in the residential areas of Milwaukee, California. He held land use constant since only residential areas were being investigated, but divided the residential areas into intensity zones as illustrated in Table 2.7

Table 2.7

Maximum Density allowed in the Residential Zones of Milwaukee

Zone	Maximum number of dwelling units per acre.
B	2904
C	36
D	18
E	9
F	7

Source: Downing,1970,111

Table 2.8

Factors Affecting Residential Land Value in Milwaukee, California

INDEPENDENT VARIABLE	REGRESSION	STD ERROR	T STAT.
Constant	-2.679864	0.735182	-3.25
Distance to CBD (reciprocal distance in miles)	3.405167	0.259656	13.11
Distance to school (miles)	0.045929	0.195524	0.23
Distance to shopping(miles)	-0.022999	0.89903	-0.26
Deteriorating or dilapidated (% dwelling units in block)	-0.014346	0.003761	-3.81
Crowding (% of dwelling units in block with more than 1 per person per room)	-0.007735	0.006502	-1.19
Non-white (% of dwelling units in block with head of house non-white)	-0.005579	0.006196	-0.90
Median education (years)	0.138444	0.057150	2.42
Median income ($ per year)	0.000129	0.000060	2.01
North/South	0.152990	0.100603	1.52
Size of lot (thousands of square feet)	0.000010	0.000144	0.07

table continued on next page

continued from previous page

Time (1958=0)	0.093791	0.038846	2.41
B zone (I/O dummy)	0.836378	0.217990	3.84
C zone (I/O dummy)	0.389173	0.188205	2.07
E zone (I/O dummy)	0.138274	0.1549180.1	-0.89
F zone (I/O dummy)	0.158883	98798	-0.80

R^2 adjusted = 0.72633

Number of observations = 352

Standard error of estimated adjusted = 0.77298

Land value mean = 1.47641 (dollars per square foot)

Land value standard error = 1.477579

Source : Downing, 1970, 114

Ignoring zone D, four dummy variables were set for the remaining four zones. Each variable took a value of one (1) if a site appeared in it and zero (0) if it was not. Zone D was ignored because it was the most common zone. The objective was to establish whether there was an incremental value attributed to being in the other zones rather than in zone D. The results of the Downing model are represented in Table 2.8. The model explained up to 72.6 percent (R^2 adjusted , 0.72633) of the behaviour of land value in Milwaukee.

The Predictor Model

Since some of the variables that Downing had considered important actually turned out as insignificant, he eliminated them and proposed a smaller model of ten variables.

Table 2.9

The Predictor Model

INDEPENDENT VARIABLE	REGRESSION CO-EFFICIENT	STANDARD ERROR	T-STATISTIC
Constant	-2.793363	0.672340	-4.15
Distance to CBD (reciprocal of distance)	3.367925	0.237086	14.21
B zone	0.950333	0.197526	4.81
C zone	0.391623	0.180955	2.16
E zone	-0.145846	0.151836	-0.96
F zone	-0.218859	0.191405	-1.14
Deteriorating or dilapidated	-0.016415	0.003314	-4.95
Median income	0.000104	0.000056	1.87
Median education	0.174118	0.052956	3.29
Time (1960 = 0)	0.098171	0.037644	2.61

R^2 adjusted = 0.72716

Number of observations = 352

Standard error of estimate adjusted = 0.77179

Land value mean = 1.147641 (dollars per square foot)

Land value standard error = 1.477579

Source : Downing, 1970, 118

Regression Analysis and Land Valuation in Kenya

Although regression analysis has been used with some degree of success for land valuation in western cities, little work towards this end has been done in Kenya. In the past ten years the most significant contribution to incorporating regression analysis into valuation has been the work of Ndwigah (1988). Although she was not primarily concerned with valuation per se, Ndwigah proposed what she considered a viable model for land value assessment.

Using figures on land sales in local newspapers, Ndwigah developed a regression model with nine independent variables. These included zoning, time in years, distance in kilometres, area in square metres, land policy decisions, economic effects, gross domestic product, GDP, (in Kenya million pounds), population and political events.

The results of this model are contained in Table 2.10. The model was able to explain up to 68 percent of the changes in land value in Nairobi. The dependent variable, land sales was averaged and presented as land value per square metre. Although Ndwigah purported to verify these figures with figures contained in the Nairobi City Commission valuation rolls they are likely to contain several irregularities. Firstly, the figures listed in the local newspapers are normally the selling prices proposed by various land owners. These are not necessarily the true estimate of land value. The land owner may offer his property at any price no matter how unrealistic (see chapter one). In most cases these prices are inflated to allow for a 'bargaining margin'. The figures recorded in the City Commission and the Lands office upon effecting a sale are on the other hand understated. The researcher (Ndwigah) agrees that this sales data is often under declared to avoid taxation. (Ndwigah, 1988, 17). Nevertheless Ndwigah's work proves that regression analysis can be used competently to assess land value.

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Table 2.10

Factors Influencing Land Value in Nairobi

DEPENDENT VARIABLE	REGRESSION CO-EFFICIENT
Constant	1053.79168
Zoning	- 259.73505
Time in years	- 9.73130
Distance in kilometres	- 72.25109
Area in square metres	0.00493
Land policy decisions	63.23638
Economic effects	- 45.44398
Gross Domestic Product "GDP" (Kenya million pounds)	0.07162
Population	- 0.00029
Political events	- 16.41468

Source : Ndwigah, 1988, 158

Summary

This chapter has looked at several theories of land value and various methods used in the assessment of this value. The strengths and weaknesses of these methods have been discussed. The next chapter will attempt to statistically determine the competence of those methods used in Nairobi namely the DCF analysis, the Comparative Market-Data approach and the Residual method.

CHAPTER THREE

A COMPARATIVE STUDY AND ANALYSIS OF ASSESSED VALUES AND SALE VALUES IN HIGH INCOME RESIDENTIAL NEIGHBOURHOODS

Some people hate statistics but I find them full of beauty and interest. Whenever they are not brutalized but delicately handled by the higher methods and are warily interpreted, their power in dealing with phenomena is extra ordinary. They are the only tools by which an opening can be cut through the formidable thicket of difficulties that bars the path of those who pursue the science of man.

Sir Francis Galton (1889)

Preview

In the previous chapters we examined several methods used to assess land value. This chapter now looks at the manner in which regression analysis can be used to estimate this value in high income residential neighbourhoods.

The first part of the chapter, however, discusses the differences between residential land values as they are assessed by valuers and their market values upon sale. This is done in order to fulfil the first objective of the study namely, to investigate the adequacy of the existing approaches to estimating land value. The assessed values are compared to the sale values using the t-statistic.

Ascertaining Land Values in High Income Residential Areas in Practice

Land values for vacant land in high income residential areas in Nairobi are estimated mainly through the use of the Comparative Market-Data approach and the Residual method (see chapter one). In order to verify this assumption, questionnaires were administered to valuers in Nairobi's four largest property management and valuation firms namely:-

(i) Lloyd Masika Limited

(ii) Bageine Karanja and Mbuu Limited

(iii) Tysons Limited

(iv) Milligan and Company Limited

Fifteen (15) questionnaires were administrated to each of these firms and interviewees asked to identify plots valued and sold within the firms between 1980 and 1992. (The plots had to have been vacant at both the time of valuation and sale). If more questionnaires were needed these were administered accordingly. The interviewees were asked to indicate for each plot the method used to asses it's value, the year during which it was assessed, the amount at which it was sold and the year during which it was sold among other things. A total of 60 questionnaires was administered and the responses given to 51 of them. In attempting to determine the most popular mode of assessment, four options were provided:-

(i) Discounted Cash Flow analysis (DCF)

(ii) Comparative Market-Data approach

(iii) Residual approach

(iv) Others

Table 3.1 gives the breakdown of the responses to this question.

Table 3.1

Methods of Assessing Residential Land Values used by

Valuers in the urban area of Nairobi.

Methods of Assessment	No. of Valuers	Percentage
Comparative	7	13.73
Residual	1	1.96
DCF	0	0
Others	43	84.31
TOTAL	51	100.00

Source : Prepared by the author based on field data, 1992

Seven (7) valuers used the Comparative (Market-Data) approach, one (1) used the Residual approach and forty-three (43) used other methods. None of the plots were valued using DCF techniques.

When those using other methods were interviewed further to ascertain the exact methods used by them, it was discovered that they did not actually value land. However, after looking at a plot and making some mental calculations they put plots up for sale and accepted the most reasonable offers made by prospective buyers as the selling price. More accurately therefore, only 8 of the 51 plots were valued before sale.

The Comparative Approach

The Comparative approach was the method used by most valuers. The fact that they preferred this method to both the Residual approach and Discounted Cash Flow analysis could be explained by several factors.

1. For certain neighbourhoods comparables are relatively easy to find. A valuer can easily look through the classified section of local newspapers and find out the rate at which plots in a neighbourhood are being sold. Using these figures he can come up with an average per unit price which he can then use to assess the plot in question.

   This of course has its weakness in that the prices given in the adverts are normally estimates and do not necessarily represent the true selling price of a particular piece of land.

2. Apart from looking up comparables in newspapers valuers can also call up their colleagues in other firms and ask them for comparables from current sales executed by them. They can then use these to carry out their valuation.

Because of this relatively easy way of getting information, many valuers use the Comparative approach whenever they need to value land. In spite of the methods popularity values arrived at when it is used are not always the true values of land.

For each of the eight plots valued before sale, the percentage difference between the assessed value and the sale value was calculated. However, before this was done the necessary discounting was effected. This was necessary because some of the plots in the selected sample of 8 were valued and sold in different years. To create uniformity one figure (the assessed value) was adjusted. For example, as shown in Table 3.2, plot 1 was valued in 1981 and sold in 1982. The assessed value as at 1982 was therefore determined using the present value formula;

$$P_c = P(1+i)^n$$

Where:

P_c is the adjusted assessed value

P represents the initial assessed value

i the interest rate and

n the time in years.

The interest rate used in the adjustment process was the average between the rate of inflation during the year of assessment (in this example, 12.6%) and the rate of inflation during the year of sale (in this example, 22.3%). The time in years is the time period between the year of assessment and the year of sale, (in this example, 1). These computations are summarized in Table 3.2

Table 3.2

Adjustment of Assessed Values of Plots in the Selected Sample.

