Journal of
African Real Estate Research

Volume 4, Issue 1

OpenUCT

JARER

Volume 4 Issue 1

<u>Table of Contents</u>

<u>Articles</u>

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA · UNIVERSITEIT VAN KAAPSTAD

Editorial

Welcome to the first issue of the fourth volume of the Journal of African Real Estate Research (JARER). This is our first publication for 2019 and my first as Editor-in-Chief. Since its relaunch, the JARER has offered opportunities for academic and professional researchers across Africa to disseminate their scholarly work in the real estate sector. There has been an increasing rate of submissions and our appreciation goes to the board members of the African Real Estate Society, the Library services at the University of Cape Town, and the Journal Manager, Luke Boyle from the Urban Real Estate Research, who has been working tirelessly in managing the journal's operations. The JARER continues to be strongly supported by IRES, ERES, and Prof. Karl-Werner Schulte from the IREBS at Regensburg University. Without this support the journal would not be financially sustainable. We also thank the many authors for publishing in the journal, and of course, our reviewers and editorial board who have given generously their time to review the papers.

The current issue focuses on a wide range of topics cutting across diverse areas of interest in real estate. It is encouraging to see a increasing number of papers dealing with valuation standards, variance and inaccuracies. Additionally, we are receiving an increasing number of papers which deal with the mechanics of residential property markets and the analysis of REIT investment markets. Reflecting international trends, this issue has attracted papers with a focus on behavioural economics and finance.

The first paper discusses the use of less researched heuristics in mortgage valuations in Tanzania. The type of heuristics examined include availability heuristics, representative heuristics and positivity heuristics. The study concludes that surveyors' often deviate from prescribed valuation procedures. Such behaviour has implications for market transparency and the risk associated with emerging African property markets which need to rely.

The second paper examines the factors influencing the choice of residential location by tenants in Bosso Local Government Area in Minna, Nigeria. From the results of the study, the authors recommend the need for property owners to pay attention to the provision of the right ratio of bathrooms and toilets to the number of bedrooms. While specific attention is paid to conditions in the city of Minna, Nigeria, the paper has implications for other developing regions.

Similar to the second paper, the findings of the third paper, examining stakeholder perceptions of Residential Rental Value (RRV) determinants in Accra, Ghana, suggest that electricity and piped water connection, type of house, property condition, and number of bedrooms are the most significant determinants of RRVs in Accra. This is another interesting piece of research which provides an understanding of rental market dynamics in a African cities.

The fourth paper provides an econometric analysis of the relationship between the the dividend yield of Nigerian Real Estate Investment Trusts (N-REITs), and Money Market Indicators (MMIs). The study found that there are both a short-term and long-term relationships between N-REITs and MMIs. This will be of particular interest to investors, analysts and capital market players.

The fifth paper investigates the implication of valuation inaccuracy on investment performance of commercial properties in Akure, Nigeria. The results show that the effect of valuation inaccuracy on commercial property investment performance is statistically insignificant. However, authors recommend that valuers exercise caution in making assumptions in the use of market indices during valuation.

Numerous studies have suggested that the accuracy of valuations and the variation of these valuations are caused by human adaptive approaches and that valuers are prone to anchoring. Such anchoring

parameters include asking price, previous estimates and other reference points. The sixth paper from South Africa examines the efficacy of a decision-support tool in reducing property appraisal bias. The study revealed that respondents/valuers were susceptible to anchoring bias and that the use of decision-support tool can help reduce the tendencies for anchoring bias, thereby decreasing valuation variations.

The final paper studies the rate of urban expansion and the subsequent loss of agricultural land in Osogbo, Nigeria. The study adopted an approach using multi-temporal imageries to map the changing land uses in the study area from 1986 to 2018 and found a significant acceleration in changing land use from agriculture to urban from the period 2002 to 2018. The study recommends that governments integrate agricultural lands into urban land use planning for efficient management and protection of the dwindling agricultural space.

I expect that you find the research in this issue of the Journal of African Real Estate Research interesting, thought provoking and informative. I look forward to receiving manuscripts for inclusion in future issues of the journal.

Best wishes,

Professor Abel Olaleye
Editor-in-Chief

The Use of Less Relevant Heuristics in Mortgage Valuations in Tanzania

Agnes Nkundwe Mwasumbi[1], and David Ignace Tarimo[2]

[1-2] Department of Business Studies, Ardhi University, Tanzania.

Abstract

Valuation-surveyors, like all other disciplines, are invariably influenced by a host of factors when estimating values for different purposes. Faced with complex decision-making in valuation, many surveyors are compelled to make use of heuristics (shortcuts). The use of heuristics helps to improve information processing systems and thus increase efficiency in decision-making processes. However, the unconscious use of these shortcuts often leads to errors in selecting solutions for the problem at hand. This study was aimed at confirming the use of less relevant and less researched types of heuristics in mortgage valuations in Tanzania. These included availability heuristics, representative heuristics and positivity heuristics. The study employed a survey research method whereby a sample of 56 valuation-surveyors from valuation firms based in Dar es Salaam were given questionnaires to complete. Out of the 56 questionnaires distributed, 44 were returned. The findings revealed surveyors' propensity to use less relevant heuristics for virtually the whole valuation process. In all the identified uses of heuristics the surveyors were found to have diverted from the prescribed valuation procedure. Such behaviours have the potential for propelling the use of wrong inputs in the value assessment process and/or modifying the final assessed value. Therefore, the findings provide another explanation for the causes of the already observed valuation variance in Tanzania.

Keywords: Heuristics; Mortgage Valuation; Valuation Standards; Behavioural Study

1. Introduction

Valuations are carried out to estimate the probable market-price for a given property at a designated date. As such, a valuation is taken as a proxy of the price for a particular asset and is used in making financing and investment decisions. A valuation-surveyor provides a value estimate which is a close

[1] anmwasumbi@yahoo.ca
[2] davignace@gmail.com

approximation of the market-price (French & Gabrielli, 2004; Mwasumbi, 2014). However, various researchers have indicated the existence of significant differences between price and the valuation opinions over the same property by different valuers (Parker, 1998; Crosby, 2000; Ayedun, et al., 2011), an observation which raises questions on the reliability of valuation output. In Tanzania, Geho (2004) noted an average of up to 35% deviation between assessed value and realizable market-price of properties located in areas with less vibrant real estate markets. Geho's observation not only indicates the inconsistency of valuations, but also the likely flaws in the estimates. Further, it has also been noted that such inaccuracies in valuation are inevitable (Havard, 2001; Babawale & Ajayi, 2011). Such assertions point out the need for actions to ensure accuracy in valuation, given the serious impact valuations have on the profession and property market in general (Babawale & Ajayi, 2011; Adegoke, 2016).

Adegoke (2016) posits that valuation inaccuracy has the potential to send wrong signals to the market and is thus likely to create future uncertainties in the property market. The impact of valuation inaccuracy has gained the attention of Tanzanian practitioners in the valuation for mortgage lending. Many complaints have been lodged with the National Council of Professional Surveyors[1] (NCPS) by financial institutions on losses suffered by relying on valuation-surveyor's advice (Geho, 2004). Elsewhere, a study on valuation variance in commercial lending in the UK observed behavioural influences of valuation-surveyors as the leading cause for valuation variance (Bretten & Wyat, 2001). These include the use of shortcuts in decision-making also known as heuristics (Diaz, 1999). These examples and other similar experiences in various types of valuation, like rating-valuation as identified by Rwechungura (1988), substantiate the consideration for more serious action to curb inaccurate valuation (Geho, 2004).

The use of heuristics in human decision-making process is a result of limitations of the human brain, especially when faced with a complex task environment (Hardin, 1997; Havard, 2001). The application of heuristics helps to increase efficiency of information processing and problem-solving and hence saves energy and time (Hardin, 1997). However, the decision made using heuristics is not guaranteed to be the best since it avoids the detailed analysis of all situations (Romanycia & Pelleti, 1985). Existing literature on behavioural property research has identified four types of these heuristics as shown in Table 1 below.

Table 1: Types and Meanings of Heuristics

Type of Heuristic	Explanation
Availability Heuristics	Use of information that can be easily retrieved or reached.
Positivity Heuristics	Tendency of confirming existing beliefs.
Anchoring and Adjusting Heuristics	Use of anchor information such as previous valuations and adjusting to ascertain a value of a subject property.

---

[1] The Former Valuation Surveyor Registration Board of Tanzania

Representative Heuristics	Stereotyping behaviour. Defining a property by grouping it with other similar properties.

Source: Havard (2001)

Unlike others, the anchoring and adjustment heuristic received considerable attention by behavioural property researchers in the 1990's (Havard, 2001; Tidwell, 2011). Various studies such as Diaz and Hansz (1997); Baum et al. (2001); and Baum et al. (2002) confirmed the adoption of heuristics and its relevance to valuation tasks. This study, therefore, sought to further investigate the use of three less relevant and less researched types of heuristics in property mortgage valuations. These are availability heuristic, positivity heuristic and representative heuristic. The aim of this study was to confirm the use of these heuristics in the context of Tanzanian practice with regards to mortgage valuation. Through this confirmation, it was anticipated that the study will provide explanations for valuation inaccuracy which has been noted to be prevalent in property valuation practice in Tanzania. Further, the study aimed to establish a foundation of knowledge that will improve valuation practice.

2. Literature Review

Valuation is a process of generating point estimates and sometimes interval estimates or approximations of the market or rental value of an interest in property for a particular purpose at a specific point in time or time-interval (Geho, 2004). Put simply, valuation is the process of estimating the worthiness of the property at a given time. This process is scientific in nature as it follows a systematic procedure and a prescribed normative valuation model to arrive at the final opinion of value (Ayittley et al., 2006). Arguing on the nature of valuation, Damodaran (2002) established that although the models that are used in valuation may be quantitative, the inputs leave plenty of room for subjective judgments. Thus, it requires one to have technical and professional skills before undertaking any valuation assignment. As decreed by RICS (2012) and IVS (2011) valuation-surveyors are required to apply professional judgment to interpret property values. Given the imperfect and heterogeneous characteristics of the property market and the resulting scanty information, application of a normative valuation model is normally complex, time-consuming and cognitively challenging (Tidwell, 2011). Accordingly, valuation-surveyors have had a tendency to divert from prescribed normative valuation procedures by using simplifying heuristics (Havard, 2001).

2.1 Human Information Processing System

The explanation behind problem-solving and decision-making as required in various stages of the valuation process is mainly found in the field of cognitive psychology. Researching in that field, Simon and Newell (1970) developed a theory, Human Problem Solving Theory (HPS) which described the human problem-solving process as similar to that of computers. Like the Random Access Memory (RAM) and Hard Disks for computers, the human information processing system was considered to have two aspects including short-term and long-term memory (Baddeley, 1999). In tackling the problem

or handling a task it confronts, the human brain makes use of its information processing system. In their 1970 study, Simon and Newell established characteristics of information processing system as shown in Table 2 below.

Table 2: Characteristics of Information Processing System

S/N	Characteristic	Implication
i.	Serial operation.	It only does one process at a time and not otherwise.
ii.	The inputs and outputs are stored in small short-term memory which has limited capacity.	The time it requires to access this memory is in order of milliseconds.
iii.	It has access to an infinite long-term memory.	The time it requires to store a symbol in it is in order of seconds.

Source: Simon and Newell (1970)

To solve a particular problem the human information processing system works alongside the problem space and the programme. The function of the programme is to search for the problem space. The HPS theory explains the problem space as the representation of the problem environment which is the way the actual problem is defined in the internal memory. It is where situations which are known to the problem solver reside. When an individual problem solver confronts a task, he/she uses the processor to selectively search for a solution from the multiple situations or nodes contained in the problem space which corresponds to the task environment (Simon & Newell, 1970). The search normally goes through the different nodes in the problem space, in a serial fashion, until it finds the correct node and operator. The size of the problem space is not the same for all problems, even so, most problem spaces have an enormous size. This problem-solving process is generally referred to as Weighted Additive Rule (WAR). The searching and analytical activity required by the WAR makes it tedious, inefficient and time-consuming.

According to Shah and Oppenheimer (2008), the WAR goes through a number of processes as shown in Table 3.

Table 3: Processes Involved in Weighted Additive Rule

S/N	Activity	Elaboration of the Activity
i.	Identifying all nodes.	All relevant pieces of information must be acknowledged.
ii.	Recalling and storing node values.	The values for the pieces of information must either be recalled from memory or processed from an external source.
iii.	Assessing the weights of each node.	The importance of each piece of information must be determined.
iv.	Integrating information for all alternatives.	The weighted node values must be summed to yield an overall value or utility for the alternative.
v.	All alternatives must be compared.	The alternative with the highest value should be selected.

Source: Shah and Oppenheimer (2008)

The choice mechanism process displayed in Table 3 above indicates the computational processing of the information (Ranyard et al., 2012). However, the capacity of the information processing system and the memory of humans has limitations. As the demand from the WAR tends to increase, humans have the habit of using the easy way around (Shah & Oppenheimer, 2008). These alternative means are referred to as Information Processing Heuristics (IPH).

2.2 Heuristics in Decision-making Defined

As is noted above, the use of heuristics is occasioned by the limited capacities of the human brain. The application of IPH has been found to be advantageous to problem solvers as it avoids the complex choice mechanism process of WAR. However, until recently the concept of heuristics has been defined differently by various authors. Romanycia and Pelleti (1985) summed some of the definitions as shown in Table 4 below.

