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Application of the Hedonic pricing model in real estate valuation in Nairobi

County:

A study of the Hedonic model

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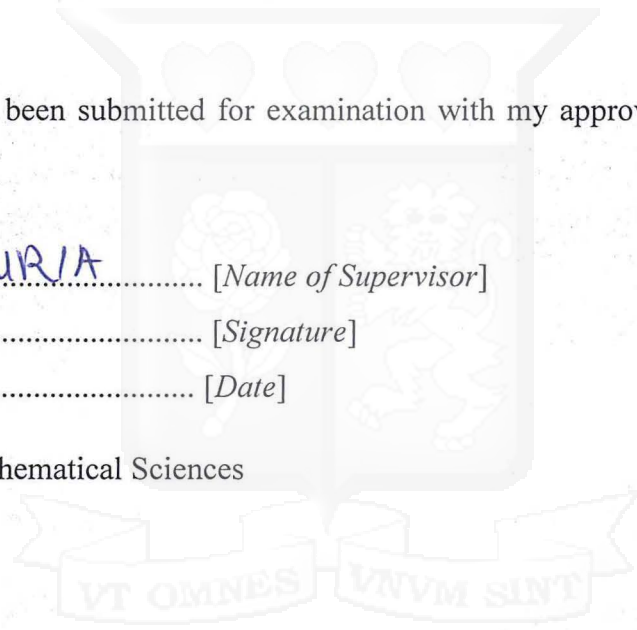
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ABSTRACT

Housing occupies an important position in the Kenyan psyche along with the concept of home ownership. The residential developments and investments attract both institutional, corporate organisations as well as private individuals. There are indications that the residential market in Nairobi is very active and that most of the valuation firms in Nairobi carry out market-based valuation of residential properties. The study is about the relevance of the hedonic pricing model in Nairobi and in particular to assess what kind of pricing methodology is used in the valuation of property in Nairobi County. The study attempted to determine the various attributes that are considered in the pricing models used in the County.

The study was carried out in Lavington and Riverside estates, which are up-market residential estates of Nairobi. The research was qualitative and was conducted using information gathered from questionnaires, interviews and secondary material from Institution of Surveyors Kenya.

The study found out that the significant factors that determine the value of a residential property are size of plot, location, services, developments, land reference number and the characteristics of the plot. The study as well found out that the most preferred method of valuation used in Nairobi is the Cost approach, however, comparable sales are adopted to justify the final outlook of the value.

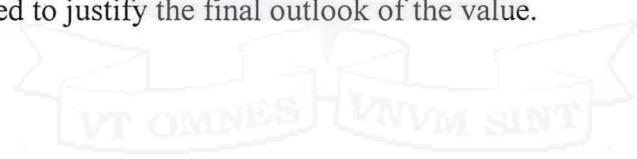


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APPLICATION OF THE HEDONIC PRICING MODEL IN REAL ESTATE VALUATION IN NAIROBI COUNTY.

CHAPTER ONE

1.0 Introduction.

Real estate is often used to refer to immovable things such as lands and the various improvements that are made on the piece of land. However, it can also be defined as property consisting of land and the building on it along with its natural resources such as; crops minerals or water immovable property of its nature an interest vested thus an item of real property building or housing in general.(Muli, 2013). The marginal implicit price of individual characteristics can be estimated using a multiple regression model with housing price as the dependent variable and various characteristics as explanatory variables(Heather, 2008).

In Kenya the values of real estate especially property has been on the rise amidst robust economic growth and sharp increase in the population of middle class and expatriates. The average value of a residential property in the country surged to KES31.1 million (US\$307,100) in June 2016, from just KES7.1 million (US\$70,110) in December 2000. The average price for a 1-3 bedroom residential property is currently KES14.1 million (US\$139,233). On the other hand, the average price for a 4-6 bedroom residential property is KES47.6 million (US\$470,034). A steady rise in the amount of disposable income by households, therefore households are willing to spend more on housing as investments. However, household income cannot be the only factor affecting the price of the real estate. (Hassconsult, 2017)

Interest rates play a major role in real estate pricing. Interest rate affects the affordability of mortgage to the household. Real estate is a capital-intensive investment that households mostly finance with mortgages taken from banks or various financial institutions. Therefore interest rates affects the real estate market as it determine the cost of real estate on the side of the buyer and as well the developers as well. A continued increase in the cost of financing of real estate is reflected in the pricing of the property.

Real estate market works with the same concept of supply and demand. The supply of property should ideally balance out the demand of property to ensure a perfect market. That which has proved to be difficult as housing demand strips the supply of housing. (Delmendo, 2016). This then places more pressure on the current supply of housing leading to a rise in prices over the years.

Demographics; this is the data about the composition of a population (age, race, gender, income and population growth). These statistics act as an indicator of what is being demanded in the market by households. Legislation is also a factor with a heavy loading on the pricing; this comes in the form of tax credits, deductions and subsidies, which act as a booster for the demand of real estate prices.

The overall performance of the economy is also a factor that is factored in the pricing of real estate, indicators of a healthy economic health is GDP .Real estate is highly sensitive to the cyclic trends in the economy. An economic boom will see the rise in prices while a trough would then see a stagnant real estate investment market especially in real estate.

1.1 Problem statement

Kenya experiences increased prices in real estate property all over the country due to the various factors such as demographics, supply and demand, and interest rates, as mentioned above. Characterized by increased demand for housing all over the country and a rush by households to secure land and property. A recent report by Hass property index reported that Overall, property prices rose by 2.4 per cent in the final quarter of 2014. All segments of the property market reported rising prices in the final quarter with the sharpest rise being in the asking prices for apartments, up 5.5% on the previous quarter, and 13.2% over the year earlier(Hassconsult, 2017). The recent increase in the average disposable income of households has boosted the real estate market as households now have more money to take part in investments.(Muli, 2013)

The real estate prices in Nairobi county seem very much escalated when compared side to side with the prices of houses in other counties, as well as other nations within Africa and some European countries(Kigige & Omboi, 2011) , this begs the question why the big difference in the prices. Property developers have put Kenya among countries with the most expensive real estate in Africa as the country fast develops into a major economic hub according to Knight Frank (a real estate consulting firm

dealing with exclusive prime residency properties). This can be testified by the sell of residential houses worth 600 million Kenya shillings .A record that has yet to be surpassed by other counties. The construction sector in Kenya recorded a growth of 8.3 percent in 2008 compared to 6.9 percent in 2007(Republic, 2009). The robust growth was supported largely by increased capital investments in roads and housing. Increase in construction activities was reflected in cement consumption, which grew by 7.0 percent from 2061.4 thousand tones in 2007 to 2205.8 thousand tones in 2008(Kenya, 2009)

The hedonic pricing model takes into consideration the property in its whole entirety it considers structural, geographical, environmental and socio-economical. However, the hedonic model is not applied in the market and rather arbitrary pricing strategies are applied in property valuation. Property valuation is not done haphazardly, therefore what pricing strategy is used in the valuation of property in Nairobi? Does the arbitrary pricing strategy used give the same value to the property as the Hedonic model? When comparing the valuation from the arbitrary model and that that can be determined from the hedonic model, is there a material difference?