Plot	Year of A.	Year of S.	A. Val.	S. Val.	T	A_i	B_i	R	adjusted A. value P_c
1	1981	1982	375	360	1	12.6	22.3	17.45	440438
2	1991	1992	850	900	1	17.6	30.0	23.8	1052300
3	1989	1989	1600	1500	0	11.5	11.5	11.5	1600000
4	1981	1981	700	900	0	12.6	12.6	12.6	900000
5	1988	1988	1400	1400	0	8.7	8.7	8.7	1400000
6	1990	1990	1500	1700	0	14.5	14.5	14.5	1500000
7	1979	1980	250	230	1	12.3	12.8	12.55	281375
8	1980	1980	750	700	0	12.8	12.8	12.8	700000

Where:

Year of A. is the year of assessment

Year of S. is the year of sale

A. val. is the assessed value in KShs thousands

S. val. is the sale value in KShs thousands

T is the time period in years

A_i is the rate of inflation in the year of assessment

B_i is the rate of inflation in the year of sale

R is the average rate of inflation $(A_i + B_i)/2$

P_c is the adjusted assessed value

Source: Prepared by author based on field data

After the discounting process the sale values and assessed values were compared and the difference in the two sets of values noted. This information is contained in Table 3.3.

Table 3.3

A Comparative Examination of Assessed Land Values and Sale Values of Vacant Land in the Study Area.

Method of assessment	Size of plot (m_2)	Assessed values (A.V.) (KShs)	Sale value (S.V.) (KShs)	Diff. between S.V. and A.V. (KShs)	Diff. by %.
Comparative	10117.3	375000	440438	65,438	17.4
Comparative	3728.0	850000	1052300	202,300	23.8
Comparative	10520.0	1600000	1600000	0	0
Comparative	3075.6	700000	900000	200,000	28.6
Comparative	3561.3	1500000	1700000	200,000	13.3
Comparative	3035.2	250000	281375	31,375	12.6
Comparative	4046.9	750000	700000	50,000	7.1
Residual	4411.1	1400000	1400000	0	0
DCF	-	-	-	-	-

Source: Prepared by the author based on field data, 1992

Out of the seven plots valued using the Comparative approach for only one was the assessed value equal to the market value. For the remaining six plots the difference in value ranged between 7.1 and 28.6 percent.

The Residual Approach

Only one valuer used this method to assess value. The value proposed was exactly the same as the market value of the same land upon sale. This means that the Residual method was very accurate in predicting value. However, the very fact that only one of the 8 valuers used this method speaks of some complications in or with the approach.

Discounted Cash Flow Analysis

None of the valuers interviewed used Discounted Cash Flow (DCF) techniques to assess land value. This could be explained by the fact that the approach is very subjective depending upon the future expectations which are in reality difficult to predict with accuracy. In any case not many valuers in practice are very familiar with this approach.

A statistical (the t-test) test was carried out in which assessed values of land were compared to the sale values of land in order to establish whether there was a significant difference between the two values.

The t-statistic was used because of the small size of the sample. In small samples the standard deviation of the sample is subject to a definite bias tending to make it consistently lower than the standard deviation of the population. This underestimation of the sampling error takes away a part of its utility rendering it incompetent for comparing differences in small samples (Gupta, 1973, 644). The t-statistic is used as an alternative.

Hypothesis

H_O : There is no significant difference between the sale values and assessed values.

H_A : There is a significant difference between the sale values and the assessed values.

Model assumptions

1. The data collected was selected randomly,

2. The population represented by this data is normally distributed.

Significant level

$$\alpha = 0.05$$

Test Statistic is the Observed t

$$t = \frac{\bar{a} - b}{\sqrt{\left(\frac{s_a}{\sqrt{n_a}}\right)^2 + \left(\frac{s_a}{\sqrt{n_b}}\right)^2}}$$

Where:

a is mean of sample a

b is mean of sample b

n_a is sample size of a

n_b is sample size of b

s_a is standard deviation of sample a

s_b is standard deviation of sample b

Assessed Value (a)	Sale Value (b)
440,438	360,000
1,052,300	900,000
1,600,000	1,500,000
700,000	900,000
1,400,000	1,400,000
1,500,000	1,700,000

281,375	230,000
750,000	700,000

a	**965514**	**b**	**961250**
S_a	**499321**	S_b	**534588**

$$t = \frac{965514 - 961250}{\left(\frac{499321}{\sqrt{8}}\right)^2 + \left(\frac{534588}{\sqrt{8}}\right)^2}$$

$$= \frac{4264}{258483}$$

$$= 0\ 016$$

Decision rule

If $t_0 > 1\ t_e$ H_o is rejected

if $t_0 < 1\ t_e$ H_o is accepted

Decision

$t_o = 0.016$

$t_e = 1.761$

$0.016 < 1.761$ H_o is accepted

Conclusion

There is no significant difference between the sale value of land in high income residential areas and the assessed value of the same land.

In spite of this conclusion it is important to remember that only 8 of the 51 plots were valued. As a result a general decision cannot be made about the relationship of the two sets of values in high income residential areas.

However, if the 8 plots were assumed to be a typical unbiased representation of the whole then it would be in order to conclude that assessed values for vacant land in high income residential areas in Nairobi do not vary significantly from the sale values of the same. This would seem to indicate that the Comparative approach which was used by most of the valuers (7 out of 8) is a competent method of assessing land value.

Nevertheless, in view of the observations already made regarding the weaknesses of this approach, there is need to improve it. Regression analysis has been proposed for this purpose. This approach is superior to the Comparative approach because it conducts a more rigorous analysis of comparability than the subjective rule of the thumb comparisons done by valuers in Nairobi when they are using the Comparative approach.

Regression Analysis as a Tool for Assessing Land Value in High Income Residential Areas

On the outset of this research it was proposed that twenty variables were important determinants of residential land value in Nairobi. These were;

1. Tenure
2. Plot ratio
3. Ground coverage
4. Distance to the CBD
5. Distance to the nearest recreational facility
6. Distance to the nearest unconforming use
7. Distance to the nearest shopping centre
8. Distance to the nearest police post
9. Existence of flood area in the plot
10. Area of plot
11. Slope
12. Nature of the subsoils
13. Shape of site
14. Frontage
15. Available water facilities
16. Available sanitary facilities
17. Telephone facilities
18. Plattage
19. Political factors
20. Time.

Tenure

Land tenure in high income residential areas in Nairobi is either freehold or leasehold. The leases are normally given for periods of 99 years. The number of years remaining on a lease depends on the date at which the lease was brought into effect.

For purposes of analysis, 6 categories of tenure were used,

1) Freehold
2) Leasehold over eighty years remaining
3) Leasehold 60-80 years remaining
4) Leasehold 40-59 years remaining
5) Leasehold 20-39 years remaining
6) Leasehold less than 20 years remaining.

Freehold plots being the most valuable were given a score of 6 and leasehold plots with less than 20 years remaining a score of one. The summary of the tenure characteristics in the sample is contained in Table 3.4.

Table 3.4

Tenure characteristics of plots

Tenure	Score	No. of plots	%
Freehold	6	14	27.5
Leasehold over 80 years remaining	5	32	62.7
Leasehold 60-80 years remaining	4	2	3.9
Leasehold 40-59 years remaining	3	0	0
Leasehold 20-39 years remaining	2	0	0
Leasehold less than 20 years remaining	1	3	5.9
TOTAL		51	100

Source : Compiled by author based on field data, 1992

Plot ratio

Plot ratios vary from zone to zone. The plots in the sample were from the high income residential zones having plot ratios of either 0.75, 0.25 or 0.20. Sewered neighbourhoods are allotted a plot ratio of 0.75, unsewered plots with septic tanks, 0.25 and unsewered plots with conservancy tanks 0.20. 58.8 percent of the plots had a plot ratio of 0.25 (see Table 3.5). 21 plots (41.2 percent) had a plot ratio of 0.75. None of the plots had conservancy tanks which would have given them plot ratios of 0.20.

Table 3.5

Plot Ratio Distribution in the Sample

Plot ratio	Number of plots	Percentage
0.20	0	0.0
0.25	30	58.8
0.75	21	41.2
TOTAL	51	100.0

Source: Compiled by author based on field data, 1992

Ground Coverage

Ground coverages also vary from zone to zone. In the residential zone investigated they vary depending on the type of sanitary facility available. Thus for sewered plots the ground coverage is 0.35. For unsewered plots it is either 0.25 or 0.20 (0.25 for plots with septic tanks and 0.20 for plots with conservancy tanks). See Table 3.6 for a summary of the ground coverage characteristics of the plots in the sample.

Table 3.6

Ground Coverage Characteristics of Plots

Ground Coverage	No. of Plots	Percentage
0.20	0	0.0
0.25	30	58.8
0.35	21	41.2
TOTAL	51	100.0

Source : Compiled by author based on field data, 1992

Distance to the CBD

The distance in kilometres along public transport routes from the Hilton bus stop to each individual plot was measured from maps provided both by the City Commission and the Ministry of Lands and Housing. Where there were no public transport routes the shortest most convenient route by motor vehicle was used.

This measure was taken rather than straight distance because movement in the city is channelled and as a result one must measure the actual distance that is to be overcome in the interaction of urban activities (Knos, 1968, 269).

Distance to the nearest recreational facility

Recreational facilities include clubs, tennis courts, golf courses, open areas, parks and arboretums. The distance from each plot to all was considered and the shortest distance to the nearest facility recorded. The argument behind this was that the inhabitants in any plot would recreate at the facility nearest to them.

Distance to the nearest unconforming use

Unconforming uses include city boundaries, national parks, slum areas and river valleys and various forms of vacant land. The straight line distance from each plot to the nearest of these was recorded.

Flood area

Some of the plots bordering on river valleys had substantial areas susceptible to flooding during rainy periods. If a plot had an approximate size of over 20 percent of its area susceptible to flooding this plot was considered to be a plot with a flood area.

This question regarding the presence of a flood area on the plot was answered by either a yes or a no. A dummy variable 1, was assigned to a yes response and 0, to a no response. Only 5 out of the 51 plots had a flood area as shown in Table 3.7.