Table 4: Definitions of Heuristics According to Various Authors

S/N	Author	Explanation	Definition
1.	Gelerner, Helbert (1958).	Earliest definition underscoring that heuristics work in effect by eliminating options from an impractically large set of possibilities.	"…*Heuristic is a filter that is interposed between the solution generator and the solution evaluator…*" Romanycia and Pelleti (1985: p.49).
2.	Sladge (1971).	After the early Artificial intelligence era in 1971, embracing all the standard definitions.	"…*Rule of thumb, strategy, method, or trick used to improve the efficiency of a system which tries to discover the solutions to complex problems…*" Sladge (1971: p.3).
3.	Boden (1977).	Heuristics considered as a process of evading unnecessary evaluations of information which seem to have no possibilities of providing a solution to the problem.	"…*Heuristic is a method that directs thinking along the paths most likely to lead to the goal, less promising avenues being left unexplored...*" Romanycia and Pelleti (1985: p.50).
4.	Newell (1980).	Heuristics seen in much similar way as those who did before 1980.	"…*Heuristics are rules of thumb and bits of knowledge, useful (though not guaranteed) for making various selections and evaluations...*" Newell (1980: p.16).

Source: Romanycia and Pelleti (1985)

It is important to note that from the definitions given in Table 4 it is apparent that a heuristic is considered a shortcut to decision-making. The complexities in real estate valuation processes have made it a norm for valuation-surveyors to resort to simplifying shortcuts. The heuristic principles exhibited by valuation-surveyors in their task as identified by Tversky and Kahneman, (1974) and later by (Havard, 2001; Iroham et al., 2013a; Iroham et al., 2013b) include Anchoring and Adjustment Heuristics, Positivity Heuristics, Availability Heuristics and Representative Heuristics.

Anchoring and Adjustment Heuristics (AAH) have been termed as an exceptional heuristic since these can be used within a normative process of valuation depending on the source of anchor adopted (Baum et al., 2002). AAH is considered a strategy in prescribed valuation procedures adopted to arrive at a valuation opinion. In its application the decision is arrived after forming and adjusting initial judgement given the available evidence (Havard, 2001). On account of AAH's close relationship with conventional valuation procedures, AAH has received an enormous amount of attention by various authors, including Gallimore (1994); Black and Diaz (1996); Diaz and Hansz (1997) as cited in Havard (2001); Diaz and Wolverton (1998); Tidwell, (2011); Iroham, (2013b). Tidwell (2011) considered AAH as the most relevant type of heuristic to valuation practice as compared to positivity, availability and representative heuristics. Subsequently, AAH has received considerable attention relative to the other three heuristics. Therefore, the rest of this work aims at confirming the usage of the other three heuristics (PH, AH and RH) which have been considered less relevant yet are still being used in the valuation process.

2.2.1 Positivity Heuristics (PH)

According to Iroham et al. (2013b) Positivity Heuristics (PH) is the propensity of the human brain to seek information that is consistent with their current beliefs and ignore the collection of evidence that is against their perception. Technically, when one uses this kind of heuristic the facts that seem to be different to the existing knowledge are normally refuted (Havard, 2001).

In this regard, valuation-surveyors tend to look for ways of confirming their perceptions of the world. Gallimore (1996) asserts that in the valuation process valuation-surveyors tend to make more adjustments with the use of positive information, that is, evidence that supports existing perception than with the negative information. Valuers are often seeking evidence to support their value estimates or perception rather than evidence that contradicts their perception. It is no wonder that valuers are accused of confirmation bias. He further postulates an innate motivation to confirm existing views and the difficulty that people face in formulating ways to look for contrary evidence as probable reasons for such behaviour. Studying this behaviour in Nigeria, Iroham et al. (2013b) observed further that valuation-surveyors tend to form an initial opinion of value before the actual valuation assessment. This supports Gallimore's (1996) view that, in carrying out valuations, valuation-surveyors' behaviour is influenced by, among others, internal knowledge on the subject and comparable properties in the form of value and price, even before the properties are precisely identified. Further, even when there is no basis for value/price preconception, a typical valuation-surveyor would still form the limits for the comparable/subjects' value/price.

2.2.2 Representative Heuristics (RH)

According to this type of heuristic, the decision-maker classifies an event or object with others of a type that they are familiar with (Havard, 2001). In this regard, the decision is influenced by past experience of the decision-maker,

in particular, by the classification that he/she makes. In a study carried out in Nigeria on the usage of heuristics it was noted that valuation-surveyors exhibit RH especially during the data collection step of the valuation process (Iroham et al., 2013b). In this regard, surveyors tend to interpret the subject property to be more representative of the comparable than the actual features suggest (Hardin, 1999). Furthermore, there is more likelihood for a valuation-surveyor to treat two properties in a similar way where there are some resembling elements between the two properties. Consequently, valuation-surveyors tend to overlook some of the unique details of the subject property. Iroham et al. (2013b) observed that features such as an extra bathroom, floor and wall finishes, as well as the size of the garage are often ignored. Similar properties with such differences will typically be treated in the exact same or similar way.

2.2.3 Availability Heuristics (AH)

Availability Heuristics (AH) rely on the ease with which information comes to mind (Havard, 2001). Elaborating this heuristic, Tversky and Kahneman, (1974) established that some elements may be available more frequently than others, not because they occur more often, but because they are easier to recall or retrieve. In this regard, decisions are more likely to be influenced by past experience which can be easily retrieved or reached. The human decision-making mechanism in this accord tends to be based on previous situations faced and successfully negotiated. Once a perception on a concept has been formed it is very difficult to change this perception unless a negative feedback is provided (Hardin, 1999).

In the valuation process, data collection tends to be based on the ease of retrieval, meaning that the decision-maker (surveyor) will choose the most recent information or the information most easily recalled or obtained. This was found to be the case when valuation-surveyors utilise easy means of data input and ignore sanctioned procedures (Iroham et al., 2013b).

As seen from the discussion above, past experience of the valuation-surveyor appears to be the most dominant among the three types of heuristics. In the main, while PH is based on confirmation of ones' perception, the AH is about the influence of information that is easily recalled/retrieved. Noted here is that the two heuristics, namely availability and positivity (AH and PH), relate to the perception of the problem solver. While PH seeks to confirm the perception, AH is about the perception that is easily called to mind. In RH, past experiences tend to cloud the unique features of individuals/objects in the population by making classification based on their major similarities.

2.3 Impacts of Information Processing Heuristic

To sum up the literature, the application of information processing heuristics seems to be advantageous to the problem solver. Dietrich (2010) noted that heuristics serve as a framework in which satisfactory decisions are made quickly and with ease, hence increasing efficiency in problem-solving by avoiding unnecessary evaluations. Moreover, heuristics were reckoned to be

preconscious since they allow for rapid acquisition and implementation of data search procedures when tackling familiar tasks (Hardin, 1999). But as noted by Havard (2001), these tasks are apparently uncertain and often complex on account of insufficient data. Consequently, valuation-surveyors might not be able to perform their duties without applying heuristic strategies. The application of heuristic strategies has tended to increase the effort-benefit ratio in the decision-making process (Dietrich, 2010). In earlier studies, Romnycia and Pelleti (1985) had contended that solutions arrived by the use of information processing heuristics could not be guaranteed as the optimal solution. Later studies, such as that by Havard (2001), established that diversion from sanctioned valuation processes (heuristics) invariably leads to valuation variance.

Unconscious usage of heuristics has been observed as introducing high chances of valuation variances by several authors (Bretten & Wyat, 2001; Havard, 2001; Diaz & Hansz, 2007; Babawale & Omirin, 2012). Whereas heuristics in valuation have not been studied in sufficient detail in Tanzania, a study carried out during 2014 confirmed biases and client influences in valuation processes were the main factors that led to complaints against valuation assessments (Mwasumbi, 2014). Complaints against assessed values were not necessarily a reflection of erroneous valuation, but rather the lack of uniform comparable data and therefore the greater lenience towards valuation clients' influences on the value assessment.

3. Methodology

This study involved valuation firms that are actively practising mortgage valuation in Dar es Salaam. Dar es Salaam metropolis is the most important commercial city in Tanzania and therefore, it provides a sufficiently vibrant economic base and enough valuation activities to provide rich studying conditions. Moreover, virtually all actively practising valuation firms in the country have their headquarters, or at least an office, in Dar es Salaam.

3.1 Research Approach and Method

The main objective of this study was to establish the extent to which heuristic behaviour in mortgage valuations is influencing valuation assessment in Tanzania. The focus was mainly to create an awareness of the usage of PH, AH and RH which have been categorised as less relevant to valuation practice as compared to AAH (Havard, 2001). The study was designed to determine whether heuristic behaviours are underpinning the replacement cost method, which is the most commonly applied in all mortgage valuations in Tanzania (Waigama, 2008). The excessive use of this method is alleged to be due to insufficient quantity and quality of open market transactional data (Geho, 2003).

In order to better understand the problem and achieve its objectives, this study adopted realism ontology assumptions which holds for the existence of a single truth, and therefore a quantitative approach. According to Tavakoli (2012), the quantitative approach enables a generalisation of the findings

since it involves tightly controlled and precise measurements. The choice of such approach was motivated by the desire to generalise the findings to the whole population of valuation-surveyors in Tanzania. This requires the involvement of a larger sample, as was done in other behavioural research (Gallimore, 1996; Diaz & Hansz, 1997; Iroham, et al., 2013b).

Under the quantitative approach, there were two options of the research methods to adopt; experiment and survey. Designing of an experiment is usual and logical in behavioural property studies since in such cases humanity becomes the object of description, as once observed by Diaz (1999). Indeed, there is a considerable number of behavioural property research that has employed the use of experiments in understanding the valuation surveyors' characteristics (Havard, 2001; Iroham, et al., 2013). However, the use of this method is limited by its large budget requirements (Akinjare et al., 2013). Experiments would also have required deploying research assistants with the likelihood of an inability to meet their operational expenses and the requisite morale to carry out the research. It would also have required reducing the size of the sample as costs increase with sample size as well as the time for the study. In the same way, an experiment designed in the form of simulation would not have involved all the necessary stages of the valuation process, such as actual property inspection and data collection, in which the surveyors' behaviour comes to light.

Consequently, this study employed the second option, the use of cross-sectional survey method. This involved an investigation of the valuation-surveyors' perception on the whole valuation process where replacement cost method is used. The identified disadvantage of using this method is the risk of overreliance on respondents' views and their analysis. To escape this predicament survey tools were prepared and pre-tested to pre-selected experienced valuation-surveyors prior to the actual data collection in agreement with what Krosnick (1999) had advocated.

3.2 Sampling

Given the distributed nature of the study population, the sampling process involved two stages; first selecting firms and then valuation-surveyors within the selected firms. The first stage of sampling adopted purposive non-probability sampling. Out of 54 valuation firms registered with the NCPS, which is the professional valuation registration board (as it was then), 20 firms were purposely selected to cater for the requirements of this study. On account of critique by scholars such as Kronsnik (1999) that the use of purposive sampling would produce non-representative samples, it was imperative to evaluate and consider only those firms that were proven to be active and with commonly acknowledged competent valuation personnel within the city of Dar es Salaam.

In the second stage of sampling, convenience and less invasive non-probability sampling techniques were applied. The convenience technique was used for 14 firms out of the sampling list. This technique was adopted to the firms that accepted to respond to the questionnaire at drop-off. The

application of convenience sampling was efficient since the questionnaires were collected on the same day that they were distributed, saving both time and money. The less invasive non-probability technique was adopted for the remaining 6 firms. Under this technique, the questionnaires were handed out to the managers of the firms for them to distribute to valuation-surveyors in their respective firms. The less invasive non-probability technique has been advocated in various studies for affording involvement of large samples and high completion rates (Kelly et al., 2012; Mwasumbi, 2014).

A total of 56 questionnaires were issued to valuation-surveyors employed in private firms; 44 were completed and collected. The response rate as therefore 78.8% which was considered satisfactory for the study.

3.2 The Questionnaire and Data Analysis

The questions contained in the questionnaire were all closed-end type structured as inspired by other related studies (Gallimore, 1996; Diaz & Hansz, 1997; Iroham, 2012; Iroham, et al., 2013a). However, some of the questions were formulated after consultations with the experienced valuation-surveyors in the field. The lack of challenges on the use of such instruments in these other early studies became proof for validity and reliability of the instruments.

The questionnaire was structured such that each heuristic type had a set of questions depending on how much it was anticipated to be used in the valuation process. In that manner, the tool contained seven questions for AH, three questions for RH and four questions for PH. All questions in the questionnaire used nominal scale except one under RH which adopted the use of a Likert scale making it an ordinal scale type. The use of Likert scale to test for relativity had also been used by other researchers in the behavioural property research field including (Iroham et al., 2013a).
The analysis started with descriptive statistic for the whole dataset whereby the frequencies and the percentages for all responses were identified. The analysis was in the form of a univariate which entails the description of a single variable only (Babbie, 2007). According to the requirements of the objective for this study, the analytical tool was descriptive statistics using Microsoft Excel. The obtained frequencies/percentages were then presented in tables and various types of bar charts, including compound and simple bar charts. For the ordinal scale question which adopted a Likert scale, the Relative Importance Index (RII) (see equation below) was used. According to the RII, the feature with the highest index is the one with the highest ratings and so most influential considering the perceptions of the respondents.

$$RII = \frac{\sum W}{A * N}$$

Where: W – is the weight given to each factor by the respondents and ranges from 1 to 3, (where "1" is "Low" and "3" is "High");

A – Is the highest weight (i.e. 3 in this case); and

N –the total number of respondents.

However, since the requirement was about how much the features, in general, were being considered in valuation, the average RII for all features was calculated.