1.2 Objectives of the study

The main objective of the study was to assess the application of the Hedonic pricing model in the valuation of property in Nairobi County.

Minor objectives:

1. To assess what pricing strategies are used in Nairobi county
2. To find out the variables that can be applied in deducing the property valuation of the hedonic pricing model in Nairobi county

1.3 Research Questions

1. What is the pricing strategies are used in Nairobi county
2. Which variables can be applied in the property valuation deduction using the Hedonic Pricing model in Nairobi County.

1.4 Justification of the statement

The paper sets out to identify the application of the hedonic model in the county of Nairobi in comparison with the prices valued from different pricing strategies currently being offered in the market.

The Households who are the buyers and sellers of housing would benefit directly, especially those based in Nairobi County as they will be able to make informed choices in real estate property investment.

Real estate developers will benefit from this study. They would get information on the pricing of the property in the county. In turn they can use that information to adjust the prices that they offer in order to maintain a competitive advantage over their competitors. As an alternate real estate valuation method, developers, corporate real estate groups, owners can use hedonic modeling, and operators to determine which building characteristics add significant value to the potential transaction price

Financial analysts can as well use the information on real estate pricing to assess a good investment from a poor investment and therefore be able to advise their clients accordingly in the making of financial decisions.

The Government. The government will benefit in the sense that it will be able to assess the pricing level in the county and then be able to protect the residents from exploitation. The government can as well use the study to try and stabilize the price in the market; this is through subsidies, reducing taxes and land rates.

To other researchers it would provoke them to carry out related research on the model in various counties. The results of this study will also benefit other scholars and learners who would be seeking information as they use the results obtained to further their studies, it would serve as an eye opener to them.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents a critical review of the research work that was done by various scholars in the field of property management more specifically Real estate pricing. In particular the literature review will focus on the Hedonic pricing model and its various variables as well as its use in the market. Dwellings behave differently as other economic goods. This is due to some of their characteristics: their high value related to family income, their heterogeneity, their durability and so forth. On the other hand, real estate markets are dynamic, with different agents, which do not act in a coordinated manner. These factors can partly explain part of the variability in their prices.

Their heterogeneity derives from each particular combination of their intrinsic factors, (Robinson, 1979). They are inseparable: each property has to be purchased as a non-separable basket of goods and thus the difficulty in an objective valuation. These combinations of attributes have to be transferred together, for each dwelling (Balchin & Kieve, 1986).

2.1 THEORETICAL FRAMEWORK

The method of hedonic house-price modeling consists basically of relating house prices to a set of various structural, geographical, environmental, and socioeconomic house determinants through an econometric functional form. Examples of commonly used house-price determinants in hedonic modeling are the size of properties, the type of neighborhood where the property is located, accessibility to the city center, business districts, or workplace, population density, pollution level, and the presence of amenities in the proximity as well as public policies such as land or property taxing (Gret-Regamey, Ricardo, & Adrienne, 2013).

The hedonic model proves very useful especially for urban planners as it looks at all the cost variables. Using ordinary least squares regression analysis to estimate the hedonic pricing model to relate home sale price to the parcel, structural, neighborhood, and environmental characteristics of each property. This model may be written as

$$\ln P_i = \beta_0 + \beta_1 S_i + \beta_2 N_i + \beta_3 Q_i + \varepsilon_i$$

Where P_i is the price of property i

S_i is a vector of parcel and structural characteristics of property i (for example, lot size, number of rooms, age, house style)

N_i is a vector of neighborhood characteristics (for example, neighborhood crime rate, population density, household income)

Q_i is a vector of environmental characteristics (for example, proximity to lakes, proximity to open space, views)

ε_i is an error term. The natural log of home sale value is the dependent variable. (Heather, 2008).

Urban data possess a strong spatial component, thus, information collected to characterize a city is highly related to the location at which the data are measured. This makes the analysis of urban data more complex as clustered patterns and heterogeneous structures are often found simultaneously in the data

Most valuations are done to secure or make borrowing decision fall through. The true value of a property helps the lender to arrive at a reasonable judgment on the term of contract with the borrower. Another reason for valuing property is to make a comparison with the market price. This helps to decide whether a property is underpriced or overpriced. Undervaluation occurs when the same property is judged to be less than it would be before an independent appraiser. Theoretically, the value added to a property is a function of quality and quantity. Quantity is about physical dimension of the real estate (space), while quality is more subjective. It is only when the true value of an asset is ascertained that it is “possible to determine whether a property is under or overpriced (Brown, 2000). It is also noted in theory of information efficiency that “a property may be worth more to one person than to another merely because of the way each individual assess the importance of relevant information”(Miller, 2005), put the issue succinctly that value concept are always “theoretical in nature while price is usually factual”, insisting that value is by nature an opinion and in the absence of a perfectly competitive market, there can be no certainty about “true absolute” or “resolutely true” value. Cost however is factual in

nature, implying that construction cost and other various cost of production may or may not impact value. Since property investment is concerned with acquiring real assets that are worth more than cost, proper valuation need to be carried out and there is the need for a well functioning market.

(Ractliff, 1972) proposed a restatement of valuation theory emphasizing that valuation is a prediction of human behavior under certainty. He discussed transaction zones pointing out that depending on negotiation skills any one of a range of prices might emerge from a sale process.

(Kummerow, 2011) reviewed hedonic price models and conclude that they represent the insight that people buy a bundle of characteristics of properties, not simple, one – dimensional source of utility as many factors influence the prices people pay for real estate, written as: $Price = \text{coefficients} * \text{characteristics} + \text{error}$

The coefficients are weights. The characteristics are features of the property that have an effect on utility to buyers. The theory of hedonic pricing is that people's willingness to pay reflects their valuation of bundles of hedonic characteristics rather than a single one-dimensional generic good. (Kummerow, 2011)

Hedonic theory applied to consumption studies originates in Lancaster (Lancaster, 1966). Based on the idea that usefulness of goods depends on their characteristics, and goods can be arranged into groups based on their characteristics. Consumers buy goods within groups based on the number of characteristics they possess per dollar. According to Lancaster, the consumer's utility originates from the different characteristics, which the goods themselves provide. Rosen, in 1974 generalizes this theory to houses and applies it to the real estate market, using linear regression techniques (Rosen, 1974). He summarized in two steps: an initial step involving an estimation of the marginal price for the attribute of interest (by regressing the price of a commodity or good on its attributes), and a second step to identify the inverse demand curve (or the marginal willingness to pay function) from the implicit price function estimated in the first stage. Rosen maintains that there is a range of goods, but that consumers typically do not acquire preferred attributes by purchasing a combination of goods, rather each good is chosen from the spectrum of brands and is consumed discretely. Accordingly, Rosen's model looks appealing to estimate demand for durable goods.