Table 3.7

Percentage plots with flood area

	Number	Percentage
Plots with flood areas	5	9.8
Plots without flood areas	46	90.2
TOTAL	51	100.0

Source : Compiled by author based on field data, 1992

Area of site

The area of plots in square metres (m^2) was recorded based on information cont in valuation rolls in the City Commission. These were verified with the figures fro valuers.

Slope

Three levels of steepness were used in analysis. A score was give to each assu that flat plots were the most desirable. As shown in Table 3.8, steep plots were assum be the least desirable thus having the lowest score of 1.

Table 3.8

Topography Characteristics of Plots

Topography	Score	No. of Plots	Percentage
Flat	3	10	19.6
Gentle	2	26	51.0
Steep	1	15	29.4
TOTAL		51	100.0

Source : Compiled by author based on field data, 1992

Subsoils

Five types of subsoils were identified. These were rocky soils, red soils, mixed soils, black cotton soils and water logged soils. Plots which had rocky subsoils were assumed to be the most valuable. These were given the highest score of 5 (see Table 3.9).

Table 3.9

Subsoil distribution of plots in the sample

Subsoil	Score	No. of plots	Percentage
Rocky soil	5	1	2.0
Red soil	4	30	58.8
Mixed soil	3	1	2.0
Black cotton soil	2	15	29.4
Water logged soil	1	4	7.8
TOTAL		51	100.0

Source : Compiled by author based on field data, 1992

Frontage

Residential areas are fronted by either tarmac or murram roads or tracks. In places where land has not been developed, no appropriate type of access may be found. Tarmac fronted plots were considered to be the most valuable being given a rating of 4. Of the 51 plots in the sample, 46 had tarmac fronts, 4 murram and 1 track.

Shape of site

Plots can take any shape. However for ease of analysis four general shapes were considered - rectangular, circular, triangular and irregular. Rectangular plots being the most desirable had the highest score as shown in Table 3.10.

Table 3.10

Shape of Site

Shape	Score	No. of plots	Percentage
Rectangular	4	42	82.4
Circular	3	0	0
Triangular	2	5	9.8
Irregular	1	4	7.8
TOTAL		51	100.0

Source : Compiled by author based on field data, 1992

Water Facilities

The findings concerning the type of water facility available for use to each of the residential plots are contained in Table 3.11. Most of the residential plots (96 percent) had access to piped water. Two percent had access to boreholes. Under "others" it was thought that residents on some plots would draw water from rivers, wells, springs or make use of rain harvesting facilities. None however did this. For one plot no type of water facility was available.

Table 3.11

Available water facilities

Type	Score	No. of Plots	Percentage
Piped	4	49	96.0
Borehole	3	1	2.0
Others	2	0	0.0
None	1	1	2.0
TOTAL		51	100.0

Source: Compiled by author based on field data, 1992

Sanitary facilities

Three types of sanitary facilities were identified - sewers, septic tanks and conservancy tanks. However, it was assumed that sewered plots were the most valuable since they allowed higher plot ratios and ground coverages and hence more development. The study thus determined only whether plots were sewered or not. A dummy variable 1 was given for a 'yes' answer and 0 for a 'no' answer. Twenty - three (23) plots were sewered and twenty-eight (28) plots were unsewered.

Telephone facilities

The study identified the number of plots to which telephone facilities were available. Even when telephone facilities had not been installed at a plot but could be accessed with limited inconvenience, the plot was considered as having telephone facilities. Of the fifty-one plots, only one (1) did not have telephone facilities at the time of assessment.

Distance to the nearest police post

Although actual distances to the police post were measure, these were not entered. Instead four intervals were created. The plots consequently fell into 4 categories - those less than 1 kilometre away from the police post, those between 1 and 2 kilometres from the police post, those between 2 and 3 kilometres from the police post, and those over 3 kilometres from the police post. The nearer the plot to the police post the more valuable it was likely to be. The smallest interval (less than 1 kilometre) was therefore given the highest score (4) and the largest interval the lowest as illustrated in Table 3.12

Table 3.12

Distance to the Nearest Police Post

Interval	Score	No. of plots	%
Less than 1 kilometre	4	1	2.0
1.0 - 2.0 kilometres	3	13	25.5
2.1 - 3.0 kilometres	2	12	23.5
Over 3.0 kilometres	1	25	49.0
TOTAL		51	100.0

Source : Compiled by author based on field data, 1992

Plattage

This variable was created by dividing the area of each plot by its minimum plot size. Minimum plot size varies from zone to zone depending on regulations set by the City Commission (See appendix VI).

The index created by the subdivision is an indication of the number of smaller plots into which a plot can be subdivided.

Political factors

All national newspapers were read for the years 1980-1992. The most important political events occurring each year were identified and recorded (see appendix IV). A dummy variable one (1) was given to each year in which a significant political event occurred and zero (0) to the year in which no significant political event could be identified.

Time

The plots investigated comprised plots assessed and sold over a 12 year period. Since property is assumed to appreciate over time, plots sold today are likely to be more valuable than plots sold 12 years ago. The year 1980 took on the value of 0 and 1992 the value of 12.

Distance to the nearest shopping centre

The actual distance from the nearest shopping centre to each individual plot in kilometres along motor vehicle routes was measured.

The Regression

The first step before embarking on regression analysis was to discount all land values to one base year - 1992. These land values were assumed to be equivalent to the sale value or market value of land.

The discounting process was accomplished using the compound interest formula;

$$V = P(1+i)^n$$

Where:

V represents the present value

P represents the principle sum

i the interest rate and

^{n} time in years.

The rate of interest used was 15 percent. This was estimated by computing the average value of the rates of inflation for the years 1980-1992. The rate of inflation was used because it reflects the annual rate of change in consumer price indexes. It can therefore give an accurate estimation of increases in land prices. These rates were obtained from the Central Bank of Kenya (appendix V).

The second step was to convert all distances to reciprocals of distance. This was necessary because of the non-linear relationship between land value and distance to the CBD, distance to the nearest recreational facility, distance to the nearest unconforming use and distance to the nearest shopping centre (Downing 1970, 113; Knos, 1968 and Brigham, 1965, 325-334).

The values of different plots change at different rates with each unit change of distance from different focal points. As a result a regression model that incorporates this non-linear (curvilinear) function is necessary. This model is a type of reciprocal function and is expressed algebraically as

$$Y = a + bX^1$$

Where:

Y is taken as land value

X^1 is taken as reciprocal of the distance from the focal point, 1/X

a and b are constants.

After these two steps initial analysis was done to determine whether all the variables contained in the equation significantly contributed to the value of land. A step by step simple regression was done for each variable independently. With each step of regression the co-efficient of determination (r^2), the adjusted r^2 and the correlation co-efficient, r, were indicated. The results for the simple step by step regression are contained in Table 3.13.

Table 3.13

Factors Influencing Residential Land Value in High Income Residential Areas in Nairobi.

Independent Variable	r	r^2	Adjusted r^2
Tenure	.38959	.15178	.13447
Plot ratio	.43780	.19167	.17517
Ground coverage	.43780	.19167	.17517
Distance to the CBD	.64088	.41073	.39870
Distance to the nearest recreational facility	.08492	.00721	-.01305
Distance to the nearest unconforming use	.02070	.00043	-.01997
Distance to the nearest shopping centre	.49382	.24386	.22843
Distance to the nearest police post	.19770	.03909	.01948
Flood area on plot	.04657	.00217	-.01819
Area of plot	.23219	.05391	.03461
Slope	.14295	.02043	.00044
Nature of subsoils	.00430	.00002	-.02039
Shape of site	.05785	.00335	-.01699
Frontage	.23096	.05334	.03402
Available water facilities	.11683	.01365	-.00648

table continued on next page ....

Table 3.13 (continued from previous page)

Independent Variable	r	r^2	Adjusted r^2
Available sanitary facilities	.43370	.18809	.17152
Telephone facilities	.11908	.01418	-.00594
Plattage	.18377	.03377	.01405
Political factors	.16443	.02704	.00718
Time	12052	.01435	-.00559

Source: Computer printout, 1992

Of all the independent variables in the model, the distance to the CBD is the variable most associated with land value. It has the strongest association of 0.64088. The r^2 of 0.41073 indicates that 41.073 percent of the variations in land value are explained by the distance of the land being assessed from the CBD.

The next most important variable is the distance from the nearest shopping centre which explains 24.386 percent of the variations in land value. The strength of association between land value on this variable is 49.382 percent.

Plot ratio and ground coverage each explain 19.167 percent of the changes in land value. These are closely related to the type of sanitary system on the plot which explains 18.809 percent of these changes. The variables showing the least association to the land value are the nature of the subsoils and the distance to the nearest unconforming use.

It is important to remember, however, that in determining the correlation co-efficient (r), the co-efficient of determination (r^2) and the adjusted r^2, land value was regressed individually against each of the independent variables. Conclusions drawn from these statistics can therefore only be used as rough guides. This is because a 'wholesome' regression of land value against all the independent variables may yield different results. This ideally is what should be done since land value is influenced by each of the variables collectively and not individually.

On this understanding, a multiple regression analysis was therefore carried out with land value being the dependent variable. Table 3.14 summarises the results of this regression.

Table 3.14

Multiple Regression Results

Independent Variable	b co-efficient
Constant	-1285.210386
Tenure	98.740412
Plot ratio	137.476136
Distance to the CBD (reciprocal distance in Kms)	6395.676005
Distance to the nearest recreational facility (reciprocal distance in Kms)	565.981979
Distance to the nearest unconforming use (reciprocal distance in Kms)	-3.852015
Distance to the nearest shopping centre (reciprocal distance in Kms)	-337.175925
Distance to the nearest police post (Kms)	-116.743797
Flood area on plot	42.444693
Area of plot (m^2)	0.008622
Slope	-0.344156
Nature of Subsoils	74.136755
Shape of site	-32.851506
Frontage	205.851985
Available water facilities	-209.003196

table continued on next page ....

Table 3.14 (continued from previous page)

Independent Variable	b co-efficient
Available sanitary facilities	171.571886
Telephone facilities	178.933849
Plattage	-24.615596
Political factors	58.873533
Time	25.493143

Multiple R	0.78936
R^2	0.62310
Adjusted R^2	0.39209
Standard Error	211.38023

Source: Computer printout, 1992.