4. Results

In this study we investigated the extent of use of the three heuristics selected (AH, PH and RH) and its implication to valuation practice in Tanzania. For each of the three heuristics studied a set of specific questions probed the use in the order below.

4.1 Availability Heuristics (AH)

AH behaviour was examined through seven independent questions that sought to establish the sources of various information and tendency to use easily available information when carrying out valuations for mortgage.

With regard to sources of information, valuation-surveyors were asked to pick on average the number of sources they consulted in ten valuations they could recall. More than half of the respondents (29) indicated using at least two sources of information to arrive at value conclusion whereas 15 conceded to using more than two sources. Probing the approaches used by the valuation-surveyors to obtain land rates it was observed that about half of the respondents (23) rely on rates provided by the Office of Chief Government Valuer (CGV) in the Ministry of Lands, while a small proportion indicated using market evidence as indicated in Table 5 below.

Construction rates per m^2 is one of the most important inputs in valuation in Tanzania. Table 5 highlights the sources relied upon by valuation-surveyors to obtain construction rates. Thirty six percent of the respondents confirmed the use of "*general knowledge or intuition*" such as unguided adjustments of the rates from previous valuations. Interestingly, about 61% indicated adopting construction rates obtained from various institutions in the construction sector, i.e. the Architects and Quantity Surveyors Registration Board (AQRB) and the National Construction Council (NCC). Among those who obtain construction rates from the boards, 7% adjust these rates by intuition to fit the subject property. Seventy Four percent of respondents were noted to adjust rates in line with market cost levels, while 19% make adjustment on the basis of previous rates approved by the CGV.

Table 5: Availability Heuristics

Sources of Data	Approaches to Arrive at Land Values			Approaches to Construction Rates			Techniques used to obtain details of materials			Approaches to Depreciation Amount/ Factor			Approaches to Forced Sale Value Amount/ Factor		
Sources	#	%	Approaches	#	%	Approaches	#	%	Techniques	#	%	Approaches	#	%	Approaches	#	%
Single	4	9%	Adjusting the rates provided by the ministry	23	52%	Using "*general knowledge*"	16	36%	Enquire from the client	8	18%	Experience from the previous valuations	4	9%	Experience from the previous valuations	9	20%
Two	25	57%	Obtaining the rates from the market evidence	12	27%	Calculations using formulas as per Valuation Handbook	1	2%	Using Experience	29	66%	Estimate from the appearance of the building	33	75%	After market search	13	30%
Three	8	18%	Relying on other surveyors' information	9	21%	Obtaining the rates from NCC, AQRB and other relevant boards and agencies	27	61%	Applying general knowledge	7	16%	Using yardstick and mathematical formulas	5	11%	Using company standards	18	41%
More than three	7	16%	others	0	0%	Others	0	0%			0%	Other	0	0%	Other	0	0%
												No response	2	5%	No response	4	9%
Total	44	100		44	100		44	100		44	100		44	100		44	100

Source: (Author, 2016)

Normally, the construction cost unit rate to be applied in the Depreciated Replacement Cost (DRC) method is an all-inclusive rate that covers all costs which, according to IVS 105 of 2017, is reflective of either (i) cost of similar asset offering equivalent utility (ii) cost of recreating a replica of an asset or (iii) sum of separate value of the components that form the asset.

In the survey, we probed an all-inclusive cost rate used irrespective of the above categories. In the discussion, it was apparent that most valuation-surveyors subscribe to IVS 105: 70.11 which provides for an all-inclusive rate that includes direct and indirect costs. These are listed in the IVS 105 as cost items:

a) Direct Cost Items: materials and labour.
b) Indirect Cost Items: transport, installation, professional fees (design, permit, architectural, legal, etc.), other fees (commissions, etc.), overheads, taxes, finance (e.g. interest on debt financing), and profit margin/entrepreneurial profit to the creator of the asset (which will include return to investors).

As such, in deciding on the construction rate to use, among other items of cost, valuation-surveyors need to have a clear understanding of the materials used to make various elements of the building and their pertinent details. This helps in making a proper search for such materials and thus allows them to do the needful adjustments in order to obtain an appropriate construction rate. In this regard, valuation-surveyors were asked to pick from the list of alternative means of getting details on the materials or list any other if not included in the list. Table 5 indicates over 60% of the respondents rely on data available within their jurisdictions in deciding on the rate to adopt. It is further noted that a small percentage of 16% rely on rates available in their offices which are often broad in nature and ignores variation in the specifications, quality and type of materials used in the construction. For example, although floor tiles are available in different sizes, brand, quality and prices, this group of valuation-surveyors assume a uniform rate for all tiled structures. The general observation indicates that 82% of all respondents tend to use information that is readily available to them.

Further, surveyors were asked to identify an approach that they mostly use in determining depreciation amounts when using DRC method. The results as displayed in Table 5 above show that the majority of respondents estimate the depreciation just from the appearance of the building with a few using probabilistic yardsticks, mathematical formulas and their experience from other valuations to estimate the depreciation amount of the subject property.

In valuation for mortgage purposes, valuation-surveyors are required to provide their clients with a two-value opinion; market value and Forced Sale Value (FSV) of the subject property. The reason for providing FSV is to help the mortgagee understand the appropriate amount to lend given the risks of defaults. Thus, the FSV refers to the proxy of the price that can be obtained in a shortened marketing period. Since the forced value is the function of market value and the FSV factor, it was deemed important to establish the

determinant of the FSV factor. From Table 5 it is evident that the use of company standards and market research is more pronounced among the respondents. As observed earlier on, valuers also use experience from the previous valuations to estimate the FSV factor for the subject property.

4.2 Positivity Heuristics (PH)

In the search for the use of PH, respondents were asked four related questions. All of these questions were set to determine the valuation-surveyors' tendency to confirm the preconceived value in the valuation process, particularly when the replacement cost method is adopted.

Out of the 44 responses received, 32 conceded that they normally have an indication of the value prior to undertaking the valuation. However, 13 out of these 32 (40.6%) would nevertheless ignore the preconceived value and adopt assessed value. Interestingly, a similar number of respondents expressed that they would adjust the assessed value with the preconceived value, while a minority of 6 (18.8%) would average the two opinions as to arrive at the opinion of value, as summed up in Table 6 below. Such statistics show that among the 32 surveyors who formed value predictions, 59.6% of them are influenced by such predictions in concluding the opinion of value.

Further, it was observed as displayed in Table 6 that the majority of respondents who form value predictions do so by using the experience they have had in doing valuation of properties in a particular locality. A small proportion (9%) of the respondents admitted to forming predictions of value due to clients' influence. The confirmation bias was also tested by looking at the reasons provided by surveyors when ending the data collection stage of the valuation process. The question suggested three possible factors used to determine when the data collection stage of valuation should come to an end. The results are as presented in Table 6 below.

Table 6: Positivity Heuristics

Tendency of Forming Predictions of Value before the Actual Valuation Assessment			Action taken due to great variation between pre-conceived and assessed value (Follow-up Question to those who form Prior Predictions)			Basis for Value Predictions (Follow-up Question to those who form Prior Predictions)			Decision to End Data Collection Stage of Valuation Process		
Responses	#	%	Action	#	%	Basis	#	%	Reasons	#	%
Yes	32	73%	Adjust the assessed value to preconceived value	13	41%	Experience in valuing such kind of properties in that locality	29	91%	After being satisfied that the collected data will support your valuation	27	61%

No	12	27%	Average the two values	6	19%	Influence from clients	3	9%	After reaching the set standard of the firm such as the number of comparable properties	2	5%
			Adopt the assessed value	13	40%	Other	0	0%	After being satisfied that all reasonable comparable properties have been captured	15	34%
Total	**44**	**100**		**32**	**100**		**32**	**100**		**44**	**100**

Source: Author (2016)

A further inquiry based on information as indicated in Table 6 above revealed the majority (61%) end the data collection stage after collecting data which they assume supports the valuation assignment. Thirty four percent of the respondents end the search after capturing all reasonable comparable properties' data, while 5% of the respondents follow their company's standard by evaluating a set number of comparable properties.

4.3 Representative Heuristics (RH)

To test RH, respondents were asked three questions based on property inspection and description stage of the valuation process. These questions aimed at checking the valuation-surveyors' tendency to ignore the impact of unique features of the property because of some easily noticeable similarities. The first question inquired whether the respondents typically take interior measurements when valuing for mortgage purposes. As observed in Table 7, only 16% of all respondents did take interior measurements. Despite this, 43% of all respondents admitted that interior measurements of various units of the property like the sitting room, kitchen or bedroom are significant to the value of the property.

Table 7: Significance of Interior Measurements on Value Estimate

Responses	Taking Interior Measurements		The significance of Interior Measurements to Value of a Property	
	Frequency	Percentage	Frequency	Percentage
Yes	7	16%	19	43%
No	37	84%	25	57%
Total	**44**	**100**	**44**	**100**

Source: (Author, 2016)

In addition, surveyors were asked whether they would be willing to pay more (as buyers) for a property that is similar to the other in general design, gross external area and materials located in an estate with slight differences in some features including; extra kitchen, number of bedroom, extra sitting room, larger parking, larger store and extra bathroom. In this question, a 3-level

Likert scale was used to calculate relative importance index (RII) as displayed in Table 8.

Table 8: Added Property Features

Features	Scale	Ratings		RII
		Frequency	Percentage	
Number of bedrooms	High	36	82%	**0.94**
	Medium	8	18%	
	Low	0	0%	
Extra sitting room	High	12	27%	**0.72**
	Medium	27	62%	
	Low	5	11%	
Larger garage/parking	High	12	27%	**0.63**
	Medium	15	34%	
	Low	17	39%	
Extra bathroom	High	7	16%	**0.58**
	Medium	18	41%	
	Low	19	43%	
Extra kitchen	High	3	7%	**0.51**
	Medium	18	41%	
	Low	23	52%	
Larger store	High	3	7%	**0.49**
	Medium	15	34%	
	Low	26	59%	

Source: (Author, 2016)

From Table 8 above it can be noted that valuation-surveyors are most likely to ignore the size of storeroom in their value assessment than they would for the size of the kitchen or an extra bathroom. As listed above, the number of bedrooms seems to be the most important factor for the value of the property compared to the rest. The results of the RII means that valuation-surveyors regard all other features except for the size of the storeroom. The general average RII for all rated features as shown in Table 8 above is 0.645.

5. Discussion of the Results

5.1 Reliance on Easily Available Information

This study has provided evidence for valuation-surveyor's inclination to use easily available information. Such an observation confirms the dominance of AH in mortgage valuation in Tanzania. In establishing land values, this study noted the excessive use of two data sources, land value rates fixed by the CGV in the Ministry of Lands Housing and Human Settlement Development, and to a lesser extent rates that the individual valuers pick from local market transactions. However, valuation normative models developed by professional bodies including the IVSC, prescribe reliance on information from the market for accurate value estimates. Land value rates developed by the CGV office are more indicative rates than market rates as they are developed and reviewed every 3-5 years. These rates were developed to ensure uniformity and consistency in value predictions. Valuers rely on these

rates mainly because they are easily available relative to market rates which are limited due to a fairly inactive property market.

Likewise, deviations from standard practice were observed in estimation of FSV and deprecation. A considerable percentage of valuation-surveyors (41%) disclosed using uniform forced sale factor standards set by their valuation firms usually established through the licensed valuation-surveyor (lead consultant). Twenty percent admitted to using their own experience, usually from previous valuations. Whereas in establishing depreciation, findings showed that 84% of the respondents estimated depreciation factors based on observed physical appearance of the building but also on the basis of rates used in previous valuations. In the final analysis, it was evident that the basis for establishing FSV and the depreciation factor is arbitrary and inconsistent, lacking the required comprehensive market search and physical examination of the subject property.

As argued by Tidwell (2011), deviation from a normative valuation model is likely to introduce bias and inaccuracy in valuation. It is therefore possible for the observed practice in the study to lead to biased and inaccurate valuations, hence defeating the purpose of adopting heuristics as suggested by Shar and Oppenheimer (2008), i.e. easing and hastening decision-making. However, it is argued elsewhere that bias introduced by the use of heuristics in decision-making can be improved by the consideration of more information.

The use of past experience was also observed in the investigation on the use of AH. Valuation-surveyors were noted to use past experience in estimating depreciation as well as FSV. This practice has been observed in other studies on decision-making such as Juliusson, Karlsson and Garling (2005). Indeed past experience may be useful in valuation but consideration of other factors such as what is happening in the market as well as those suggested in the valuation normative model is important for arriving at acceptable value predictions. Tversty and Kahneman (1974) noted that as much as AH is important for considering some signals and alternatives for a particular decision-making task, there are more factors that effect decision-making other than the ones that are easy to recall from knowledge and experience. They further argue that non-consideration of all relevant factors is likely to result into predictable biases.

It can therefore be argued that valuation-surveyors need to consider all possible alternatives and information necessary for every valuation assignment instead of relying on knowledge and experience that comes to mind, thereby avoiding introducing bias in valuation.

5.2 Value Preconception

About half (40.6%) of the respondents who had admitted to forming value predictions confirmed that they would adjust the assessed value to the preconceived value. This view is consistent with a study by Gallimore (1996) who noted that surveyors are more likely to adjust the value more with

positive information than with negative information. From the study it could be concluded that valuation-surveyors tend to adjust the assessed value more when they have data that supports their predictions.