Model specifications in these two theories differ as well. Lancaster's consumer theory assumes a linear relationship between the price of goods and the characteristics contained in those goods. Implicit prices are constant over their range of characteristic amounts, and only a change in the combination of goods consumed is possible. Rosen assumes a non-linear relationship between the price of goods and their inherent attributes. The implicit price is not a constant but a function of the quantity of the attribute being bought and of the quantities of other attributes associated with the good.(Maier, 2010).

Bailey in 1963 studies the time evolution of the price of a particular property, through its repeated sales. This approach requires long periods of observation and thus is of limited applicability (M.J Bailey, 1963).

In Portugal, the first publications began in the nineties, with Pinho (Pinho, 1992) and Cavalho(Carvalho, 1995). Pinho states that hedonic models for Porto and Aveiro using internal attributes of each dwelling and localization data, maintain common explanatory variables in both cities like their surface, number of bathrooms, stage and other attributes. The localization factor is considered important in this market, but conditioned to other attributes. In America new studies have taken into account so externalities associated to the localization of the dwelling, as sights and parks (Zabel., 2008)(Polasky, 2009), or the proximity of underground transport(Estrella, 2008)(Bazyl, 2009), or to green fields in Sweden(Juusola, 2009). The quality of the surrounding where the property is located as been introduced(Kiel, 2006), as this matter is of interest to environment economists.

2.2 EMPIRICAL REVIEW

The application of the hedonic price model to the housing market rests on several key assumptions. First, homogeneity of the housing product is assumed. This assumption, however, is arguable. It would be more accurate to view housing products as heterogeneous because they can be differentiated in terms of location, structural, or neighborhood attributes, or based on some other criteria as well, such as type of dwelling (bungalow, terrace house, high rise apartment, or condominium).

Another underpinning assumption is that the market operates under perfect competition, and there are numerous buyers and sellers. This assumption is justified as there are many buyers seeking housing in the market, and there are also many housing developers that supply the housing. Thus, no individual buyer or supplier can significantly affect the price of the properties because the purchases or sales of each individual unit constitute a negligible portion of the market.

Buyers and developers are deemed to have freedom to enter and exit the market. Unlike some other industries, such as the petroleum and aviation industries that may have to comply with certain requirements, there are neither constraints artificially imposed on the demand and supply of housing, nor restrictions on the resources used to produce the housing product. In practice however, there might be some budget constraints for the buyers. Likewise, for developers, only those with enough capital can contemplate property development.

The assumption that buyers and sellers have perfect information concerning housing product and price is quite reasonable, although one may still contend that perfect knowledge is impossible to achieve in reality. Buying a house involves a substantial capital outlay. Thus, buyers will endeavor to shop around to acquire as much information about the attributes of the units they desire before making the purchase. Most of the relevant information, such as availability of the housing unit, its price and attributes, is readily available in the newspapers, or can be obtained from brokers and real estate agents. As for suppliers, perfect knowledge of their core business and the market price enables them to increase their profits and utility, too. However, such perfect information may never be fully realized in practice.

Finally, the hedonic price model only works under the assumption of market equilibrium, and that there are no interrelationships between the implicit prices of attributes (Dusse & Jones, 1998). Market equilibrium is not plausible because there are imperfections in the real world property market. It is idealistic to assume that the price vector will adjust instantaneously to changes in either demand or supply at any point in time. The notion that there are no interrelationships between the implicit prices of attributes is also fallacious because it implies that the implicit price of an attribute does not vary throughout all areas and property types. It is not necessarily

true that all attributes will give the same level of utility or identical levels of disutility to all buyers.

Despite these disputable assumptions, which involve substantial simplification and abstraction from a complex reality, the hedonic price model has been deployed extensively in housing market research (Ball, 1973; Chau et al., 2001; Freeman, 1979; Leggett & Bockstael, 2000). As astutely observed by Freeman, the data may be inadequate; variables are measured with error; and the definitions of empirical variables are seldom precise, but these do not render the technique invalid for empirical purposes.

The hedonic price approach does have its merits. Its main advantage is that one only needs to have certain information, such as the property price, the composition of housing attributes, and a proper specification of the functional relationships. The marginal attribute prices are obtained by estimating the parameters of the hedonic price function. It is a straightforward approach because only the coefficients of the estimated hedonic regression are needed to indicate the preference structure. No information whatsoever about individual characteristics or a personal particular of either the house buyers or the suppliers is required.

The heterogeneous nature of houses, buildings and other real estate property justifies the use of Hedonic pricing model for estimating their demand or value. Houses, buildings and land slots are different at least by their location, making it difficult to estimate the demand for them generically. The Hedonic pricing model takes into account the properties of real estate separately and estimates prices based on the assumption that these properties can be separated into characteristics such as attributes of the spatial unit (size of plot, number of bedrooms, bathrooms, toilets and so forth), infrastructure and location attributes, natural environment, social environment, ecology and quality of design and architecture.(Kekal, 2010)

The hedonic pricing method can be used to value an attribute or a change in an attribute, whenever its value is capitalized into the price of an asset. The price of a house, P , depends on such attributes as the quality of its scenic view, $VIEW$, its distance from the central business district, CBD , its lot size, $SIZE$, and various characteristics of its neighborhood, $NBHD$, such as school quality. A model of the factors affecting house prices can be written as follows:

$$P = f(\text{CBD}, \text{SIZE}, \text{VIEW}, \text{NBHD})$$

This equation is called hedonic price function. The equation shows the various variables that are used in the Hedonic model in pricing in line with our second objective. The change in the price of a house that results from a unit change in particular attribute is called hedonic price. Assuming the hedonic pricing model represented in equation has a multiplicative functional form:

$$P = \beta_0 \text{CBD}^{\beta_1} \text{SIZE}^{\beta_2} \text{VIEW}^{\beta_3} \text{NBHD}^{\beta_4} e^{\epsilon}$$

The parameters, $\beta_1, \beta_2, \beta_3$ and β_4 are elasticity: They measure the proportional change in house prices that results from a proportional change in the associated attribute. We expect $\beta_1 < 0$ because house prices decline with distance to the CBD, but β_2, β_3 and $\beta_4 > 0$ because house prices increase as SIZE, VIEW, and NBHD increase.

2.2.1 A simple linear regression model

Below is the simplest form equation of the hedonic regression model:

Y = unit price

X_k = $k = 1, 2 \dots m$ are independent variables

a_0 and a_k = Parameters to be established

ϵ = Error term

$$y = a_0 + \sum a_k x_k + \epsilon$$

An ordinary linear model in this form was developed in (Gao X. a., 1992). It explains 75.6% of unit price has 16 independent variables, all of which statistically significant at the level of F below 0.05

This model has not fully considered impact of spatial location on unit price, to study the spatial characters of dataset with location data is thought of a way to improve it.