Tenure

Tenure had a positive partial correlation co-efficient of 98.740412. This means that there is a positive relationship between land value and the tenure of the land being assessed. The higher/larger the number of years remaining in the lease the higher the land value. Freehold plots are therefore the most valuable of all vacant lands in high income residential areas. A partial correlation co-efficient of 98.740412 means that for every unit change in land tenure, land value per square metre increases by KShs 98.740412. It is important to remember that for our purposes land tenure was in terms of six different categories. A unit change in land tenure is therefore not an increase in the number of years remaining on a lease but rather a change from one group of years to another.

Ground Coverage and Plot ratio

An analysis of the correlation matrix for all the variables in the model (see appendix III) showed that ground coverage and plot ratio had a perfect correlation of 1. As a result during the multiple regression process, one variable ground coverage was automatically deleted. Plot ratio had a partial correlation co-efficient of 137.476136. This suggests a positive relationship between land value per square metre and the plot ratio. The positive nature of the relationship indicates an increase in land value with an increase in plot ratio. Therefore for every unit increase in plot ratio, the land value increases by KShs 137.476136, assuming that all other variables in the model remain constant.

Distance to the CBD(kms)

As already proven by the results of the independent regression in Table 3.13, the distance to the CBD, is the most important determinant of residential land value. A positive partial correlation co-efficient of 6395.676005 would indicate that land value increases with increasing distance from the CBD. However, it is important to remember that the reciprocal of distance to the CBD in kilometres was used in the analysis. This therefore means that there is a negative relationship between land value and ***actual*** distance from the CBD. For every kilometre increase land value decreases by KShs 6395.676005.

Distance to the nearest recreational facility (kms)

This variable had a positive partial correlation co-efficient of 565.981979. This means that there exists a negative relationship between land value and the ***actual*** distance from a plot to the nearest recreational facility. Therefore all other variables being constant, the value of land decreases by KShs 565.981979 with every kilometre from the nearest recreational facility. (Land is more valuable nearer the facility).

Distance to the nearest unconforming use (Kms)

A negative relationship between land value and the reciprocal of distance to the nearest unconforming use, can be interpreted as a positive relationship between land value and the *actual* distance to the nearest unconforming use. Therefore the further away one moves from an unconforming use the higher the land value. This land value increased by KShs 3.852015 with every kilometre travelled.

Distance to the nearest shopping centre (Kms)

The regression model indicated that there is a negative relationship between land value and distance from the nearest shopping centre (reciprocal). This would suggest that land value decreases as one moves further away from a given shopping centre. However because the reciprocal of distance was used in analysis, the model actually predicts a positive relationship between land value and the distance from the nearest shopping centre.

Land value increases by KShs 337.175925 with every one kilometre from the nearest shopping centre. This contradicts the assumption made regarding this variable. It had been assumed that because shopping centres in residential neighbourhoods were making shopping for essential goods convenient, most people would tend to locate near them, thus increasing demand and hence value.

Distance to the nearest police post

A negative relationship was found to exist between land value and the distance from a plot to the police post nearest to it. Land value was therefore more valuable nearer to the police post. A partial correlation of co-efficient of -116.743797 indicates that all other variables being constant, land value decreases by KShs 116.743797 with every unit distance from the police post. Since intervals were used for this variable a unit change in distance means a shift from one interval to another.

Existence of flood area on a plot

This variable has a positive partial correlation co-efficient of 42.444693. This would seem to indicate that a plot that has a flood area is more valuable than one that does not have one. One square metre of a plot which has a flood area is more valuable than one square metre of a plot with a flood area by KShs 42.44469. This finding does not conform to any logic since it is not possible that the more flooding of an area a plot has, the more valuable it is.

Area of site (m^2)

The dependant variable used in analysis was sale value per square metre. By incorporating the variable, area of site into the model, the research attempted to find out whether one square metre of larger plots is more valuable than one square metre of smaller plots. There was indicated a positive relationship between land value and this variable meaning that one unit area of larger plots is comparatively more valuable than one unit of area of smaller plots. This relation is however very weak as indicated by the partial correlation co-efficient of 0.008622.

Slope

There exists a negative relationship between slope and land value. This suggests that as the slope increases land value decreases. All other variables being constant land value decreases by KShs 0.344156 for every unit increase in slope.

Nature of the subsoils

A positive relationship was found to exist between land value and the nature of the subsoils. A positive partial correlation co-efficient of 74.136755 indicates that all other variables being constant, land value increases by KShs 74.136755 for every unit change in the nature of the subsoils. Sites that have a rocky type of subsoil are therefore more valuable than water logged soils.

Shape of site

It was expected that land value would be positively related to the shape of the site. Sites most convenient to develop such as rectangular plots were assumed to be most valuable. However, a negative partial correlation co-efficient, -32.851506, suggests the opposite. It indicates that with every unit positive change in the shape of the site land value decreases by KShs 32.851501. Irregular plots which are the most convenient to develop would therefore be more valuable than rectangular plots.

Frontage

A positive relationship exists between land value and the frontage of a plot. This is evident from the positive partial correlation co-efficient of 205.851985 attributed to this variable. Land value increases by KShs 205.851985 with every unit increase in frontage. A unit increase in frontage means a changes from one type of frontage to another.

Available water facilities

This variable has a negative partial correlation co-efficient, -209.003196. This is an indication that the value of land per square metre decreases as the type of water facility available improves. This contradicts the assumption made by the study.

Available sanitary facilities

There exists a positive relationship between the type of sanitary facility available on a site and its subsequent land value. A positive partial correlation co-efficient of 171.571886 indicates that land value increases by KShs 171.571886 with every until change in the type of sanitary facility available.

In collecting data regarding this variable plots were divided into two categories - sewered plots and unsewered plots. The research attempted to investigate the nature of difference in relation to land value of the two types of plots. The positive partial correlation co-efficient indicates that all other variables being constant, sewered plots are more valuable than non-sewered plots. The difference in value is KShs 171.57886 per square metre.

Telephone facilities

Plots with telephone facilities are more valuable than plots without these facilities. All other variables being constant the difference in value is KShs 178.933849 per square metre (m^2) as is indicated by the positive partial correlation co-efficient of 178.933849.

Plattage

This variable had a negative partial correlation co-efficient of 24.615596. This means that all other variables being constant, land value decreases by KShs 24.615596 as the plattage increases. This is quite realistic since plots with large plattages (and can be subdivided into small units) are normally those further away from the CBD.

Political factors

A positive relationship exists between political factors and land value. This means that the occurrence of a significant political event during the year when a plot was valued increases the values of that plot by KShs 58.873533 (all other variables being constant).

Time

A positive partial correlation co-efficient attributed to this variable suggests that land value increases over time. More specifically it suggests that all other variables being constant, land value increases by KShs 25.493143 over each time period (year).

The regression of land value against these 19 variables yields a multiple correlation co-efficient (R) of 0.78936. This indicates that the relationship between land value and independent variables in the model is 78.94 percent. However, the equation explains only 62.319 percent of the changes in land value. This means that a certain number of variables explaining 37.681 percent has been omitted. The adjusted co-efficient of multiple determination (adjusted R^2) was 0.39209. This means that taking into account the sample size, the 19 variables in the model explain 39.209 percent of the changes in land value.

Test of significance

The purpose of carrying out this research was not just to investigate the nature of relationship between land value and the various independent variables but also to determine whether the equation developed is significant to determining land value. If it is, it can be used to predict land value and can therefore be used as an assessment tool. The F-statistic was used for this purpose.

Statement of hypothesis

H_o : The equation is not significant in determining land value.

H_A : The equation is significant in determining land value.

Model assumptions

i) The data collected was selected randomly

ii) The population represented by this data is normally distributed

Significance

$$\alpha = 0.05$$

Test statistic is the observed ratio

Analysis of variance

	DF	Sum of squares	Mean square
Regression	19	2289893.42635	120520.70665
Residual	31	1385129.69753	44681.60315

F = 2.69732

Decision rule

If $F_o > F_e$ H_o is reflected

If $F_o < F_e$ H_o is accepted

Decision

$F_o = 2.69732$

$F_e = 1.93$

$F_o > F_e$ H_o is rejected.

Conclusion

The equation is significant in determining land value.

In spite of this conclusion it is important to remember that based on none statistical considerations already discussed and statistical considerations not all the variables in the equation are significant determinants of urban residential land value. It is therefore important to determine the most significant variables and from these develop a predictor model. Stepwise multiple regression was used for this process.

Stepwise multiple regression

Stepwise multiple regression is an automatic process which enables statisticians to know how powerful an explanation the regression for each variable is against the dependent variable (Ndwigah, 1988, 152). In so doing it enables conclusions to be made on how well the independent variables being investigated account for variations in the dependent variable(s) and how much additional variation each variable or all combined contribute in the whole model.

In the first step of stepwise multiple regression the computer investigates each variable with an aim to determining whether any information is missing. This process is referred to as listwise deletion of missing data. At this stage the computer produces the mean and standard deviation for all the variables in the model.

In the second stage a correlation analysis is done for all the variables to establish how the variables correlate within themselves. The results are produced on a correlation matrix. This is important because it helps determine which variables are highly correlated, therefore enabling one of them to be deleted from the model. A high correlation between independent variable could be interpreted as a 'double accounting' of the effects of one phenomena. To avoid this, the only solution is to delete from the model one of the highly correlated variables.

In the final stage of stepwise multiple regression the most significant variables in the equation are picked individually. For each variable an independent regression is done to determine its relationship and in so doing it enables conclusions to be made on how well association to the dependent variable. The process continues until all significant variables have been picked. From this process the most important variables to determining land value were listed as distance to the CBD, flood area on plot, plattage, distance to the nearest shopping centre and the tenure. These were incorporated into the predictor model contained in Table 3.15.