Further, there was overwhelming evidence to suggest that a majority of valuation-surveyors (61%) would end data collection when they perceived the amount of information already at hand to be indicative of pre-conceived values. These findings support the view that valuation surveyors' behaviour confirms their beliefs during the data collection and analysis stage. The data also indicated that most valuation-surveyors who form value predictions tend to tweak the assessed value towards the preconceived value. With such practices there is a danger of bias and the introduction of errors resulting from individual surveyors' judgement, particularly where information collected is incorrect.

5.3 Neglecting Property's Unique Features

In probing the use of RH it was noted that there is a tendency by valuation-surveyors to ignore some of the property's unique features. This was confirmed by 57% of the respondents who held that the size of various units of the property, such as sitting room and kitchen, does not have an impact on the value of the property. This is not surprising since such findings have also been observed in a study by Tan (2012) in Kuala Lumpur where the number of rooms were noted to have a significant influence on house choice over kitchen and number of bathrooms. It is possible that other factors such as culture, socio-economic status and lifestyle influence preference of one factor over the other (Adair et al., 2000). Whereas the number of bedrooms and bathrooms are significant factors in Saudi Arabia (Opoku & Abdul-Muhmin, 2010); a study in Ghana observed swimming pools, car parks and boundary walls to be other important price determinants (Anthony, 2012). Olusenyi (2014) on the other hand noted that for medium density areas, among others, the presence of a burglar alarm was a significant factor in renting decisions. With this consistency, it is evident from the findings of this study that valuation-surveyors in Tanzania benchmark their decisions on some prototypes.

On the other hand, surveyors were also found to ignore heterogeneous features of real estate. Thence, two properties cannot be construed to be identical in valuation merely because of the existence of some general similarities. The RII in Table 8 highlights the relationship between property features and value. The RII ($0 \leq RII \leq 1$) for the number of bedrooms was 0.94, an extra sitting room 0.72, a larger garage was 0.63, an extra bathroom was 0.58, an extra kitchen was 0.51, and 0.49 for a larger storeroom. From the indices it can be noted that valuation-surveyors are more likely to ignore the size of the store room in their value assessment than they would for the size of the kitchen or an extra bathroom.

6. Implications of the Findings to Valuation Practice

This study provided evidence regarding a number of fundamental aspects of heuristics research in the context of valuation practice in Tanzania. In particular, the study has confirmed the use of three less relevant types of heuristics in mortgage valuation in Tanzania. However, the use of these cognitive shortcuts does not guarantee accuracy of the decision made since it avoids the analysis of all alternative solutions before making a choice (Romanycia & Pelleti, 1985). From the results, valuation-surveyors were noted to leave aside the prescribed normative valuation procedures and adopt descriptive procedures that are considered to be heuristics.

Although validating the valuation results obtained by applying various heuristics was not part of this study, deducing from the observed application, the usage of heuristics tends to introduce errors to valuation output. The results indicate that heuristics is present in virtually all stages of valuation decision-making processes. In that perspective, the valuation stages that are directly affected by the heuristics include the data collection and analysis stage.

The findings indicate valuation-surveyor's tendency to use easily available information. This shows the disregard for the data and data source's quality. Further, the cases of property classification for the purpose of valuation such as establishing valuation rates tend to ignore unique features of each property. In other instances, the formation of preconceived value, as seen in this study, tend to influence the opinion of value. The influence of the predicted value can reveal itself from the data collection stage to the value assessment stage of valuation processes.

As it has been asserted above, the use of heuristics in property valuation has the potential for introducing errors particularly when it is applied unconsciously. The implication of this study's findings cut across the whole valuation profession. For the profession, the findings call for the consideration of the risks of applying these shortcuts in the valuation process. The valuation firms should carefully consider directives given to their valuers that interfere with the prescribed valuation process since in the end the adopted procedure will be more important than the value opinion, especially when it comes to a negligence claim. Professional standards enforcing boards should examine and review impacts of the prescription of indicative rates to the profession. There should be deliberate efforts in establishing a more live and comprehensive database regarding the performance of the property market.

This study on heuristics has emerged as an aspect of research in valuation in general. Little is known about its prevalence in valuation, the factors influencing it and the potential significance of heuristics in valuation. Hence, there is a need for more systematic research on heuristics in valuation as well as valuers behaviour in the valuation process within the context of Tanzania. This is necessary to address the gaps as depicted by the issues noted above. It is important to understand valuation-surveyors' behaviour and how it affects

the final value estimate. From the findings there are indications that the behaviour of the valuation-surveyor has implications to a range of aspects in the valuation process.

An intriguing area for future research relates to development of a methodology for studying heuristics and the accompanying bias in valuation, taking into consideration the normative valuation model prescribed by professional bodies.

7. Conclusion

This study focused on the decision-making behaviour exhibited in the valuation process by valuation-surveyors in Tanzania. The study confirmed that availability heuristics, positivity heuristics and representative heuristics are widely used in various stages of the valuation process by valuation-surveyors in Tanzania. However, it was noted that by using these heuristics, there is a potential for using incorrect inputs in the value assessment process as well as modification of the final assessed value. Hence the need to understand the use of simplified shortcuts and the associated impacts in curbing the improper and unconscious use of such information processing heuristics. The realization that such heuristics are in use is an important milestone towards understanding valuation-surveyor's decision-making behaviour, particularly in the Tanzanian context and how this impacts the opinion of value.

8. References

Adair, A., McGreal, S., Smyth, A., Cooper, J. & Ryley, T. (2000). House price and accessibility: The testing of relationships within the Belfast urban area. *Housing Studies, 15*(5), pp.699-716.

Adegoke, O.J. (2016). Effects of Valuation Variance and Inaccuracy on Nigerian Commercial Property Market; An Empirical Study. *Journal of Property Investment & Finance, 34*(3), pp.276-292.

Akinjare, O.A., Iroham, O.C. & Oloke, O.C. (2013). Valuation Discrepancies in the Value Opinion of Professional Valuers' in Lagos, Nigeria. *International Journal of Economy, Management and Social Sciences Professional Valuers' in Lagos, Nigeria, 2*(6), pp.272-276.

Ayedun, C.A., Ogunba, O.A. & Oloyede, S.A. (2011). Empirical Verification of the Accuracy of Valuation Estimates Emanating from Nigerian Valuers: A Case Study of Lagos Metropolis. *International Journal of Marketing Studies, 3*(4), pp.117-129.

Babawale, G.K. & Ajayi, C.A. (2011). Variance in Residential Property Valuation in Lagos, Nigeria. *Property Management, 29*(3), pp.222-237.

Babawale, G.K. & Omirin, M. (2012). An Assessment of the Relative Impact of Factors Influencing Inaccuracy in Valuation. *International Journal of Housing Markets and Analysis, 5*(2), pp.145-160.

Baddeley, A.D. (1999). *Essentials of Human Memory.* East Sussex: Psychology Press Ltd.

Baum, A., Crosby, N., McAllister, P., Gallimore, P. & Gray, A. (2001). *The Influence of Valuers and Valuation in the Workings of the Commercial Property Investment Market*. Chicago: Jones Lang LaSalle.

Baum, A., Crosby, N., McAllister, P., Gallimore, P. & Gray, A. (2002). *Appraiser Behaviour and Appraisal Smoothing: Some Qualitative and Quantitative Evidence*. Florida: ARES.

Bretten, J. & Wyat, P. (2001). Variance in Commercial Property Valuations for Lending Purposes: An Empirical Study. *Journal of Property Investment & Finance, 19*(3), pp.267-282.

Burns, A.C., & Bush, R.F. (2003). *Marketing Research: Online Research Applications* (4th ed.). Upper Saddle River: Prentice Hall Inc.

Crosby, N. (2000). Valuation Accuracy, Variation and Bias in the Context of Standards and Expectations. *Journal of Property Investment & Finance, 18*(2), pp.130-161.

Diaz, J. (1999). The First Decade of Behavioral Research in the Discipline of Property. *Journal of Property Investment & Finance, 17*(4), pp.326-332.

Diaz, J.I. & Hansz, A. (1997). How Valuers use the Value Opinions of Others. *Journal of Property Valuation & Investment, 15*(3), 256-260.

Diaz, J.I. & Hansz, A. (2007). Understanding the Behavioural Paradigm in Property Research. *Pacific Rim Property Research Journal, 13*(1), pp.16-34.

Dietrich, C. (2010). Decision Making: Factors that Influence Decision Making, Heuristics Used, and Decision Outcomes. *Student Pulse, 2*(2), pp.1-8.

Etikan, I., Musa, A.S. & Alkassim, S.R. (2016). Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), pp.1-4.

French, N. & Gabrielli, L. (2004). The Uncertainty of Valuation. *Journal of Property Investment & Finance, 22*(6), pp.484-500.

Gallimore, P. (1996). Confirmation Bias in the Valuation Process: A Test for Corroborating Evidence. *Journal of Property Research, 13*, pp.261-273.

Geho, M.L. (2003). *Prospects of Applying Computer Aided Mass Valuation in Tanzania.* Paris: FIG.

Geho, M.L. (2004). *Thin Property Markets and Valuation Variance: The Evidence From Tanzania*. Kampala: AFRES.

Hardin, W.G. (1997). Heuristic Use, Credit Constraints and Real Estate Lending. *Journal of Property Valuation & Investiment, 15*(3), pp.245-255.

Hardin, W.I. (1999). Behavioral Research into Heuristics and Bias as an Academic Pursuit Lessons from other Disciplines and Implications for Real Estate. *Journal of Property Investment & Finance, 17*(4), pp.333-352.

Havard, T. (2001). *Valuation Reliability and Valuer Behaviour.* London: RICS Research Paper Foundation.

Iroham, O.C. (2012). *Heuristics in Property Investment Valuation in Nigeria (Thesis)* (1st ed.). Ota: Covenant University.

Iroham, C.O., Ogunba, O.A. & Oloyede, S.A. (2013a). Usage of Major Heuristics in Property Investment Valuation in Nigeria. *An International Multidisciplinary Journal, Ethiopia, 7*(4), pp.93-119.

Iroham, O.C., Ogunba, A.O. & Oloyede, S.A. (2013b). Relative Level of Occurence of the Principal Heuristics in Nigeria Property Valuation. *International Journal of Development and Sustainability, 2*(2), pp.493-504.

Kelly, M.J., Betsch, J., Wultsch, C., Mesa, B. & Mills, L.S. (2012). Noninvasive sampling for carnivores. In Boitani, L & Powell, R.A. *Carnivore Ecology and Conservation: A Handbook of Techniques*. Oxford: Oxford University Press, pp.47-69.

Komu, F. (2018). Valuation Accuracy and Certainty in Developing Countries- A Socio-Political Analysis. *International Journal of Real Estate & Land Planning, 1*, pp.67-77.

Krosnick, J.A. (1999). Survey Research. *Annual Review of Psychology, 50*, pp.537-567.

Mwasumbi, A.N. (2014). External Influence on Valuation: Looking for Evidence from Tanzania. *Journal of Land Administration in Eastern Africa, 2*(2), pp.224-234.

Parker, D.R. (1998). *Valuation Accuracy - an Australian Perspective*. Perth: Pacific Rim Real Estate Society.

Ranyard, R., Crozier, R. & Svenson, O. (2012). *Decision Making* (3rd ed.). London: Routledge.

Romanycia, M.J. & Pelleti, F.J. (1985). What is a Heuristic? *Journal of Computational Intelligence, 1*, pp.47-58.

Shah, A.K. & Oppenheimer, D.M. (2008). Heuristics Made Easy: An Effort-Reduction Framework. *Psychological Bulletin, 134*(2), pp.207-222.

Simon, H.A. & Newell, A. (1970). *Human Problem Solving: The State of the Theory.* Pittsburgh: Carnegie-Mellon University press.

Tavakoli, H. (2012). *A Dictionary of Research Methodology and Statistics in Applied Linguistics* (1st ed.). Tehran: Rahnama PRESS.

Tidwell, O.A. (2011). *An Investigation into Appraisal Bias: The Role of Decision Support Tools in Debiasing Valuation Judgments*. Atlanta: Georgia State University.

Tversky, A. & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. *Journal of Science, 185*(4157), pp.1124-1131.

Waigama, S.M. (2008). *Privatization Process and Asset Valuation.* Stockholm: Royal Institute of Technology (KTH).

Factors Influencing Tenants' Choice of Location of Residence in Bosso Local Municipality, Minna, Nigeria

Oladapo, R. A.[1], Ojo, B.[1], Ayoola, A. B.[2], and Kemiki, O. A.[2]

[1] Department of Estate Management, Federal University of Technology, Akure, Nigeria.
[2] Department of Estate Management & Valuation, Federal University of Technology, Minna, Nigeria.

Abstract

Residential location choice (RLC) is key to the pattern of urban development in any city. This paper investigates factors influencing the choice of residential location by tenants in Bosso Local Government Area (LGA), Minna. The objective of the paper is to establish the roles played by a variety of housing attributes, and thus the design is an analytical survey. Data was collected from 277 structured questionnaires completed by household heads who are tenants in Bosso LGA neighbourhoods. This data was further investigated through factor analysis to reduce the variety of housing variables to a smaller set of influential components. The results reveal that the principal component in the determination of residential location of tenants is dwelling attributes comprising of the number of bathrooms, number of toilets and number of bedrooms. In addition, the second principal component, named accessibility attributes, plays a modest role with proximity to a secondary school and/or primary school loading very high. The study recommends that property owners should respond to the desires of tenants by paying attention to the provision of the right ratio of bathrooms and toilets to the number of bedrooms. Also, urban planners and policymakers should efficiently allocate educational properties like secondary and primary schools across all the neighbourhoods in the study area. With these recommendations, it is hoped that residential locations across Bosso LGA will be equally attractive to tenants.