One of the spatial relationships being explored is spatial dependency. Another is spatial heterogeneity. The estimates of regression parameters in the presence of spatial dependency have been discussed by (Dubin R. A., 1992), (Dubin R. A., 1998) and (Can A. , 1990), (Can A. , 1992) while various localized modeling techniques were proposed to capture spatial heterogeneity (Casetti, 1972), (Getis, 1992)

2.2.2 A Spatial Dependency Model

In order to study spatial dependency effects, prior probability method proposed by (Switzer, 1982), is applied. The model had been used to process satellite classification maps. To evaluate the class at the center of a window using the data for that location and the prior probability estimates obtained from the nearby observations in the window area was shown to have increased classification accuracy. Similarly, the prior characteristic terms of sample lots, denoted by x_k' for $k= 1, 2, \dots, m$, are added to the simple linear model:

$$y = a_0 + \sum a_k x_k + \sum a_k' x_k' + \varepsilon. \quad (2)$$

For simplification, let x_k' take the value of x_k that is associated with the nearest neighbor of a sample. Appendix C gives the OLS estimates of this model, with an R-square of 0.801.

Although one might argue that correlations between x_k and x_k' may lead to unstable estimates, the question is secondary to the concern whether spatial dependency is present. If the absence of spatial dependency effects were demonstrated, the model itself would be improper, let alone its estimates. (Gao, Asami, & Chang, 2002)

2.2.4 Geographically Weighted Regression (GWR) Model

To identify spatial variations in relationships, a GWR model proposed in (Fotheringham, 1998), is adopted. The model extends traditional regression framework by allowing parameters to be estimated locally so that the model is written as

$$y_i = a_{0i} + \sum a_{ki} x_{ki} + \varepsilon_i,$$

Where, a_{0i} and a_{ki} represent the values of a_0 and a_k at point i .

In order to estimate the model, an observation is weighted in accordance with its proximity to point i . Let W_i be an $n \times n$ matrix whose diagonal elements w_{ij} denotes the geographical weighting of all observed data for point i , and the off-diagonal elements are zero. Data from observations close to i are weighted more than data from observations far away:

$$\hat{a} = (X^T W X)^{-1} X^T W Y$$

Where, X and Y are the matrix of explanatory variables and unit prices, respectively.

A weighting function in Equation is applied:

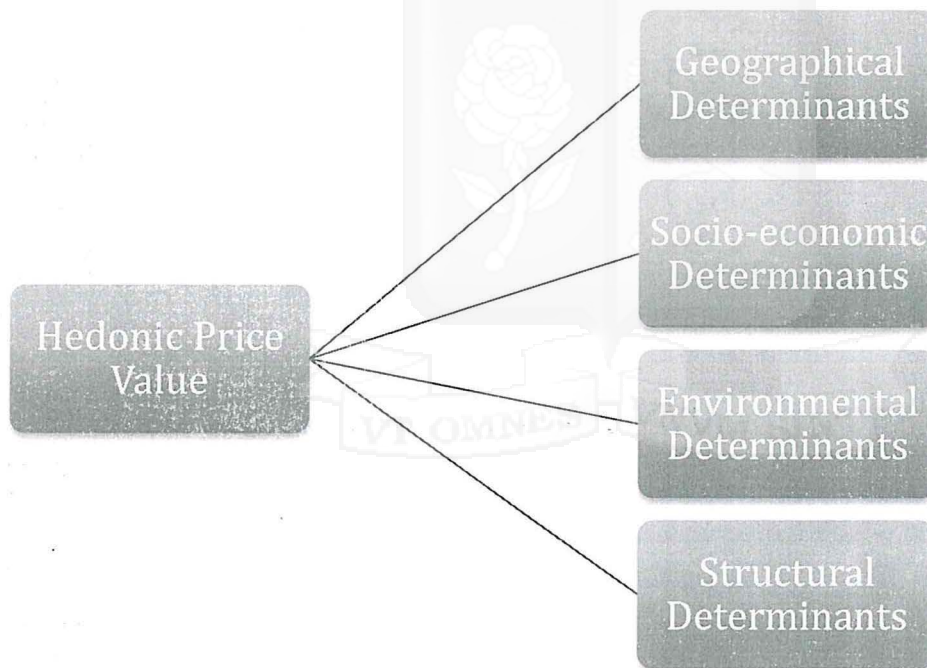
$$w_{ij} = \exp(-d_{ij}^2/\beta^2)$$

Where, d_{ij} is the Euclidean distance between point i and j , β is a bandwidth. By

minimizing, β is set to 1,250m.

$\sum_i [y_i - \hat{y}_i(\beta)]^2$ Note that $\hat{y}_i(\beta)$ is the estimates at i with samples near to i but not i . At location regressions are run. The localized parameter estimates exhibit a high degree of variability over space and demonstrate fairly complex spatial patterns of the simple linear mode

2.3 CONCEPTUAL FRAEWORK



Geographical determinants in this case refer to the location of the property for example the area where the property is found. Environmental factors in this case looks at the various aesthetics that may be present in the property such as a beautiful skyline view, proximity to a lake or the presence of a serene environment. Structural factors will include the various amenities that are present in the property such as a

social hall, swimming pool, and gym facilities. Socio-economic factors point out to things like proximity to hospitals, recreational parks, police post and major malls.

$$\ln P_i = \beta_0 + \beta_1 S_i + \beta_2 N_i + \beta_3 Q_i + \epsilon_i \dots \dots \dots \text{Where } P_i \text{ is the price}$$

S_i is the structural characteristics

N_i neighborhood characteristics

Q_i environmental characteristics

ϵ_i is the error term



METHODOLOGY

3.0 Introduction

Research methodology is a way to systematically solve the research problem. It indicates the various steps that are generally adopted by a researcher in studying his research problem along with the logic behind them (Kothari, 2004). The aim of the chapter is therefore to provide arguments for the approaches that the researcher adopted in gathering and in the treatment of the data in order to answer the research questions and objectives. In this regard, this chapter discusses the following aspects: the research design, the sampling strategies, the data collection process, the instruments used for data gathering, as well as, data analysis methods which helps in coming up with a meaningful conclusion.

3.1 Research Design

Research design refers to the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in the procedure (Orotho, 2013). Orotho further defines descriptive survey as a method of collecting information by interviewing or administering a questionnaire to a sample of individuals. The research undertaken was a descriptive survey. (Mugenda, 2003), supports this view by asserting that this type of research attempts to describe things as possible behavior, attitudes and characteristics.