Table 3.15

The Predictor Model

INDEPENDENT VARIABLE	B CO-EFFICIENT	BETA*
Distance to the CBD (reciprocal) (X_1)	3620.58	.712660
Flood area on plot (X_2)	-221.68	-.24556
Plattage (X_3)	- 5.69	-.221817
Distance to the nearest shopping centre (reciprocal) (X_4)	19.61	.029113
Tenure (X_5)	4.29	.01794

Multiple R	.71855
R^2	.51632
Adjusted R^2	.46258
Standard error	198.74848
Constant	-67.048890

* Beta is the normalized regression co-efficient which is also the mean regression "scope" co-efficient.

Source : Computer printout, 1992.

The five independent variables in the model account for 51.632 percent of the changes in residential land values. The degree of association between them and the dependent variable is 71.855 percent.

The regression equation can be read as:-

$$\text{Land value} / m^2 = -67.048890 + 3620.58X_1 - 221.68X_2 - 5.69X_3 + 19.61X_4 + 4.29X_5$$

Distance to the CBD

The positive relationship existing between land value per square metre and the reciprocal of distance to the CBD indicates that the value of land increases as the reciprocal of distance to the CBD increases. Therefore land value decreases as the ***actual*** distance from a plot to the CBD increases. These results correspond with those of the multiple regression discussed on page 104. When all the other variables are held constant and the distance to the CBD allowed to vary, land value decreases by KShs 3620.58 for every kilometre from the CBD.

The distance to the CBD was the first independent variable to be picked in the stepwise process indicating that it is the most important determinant of land value. This corresponds with earlier results contained in Table 3.14.

Flood area on plot

A negative relationship exists between the value of land and the existence of a flood area on a plot. A plot that has a flooding portion on it is less valuable than one without. This is indicated by the negative partial correlation co-efficient of -221.68. Thus plots with flood areas are less valuable per square metre than plots without flood areas by KShs 221.68 when all other variables are constant. Since this variable was picked second, the indication is that it is the second most important influence of land value in high income residential areas.

Plattage

Plattage has a negative partial correlation co-efficient of 5.69. This means that when all other variables are constant land value decreases as plattage increases.

Distance to the nearest shopping centre

A positive relationship exists between the reciprocal distance to the nearest shopping centre and land value. A negative relationship would therefore exist between land value per square metre and the *actual* distance. The partial correlation co-efficient of 19.61 means that all the other variables being constant land value per square metre decreases by 19.61 for every kilometre away from the shopping centre. Although this contradicts the findings of the multiple regression as discussed earlier it would be the more acceptable finding.

Tenure

A positive partial correlation co-efficient of 4.29 indicates that when all other is constant land value increases as the number of years remaining on a lease increases (see Table 3.4).

The question now asked is, "Is this equation significant in predicting land value?". The F ratio will be used in attempting to answer it.

Statement of hypothesis

H_o : This equation is not significant in predicting land value

H_A : This equation is significant in predicting land value.

Model assumptions

i) The data collected was selected randomly

ii) The population represented by this data is normally distributed.

Significance

$$\alpha = 0.05$$

The test statistic is the observed F-ratio

Analysis of variance

	DF	Sum of squares	Mean square
Regression	5	1397479.93	379495.98
Residual	45	1777543.19	39500.95

$F = 9.60726$

Decision rule

If $F_o > F_e$ H_o is rejected

If $F_o < F_e$ H_o is accepted

Decision

$F_o = 9.60726$

$F_e = 3.82$

$F_o > F_e$ H_o is rejected

Conclusion

This equation is significant in predicting land value.

From the foregoing statistical test it has been concluded that regression analysis can be used as a method for assessing the value of land.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

Preview

At the onset of this study the various methods used in assessing land values in high income residential neighbourhoods were discussed. The end result of this discussion was the view that the methods being used are inadequate and do not competently meet their objectives.

In chapter two the conceptual framework behind land value assessment was laid out. Neo-classical approaches, marxist approaches and contemporary land development models were discussed.

Chapter three of the work comprised the data analysis section which set out to investigate the two objectives of the study namely:

1. To investigate the adequacy of existing approaches to estimating land value.
2. To offer an improved more efficient methodology for calculating land value.

This chapter now discusses the main findings of this work. It also gives recommendations and discusses possible areas of further research.

Conclusions

To meet the first objective of this research, assessed values of various plots of land and sale values of the same land were compared using the t-statistic. This was necessary because of the argument put forth by the study that there existed significant differences between assessed values and consequent market (sale) values. These differences existed because of the weaknesses inherent in conventional approaches being used by valuers to determine the value of land.

Upon carrying out the t-test it was noted that, at a 95 percent confidence level, the t observed (t_o) was less than the t-expected (t_e). This led to the conclusion that there was no significant difference between the assessed values of land in high income residential neighbourhoods as assessed by valuers and the market values of the same land. This would seem to indicate therefore that the conventional methods (the Comparative Market-Data approach and the Residual method) are competent methods of assessing value.

Howbeit, based on the understanding of the nature and number of weaknesses inherent in the most commonly used conventional approaches, it was concluded that there was need to improve on them. Regression analysis was proposed for this purpose. This approach is superior to the Comparative approach used by most valuers in Nairobi in that it conducts a more rigorous analysis of comparability, it creates uniformity in the valuation profession and it ensures speed and efficiency. On this understanding land value was regressed against 20 variables thought to be significantly related to it. These were:-

1. Tenure
2. Plot ratio
3. Ground coverage

4. Distance to the CBD
5. Distance to the nearest recreational facility
6. Distance to the nearest unconforming use
7. Distance to the nearest shopping centre
8. Distance to the nearest police post
9. Flood area on plot
10. Area of plot
11. Slope
12. Nature of the subsoils
13. Shape of site
14. Frontage
15. Available water facilities
16. Available sanitary facilities
17. Telephone facilities
18. Plattage
19. Political factors
20. Time

Initial analysis indicated a perfect correlation between two of the independent variables (plot ratio and ground coverage). One variable, ground coverage was therefore dropped from the model.

The 19 independent variables remaining explained 62.319 of the changes in land value. A stepwise multiple regression analysis was then carried out with an aim to isolating the variables most important to the prediction of land value. Five variables were isolated, namely:

1. Distance to the CBD
2. Flood area on plot
3. Plattage
4. Distance to the nearest shopping centre
5. Tenure.

The regression of land value against these five variables yielded the following equation.

$$Y = -67.05 + 3620.58\, X_1 - 221.68X_2 - 5.69X_3 + 19.61X_4 + 4.29X_5.$$

Where:

Y represents land value per square metre

X_1 is the reciprocal of distance to the CBD in kilometres.

X_2 flood area on plot

X_3 plattage

X_4 the reciprocal of distance to the nearest shopping centre in kilometres and

X_5 is tenure.

This research was not only concerned with determining the variables which influenced the value of land in high income residential neighbourhoods. It also proposed that regression analysis be used as a method of predicting that value. The F-statistic was used to determine if this was possible. The end result of this statistical test was the null hypothesis being rejected therefore proving that the equation and consequently regression analysis is significant in predicting land value.

The question now asked is whether the model proposed can be used for predicting land value in Nairobi. Technically the answer is yes. This is because the value for each of the independent variables can be easily computed. The distance from the plot can be measured in kilometres on maps and verified on the ground. The distance to the nearest shopping centre can also be measured in this manner. Plattage can be calculated by dividing the area of the a plot by the minimum plot size allowed for it. The tenure can be verified from the local authority and observation can help determine whether there is a flood area on a plot or not. The dummy variable technique is used in recording this observation. On a more practical level however, this research has not ascertained whether valuers in Kenya would be able to adopt this regression model. Although fairly competent analysis has been done and precautions taken to reduce the risk of error a conclusion cannot be made towards this end. It would be necessary to use the model over a period of years (time) in order to determine its competence and ease of application. Because of the short period allocated to the undertaking of this research (one year) this could not be done.

Regression analysis being highly mathematical and done manually is both tedious and time consuming. As a result it must be undertaken on computer. The question arising is whether valuation firms in Kenya have in their possession or at their disposal computer facilities with the necessary statistical packages.

A field survey carried out to answer this question indicated that only the large valuation firms had these facilities. To smaller firms who do not have computer facilities to introduce regression analysis would mean a large commitment of capital for the purchase of equipment, training of personnel, maintenance and purchase of the assessment package.

Regression analysis had one other complication. Like the comparative approach the model is developed from comparative sales data. (Although, unlike the Comparative approach, regression analysis does not require the comparison of similar plots). As a result there is need to develop a method of appraising proposed regression models so as to make them progressively current each year.

Recommendations

The final part of this research has revolved around developing a regression model that can be used as a land value assessment tool. Having established that such a model can be developed and competently used, (due regard being given to discussed limitations) the following is recommended.

1. Valuation firms already having computers in their possession should adopt regression analysis as a method of assessing land value. In order to ensure efficiency, training courses and workshops on the use of regression analysis in valuation and other related subjects should be organized.

   The use of personal computers (PCs) instead of mainframe computers should be encouraged in this venture in an attempt to avoid piracy and the spread of computer viruses.

2. Valuers should explore the possibilities of developing other models for valuing land in different zones.

3. In view of the fact that a lot of data will be needed for development of regression models and in their use as assessment tools, it is recommended that

a centralized data bank be created. This may take the form of a documentation centre containing among other things cost of living indices, construction costs, sales data and property characteristics. The availability of such information should be made known to financiers, estate managers and investors.

4. Local authorities should adopt computerized rating assessment based on multiple regression analysis techniques. They should prepare different multiple regression equations for different urban zones.

This information should also be made easily accessible to students, lecturers and other scholars, government officials, librarians and other information technologists.

Areas of Further Research

This research has attempted to show how regression analysis can be used to assess land value. It has also indicated that the uses of computer facilities is paramount to the success of the method. The economic implications of introducing computers to valuation firms must therefore be investigated. The benefits accruing to valuation firms adopting this method and introducing computers can be discussed and a cost benefit analysis undertaken.

Regression analysis models can be developed for high income residential areas in other towns and comparisons made. Such a comparison would be important to land economists giving information on land value structure, land value determinants and land market characteristics. Different regression models can also be developed for different zones since different factors influence value in different areas.

The model proposed in this project does not incorporate all the determinants of land value in high income residential neighbourhoods in Nairobi. An examination of the remaining percentage that has not been explained by the variables considered would therefore be profitable.