Keywords: Housing Attributes; Dwelling Attributes; Accessibility Attributes; Neighbourhood Attributes; Residential Location Choice

---

[1] ayobabatunde@futminna.edu.ng , +2347038354214

1. Introduction

The concept of Residential Location Choice (RLC) assumes a prominent position when households are planning their lives. As the name suggests, RLC is the locational choice made by an individual household in relation to residential property and is informed by a variety of factors. Traditional residential location models have typically employed housing and commuting costs to describe households' RLC (Alonso, 1964; Lowry, 1964; Muth, 1969). Modern discourse suggests that as cities' complexities grow, urban spatial structures have become polycentric due to many economic focal points. Other than housing and commuting costs, there are multiple factors influencing household's residential location decisions (Blijie, 2004; Curtis & Montgomery, 2006; Kim, 2010).

McFadden (1977; 1978) working within this contemporary time, introduced a discrete modelling framework. This model suggests that consumer housing location analysis provides insight into the variance of preferred dwelling types despite similar dwelling alternatives for a population. The study also noted that individual taste for housing attributes vary by households' types and from one geographical location to the next. Consequently, the circumstances under which households select their residential locations in different geographical areas needs empirical investigation.

Minna is the capital city of Niger State. The city houses two local government areas (LGAs). Bosso LGA, which is the study area, is one of these LGAs, while the other is called Chanchaga LGA. In Minna, varying outcomes have continued to trail the RLC of tenants as they satisfy their location desires. The study of Ogunbajo et al. (2018) on the contributory effect of externalities to the void periods for residential buildings in Minna, suggests that while some tenants are satisfied with their residential locations in a reasonable time-period, others have shown an intention to move. Thus, identifying the housing attributes that influence tenants' decisions to move or stay is of concern. Against this background, this study examines factors influencing tenants' choice of residential location by a variety of housing attributes using Bosso LGA as a case study.

2. Literature Review

2.1. Conceptual Issues of Choice in Residential Location

One of the dynamics of urban development is RLC. The definition of the term residential location could sensibly refer to the exact house or apartment that a household chooses (Sanit et al., 2013). According to Giuliani (2004), residential choice involves an assessment wherein the desires of an ideal environment are evaluated and used to make a choice among alternatives. The literature outlines various techniques or approaches to studying housing choice. The two major techniques are the revealed and stated (expressed) preferences (Zondag & Pieters, 2005; Kirkpatrick, 2011; Bocarejoa et al., 2017).

The revealed preference approach relates to observed or actual behavior of individual respondents to estimate housing choices that have taken place. Contrastingly, stated preference estimates utility functions based on peoples' opinions – what they like or dislike in a set of alternatives (Giuliani, 2004; Lazarow et al., 2007; Pendleton et al., 2007; Wittink, 2011; Wildish, 2015). In this study, revealed preference information from the tenants' survey was used. The tenants were asked to assess the influence of certain housing attributes on their housing decisions when they moved to their current residential locations.

Studies by Kim et al. (2005a), Zondag and Pieters (2005) and Curtis and Montgomery (2006) suggest that irrespective of the stated preference and revealed preference approaches, household's decisions consist of two major stages, namely the residential mobility stage and the housing choice stage. Kim et al. (2005a) add that the residential mobility stage and housing choice stage as shown in Figure 1 are interdependent and hierarchical. Furthermore, Curtis and Montgomery (2006) explain that a household's decision to move or stay in a current home is influenced by a range of push factors (crime and housing affordability) and pull factors (access to quality schools and employment). In the residential mobility stage, once the decision to relocate is made, it leads to the housing choice stage which involves a series of interconnected decisions about dwelling and location attributes. In the first stage, the decision to relocate or stay by a household is ascertained after weighing housing attributes. If the household's assessment of housing attributes is satisfying, then the current house is maintained. On the other hand, households will consider moving from the current house if the push factors outweigh the pull factors. This results in the housing choice stage which involves residential searches and choices between various available residences.
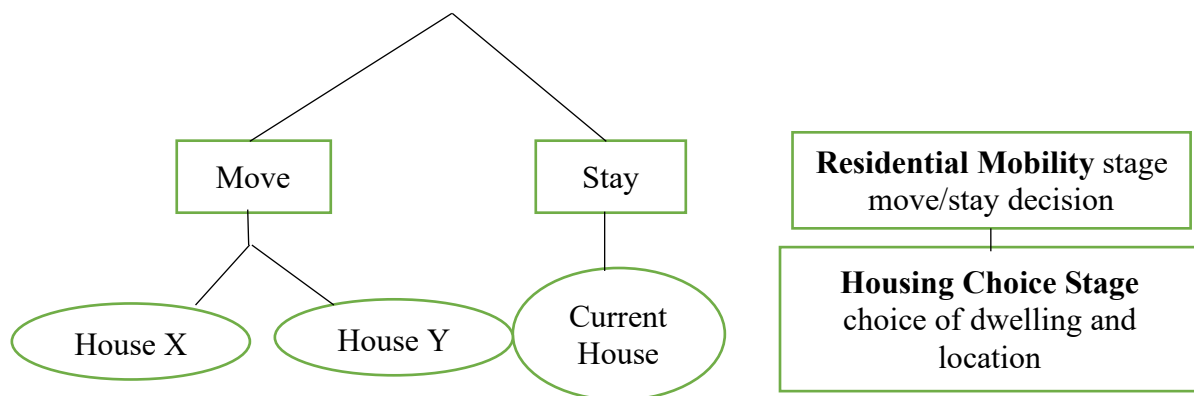
Figure 1. The Sequence of the Housing Choice Decision-Making Process
Source: Adapted from Kim et al. (2005a)

Subsequently, a large part of housing preferences/choice theory suggests that a household's residential location decision is a function of dwelling (dwelling type, house price and size of dwelling unit), socio-demographic (household income, household size and workplace location), a variety of accessibility (travel time and cost to work), neighbourhood (neighbourhood type and

availability of community facilities), environmental (air quality and size of natural areas) and socio-cultural attributes (racial diversity and dependence on decision) (Kim et al., 2005a; Kim et al., 2005b; Zondag & Pieters, 2005; Jun & Morrow-Jones, 2011; Sanit et al., 2013; Shawal & Ferdous, 2014; Opaluwa & Aribigbola, 2015).

2.2. Factors Influencing Choice of Residential Location

RLC is key to the pattern of urban development in any city. A household chooses its location by evaluating the housing attributes of each available dwelling unit and selecting the one which offers the highest possible utility. International literature highlights various empirical factors as influential in the RLC of households.

Research by Rivera and Tiglao (2005) study the choice preferences of households having only two workers that moved into a new home two years prior to the survey in Metro Manila. The authors employed nested logit models to analyse a variety of accessibility, dwelling, socio-demographic and neighbourhood variables. Their study notes that accessibility variables such as shorter commuting times and lower commuting costs are prioritised in household decisions compared to other attributes such as location to residence and workplace, land values and population density. They also suggest that households prefer to live in neighbourhoods far from their workplaces which contrasts their preference for shorter commutes and lower commuting cost.

Zondag and Pieters (2005), in their study of the Netherlands, utilised a multi-nominal logit model to analyse various household types. Their results indicate that the role of accessibility in explaining RLC of the different household types is significant but comparably less when compared to demographic factors, neighbourhood amenities and dwelling attributes. Similarly, a study by Kim et al. (2005a) employed a nested multinomial logit model to estimate the nested structure of housing choices in terms of the intention to change residential location by home-owners in Oxfordshire, in the UK.

This study makes use of the stated preference approach which models the intention to move according to the tradeoffs between accessibility, neighbourhood, dwelling and household characteristics. This contrasts the variables included in the empirical model of the housing choice which are house price, accessibility and neighbourhood. The authors therefore find that the probability of a household moving increases with more expensive housing costs, higher travel times, higher costs to work, higher costs to shop, higher population densities and residence in the central city. When they estimate the indirect random utility functions of RCL, Kim et al. (2005a) conclude that individuals prefer a residential location with a combination of shorter commuting time, lower transport costs, lower density, higher quality schools and lower house prices.

Kim et al.'s findings are challenged by Zondag and Pieters (2005) and Jun and Morrow-Jones (2011). Both studies did not attempt to define the level of contribution of the categorised housing attributes to the RLC of households.

Instead they conclude that both accessibility and neighbourhood amenities are significant in residential mobility and housing location choice behaviour.

Furthermore, Jun and Morrow-Jones (2011) use regression analysis to describe a homeowner's choice of denser neighbourhoods in Columbus, Ohio. In contrast with Kim et al. (2005a), Jun and Morrow-Jones provide a specific role for each of the explanatory variables employed in the model; neighbourhood characteristics rank the lowest with a limited role while accessibility factors and household characteristics play moderate and important roles respectively. Following this trend to rank characteristics, the multinomial logit model used by Sanit et al. (2013) shows that socio-demographic characteristics, particularly income and workplace location, play a significant role in explaining the location decisions of people to live near a rail transit system in Bangkok, Thailand. Unlike Rivera and Tiglao (2005), Sanit et al. (2013) find that transportation variables such as travel costs and travel time are significantly less important in the minds of households.

Similarly, African scholars have investigated the theory surrounding RLC. In Ghana, a study by Acheampong and Anokye (2013) notes that family relations, proximity to workplace, relatively low land price and house rentals are the most important explanatory variables for RLC in two of Kumasi's peri-urban settlements. The study suggests that socio-cultural, dwelling and accessibility considerations are significantly more important than the housing attributes related to the neighbourhood. Similarly, the findings of Nkeki and Erimona (2018) reflect on the role of socio-cultural cohesion and accessibility as the most prominent determinants of household choice of residential location in Benin City, Nigeria. This view is supported by Acheampong and Anokye (2013). Contrastingly, these authors critique the work of Jun and Morrow-Jones (2011) who suggest that the role of neighbourhood characteristics are significantly more important than housing attributes. Nkeki and Erimona (2018) did not take into account the function of dwelling attributes in their study. They considered socio-economic attributes, and like Zondag and Pieters (2005) and Opaluwa and Aribigbola (2015), find the component to be significantly less important.

The multinomial logistic regression used by Opaluwa and Aribigbola (2015) shows that accessibility to work, distance to health facilities and housing costs in particular have a strong impact on households' RLC for all dwelling types in Lokoja, Kogi State, Nigeria. The findings of the study suggest that accessibility and dwelling attributes are almost constant explanatory variables for the considered dwelling types while attributes related to socio-economic factors are less important. In another study, Ubani, Alaci and Udoo (2017) use a variety of push and pull factors to explain housing decisions of households in Port Harcourt Metropolis, Nigeria. They find that highly ranked push factors include ownership of a home in a new location, high levels of crime and insecurity. Highly ranked pull factors comprise of the new destination's security, household's change in the level of income and home ownership status in a new destination. The study did not attempt to

statistically identify the significant determinants of RLC of households in the study area.

A careful look at studies in Africa reveal the importance of socio-cultural attributes in the RLC of households unlike studies in continents like America and Europe. The possible reason for this could be as a result of the cultural affinity of many people in an African setting. The findings from the above empirical studies suggest that the factors that influence households' residential location preferences vary from one geographical area to another and by household types. However, the important role played by dwelling attributes in RLC remain constant across these studies (see, Zondag & Pieters, 2005; Acheampong & Anokye, 2013; Opaluwa & Aribigbola, 2015). Moreover, the findings give a sense of how individuals and households select their residential locations. By understanding households' needs, policymakers can work to better policy in a real and meaningful way. Hence, it is justifiable to research the RLC of different household types across different geographical areas. It is on this premise that this study employs a variety of housing attributes to examine their influence on residential location choices of tenants in Bosso Local Municipality of Minna in Nigeria.

3. The Study Area

The study area is Bosso LGA in Niger State, Nigeria. Bosso LGA and the Chanchaga area are the two main local government areas in Minna, the capital of Niger State located on latitude 9° 36' 22" North and longitude 6° 33' 15" East. Figure 2 shows the map of Niger State with Bosso LGA. The LGA has geographical coordinates of 9° 39' 12" North and 6° 30' 58" East. According to the Population and Housing Census Figures, the local government has a population of 148 136 and occupies a land area of 1 636.33km² (National Population Commission, 2006). Bosso LGA houses seven urban neighbourhoods, which are: Bosso Estate, Bosso Town, Chanchaga, Jikpan, Maitumbi, Shango and Tudun Fulani. All these neighbourhoods are included in this study so as to have a holistic measure of RLC of tenants.
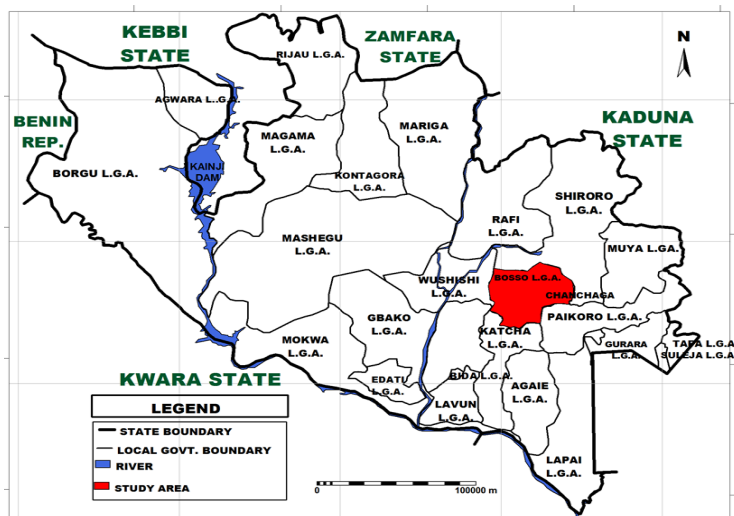
Figure 2: Minna of Niger State Showing Bosso Local Government Area
Source: Ministry of Lands and Housing, Niger State (2013)

4. Methodology

This paper's emphasis is on the perception of tenants regarding the influence of certain housing attributes on RLC. The objective is to understand the contributory effect of housing attributes on the housing choice decisions of tenants. The survey research is quantitative and employs a revealed preference approach. The survey-based technique involves a designed 14-item structured questionnaire. It was employed to investigate the influence of the various housing attributes on tenants' RLC in the study area.