3.2 Population

(Mugenda, 2003) described population as the entire group of individuals or items under consideration in any field of inquiry and have a common attribute. The population in this study is the real estate developers while the target population included private property developers. Data for analysis was based on the real estate and renting businesses as sourced from the Kenya Statistical Abstracts Issues

3.3 Sample design

The sample comprises of real estate and renting businesses where data for the most recent five years was used. Data for the hedonic model analysis variables namely: the land (acres), construction type, CPI (Consumer Price Index), proximity to social amenities (for example school, hospital), size of the property, neighborhood and GDP

obtained for the years between 2012 and 2017 was used for analysis. The sample design used was the clustered sampling. Cluster sampling involves the researcher divides the population into separate groups, called clusters. Then, a simple random sample of clusters was selected from the population

3.4 Data Collection Methods

The method of data collection used was both primary and secondary methods. Primary data collection methods entails the first hand information, primary data was collected from property developers both government owned and private owned, financial institutions dealing in real estate property. Data was collected using questionnaires. The respondents filled in the questionnaires provided while being assisted by research assistants where they were unable to interpret the questions during any scheduled meetings, otherwise, the research assistants will drop and pick the questionnaires as agreed. The questions were both closed and open-ended and covered the four independent variables that were used to obtain responses. Issues covered were sequenced and worded to make the data collection systematic.

Secondary data on the other hand entails second hand data. The data was collected from Government of Kenya publications such as the Annual Budget and Financial estimates, Central Bank of Kenya annual report, Kenya economic survey and statistical abstracts by the Ministry of planning national development and vision 2030, journals, published and unpublished research work, dissertations among others.

3.5 Data Analysis

Data analysis was done using computer software, Microsoft excel and SPSS. The data collected was then edited for accuracy, consistency and completeness. The data was coded and cross-tabulated to enable the responses to be statistically analyzed.

This involved interpreting information collected from respondents when the respondents completed the questionnaires. The researcher compiled them by use of data editing, data coding and data tabulation. Data analysis was carried out by use of Statistical package for the social Scientists (SPSS) to obtain descriptive statistics and excel to obtain a summary regression and the linear regression model. Inferences and calculations were made from these measures and compared with the existing literature to arrive at the conclusion of the study.

3.6 Data Presentation

After collecting, data was presented in the form of tables and percentages. This was done by use of the information obtained from software statistical packages. Based on the data analysis and presentation, interpretation was made on the findings of the study. Pie charts were used to represent the various variables that should be put in the hedonic pricing model for Nairobi, application of pie charts will highlight the various weights that are placed on variables in property valuation. Tables will be used to sort out the various responses that were received and as well to determine the effectiveness of the reach of the questionnaires. Bar graphs were used to present the property valuation from the arbitrary pricing model and another graph to represent the valuation from the hedonic model; this will be done across the various clusters.



DATA ANALYSIS, FINDINGS AND DISCUSSIONS

4.0 Introduction

This chapter provides the research findings on the valuation of residential properties in Nairobi.

The chapter is divided into three parts.

1. Factors that are considered in the valuation of residential properties
2. The methods of valuation that are adopted in the valuation of residential properties
3. A regression model to determine the significance of the factors outlined in (1) and their contribution to the value of residential properties in a similar location.

4.1 Factors that are considered in the valuation of residential properties

Data was obtained from examination papers submitted for institution of Surveyors of Kenya Diploma Examinations. A total of 20 papers were used for the project and the following details were obtained from the valuation reports and attached working papers

4.1.1 Property details

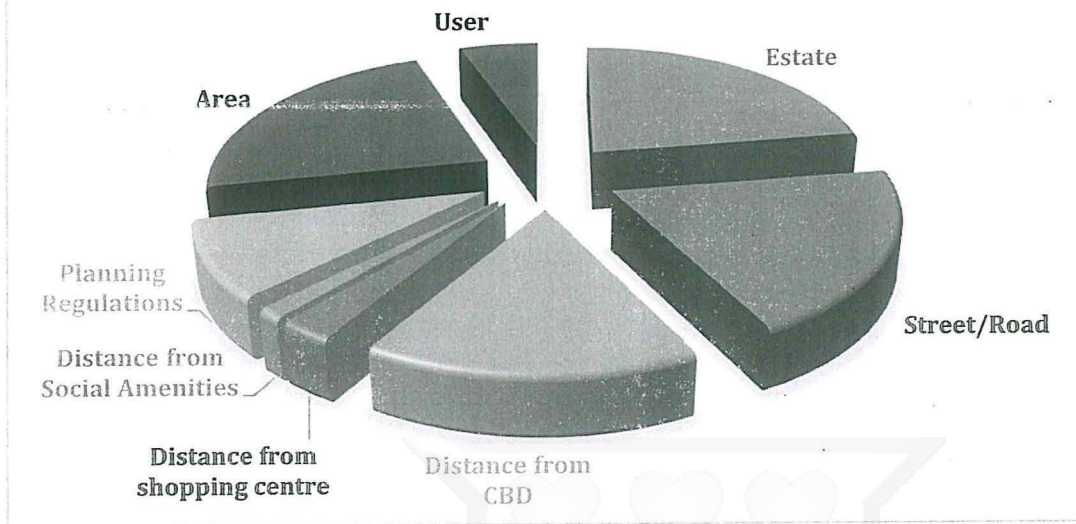
The objective was to find out what property details the consumer prioritizes in their search for a suitable piece of property. The study was grouped according to location, characteristics of the plot, site-works, developments, services and non-property characteristics.

Location:

When it came to location it was discovered that the area and the estate in which the property was located was crucial to the consumer/buyer of the property. Most of the buyers will assess the area in which the property is located as a key factor to consider in their decision making process.

The pie chart below outlines the attributes that the consumer gives more importance.

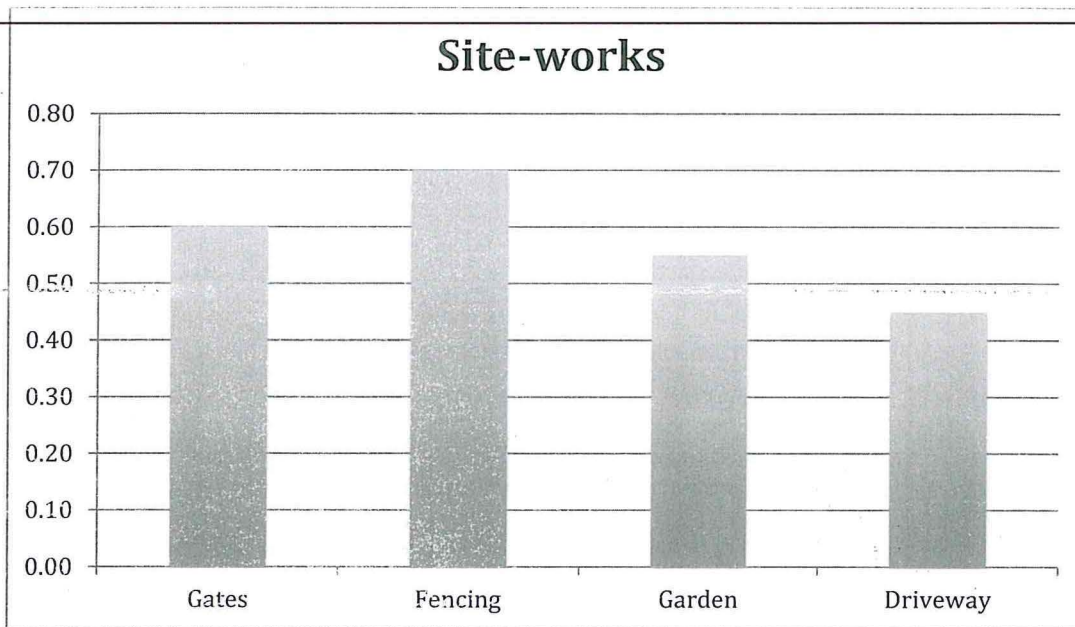
LOCATION ATTRIBUTES



Therefore, when it comes to location attributes the consumer is willing to pay more for a piece of property that is located in a good area therefore raising the demand of houses that are located in areas that are dimmed fit by the consumer and thus an increase in the price of the property.