BIBLIOGRAPHY

Abbot, D.M., Encyclopedia of Real Estate Terms. England: Gower Technical Press, 1987.

American Institute of Real Estate Appraisers., The Appraisal of Real Estate. Chicago: Prepared by the Sixth Edition Textbook Committee, 1973.

Asabere, P.K., 'The Determinants of Land Values in an African City: The case of Accra, Ghana'. Land Economics 57: 385 -397, 1981a.

Asabere, P.K., 'The price of Urban Land in a Chiefdom: Empirical Evidence on a Traditional African City, Kumasi'. Journal of Regional Science 21: 529 - 539, 1981b.

Back, K., 'Land Value Taxation in Light of Current Assessment Theory and Practice' in Holland, D.M. (ed.), The Assessment of Land Value. London: The University of Wisconsin Press, 1970.

Ball, M., Bentivegna, M.E., and Folin, M., 'Modern Capitalisation and the Theory of Urban Rent: A Review' in Ball, M., Bentivegna, V., Edwards, M. and Folin, M. (eds.), Land Rent, Housing and Urban Planning. London: Croom Helm Limited, 1985.

Balchin, P.N. and Kieve, J.L., Urban Land Economics. Basingstoke: Macmillan Publishers Limited, 1985.

Baum, A. and Crosby, N., Property Investment Appraisal. London: Routledge, 1988.

Berry, B.J.L. and Horten F.E., Geographic Perspective on Urban Systems. New Jersey: Prentice Hall, Inc., 1970.

Berry, B.J.L. and Marble, D.F. (eds.), Spatial Analysis: A Reader in Statistical Geography. New Jersey: Prentice Hall Inc., 1965.

Blalock, H.M., Social Statistics. New York: McGraw Hill Book Company Inc., 1966.

Bobo, B.F., 'Population Density, Housing Demand and Land Values: The Case of Accra, Ghana'. Journal of African Studies 4: 140 - 141, 1977.

Bowcock, P., 'High Speed NPV'. Estates Gazette 242: 443-445, 1977.

Brigham, E.F., 'The Determinants of Residential Land Values'. Land Economics 41: 325 - 334, 1965.

Brutton, W., Davies, K. and Johnson, T., Modern Methods of Valuation. London: The Estates Gazette Limited, 1980.

Butter, B., 'Discounted Cash Flow and the Valuer'. The Valuer XXVI: 222 - 225, 1989.

Bryant, R.W.G., Land: Private Property Public Control. Montreal: Harvest House Limited, 1972.

Baum, A. and Crosby, N., Property Investment Appraisal. London: Routledge, 1988.

Berry, B.J.L. and Horten F.E., Geographic Perspective on Urban Systems. New Jersey: Prentice Hall, Inc., 1970.

Berry, B.J.L. and Marble, D.F. (eds.), Spatial Analysis: A Reader in Statistical Geography. New Jersey: Prentice Hall Inc., 1965.

Blalock, H.M., Social Statistics. New York: McGraw Hill Book Company Inc., 1966.

Bobo, B.F., 'Population Density, Housing Demand and Land Values: The Case of Accra, Ghana'. Journal of African Studies 4: 140 - 141, 1977.

Bowcock, P., 'High Speed NPV'. Estates Gazette 242: 443-445, 1977.

Brigham, E.F., 'The Determinants of Residential Land Values'. Land Economics 41: 325 - 334, 1965.

Brutton, W., Davies, K. and Johnson, T., Modern Methods of Valuation. London: The Estates Gazette Limited, 1980.

Butter, B., 'Discounted Cash Flow and the Valuer'. The Valuer XXVI: 222 - 225, 1989.

Bryant, R.W.G., Land: Private Property Public Control. Montreal: Harvest House Limited, 1972.

Colwell, P.F. and Sirmans C.F., 'Area, Time, Centrality and the Value of Urban Land'. Land Economics 54: 514 - 519, 1978.

Copes, J.M., 'Reckoning with Imperfections in the Land Market' in Holland, D. M (ed.), The Assessment of Land Value. London: The University of Wisconsin Press, 1970.

Downing, P.B., 'Estimating Residential Land Value by Multivariate Analysis'. Holland D.M. (ed.), The Assessment of Land Value. London: The University of Wisconsin Press, 1970.

Dunkerley, B.B., Urban Land Policy Issues and Opportunities. Oxford: Oxford University Press, 1985.

Estates Gazette, 'DCF and Incremental Analysis'. Estates Gazette 246: 1028 - 1029, 1978.

Eve, H.B., White, P.H. and Wilks, H.M., Principles and Practice of Rating. London: The Estates Gazette Limited, 1960.

Gitonga, A., 'Taxation of Unimproved Land Values. The Kenya Experience'. Paper presented at a conference organized by the International Union for Land Value Taxation and Free Trade: San Francisco, U.S.A., 1979a.

Gitonga, A., 'Principles of Rating'. Build Kenya 4: 44-46, 1979b.

Gitonga, A., 'Rating: Local Property Taxation in Kenya'. Paper presented and read at a seminar organized by the Department of Land Development, Faculty of A.D.D., University of Nairobi, 1979c.

Gitonga, L.M., 'Valuation of Vacant Plots in an Urban Area: A Case Study of Nairobi'. Unpublished B.A. Thesis, University of Nairobi, 1988.

Gronow, S. and Scott, I., 'Expert Systems and Multiple Regression Analysis'. Estates Gazette 246: 1028 - 1029, 1985.

Gupta, C.B., An Introduction to Statistical Methods. New Delhi: Vikas Publishing House PVT Limited, 1973.

Henkel, R.E., 'Tests of Significance'. Sage University Series on Quantitative Applications in the Social Sciences, Series No. 07 - 022. Beverly Hills and London: Sage Publications, 1976.

Herps, A.C.B., 'Land Value - Its Origin, Nature and Effect'. The Valuer XXVI: 106 - 108, 1980.

Hicks, U.K., 'Can Land be Assessed for Purposes of Site Value Taxation ?' in Holland D.M. (ed.), The Assessment of Land Value. London: The University of Wisconsin Press, 1970.

Holland, D.M. (ed.), The Assessment of Land Value. London: The University of Wisconsin Press, 1970.

Hutton, G.H. and Devonald, A.D.G., Value in Buildings. London: Applied Science Publishers Limited, 1973.

Inglis, M.W., 'Discounted Cash flow Analysis and the Valuation of Land'. The Valuer XXIV: 625 -631, 1977.

Ingram, D.R., 'The Concept of Accessibility: A Search for an Operational Form'. Regional Studies 5: 101 - 107, 1971.

King'oriah, G.K., Introduction to Land Economics. Unpublished manuscript, University of Nairobi, 1987.

Kimani, S.M., 'The Structure of Land Ownership in Nairobi'. Canadian Journal of African Studies VI: 379 - 442, 1978.

Knos, D.S., 'The Distribution of Land Values in Topeka, Kansas' in Berry, B.J.L. and Marble, D.F., Spatial Analysis: A Reader in Statistical Geography. New Jersey: Prentice Hall Inc., 1965.

Lapin, L.L., Statistics for Modern Business Decisions. New York: Harcourt Brace Javanovick, Inc., 1981.

Lean, W. and Goodall, B., Aspects of Land Economics. London: The Estates Gazette Limited, 1966.

Lewis-Beck., M.S., 'Applied Regression - An Introduction'. Sage University Paper Series on Quantitative Applications in the Social Sciences, series No. 07-022. Beverly Hills and London: Sage Publications, 1986.

Lynn A.D. (Jr.), 'Legal Problems and Obstacles in Assessing Land for Site Value Taxation' in Holland, D.M. (ed.), The Assessment of Land Value. London: The University of Wisconsin Press, 1970.

Mc Millan, M.L., Reid, B.G. and Gillen, D.W., 'An Extension of the Hedonic Approach for Estimating the Value of Quiet'. Land Economics 56: 315 - 329, 1980.

Miles, C.W.N. and Seabrooke, W., Recreation Land Management. London: E.F.N. Spon Limited, 1977.

Mills, E., 'The Value of Land' in Harvey, S.P. (ed.), The Quality of the Urban Environment. Baltimore: John Hopkins University Press for Resources for the Future, Inc., 1970.

Motha, P., 'Approaches to Land Valuation'. The Valuer XXIV: 444 - 449, 1979.

Mosich, A.N. and Larsen, E.J., Intermediate Accounting. Auckland: McGraw Hill International Book Company, 1982.

Mugo, S.M., Methods of Insurance Valuation. Unpublished B. A. Thesis, University of Nairobi, 1987.

Ngugi, P.G., 'Valuation for Auction'. Unpublished B.A. Thesis, University of Nairobi, 1988.

Ndwigah, C.P., 'Urban Land Policy and Urban Land Values: A Case Study of Land Zoning in Nairobi'. Unpublished M.A. Thesis, University of Nairobi, 1988.

Oakley, D., Tropical Houses: A Guide to their Design. London: B.T. Batsford Limited, 1961.

Okpala, D.C.I., Urban Ecology and Residential Location Theories. Application in Nigeria's Socio-cultural Milieu'. Socio-Economic Planning Sciences 12, 1978.

Ondiege, P., Urban Land and Residential Market Analysis'. Report prepared for Urban Management Program - United Nations Centre for Human Settlements, UNCHS (Habitat), Nairobi, 1989.

Pendeton, W.C., 'Statistical Inference in Appraisal and Assessment Procedures'. Appraisal Journal 33: 73 - 85, 1965.

Peterson, G., 'Land as Money'. Urban Perspectives 2: 6 - 7, 1991.

Quigley, I.H., 'Discounted Cash Flow and its Applications'. The Valuer XXV: 262 - 268, 1978.

Rakodi, C., 'Land Markets in Sub-Saharan African Cities: A Review'. Unpublished paper, University of Wales, Cardiff, 1991.

Reynolds, A., 'Current Valuation Techniques - A Review'. The Valuer XXVIII: 198 - 204, 1984.

Richmond, P.C., Introduction to Valuation. London: Macmillan Publishers Limited, 1985.

Sada, P.O., 'Residential Land Use in Lagos: an Inquiry into the Relevance of Traditional Models'. African Urban Notes 7: 3 - 25, 1972.