The 2003 household data for Bosso LGA was retrieved from Sanusi (2006) and subsequently projected at an annual growth rate of 3.80% (National Population Commission, 2006) for the 14-year period between 2003 and 2017. The total number of households in the local government area is 31 599. The details are as shown in Table 1.

Table 1: Neighbourhood Household Size for Bosso Local Government Area

Neighbourhood	Household Size (2003)	Projected Household Size (2017)
Bosso Estate	306	552
Bosso Town	6 717	12 003
Chanchaga	4 505	8 050
Jikpan	1 475	2 636
Maitumbi	2 377	4 248
Sango	512	915
Tudun Fulani	1 788	3 195
Total	**17 680**	**31 599**

Source: Adapted from Sanusi (2006)

Furthermore, according to Amenyah and Fletcher (2013), roughly 40% of the world's population lives in rented housing. With that in mind, 40% of the total households of Bosso (31 599) amounts to 12 639 rented households as of 2017's sampling frame (Table 2). The sample sizes of the tenant questionnaire at the local government level is determined by the formula for a finite population as propounded by Kothari (2004). This formula is;

$$n = \frac{Z^2 \times N \times \sigma^2}{(N-1)\,e^2 + Z^2\,\sigma^2}$$

n is the sample size, Z is the standardised normal value and for this study it is taken as 1.96 for a 95% confidence interval, σ is the standard of deviation which was put at 0.5 depicting a safe decision enhancing large enough samples, N is the number of rented dwellings and e is the margin of error put at +/- 5%.

Thus, 372 tenants represent the sample size in the study area for questionnaire. 277 questionnaires were subsequently retrieved representing a response rate of 74%. Table 2 shows the breakdown of the questionnaires' administration and retrieval.

Table 2: Questionnaire Distribution to Tenants in the Study Area

Neighbourhood	Proportion of Rented Dwellings	Sample Size	Questionnaire Retrieved
Bosso Estate	221	7	6
Bosso Town	4 801	141	96
Chanchaga	3 220	97	76
Jikpan	1 054	30	25
Maitumbi	1 699	49	36
Sango	366	11	8
Tudun Fulani	1 278	37	30
Total	**12 639**	**372**	**277**

Source: Authors' Computation (2017)

The resulting survey provided a perceptual rating of the identified factors as they influence tenants' choices of residential location during the search period. Respondents were asked to assess each of the factors on a 5-point Likert scale with "not important" assigned a score of 1; "less important" rated as 2; "moderate" as 3; "important" as 4 and "very important" rated as 5. For the factor analysis, data reduction statistics was performed on the housing variables to extract the factors influencing the choice of residential properties for the seven neighbourhoods in the study area. The analyses was achieved through SPSS Statistics Version 21.

The use of factor analysis in this paper is to assess and determine whether the study dataset is suitable. According to Pallant (2005), sample size and the strength of the relationship among variables (or items) are crucial to the suitability of a dataset for factor analysis. The authors argue that the overall sample size of a factor analysis study should be more than 150 while each of the variables should have a ratio of at least 5 cases. Umeh (2018) suggests that the size of the sample respondents to be used for the Principal Component Analysis (PCA) should be at least 4 to 5 times the number of variables.

On the required number of variables for factor analysis, Alabi and Anifowose (2018) mention that 20 to 50 variables are suitable, but emphasize that fewer variables can be used. They adopt 17 variables and sample size of 59 to assess the factors influencing ICT facilities deployment in quantity surveying firms (QSFs) in Abuja, Nigeria. Similarly, Kuma et al. (2018) employ 15 variables and sample size of 400 to study the challenges facing effective land acquisition exercise in Durumi, Abuja, Nigeria. In their study, Saidu and Oyewobi (2018) use 15 variables and 105 respondents to assess the impact of contractual claims on public building projects performance in Abuja, Nigeria. In Benin City, Nigeria, Nkeki and Erimona (2018) employ 12 variables and a sample size of 1 078 to study the determinants of household choice of residential location. Thus, the 14 housing variables and sample size of 277 employed in this study are considered adequate for the factor analysis. The housing attributes utilised to assess the factors influencing the choice of residential location are as shown in Table 3. The data was obtained from the tenants' survey conducted in May 2018.

Table 3: The Study Housing Variables

Variable Code	Variable Type
V_1	Floor level
V_2	Adequacy of public rooms
V_3	Number of bedrooms
V_4	Number of bathrooms
V_5	Number of toilets
V_6	Number of garage/parking space
V_7	Adequacy of floor area
V_8	Availability of fence wall
V_9	Location of property in a particular neighbourhood
V_{10}	Proximity to clinic or hospital
V_{11}	Proximity to primary school
V_{12}	Proximity to secondary school
V_{13}	Proximity to workplace
V_{14}	Neighbourhood security

Source: Authors Survey (2018)

The Cronbach's Alpha (α) reliability test, correlation matrix, Kaiser–Meyer–Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity were employed to test for the suitability and factorability of the data obtained. The Cronbach's Alpha (α) reliability test was conducted on the questionnaires administered to the tenants to measure the internal consistency and the reliability of the scale used. Cronbach's coefficient alpha values range from 0 to 1. The Cronbach alpha coefficient of a scale should be 0.7 or above for the items of the instrument to be considered reliable for analysis (Cronbach, 1947; 1951; Saidu & Oyewobi, 2018).

Pallant (2005) notes that for the study data to be considered suitable for factor analysis, the correlation matrix should show at least some correlations of r=0.3 or greater. Pallant also mentions that the KMO index ranges from 0 to 1. She suggests 0.6 as the minimum value while noting Bartlett's test of sphericity should be significant ($p < 0.05$) for data obtained for the factor analysis to be considered good and appropriate. Other studies have proposed that a sample with a KMO value between 0.5 and 0.7 is marginal, and thus reliable for factor analysis. A sample with a KMO value lower than 0.5 is considered to be unsuitable for factor analysis (Hair et al., 2006; Stern, 2010; Alabi & Anifowose, 2018).

Furthermore, the PCA which is the most commonly used extraction technique (Pallant, 2005) was used to ascertain the smallest number of components or factors that can represent the correlations amid a study's set of variables. The Kaiser's criterion and Cattell's scree test constitute techniques that were utilised to help establish the number of components to retain. While Kaiser's criterion recommends that components with eigenvalues of 1.0 or more be retained, given their high relativity. Cattell's scree test suggests plotting eigenvalues of the components and finding a point where the curve changes direction, becomes horizontal, thus retaining the components above the point (Pallant, 2005).

5. Results and Discussion

5.1. Summary Statistic of the Characteristics of the Respondents for the study

Table 4 provides a statistical summary characteristics of the study's respondents. As expected, with the gender of household head, the male population is almost twice the female. The household heads with family (42.2%) and single person households (52.3%) are the major categories of the household type in the sample. Occupation components of the sample are almost equally distributed between government employees (28.5%), students (31.0%), private employees (16.2%) and self-employed (21.7%). The statistics also show that a reasonable percentage of the respondents (41.2%) moved into new homes three years prior to the survey which points to the fact that they will still remember the circumstances that informed their current residential locations. Also, 29.6% of the respondents have lived in their current homes between three and six years which appears good for a clear response to the items of the questionnaire. Income distribution indicates that the percentage of respondents in low levels of income are much higher than those in higher income levels.

Table 4: Descriptive Summary of Socio-Economic Characteristics of Respondents

Variables	Variable Type	Mean ($1=NG₦ 361.92)	Standard Deviation
PANEL A (Continuous Variable)			
Annual Rent	Continuous	₦ 84 687.27 ($234.00)	₦ 64 370.42
PANEL B (Binary/Categorical)		**Frequency**	**Percentage**
Gender of Household Head	Binary		
Male		174	62.8%
Female		103	37.2%
Marital Status	Categorical		
Single		145	52.3%
Married		117	42.2%
Separated		6	2.2%
Divorce		2	0.7%
Widowed		6	2.2%
Missing Response		1	0.4%
Occupation	Categorical		
Government Employee		79	28.5%
Private Employee		45	16.2%
Self Employed		60	21.7%
Student		86	31.0%
Unemployed		7	2.5%
Length of Stay	Categorical		
Less than 3 years		114	41.2%
Between 3 – 6 years		82	29.6%
Between 7 – 9 years		35	12.6%
10 years and above		43	15.5%

Missing Response		3	1.1%
Range of Monthly Income	Categorical		
Less than N10 000		15	5.4%
N10 000 - N29 999		81	29.2%
N30 000 - N49 999		63	22.7%
N50 000 - N69 999		38	13.7%
N70 000 - N89 999		13	4.7%
N90 000 - N109 999		23	8.3%
N110 000 and above		24	8.7%
Missing Response		20	7.2%

Source: Field Survey (2018)

5.2. Reliability Test and Factorability of the Study Instrument

As evident from Table 5, the reported Cronbach's alpha value of 0.719 is an indication of an acceptable level of correlation among all items of the questionnaire. This value justifies the reliability of the instrument to adequately measure the information obtained.

Table 5: Reliability Test

Test Technique	Value
Cronbach's Alpha	0.719
Number of Items	14

Source: Authors Analysis (2018)

Table 6 provides a correlation matrix which indicates that factor analysis can be used to analyse the study data as the variables exhibit some correlations of r=0.3 and more. In Table 7, the KMO value is 0.673 and the Bartlett's test of sphericity is significant (p<0.05). The results of the reliability test, correlation matrix, Kaiser–Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity show that the data obtained is reliable and sufficient to conduct a factor analysis.

Table 6: Correlation Matrix

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14
V1	1.000	.181	.156	.114	.082	.169	.159	.128	.134	.223	.035	.085	.081	.003
V2	.181	1.000	.370	.336	.330	.306	.187	.207	.046	.072	-.050	-.014	.021	.213
V3	.156	.370	1.000	.693	.587	.248	.266	.314	.066	.150	.120	.087	-.026	-.002
V4	.114	.336	.693	1.000	.881	.349	.244	.283	.014	.100	.133	.110	-.074	.068
V5	.082	.330	.587	.881	1.000	.333	.167	.251	.001	.016	.062	.016	-.117	.108
V6	.169	.306	.248	.349	.333	1.000	.299	.281	.033	.050	.059	.044	-.047	.233
V7	.159	.187	.266	.244	.167	.299	1.000	.218	.122	.214	.047	.038	.022	.232
V8	.128	.207	.314	.283	.251	.281	.218	1.000	.198	.210	-.080	-.087	-.070	.071
V9	.134	.046	.066	.014	.001	.033	.122	.198	1.000	.309	.065	.011	.212	.153
V10	.223	.072	.150	.100	.016	.050	.214	.210	.309	1.000	.423	.386	.334	.249
V11	.035	-.050	.120	.133	.062	.059	.047	-.080	.065	.423	1.000	.813	.180	-.048
V12	.085	-.014	.087	.110	.016	.044	.038	-.087	.011	.386	.813	1.000	.305	.021
V13	.081	.021	-.026	-.074	-.117	-.047	.022	-.070	.212	.334	.180	.305	1.000	.170
V14	.003	.213	-.002	.068	.108	.233	.232	.071	.153	.249	-.048	.021	.170	1.000

Source: Authors Analysis (2018)

Table 7: KMO and Bartlett's Test

Statistical Measures		Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.673
Bartlett's Test of Sphericity	Approx. Chi-Square	1 322.567
	df	91
	Sig.	.000

Source: Authors Analysis (2018)

The results of the various tests in this section form the foundation of the analysis of factors influencing RLC of tenants in Bosso LGA of Minna.

5.3. Factors Influencing Residential Location Choices in Bosso Local Government Area, Minna

The results of the principal component analysis are shown in Table 8 and the Scree plot (Figure 3). Based on Kaiser's criterion, four components were extracted for having eigenvalues above 1.0 (3.393, 2.308, 1.582 and 1.072). Component 1 with an eigenvalue of 3.393 accounts for 24.24% of the variance in the dataset. Component 2 with an eigenvalue of 2.308 accounts for 16.48% of the variance. Component 3 with an eigenvalue of 1.582 accounts for 11.30% of the variance while Component 4 with an eigenvalue of 1.072 accounts for 7.86% of the variance. Subsequently, all the four components account for 59.68% of the variation in the factors influencing RLC in Bosso LGA, Minna.

Referring to the Cattell's scree plot in Figure 3, there are four components above the point where the curve changes direction and becomes horizontal. These four components should therefore be retained. This further confirms the result in Table 8 where four components with eigenvalues greater than one were extracted based on Kaiser's criterion.