Site-works:

Site-work in this context refers to additional features that have been placed in the property that aid in the aesthetics of the property, such features include: gates, fencing, garden,



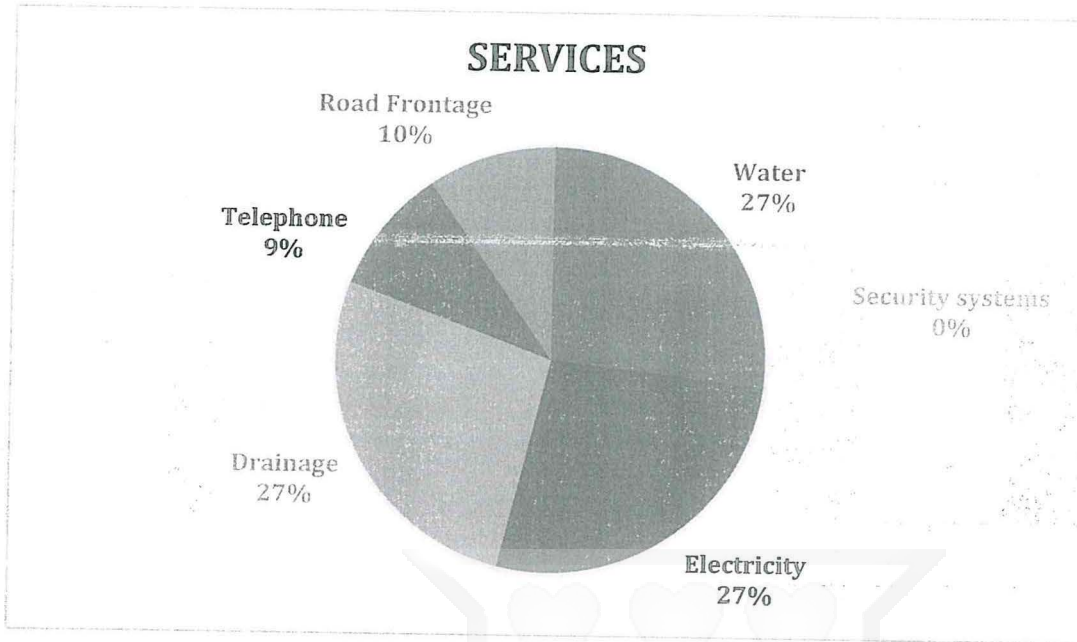
driveway and pools.

It is evident that fencing of the property from external interference takes priority when it comes to site-works. The reason as to this is because it is perceived that fencing is a form of security therefore keeping the household and their property safe. Driveway comes in as the least prioritized, however, a buyer looking to purchase a lavish mansion will find a driveway to be of great importance in determining whether to buy the property or not.

Services:

From the study it was concluded that consumers generally desire equally the need for proper water, electricity and drainage services to be available in the

property that they purchase.

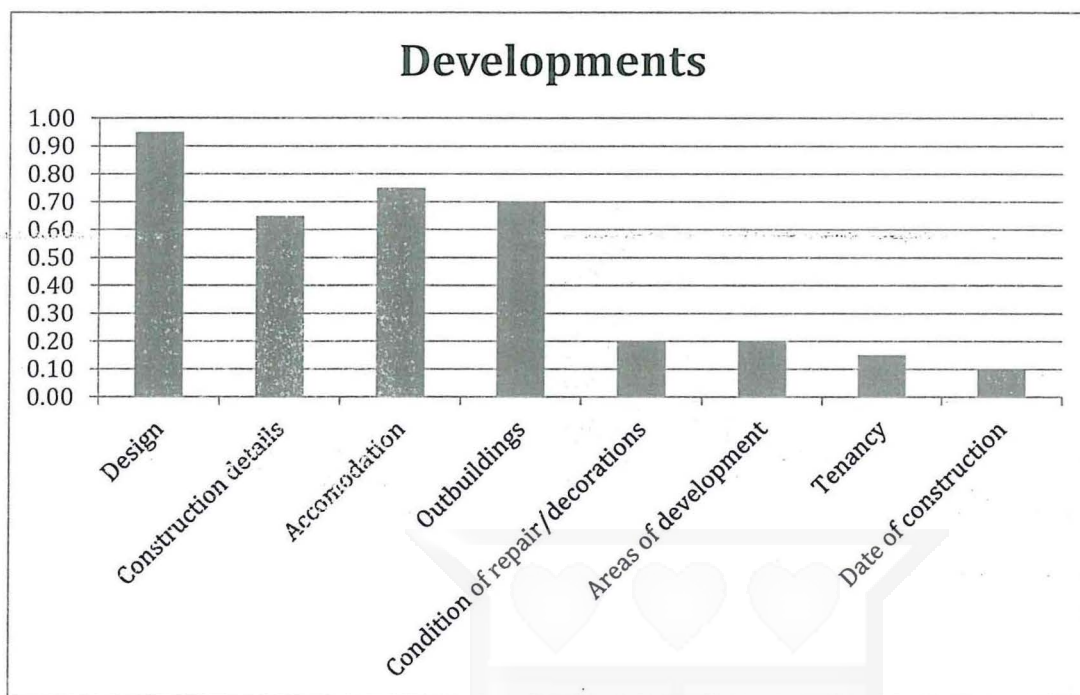


It is evident from the pie chart that security systems put in place beforehand purchase are not put into consideration in the pricing of the property. This is so as most of the buyers can contract their own security company to provide that service

Developments:

With upcoming infrastructural innovation the design of the property becomes a crucial factor in the desired features of a property. The design of the property

took lead with almost every respondent agreeing that the design crucial.



Residential properties with the latest architectural designs will attract a bigger price than those designs that are outdated followed by the size of the house that is the number of bedrooms the house occupies and recreational rooms.

Outbuildings include extra units like the servants quarter; properties with such features are sold at a high price than those with none. Construction details such as the foundation of the house and the walls are considered a strong foundation will be appreciated by both the consumer and the real estate company, the cost of the construction details have to be offset in the price of the property.