Smith, A., 'Wealth of Nations' in Abbott, D.M. (ed.), Encyclopedia of Real Estate Terms. England: Gower Technical Press, 1987.

Syagga, P.M., 'The Impact of Building Design on Maintenance Costs of Residential Housing Estates Owned by Mombasa Municipal Council'. Unpublished Ph.D. Thesis, University of Nairobi, 1988.

Van den Burg, L.M., 'Anticipating Urban Growth in Africa. Land Use and Land Values in the Rurban Fringe of Lusaka'. Occasional Study No. 13. Lusaka: Zambia Geographical Association, 1984.

Waldo, R.D., 'Urban Land Values and Accessibility'. Land Economics 1: 101 - 107, 1974.

Yahya, S.S., 'Residential Land Markets in Kenya' in Amis, P. and Lloyd, P. (eds.), Housing Africa's Urban Poor. Manchester: Manchester University Press, 1990.

Yeates, M., (1965) 'Some Factors Affecting the Spatial Distribution of Chicago Land Values'. Economic Geography XL1: 55 - 70.

_______ Particulars of Plots on Sale - Runda (1992) Lloyd Masika Limited, Nairobi.

_______ Quarterly Economic Review (1980 - 1991). Central Bank of Kenya.

APPENDIX 1

QUESTIONNAIRE ADMINISTERED TO VALUERS IN NAIROBI

"A CRITICAL EXAMINATION OF VALUATION METHODS FOR VACANT LAND IN HIGH INCOME NEIGHBOURHOODS IN NAIROBI, KENYA"

Preliminaries

1. Plot number ____________________
2. Residential area ____________________
3. Year of valuation ____________________
4. Assessed value of plot ____________________
5. Method of valuation
   - (i) Discounted Cash Flow Analysis ( )
   - (ii) Comparative Market-Data approach ( )
   - (iii) Residual approach ( )
   - (iv) Others (Specify) ____________________
6. Year of sale ____________________
7. Sale value of plot ____________________

Factors Influencing Residential Land Value

1. Tenure
   - (i) Freehold ( )
   - (ii) Lease hold over 80 years ( )
   - (iii) Lease hold 60-80 years remaining ( )
   - (iv) Leasehold 40-59 years remaining ( )
   - (v) Lease hold 20-39 years remaining ( )
   - (vi) Lease hold lease than 20 years remaining ( )
2. Plot ratio ____________________

3. Ground coverage ____________________

4. Distance to the CBD ____________________

5. Distance to the nearest recreational facility ____________________

6. Distance to the nearest unconforming ____________________

7. Distance to the nearest shopping centre ____________________

8. Distance to the nearest police post ____________________

9. Flood area on plot
   - (i) Yes ( )
   - (ii) No ( )

10. Area of plot ____________________

11. Slope
    - (i) Flat ( )
    - (ii) Gentle ( )
    - (iii) Steep ( )

12. Nature of the subsoils
    - (i) Rocky soils ( )
    - (ii) Red soil ( )
    - (iii) Black cotton soil ( )
    - (iv) Water logged ( )

13. Shape of site
    - (i) Rectangular ( )
    - (ii) Circular ( )
    - (iii) Triangular ( )
    - (iv) Irregular ( )

14. Frontage

(i) Tarmac ( )

(ii) Murram ( )

(iii) Track ( )

(iv) None ( )

15. Available water facilities

(i) Piped ( )

(ii) Boreholes ( )

(iii) Others ( )

(iv) None ( )

16. Sewer system

(i) Yes ( )

(ii) No ( )

17. Telephone facilities

(i) Yes ( )

(ii) No ( )

18. Plattage

$$= \frac{\text{area of site (} \qquad \text{)}}{\text{min. plot size (} \qquad \text{)}} = \_\_\_\_\_\_\_\_$$

19. Political factors

(i) Yes ( )

(ii) No ( )

20. Time ________________

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APPENDIX II

REGRESSION ANALYSIS DATA

Y	Sale value of plot (KShs /m^2)
X^1	Tenure
X_2	Plot ratio
X_3	Ground coverage
X_4	Distance to the CBD
X_5	Distance to the nearest recreational facility
X_6	Distance to the nearest unconforming use
X_7	Distance to the nearest shopping centre
X_8	Distance to the nearest police post
X_9	Flood area on plot
X_{10}	Area of plot
X_{11}	Slope
X_{12}	Nature of the subsoils
X_{13}	Shape of site
X_{14}	Frontage
X_{15}	Available water facilities
X_{16}	Available sanitary facilities
X_{17}	Telephone facilities
X_{18}	Plattage
X_{19}	Political factors
X_{20}	Time

Y	X_1	X_2	X_3	X_4	X_5	X_6
114.2	6	0.25	0.25	9.95	3.00	0.700
257.1	5	0.25	0.25	8.70	3.70	1.300
110.4	5	0.25	0.25	7.70	4.30	0.300
500.0	5	0.25	0.25	8.50	3.50	1.250
52.7	6	0.25	0.25	8.40	5.00	0.475
259.8	5	0.25	0.25	8.30	4.50	1.000
74.1	5	0.25	0.25	7.00	5.00	0.295
144.0	6	0.25	0.25	15.95	5.40	0.840
73.2	5	0.25	0.25	13.50	2.00	0.350
120.2	6	0.25	0.25	17.85	5.00	0.300
241.4	6	0.25	0.25	15.00	2.00	0.200
797.2	4	0.35	0.35	5.80	1.50	0.240
368.0	5	0.35	0.35	7.00	2.85	0.140
304.4	5	0.35	0.35	7.10	2.95	0.138
193.1	5	0.35	0.35	7.10	2.95	0.055
574.7	5	0.35	0.35	6.20	3.15	0.035
309.9	5	0.35	0.35	6.80	2.65	0.070
444.0	5	0.35	0.35	6.80	2.65	0.125
443.6	5	0.35	0.35	6.75	2.15	0.160
470.0	5	0.35	0.35	6.80	2.65	0.154
137.0	5	0.35	0.35	5.05	2.40	0.010
416.3	4	0.35	0.35	7.35	3.20	0.290
280.6	5	0.35	0.35	6.95	2.67	0.275
244.2	6	0.25	0.25	10.20	9.00	0.437
216.9	5	0.35	0.35	12.00	4.00	0.000
225.8	5	0.35	0.35	16.50	4.50	2.500
1361.8	6	0.35	0.35	4.50	5.40	0.610
551.1	6	0.35	0.35	4.50	7.50	0.370
613.4	6	0.35	0.35	4.50	7.50	0.265
409.9	6	0.25	0.25	6.00	5.00	0.000
543.6	5	0.25	0.25	12.00	5.00	1.000
288.4	5	0.25	0.25	9.75	8.00	2.050
909.3	5	0.25	0.25	9.20	3.20	0.455
259.8	5	0.25	0.25	9.80	3.80	0.633
228.9	5	0.25	0.25	9.40	3.40	0.550
247.0	5	0.25	0.25	9.00	3.00	0.530
302.5	5	0.25	0.25	16.90	5.00	0.045
155.3	5	0.25	0.25	11.00	5.00	0.115
514.5	5	0.25	0.25	11.80	5.75	0.200
150.1	5	0.25	0.25	11.50	5.50	0.390
434.5	5	0.25	0.25	10.50	5.00	0.045
259.6	6	0.25	0.25	10.00	2.00	1.250
428.1	6	0.75	0.35	5.00	8.20	0.015
351.0	6	0.25	0.25	12.00	6.00	0.056
454.7	5	0.25	0.25	10.00	4.00	1.000
369.4	5	0.25	0.25	11.50	5.50	0.960
449.9	6	0.25	0.25	12.50	6.50	1.410
140.7	6	0.25	0.25	12.00	6.00	1.200
405.5	1	0.75	0.35	4.00	3.50	0.245
925.6	1	0.75	0.35	4.00	2.50	0.140
1156.7	1	0.75	0.35	4.00	3.50	0.074

X_7	X_8	X_9	X_{10}	X_{11}	x_{12}	X_{13}	X_{14}	X_{15}	X_{16}
4.95	1	0	21205.8	3	5	4	2	4	0
2.70	1	0	4628.8	2	4	1	4	4	0
1.55	3	1	2184.9	1	4	4	4	4	0
2.50	1	0	6083.7	2	4	4	4	4	0
2.40	1	0	152673.3	2	4	2	4	4	0
2.30	1	0	2225.8	1	4	4	4	4	0
5.00	1	0	20234.5	1	4	4	4	4	0
3.00	2	0	10117.3	2	4	4	3	1	0
5.50	1	0	14435.3	3	4	4	3	4	0
4.90	1	0	10117.3	2	4	4	4	4	0
2.00	3	0	3728.0	2	3	1	3	4	0
2.35	4	0	1335.5	2	2	2	4	4	1
4.49	3	0	2286.5	1	2	4	4	4	1
4.69	3	0	3517.2	1	2	4	4	4	1
4.69	3	0	3442.3	1	2	4	4	4	1
4.55	3	1	2645.9	1	1	4	4	4	1
4.39	3	0	3132.0	1	2	4	4	4	1
4.39	3	0	1981.0	1	2	4	4	4	1
4.34	3	0	1983.0	1	2	4	4	4	1
4.39	3	0	1981.0	1	2	4	4	4	1
4.24	3	1	5581.1	1	2	2	4	4	1
4.94	2	0	1984.0	2	2	4	4	4	1
3.80	3	0	2370.0	3	2	4	4	4	1
8.05	2	0	2023.5	2	4	4	4	4	0
4.00	2	0	10520.0	3	2	4	4	4	1
4.50	1	0	8093.8	2	2	4	4	4	0
1.00	2	0	3075.6	3	4	4	4	4	1
0.50	2	0	4411.1	3	4	4	4	4	1
0.50	2	0	3561.3	3	4	4	4	4	1
1.00	2	1	5566.9	1	1	4	4	4	1
5.00	2	0	2023.5	3	4	4	4	4	0
7.00	1	0	2090.2	1	4	4	4	4	0
2.20	1	0	2023.5	2	4	4	4	4	0
2.80	1	0	1959.1	2	4	4	4	4	0
2.40	1	0	1934.0	2	4	4	4	4	0
2.00	1	0	2059.9	2	4	4	4	4	0
4.00	1	0	2023.5	3	4	4	4	4	0
4.70	1	0	3770.1	2	4	4	4	4	0
4.75	1	0	1330.2	2	4	2	4	4	0
4.50	1	0	4662.0	1	4	2	4	4	0
4.00	1	0	2382.0	2	4	4	4	4	0
3.00	1	0	2711.8	2	1	1	4	4	0
3.30	3	0	3286.1	2	1	4	4	4	1
5.00	1	0	3956.0	2	4	4	3	3	0
3.00	1	0	2023.5	2	4	4	4	4	0
7.50	1	0	2023.5	2	4	4	4	4	0
5.50	1	0	4046.9	2	2	4	4	4	1
5.00	1	0	5000.0	2	2	4	4	4	1
1.00	2	0	3035.2	3	4	4	4	4	1
1.00	2	0	4046.9	2	4	1	4	4	1
1.00	2	0	3237.4	2	4	4	4	4	1