Table 8: Total Variance Explained

| Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.393	24.24	24.24	3.393	24.24	24.24	2.886	20.61	20.61
2	2.308	16.48	40.72	2.308	16.48	40.72	2.250	16.07	36.68
3	1.582	11.30	52.02	1.582	11.30	52.02	1.631	11.65	48.33
4	1.072	7.66	59.68	1.072	7.66	59.68	1.589	11.35	59.68
5	.970	6.93	66.61						
6	.913	6.52	73.13						
7	.748	5.34	78.47						
8	.686	4.90	83.37						
9	.648	4.63	88.00						
10	.639	4.57	92.57						
11	.413	2.95	95.52						
12	.368	2.63	98.15						
13	.163	1.16	99.31						
14	.097	.69	100.00						

Source: Authors Analysis (2018)
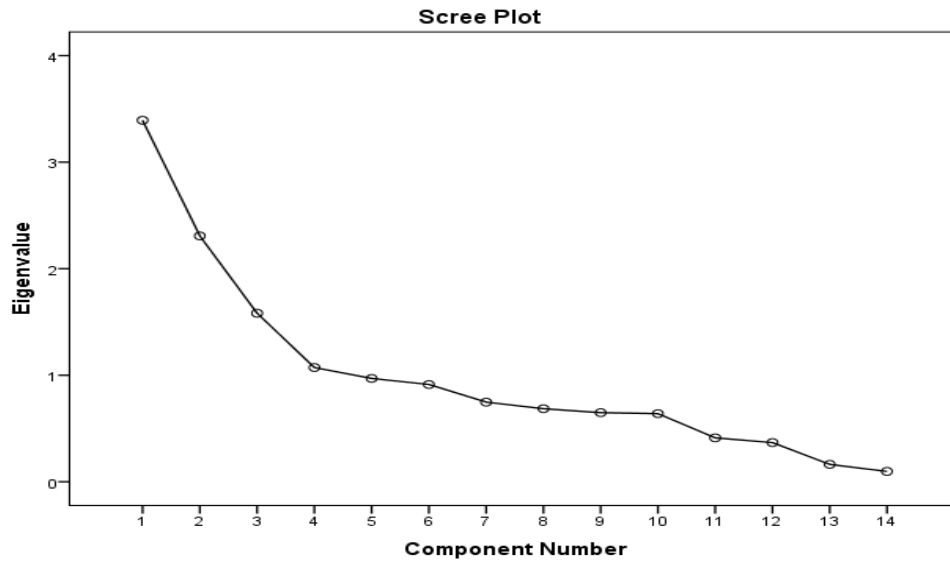
Figure 3: Scree plot of the Components Influencing Residential Location Choices in Bosso LGA
Source: Authors Analysis (2018)

Kaiser's criterion and Cattell's scree test were used to determine the four factors to retain. Factor rotation based on the Varimax Orthogonal rotational technique was employed to reveal the pattern of loadings in a way that it would be easier to explain. Following previous studies by Pallant (2005) and Kuma et al. (2018), factors with absolute values less than 0.3 correlation loadings were sorted by size and suppressed to make the output easier to explain. The results of each of the four extracted components and their variables are shown in Table 9.

Table 9: Rotated Component Matrix

	Variables	**Component**			
		1	**2**	**3**	**4**
1	Number of bathrooms	.908			
2	Number of toilets	.869			
3	Number of bedrooms	.794			
4	Proximity to secondary school		.916		
5	Proximity to primary school		.899		
6	Proximity to clinic or hospital		.567		
7	Proximity to workplace		.459		
8	Neighbourhood security			.853	
9	Number of garage/parking space			.530	
10	Adequacy of floor area			.494	
11	Adequacy of public rooms			.448	
12	Location of property in a particular neighbourhood				.711
13	Availability of fence wall				.558
14	Floor level				.549

Source: Authors Analysis (2018)

From Table 9 four components are extracted as factors influencing RLC of tenants in the study area. The first component has significant correlation loadings for a group of three variables, namely: the number of bathrooms, number of toilets and number of bedrooms. These variables are based on

previous studies and are referred to as *dwelling attributes* (Component 1). The second principal component has four variables with proximity to a secondary school and proximity to primary school loading very high. Others are proximity to a clinic or hospital and proximity to one's workplace. All these variables are based on previous studies and are related to *accessibility attributes* (Component 2).

Furthermore, four items comprising of one neighbourhood attribute (neighbourhood security) and three dwelling attributes (number of garage/parking space, adequacy of floor area and adequacy of public rooms including living room, dining room and kitchen) were loaded onto principal Component 3. Based on the content of the variables, the component was named *neighbourhood cum dwelling attributes* (Component 3). A careful look at Component 4 reveals the loading of three items onto it, namely: location of the property in a particular neighbourhood (an *accessibility attribute*) with the availability of fence wall and floor level which are *dwelling attributes*. The component was named *accessibility cum dwelling attributes* (Component 4) based on its content.

The roles played by each of the components vary as they account differently for variations in factors influencing tenants' RLC in the municipality. The first component, *dwelling attributes* with an eigenvalue of 3.393, accounts for 24.24% variation in the factors influencing RLC of tenants in Bosso LGA, Minna. This component constitutes the largest variation of the total variance (59.68%) explained by the dataset. Hence, it plays an important role in determining the RLC of tenants in the study area. The second component, *accessibility attributes*, has an eigenvalue of 2.308. The component accounts for 16.48% of the total variance. On these accounts, the component can be said to play a modest role in determining the RLC.

The third component played a limited role with an eigenvalue of 1.582. This accounts for 11.30% of the total variance explained. In a similar manner, the fourth component, with an eigenvalue of 1.072 and variance of 7.86%, can be said to play an even more limited role. Although the component had the least variance of the total variance explained, it has an accessibility item named *location of the property in a particular neighbourhood* loading high. These findings suggest that irrespective of the neighbourhood, the accessibility level of a property is of primary concern to any prospective tenant during the search period. A short distance from the property to major roads or bus stops and an access road to property enhance the accessibility level of a property. These aspects are crucial to the RLC of prospective tenants.

Overall, the findings imply that *dwelling attributes* play an important role. *Accessibility factors* and *neighbourhood characteristics* play moderate and limited roles respectively in determining RLC of tenants in Bosso LGA of Minna. These corroborate Jun and Morrow-Jones (2011) submissions that *neighbourhood characteristics* play a limited role while accessibility factors play a moderate role in RLC. The findings are also consistent with previous findings of Acheampong and Anokye (2013), Oyetunji and Abidoye (2016) on the roles of dwelling and accessibility attributes as significantly more

important than housing attributes related to the neighbourhood. Furthermore, the results agree with Zondag and Pieters (2005) on the role of accessibility being significant but rather limited compared to the effect of dwelling attributes in explaining RLC of different household types, but contradict the authors on the role of neighbourhood attributes as more important than attributes related to accessibility. Notably, the results reaffirm studies like Zondag and Pieters (2005), Archeampong and Anokye (2013) and Opaluwa and Aribigbola (2015) on the role of dwelling attributes as very important in a residential choice location.

6. Conclusion and Recommendations

This study examined the factors influencing the choice of residential locations by tenants in Bosso LGA to ascertain the roles played by a variety of housing attributes in decision-making. Considerably, the findings of this study align with the findings in literature.

The results of this research reveal that the component of housing attributes that played the most important role in influencing tenants' residential location is *dwelling attributes*. These include the number of bathrooms, number of toilets and number of bedrooms. This implies that tenants are attracted by these attributes in terms of their quantity and quality. To considerably improve desire for properties by tenants across the neighbourhoods in the study area, property owners and real estate developers should therefore ensure the provision of the right ratio of bathrooms and toilets to the number of bedrooms.

The results also show a modest influence of *accessibility attributes* on RLC. Dominant explanatory variables of the *accessibility attributes* influencing RLC in Bosso LGA are the proximity to a secondary school and/or a proximity to primary school. These findings may be useful for policymakers and planners to better comprehend and respond to local desires and thus necessitating direct policy implications. To satisfy the residential location desires of tenants, urban planners and policymakers should efficiently allocate educational properties like secondary and primary schools across all the neighbourhoods in the study area.

This study contributes to the RLC literature. It has included a variety of housing attributes to the discourse and has increased the knowledge surrounding residential location choices of tenants' households in a Local Government Area in Minna, Nigeria. A limitation of the study is that the data is based on an incomprehensive list of housing attributes. Furthermore, the impact of housing attributes categories such as socio-economic, socio-cultural and environmental on the RLC have not been accounted for. Analyzing a comprehensive list of variables may reveal a more robust result. Going forward, studies should consider examining the effects of all groups of housing attributes on RLC. In addition, there is a need to employ comparative analysis of data from different local government areas.

References

Acheampong, R.A. & Anokye, P.A. (2013). Understanding Households' Residential Location Choice in Kumasi's Peri-urban Settlements and the Implications for Sustainable Urban Growth. *Research on Humanities and Social Sciences, 3*(9), pp.60-70.

Alabi, T.T. & Anifowose, O.M. (2018). Impact of Information and Communication Technology (ICT) Facilities Deployment on Quantity Surveying Practice in Abuja. *Paper presented at the School of Environmental Technology International Conference (SETIC) on Contemporary Issues and Sustainable Practices in the Built Environment,* 10-12 April 2018, Federal University of Technology, Minna, Nigeria, pp.425-437.

Alonso, W. (1964). *Location and Land Use: Toward a General Theory of Land Rent.* Cambridge: Harvard University Press.

Amenyah, I.D. & Fletcher, E.A. (2013). Factors Determining Residential Rental Prices. *Asian Economic and Financial Review*, *3*(1), pp.39-50.

Blijie, H.P. (2004). *Residential Location Choice: The Influence of Migration and Commuting Distance*. Available at: https://www.cvs-congres.nl

Bocarejoa, J.P., Guzmana, L.A., Portillaa, I., Meléndeza, D., Gómeza, A.M. & Riveraa, C. (2017). Access as a Determinant Variable in the Residential Location Choice of Low-income Households in Bogotá. *Transportation Research Procedia*, *25*, pp.5121-5143.

Cronbach, L.J. (1947). Test Reliability: Its Meaning and Determination. *Psychometrika, 12*, pp.1-16.

Cronbach, L. J. (1951). Coefficient Alpha and the Internal Structure of Tests. *Psychometrika, 16*(3), pp.297-334.

Curtis, C. & Montgomery, M. (2006). *Housing Mobility and Location Choice: A Review of the Literature.* Working Paper, Curtin University of Technology, Australia. Available at: http://urbanet.curtin.ed.au/

Giuliani, M.V. (2004). Residential Preferences and Attachment across the Lifespan. In *Encyclopedia of Applied Psychology,* C. Spielberg (ed.). San Diego: Elsevier/Academic Press, pp.259-266.

Hair, J., Bush, R. & Ortinau, D. (2006). *Marketing Research within a Changing Environment*. New York: McGraw-Hill.

Jun, H. & Morrow-Jones, H.A. (2011). Residential Density and Location Decisions: The Factors affecting Homeowners' Choice of Denser Neighbourhoods. *Housing and Society*, *38*(2), pp.117-142.

Kim, J.H., Pagliara, F. & Preston, J. (2005a). The Intention to Move and Residential Location Choice Behavior. *Urban Studies, 42*(9), pp.1621-1636.

Kim, M. (2010). *Residential Location Decisions: Heterogeneity and the Trade-off between Location and Housing Quality.* Doctoral Dissertation, Ohio State University.

Kim, T., Horner, M.W. & Marans, R.W. (2005b). Life Cycle and Environmental Factors in Selecting Residential and Job Locations. *Housing Studies, 20*(3), pp.457-473.

Kirkpatrick, S. (2011). *The Economic Value of Natural and Built Coastal Assets.* Available at: htttp://www.nccarf.edu.au

Kuma, S.S., Fabunmi, F.O., Adamu, S. & Kemiki, O.A. (2018). Effectiveness of Compulsory Land Acquisition Process in Durumi District, Abuja, Nigeria. *Paper presented at the School of Environmental Technology International Conference (SETIC) on Contemporary Issues and Sustainable Practices in the Built Environment,* 10-12 April 2018, Federal University of Technology, Minna, Nigeria, pp.1413-1421.

Lazarow, N., Miller, M.L. & Blackwell, B. (2007). Dropping in: A Case Study Approach to Understanding the Socioeconomic Impact of Recreational Surfing and its Value to the Coastal Community. *Shore and Beach, 75*(4), pp.21-30.

Lowry, I.S. (1964). *A Model of Metropolis*. Santa Monica: Rand Corporation.

National Population Commission (2006). Population and Housing Census of the Federal Republic of Nigeria, Priority Tables Volume III.

McFadden, D. (1977). *Modelling the Choice of Residential Location*. Available at:
https://cowles.yale.edu/sites/default/files/files/pub/d04/d0477.pdf

McFadden, D. (1978). Modelling the Choice of Residential Location. In *Spatial Interaction Theory and Residential Location*, A. Karlqvist (ed.). Amsterdam, pp.75-96.

Muth, R.F. (1969). *Cities and Housing: the Spatial Pattern of Urban Residential Land Use*. University of Chicago, USA.

Nkeki, N.F. & Erimona, E.O. (2018). Sector-wise Exploratory Analysis of Household Residential Location Choice in the African Context: Empirical Evidence from Benin City, Nigeria. *Current Urban Studies, 6,* pp.37-69.

Ogunbajo, R. A., Adewusi, A.O., Usman, B.S. & Ayoola, A.B. (2018). The Contributory Effect of Externalities to the Void Periods for Residential Buildings in Minna, Nigeria. *Paper presented at the School of Environmental Technology International Conference (SETIC) on Contemporary Issues and Sustainable Practices in the Built Environment,* 10-12 April 2018, Federal University of Technology, Minna, Nigeria, pp.226-232.