4.2 Method of valuation

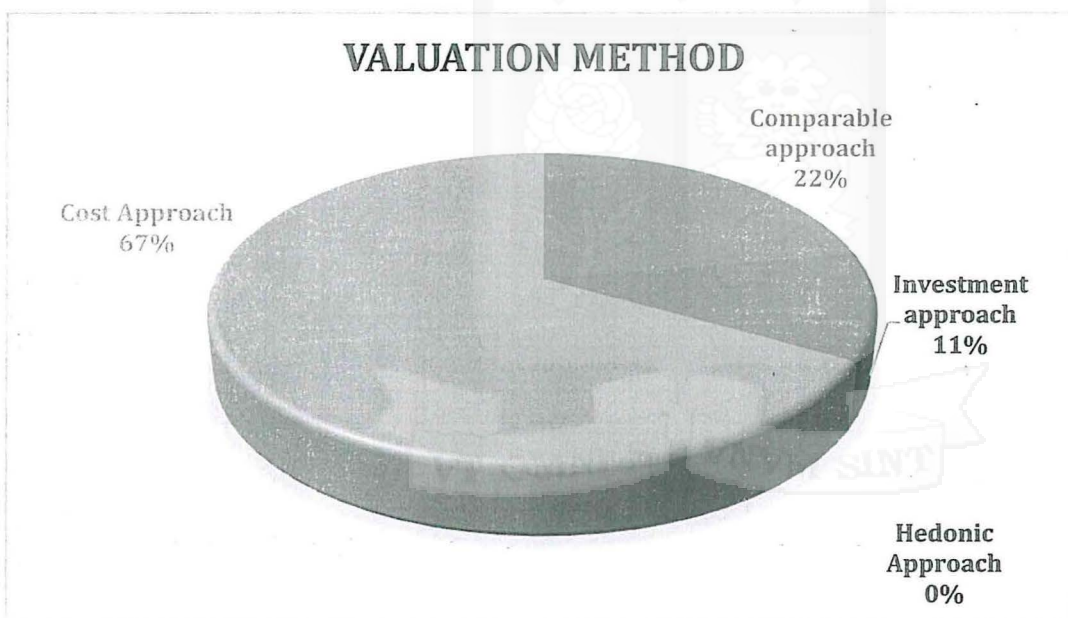
The objective of the study was to find out the pricing methodology used in the valuation of residential properties in Nairobi County.

From the data collected it is clear to say that the pricing methodology used in Nairobi county for the valuation of real estate property is the cost approach method, which advocates that the price a buyer pays for the piece of property should be equal to the cost of building a similar building. The market price for the property is equal to the cost of land plus the cost of construction, less depreciation. The cost approach was more favoured as it ensured that the

investor does not make losses as the cost of the building will offset the costs the investor had to incur to put up the building.

Comparable sales method was second. This method compare recently sold similar properties with the piece of property seeking to be sold. Price adjustments are then made based on the various differences. The comparable sales method however was not used in isolation rather it was used as a supporting method of valuation by the cost approach method.

The hedonic model was said to have lost its relevancy in the Kenyan market in the face of the leading two methods of valuation. The other two methods are based on the market and the costs of building the property, the hedonic model however looks at the physical attributes of the property only. Thus making it an unpopular method of evaluation for the real estate firms, agents and valuers.



4.3: Regression analysis

The objective of the project was to find out what factors are used in the arbitrary real estate pricing and valuation so as to what factors can be used in the hedonic model for pricing. In order to find out the variables the details found out from the valuers and agents were subjected to a regression analysis in order to find out the contribution of each unit of comparison to market value of a residential property.

The variables included in the regression analysis were title, location, area of plot, area of main house, number of bedrooms, number of bathrooms, number of reception rooms, market rent and date of sale.

The regression analysis was done using the tables 4.1.1, 4.1.2, and 4.2 in the appendix.

The results of the regression analysis were as follows:

Correlation coefficients of the variables

The following were the correlation coefficients of the variables to the market values:

Market Variables	Correlation coefficient
Market Rent	0.6517
Location	0.5715
Area of main house	0.5235
Number of bathrooms	0.4721
Area of plot	0.4557
Number of reception rooms	0.3904
Number of bedrooms	0.2724
Title	-0.1700

Location is highly correlated to the area of main house

Area of main house is highly correlated to the location and the number of bedrooms

Rent is highly correlated to area of main house and number of bedrooms

In view of the number of variables in the equation all the variables were entered using the stepwise method.

The result of the regression analysis using SPSS were as follows

Regression Output

Multiple R	0.8369
R Square	0.70049

Adjusted R Square	0.59631
Standard Error	2643935.1480

Analysis of variance DF	Sum of squares	Mean square
8	376020959462204.600	470026199332775.6
23	160779040537795.500	6990393066860.67

F= 6.72389

Significant F= .0001

Another regression analysis was carried out to determine the factors that affect the price of rent of residential properties in, the results were as follows

Variable	T	Sig T
Area of main house	6.730	0.000
Location 1	0.522	0.1388
Number of bathrooms	1.203	0.2387
Number of Reception Rooms 1	1.097	0.2817
Number of Bedrooms	0.902	0.3746
Title	0.370	0.7141
Area of Plot	-0.184	0.8549

Multiple R	0.77560
R Square	0.60155
Adjusted R Square	0.58827
Standard Error	145657.08817

Analysis of variance DF	Sum of squares	Mean Square
Regression 1	960907879987.08000	960907879987.080
Residual 30	636479620012.92000	21215987333.7640

F=45.2917

Significant F= .000

From the regression analysis with regards to the significant factors that affect the value of the residential properties in the same location are; the area of the plot and rent

Rent on the other hand is affected by; the area of the main house location and accommodation in reference to the number of bedrooms and reception rooms.



CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The objectives of the research paper was to find out the pricing strategy that is used in Nairobi County in the pricing of real estate, furthermore, the variables that are used in the pricing methodology of the properties.

This chapter entails the summary of the findings from the research that was carried out and some recommendations based from the findings.

5.1 Summary of Findings

5.1.1 the factors that are considered in the valuation of real estate property in Nairobi County

From the factors that were considered in the valuation of residential properties according to the factors that are given priority are as follows

Date of valuation of the property, this is key as to ascertain the economic conditions especially when using the comparable sales method, the state of the economies may be different.

Land reference Number, given the rise in cases of fraud, the land reference number that has been acknowledged by the land ministry ensures that the house will not need to be demolished in the future because it is on land reserved for public use, for example construction of roads.

Title deed, the possession of a title deed ready to be processed to the buyers name is crucial to curb fraud, where third parties take up property that does not belong to them and sell to unsuspecting public.

Location Characteristics, for example: distance from the central business district, this gives the house more demand as it located next to social amenities especially for residential houses, a central location is dimmed more attractive.

Area of the plot, this is in regard to the size of the property in relation to the price that the real estate firm is selling the property at.