X_{17}	X_{18}	X_{19}	X_{20}
1	10.6	1	8
1	2.3	0	9
1	1.1	0	6
1	3.0	0	9
1	76.3	1	7
1	1.1	0	6
1	10.1	1	10
0	5.0	1	2
1	7.2	1	10
1	5.1	1	2
1	1.9	1	12
1	2.7	0	9
1	1.1	1	4
1	7.0	1	4
1	6.9	0	5
1	5.3	0	9
1	6.3	1	3
1	3.9	1	3
1	3.9	1	3
1	3.9	0	5
1	11.2	1	4
1	3.9	1	4
1	4.7	0	5
1	1.0	0	9
1	1.0	1	10
1	4.0	1	11
1	1.5	1	1
1	2.2	1	8
1	1.8	1	10
1	2.8	0	9
1	1.0	1	12
1	1.1	1	7
1	1.0	1	11
1	1.0	0	6
1	1.0	1	7
1	1.0	0	6
1	1.0	1	8
1	1.9	0	5
1	1.0	0	9
1	2.3	1	8
1	1.2	1	11
1	1.4	1	3
1	6.6	1	3
1	1.9	1	10
1	1.0	1	11
1	1.1	1	11
1	2.0	1	2
1	2.5	1	4
1	6.1	0	12
1	8.1	0	12
1	6.5	0	12

Source : Field Data, 1992

APPENDIX III

CORRELATION MATRIX

	Y	X_1	X_2	X_3	X_4	X_5	X_6
Y	1.000	-0.390	0.438	0.438	0.641	0.085	-0.021
X_1	-0.390	1.000	-0.356	-0.356	-0.527	-0.266	0.002
X_2	0.438	-0.356	1.000	1.000	0.706	0.320	0.315
X_3	0.438	-0.356	1.000	1.000	0.706	0,320	0.315
X_4	0.641	-0.527	0.706	0.706	1.000	0.156	0.298
X_5	0.085	-0.266	0.320	0.320	-0.156	1.000	0.073
X_6	-0.021	0.002	0.315	0.315	0.298	0.073	1.000
X_7	0.494	-0.203	0.292	0.292	0.670	-0.150	-0.110
X_8	0.198	-0.138	0.725	0.725	0.510	0.483	0.342
X_9	-0.047	0.059	0.126	0.126	0.281	-0.062	0.617
X_{10}	-0.232	0.155	-0.151	-0.151	-0.077	-0.094	-0.065
X_{11}	0.143	0.000	-0.054	-0.054	0.029	-0.133	-0.206
X_{12}	-0.004	-0.094	-0.525	-0.525	-0.164	-0.358	-0.318
X_{13}	-0.058	0.147	0.086	0.086	-0.007	-0.354	0.132
X_{14}	0.231	-0.231	0.260	0.260	0.264	-0.161	0.062
X_{15}	0.117	-0.161	0.151	0.151	0.199	0.147	0.032
X_{16}	0.434	-0.281	0.843	0.843	0.711	0.231	0.275
X_{17}	0.119	-0.126	0.118	0.118	0.170	0.110	0.060
X_{18}	-0.184	0.051	-0.016	-0.016	0.058	-0.013	0.069
X_{19}	-0.164	0.440	-0.049	-0.049	-0.295	-0.131	0.100
X_{20}	0.121	-0.410	-0.173	-0.173	0.000	-0.034	-0.176

	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}
Y	0.494	0.198	-0.047	-0.232	0.143	-0.004	-0.058
X_1	-0.205	-0.138	0.059	0.155	0.000	-0.094	0.147
X_2	0.292	0.725	0.126	-0.151	0.054	-0.525	0.086
X_3	0.292	0.725	0.126	-0.151	0.054	-0.525	0.086
X_4	0.670	0.510	0.281	-0.077	0.029	-0.164	-0.007
X_5	-0.150	0.483	-0.052	-0.094	-0.133	-0.358	-0.354
X_6	-0.110	0.342	0.617	-0.065	-0.206	-0.316	0.132
X_7	1.000	0.096	0.052	-0.021	0.339	0.202	-0.020
X_8	0.096	1.000	0.371	-0.178	-0.287	-0.580	0.016
X_9	0.052	0.371	1.000	-0.056	-0.334	-0.407	0.149
X_{10}	-0.021	-0.178	-0.056	1.000	0.054	0.143	-0.202
X_{11}	0.339	-0.287	-0.334	0.054	1.000	0.377	-0.005
X_{12}	0.202	-0.580	-0.407	0.143	0.377	1.000	0.035
X_{13}	-0.020	0.016	0.149	-0.202	-0.005	0.035	1.000
X_{14}	0.115	0.107	0.103	-0.175	-0.268	-0.276	0.022
X_{15}	0.053	0.011	0.059	-0.010	-0.025	-0.133	-0.081
X_{16}	0.320	0.690	0.231	-0.165	-0.099	-0.638	0.121
X_{17}	0.030	-0.031	0.047	-0.018	-0.020	-0.104	-0.064
X_{18}	-0.017	-0.051	0.016	0.976	-0.017	0.060	-0.208
X_{19}	-0.112	-0.104	-0.170	0.155	0.132	-0.030	0.096
X_{20}	0.223	0.227	-0.101	0.009	0.292	0.403	-0.150

	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	X_{19}	X_{20}
Y	0.234	0.117	0.434	0.119	-0.184	-0.164	0.121
X_1	-0.231	-0.161	-0.281	-0.126	0.051	0.440	-0.410
X_2	0.260	0.151	0.843	0.118	-0/016	-0.049	-0.173
X_3	0.260	0.151	0.843	0.118	-0.016	-0.049	-0.173
X_4	0.264	0.199	0.711	0.170	-0.058	-0.295	0.000
X_5	-0.161	0.147	0.231	0.110	-0.013	-0.131	-0.034
X_6	0.062	0.032	0.275	0.060	0.069	0.100	-0.176
X_7	0.115	0.053	0.320	0.030	-0.017	-0.112	0.223
X_8	0.107	0.011	0.690	-0.031	-0.051	-0.163	-0.239
X_9	0.103	0.059	0.231	0.047	0.016	-0.170	-0.101
X_{10}	-0.075	-0.010	-0.165	-0.018	0.976	0.155	0.009
X_{11}	-0.268	-0.025	-0.099	-0.020	-0.017	0.132	0.296
X_{12}	-0.276	-0.133	-0.638	-0.104	0.060	-0.030	0.403
X_{13}	0.022	-0.081	0.121	-0.064	-0.208	0.096	-0.150
X_{14}	1.000	0.420	0.282	0.330	-0.039	-2.230	-0.109
X_{15}	0.420	1.000	0.163	0.948	0.011	-0.133	0.177
X_{16}	0.282	0.163	1.000	0.128	-0.040	-0.073	-0.298
X_{17}	0.330	0.948	0.128	1.000	-0.001	-0.104	0.227
X_{18}	-0.039	0.011	-0.040	-0.001	1.000	0.108	-0.031
X_{19}	-0.230	-0.133	-0.073	-0.104	0.108	1.000	-0.170
X_{20}	-0.109	0.177	-0.298	0.227	-0.031	-0.170	1.000

Source: Computer Printout, 1992

APPENDIX IV

POLITICAL EVENTS FROM 1980 - 1992

Year	Political Event	Dummy Variable
1980		0
1981	OAU Summit	1
1982	Coup de tat attempt on the government of President Daniel arap Moi	1
1983	General Elections	1
1984	Severe drought and famine resulting in the introduction of Yellow maize	1
1985		0
1986		0
1987	Confrontation between the NRA of Uganda and the Kenya security	

	personnel at the Kenya - Uganda border	1
1988	General Elections	1
1989		0
1990	The Minister for foreign affairs, Dr Robert Ouko murdered resulting in countrywide riots and disturbances.	
	Iraq invades Kuwait as oil prices rise steeply	1
1991	The beginning of multiparty politics with the formation of the Forum for the Restoration of Democracy (FORD), Democratic Party of Kenya(DP) and the repealing of section 2A of the Kenya constitution.	1
1992	Tribal wars across Kenya. General Elections	1

Source : Compiled from local newspapers

APPENDIX V

INFLATION RATES

Year	Rate of Inflation (%)
1980	12.8
1981	12.6
1982	22.3
1983	14.5
1984	9.1
1985	10.7
1986	5.7
1987	7.1
1988	8.7
1989	11.5
1990	14.5
1991	15.6
* 1992	30.0

Inflation is measured by the annual rate of change in the Nairobi consumer price indexes (Cpi).

*Estimated

Source : Central Bank of Kenya

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APPENDIX VI

Minimum plot sizes in high income residential zones in Nairobi (in hectares)

Zone	Area represented		Minimum plot size
2	Parklands, Westlands		0.1
4	Kilimani, upper parklands, Kileleshwa,Thompson Estate, Woodley	Unsewered	0.1
		Sewered	0.05
5	Lavington, Bernard Estate, Spring Valley, Kabete, Loresho		0.2
6	Muthaiga		0.2
12	Langata, Karen		0.2
13	Kitusuru, Redhill, Gigiri, Runda		0.2
14	Ridgeways, Garden Estate		0.1

Source : Based on interviews with employees of the Nairobi City Commission, 1992