Characteristics of the plot, for example: infrastructure, soil, and climate. The infrastructure surrounding the property for example road frontage automatically raises the demand for the property as this allows for a proper transport network to and from the property.

Services (water, electricity), this is crucial and in the marketability of a piece of property. Collection of waste and drainage is also key when looking at the services provided to the piece of property.

These are the factors that real estate valuers and real estate firm take into consideration in the pricing of the property in the county. A piece of property portraying all the desirable factors being sought out by consumers will generally attract a higher price than a property that may be missing some of the factors.

5.1.2 The method of valuation used

The methods cost approach, comparable sales and investment approach they are all used interchangeably in the valuation of real estate property in Nairobi. However the method most adopted is the cost approach method especially for the residential properties.

In valuation of the property, the figure arrived at using the cost approach is compared with the comparable sales data obtained from within the organization. From the comparable sales data the details obtained include: area of the plot, area of main house, location, date of sale

5.2 Conclusion

Residential properties are not homogenous therefore one property will not be similar to another property. Therefore different realtors will take up different methods to value the properties but the most used method is the income approach method or the investment approach, however, these valuation methods borrow from the comparable sales model in order to get data.

Therefore from the findings of the research it can be concluded that the hedonic pricing method is not applicable in the valuation of real estate properties, the hedonic model is overtaken by the other three methods. Here are some of its limitations and shortcomings:

The scope of environmental benefits that can be measured is limited to things that are related to house prices

The method only captures people's willingness to pay for perceived differences in environmental attributes and their direct consequences. Thus, if people aren't aware of the linkages between the environmental attribute and benefits to them or their property, the value will not be reflected in home prices

The method assumes that people have the opportunity to select the combination of features they prefer, given their income. However, the housing market may be affected by outside influences, like taxes, interest rates, or other factors

The method is relatively complex to implement and interpret, requiring a high degree of statistical expertise

The results depend heavily on model specification

Large amounts of data must be gathered and manipulated.

The time and expense to carry out an application depends on the availability and accessibility of data.

5.4 Limitations to the study

In conducting the study there were a few limitations that strained the procedure of the study.

Some of the challenges faced included the collection of adequate data as most real estate firms were hesitant in sharing their information, which proved quite tedious, as the researcher needed to avail documents to prove that they belong to an institution of higher learning.

Low response rate for the questionnaires sent to the various individuals charged with the task of valuing the property. Constant follow-ups were required in order to get responses from the individuals.

The presence of confidentiality clauses as well proved to be a struggle as some of the material that I was seeking to collect from the data fall in the confidentiality clause. Such include; valuation dates, land reference number.

Some data was collected from secondary sources, it was thus a big limitation when some sources of secondary data required payment to be able to access the data bank.

5.5 Areas of Further Research

This research has indeed confirmed the applicability of the hedonic model in the real estate industry in Kenya, specifically Nairobi County. There is need to research on the standardization of valuation process and the method of valuation. Further research should be done on the variations in market value of residential properties



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Appendix

4.1.1: Property Details

	Frequency of occurrence	Ranking
Date of inspection	1/20	13
L.R Number	17/20	2
Title	19/20	1
<u>Location:</u>		
Estate	17/20	
Street/Road	15/20	3
Distance from CBD	12/20	6
Distance from shopping centre	2/20	11
Distance from Social Amenities	1/20	
Planning Regulations	7/20	9
Area	17/20	2
User	4/20	11
<u>Characteristics of the plot:</u>		
Shape	12/20	6
Soils	14/20	4
Topography	5/20	10
<u>Site-works:</u>		
Gates	12/20	6
Fencing	14/20	4
Garden	11/20	7
Driveway	9/20	8
<u>Services:</u>		

Water	14/20	4
Electricity	14/20	4
Drainage	14/20	4
Telephone	5/20	10
Road Frontage	5/20	10
Security systems	Nil	
<u>Developments:</u>		
Design (single or double storey)	19/20	1
Construction details	13/20	5
Accommodation	15/20	3
Outbuildings	14/20	4
Condition of repair /decorations	4/20	11
Areas of the development	4/20	11
Tenancy	3/20	12
Date of construction	2/20	13
<u>Non property characteristics</u>		
The state of the market	5/20	1
Effect of interest rates	1/20	4
Characteristics of neighbourhood	3/20	3
Comment on the design and accommodation	4/20	2

Sources: Institution of Surveyors of Kenya Diploma Examination Papers

4.1.2: Method of Valuation

	Frequency of Occurrence	Ranking
Comparable Approach	4/20	2
Investment Approach	2/20	3
Cost Approach	12/20	1
Hedonic approach	-	-
<u>Determination of value:</u>		
Comparable Sales	10/20	1
Average of two or three methods	2/20	2
<u>Number of comparable sales used</u>		
0-5	12/20	1
5-10	2/20	2
Above 10	Nil	3
<u>Method of analysis of comparable Sales</u>		
Unit cost	5/20	1
Cost analysis	3/20	2
Paired Data	1/20	3
Adjustment	1/20	3
Regression Analysis	Nil	
Graphic analysis	Nil	
Trend analysis	Nil	

Source: Institution of Surveyors of Kenya, Diploma Examinations Papers

4.2: Methods of valuation adopted in valuation of residential properties

This data was obtained from interviews and Questionnaires with valuers in Nairobi.

The respondents were chosen at random from list of registered valuers.

	Frequency of occurrence	Ranking
Comparable sales Approach	-	
Investment Approach	-	
Cost Approach	20/22	
<u>Methods mostly adopted in valuation of up-market properties above Kshs. 5.0 million</u>		
Comparable Sales Approach	5/22	2
Investment Approach	4/22	3
Cost Approach	15/22	1
Hedonic Approach	-	-
<u>Determination of value</u>		
Average	5/22	2
Rule of Thumb	1/22	3
State of market	1/22	3
Comparable Sales	15/22	1
<u>Sources of comparable sales data</u>		
From within the organization	20/22	1
Other valuers	19/22	2
Estate Agents	18/20	3
Sellers	16/20	4
Buyers	10/20	5
Land Office	12/22	6
Print Media	2/22	7

Auctioneers	1/22	3
<u>Method of analysis of sales data :</u>		
Unit cost	12/22	2
Cost analysis	14/22	1
Paired data	3/22	3
Adjustments	Nil	-
Regression Analysis	Nil	-
Graphic analysis	Nil	-
Trend analysis	Nil	-
<u>Number of comparable sales obtained</u>		
0-5	18/22	1
5-9	3/22	2
Above 10	Nil	-
<u>Details obtained on comparable sales data</u>		
Date of Sale	11/22	3
L.R Number/Title	10/22	4
Location	12/22	2
Planning/Zoning regulations	2/22	7
Area of plot	15/22	1
Area of main house	12/22	2
Construction details	9/22	5
Accommodation	11/22	3
Rent	5/22	6