Opaluwa, A.I. & Aribigbola, A. (2015). Factors affecting the Choice of Residential Housing in Lokoja, Kogi State, Nigeria. *International Journal of Innovative Science, Engineering & Technology, 2*(10), pp.850-859.

Oyetunji, A.K. & Abidoye, R.B. (2016). Assessment of the Factors Influencing Students' Choice of Residence in Nigerian Tertiary Institutions. *SainsHumanika, 8*(2), pp.39-47.

Pallant, J. (2005). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS* (2nd ed.). Allen & Unwin Crow's Nest NSW 206, Australia.

Pandya, F. & Maind, S.N. (2017). Discrete Choice Model: Residential Location Choice. *Report for the ISF Institute of Research and Education (No. 28)*. Mumbai, India, pp. 1-14.

Pendleton, L., Atiyah, P. & Moorthy, A. (2007). Is the Non-Market Literature Adequate to Support Coastal and Marine Management?. *Ocean & Coastal Management, 50*, pp.363-378.

Rivera, M.A.I. & Tiglao, N.C.C. (2005). Modelling Residential Location Choice, Workplace Location Choice and Mode Choice of Two-

Worker Households in Metro Manila. *Eastern Asia Society for Transportation Studies, 5*, pp.1167-1178.

Saidu, J.K. & Oyewobi, L.O. (2018). Impact of Contractual Claims on Public Building Projects Performance in Abuja, Nigeria. *Paper presented at the School of Environmental Technology International Conference (SETIC) on Contemporary Issues and Sustainable Practices in the Built Environment,* 10-12 April 2018, Federal University of Technology, Minna, Nigeria, pp.803-811.

Sanit, P., Nakamura, F., Tanaka, S. & Wang, R. (2013). Residential Location Choice Analysis along the Urban Railway Corridor in Bangkok, Thailand. *Paper presented at the 13th World Conference on Transport Research,* Rio de Janeiro, Brazil.

Sanusi, Y.A. (2006). *An Assessment of the Spatial Relationship between Poverty and Environmental Quality in Minna metropolis, Niger State, Nigeria.* Unpublished Doctoral Dissertation, Federal University of Technology, Minna, Nigeria.

Shawal, S. & Ferdous, J. (2014). Study on the Factors Influencing Residential Location Choice of the Garments Workers of Mirpur, Dhaka City. *International Journal of Chemical and Process Engineering Research, 1*(6), pp.73-86.

Stern, L. (2010). *A Visual Approach to SPSS for Windows: A Guide to SPSS 17.0.* (2nd ed.), Allyn and Bacon, Boston.

Ubani, P., Alaci, D.S.A. & Udoo, V. (2017). Determinants of Residential Neighbourhood Choice in a Nigerian Metropolis. *IOSR Journal of Humanities and Social Science, 22*(7), pp.1-11.

Umeh, O.L. (2018). *Research methodology* (1st ed). Lagos: University of Lagos Press and Bookshop Ltd.

Wildish, B (2015). Housing Choice and Preference: A Review of the Literature. *Report to the Research and Evaluation Unit*. Auckland Council, New Zealand.

Wittink, L.T. (2011). *Choice Modelling: An Overview of Theory and Development in Individual Choice behavior Modelling*. Available at: www.https//beta.vu.nl

Zondag, B. & Pieters, M. (2005). Influence of Accessibility on Residential Location Choice. *Paper for Presentation at the 84th Annual Meeting of the Transportation Research Board.* Washington.

Stakeholders' Perception of Residential Rental Value Determinants in Ghana

Emmanuel Kofi Gavu[1,2], Dietwald Gruehn[1], Karl-Werner Schulte[3], and Lewis Abedi Asante[4,5]

[1] School of Spatial Planning, TU Dortmund University, Germany.
[2] Department of Land Economy, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
[3] International Real Estate Business School, University Regensburg, Regensburg, Germany.
[4] Department of Geography, Humboldt University of Berlin, Germany.
[5] Department of Estate Management, Kumasi Technical University, Kumasi, Ghana.

Abstract

The determinants of Residential Rental Values (RRVs) have been analysed differently by housing researchers across the globe. This paper scrutinises the perception of stakeholders in Accra's housing market in order to identify and conceptualise commonalities and differences in variables that determine RRVs. It adopts relative importance index to rank 38 different variables that determine RRVs. Using the stratified sampling technique, the population of experts and stakeholders with knowledge in the rental market space were identified and categorised into six distinct strata. The sample frame was drawn from landlords; tenants; real estate agents; academic staff from real estate departments in universities; valuation and estate surveyors; and a group labelled as 'others'. Purposive sampling was then used to identify respondents within each stratum. The findings suggest that electricity and piped water connection, type of house, property condition and number of bedrooms are the most significant determinants of RRVs in Accra. Contrariwise, the least significant variables include storeroom availability, proximity to recreational facilities, proximity to place of worship, landscape quality and number of storeys. This study contextualises RRVs by identifying variables that reflect characteristics of the rental housing market in Accra. This paper serves as a guide in understanding rental market dynamics in a typical African city where access to data remains a challenge.

Keywords: Perceived Value; Rent; Stakeholders; Real Estate; Relative Importance Index

---

[1] emmanuelkofi.gavu@tu-dortmund.de

1. Introduction

In many African countries the majority of the people reside in rental housing (Mahama & Adarkwa, 2006; UN-Habitat, 2011b; Asante et al., 2018). In Ghana about 40% of the population are tenants (Ghana Statistical Service, 2014). Rental housing is not only an important housing option for the urban poor but also middle and high-income populations in Africa. According to the UN-Habitat (2011b: p.3), "*rental housing is an integral part of a well-functioning housing market*". Further, it is noted that rental housing markets are influenced by a broad spectrum of stakeholders; and respond to local economic, social, regulatory and political realities, whilst operating differently from one city to another. In Ghana and most parts of Africa, more than 90% of tenants rent accommodation from private landlords (Obeng-Odoom, 2011a; 2011b).

Landlords have been perceived as exploitative toward tenants given 'unrealistic' (high and exorbitant) rents and ineffective regulatory mechanisms (Gough & Yankson, 2000; 2011; Yankson, 2012; Amenyah & Fletcher, 2013; Owusu-Ansah & Abdulai, 2014; Asante et al., 2018; Owusu-Ansah et al., 2018). Anecdotal evidence suggests that without landlords doing any 'proper' market research or consulting real estate professionals, they unilaterally fix rental values. Valuers, on the other hand, have also been criticised for not providing accurate valuations due to the disparities between market observed rental values (charged to tenants) and values reported in valuation reports (perceived); which are either overestimated or underestimated (Baffour Awuah et al., 2016). These disparities in Residential Rental Values (RRVs) arise due to the predominantly informal nature of the rental housing market in Ghana. In spite of the informal nature of the market, if these RRVs are properly analysed based on sound market considerations, it may guide market players in assigning realistic values to rental units. Roulac (2001; 2007) suggests that researchers have primarily used physical metrics of age and size, among others, as the explanatory variables that determine a residential property's value relative to other property data samples. This emphasis has been on statistical correlation (for example ANOVA and multiple regression analysis) rather than the fundamental issue of causation. Roulac's concern emphasises the need to also focus on the causes of these correlations. Thus, these studies are critical in understanding how the rental pricing regime works and also serve as a standardised measure in rental housing markets research and analysis. These studies also enable the construction and analyses of rental values from the perspective of players on both the demand and supplier sides of the rental housing market.

RRVs that are observed in the market have individual utility bearing attributes (explanatory variables) that could be modelled to ascertain their effects on rental value. Due to data asymmetries and the lack of a consistent datasets, especially in Africa's housing market, most studies draw on a few 'available' sources (mostly from aggregated census data, data from land sector agencies and valuation reports) to empirically model RRV determinants (Owusu-Ansah, 2012a). This makes it practically impossible to compare analyses on rental value determinants on a standardised basis.

In Nigeria (Arimah, 1992; Adegoke, 2014), Kenya (Gulyani & Talukdar, 2008), Togo (Choumert, Kere, & Laré, 2015) and Uganda (Knight, Herrin, & Balihuta, 2004), the extant literature has focused on the effects of specific location and neighbourhood attributes on rental value. In Ghana, for example, studies such as Anim-Odame et al. (2010a), Anim-Odame et al. (2010b), Owusu-Ansah (2012a), Owusu-Ansah and Abdulai (2014), Owusu-Ansah et al. (2017), have relied on data from land sector agencies and valuation reports to examine the dynamics of the property markets in Kumasi, Accra and Tema. These studies, however, were limited to residential property values and price dynamics. On the rental market, Owusu-Ansah et al. (2018) have examined the nature of rental contracts. These studies did not examine market stakeholders' understanding of value dynamics in order to understand how these perceptions may translate to observed value on the property market. Although Abidoye and Chan (2016) examine the determinants of residential value by analysing perceptions of professional valuers in Nigeria, the study excluded other key stakeholders in the housing market like landlords, tenants, real estate agents and academics (university staff) teaching in real estate departments.

Productivity theory serves as a guide in explaining the perception of value. This theory is based on the belief that the productivity of a real estate unit is dependent on how different attributes are combined and how different market stakeholders react to these attributes (Ratcliff, 1961; Lancaster, 1966; Lundgren, 2013). Different stakeholder groups in the housing market seek different attributes from the use of a particular real estate unit. This results in differences in rental value perceived by these stakeholders. Thus, all attributes that are perceived to influence value are critically analysed by stakeholders depending on the objective they seek from the use of such real estate. This begs the question, what explains the differences in residential rental spaces within the built environment? An attempt is made in this study to analyse trends in commonalities and differences in value perceptions among the various stakeholder groups. From the literature, it can be concluded that although some work has been done on housing markets within the sub-region, no attention has been given to how key stakeholders perceive and rank residential rental value determinants. As noted by the UN-Habitat (2011b: p.4), "*it is important that policymakers understand the intricacies of their cities' rental housing (both formal and informal) and know how to formulate effective, flexible policies to promote and regulate it.*" It must be appreciated that these stakeholders' interaction with the market determine, to a large extent, values of properties which researchers can use to unravel determinants of value. This study is developed as a response to gaining a better understanding on rental value determinants.

Value perception can be studied through various lenses. Furthermore, the way in which market stakeholders perceive rental value determinants provides feedback for empirical analysis. Interestingly, there is very little research on this subject matter within the Ghanaian literature. We fill this knowledge gap by extending the spatial scope of the discussion. By using a survey, the research examines the perception of key stakeholders in the rental market. These stakeholder perceptions are ranked using the Relative Importance

Index (RII). This approach enables researchers to identify data that are relevant to empirically model market interactions.

The entire paper is structured into six sections. The introduction provides an overview and contextualises the research. Section 2 is a review of the literature on explanatory variables that determine residential rental value, while Section 3 gives a brief overview of the structure of the residential rental housing market in Ghana. Section 4 discusses the methodology adopted for the research. Sections 5 present data analysis, results and discussion. Lastly, Section 6 presents the conclusion and implications of the research on the Ghanaian rental market.

2. Theoretical Framework: Explanatory Variables that Determine Rental Value – Evidence from Extant Literature

A variety of theoretical and econometric studies have explored the determinants of house prices (Tse, 2002). One of the theories that help in this regard is Location Theory; attributable to Heinrich von Thünen's theory of location of agricultural land uses in his book '*Der Isolierte Staat*' and Alfred Weber's theory of location of manufacturing industries. von Thünen's depiction of concentric circles of agricultural activities or uses around the consuming centre is a useful and good starting point for research in this field (Predöhl, 1928). In his model, those paying higher prices at the consuming centre are compensated by lower costs of commuting to the CBD. The relationship between house prices and location are as a result of unobservable variations in location across properties coupled with a heterogeneous market.

Originally, land rent theory focused on agriculture and the price and value of a product. The debate as to whether land rent theory as developed for agriculture is applicable to the urban situation has been debated by several scholars (Harvey 1973; Ball 1977; Ball 1985a; Ball 1985b; Lipietz 1985; as cited in Haila 2016). One assumption of urban economic models has been that rents decrease with distance from the city centre. However Haila (2016: p.59) posits that "*empirical research has neither verified nor disproved this*". When rents increase with distance it is explained that perhaps the neighbourhood and quality of the environment is superior compared to others.

Ozanne and Thibodeau (1983) posit that the quality of a location has a ripple effect on house prices within that particular neighbourhood. They depict that in a particular neighbourhood, the quality of a property can be mimicked or duplicated, resulting in every property having similar qualities over time. The same will hold true for low quality properties in a neighbourhood. Figure 1 shows that with the passage of time, a whole neighbourhood can have one common identity in terms of neighbourhood characteristics. On the left-hand side of Figure 1, quality housing is depicted but scattered within a particular neighbourhood, over time other properties mimic the trend and eventually show a similar identity.

One thing worth noting in this model is that better quality properties could reflect the quality of location, which will in turn have a ripple effect to induce

more quality housing in that particular neighbourhood or geographical area. Higher income metropolitan areas will generally have more new houses of better quality and a large size. Where there are inter metropolitan variations, it will contribute to house price variations.

A house is composed of characteristics which together affect its rental value. These include physical (structural), locational, neighbourhood and environmental characteristics. There is disagreement as to how much each of these attributes influence rental values (Harrison & Rubinfeld, 1978; Arimah, 1992; Sirmans, Macpherson, & Zietz, 2005; De & Vupru, 2017). Value could be defined as the importance of something, in this case, the value of a residential property or the anticipated benefits from the market perspective. There is no single universal agreement to the definition of value. Some researchers complicate the discussion on value by asking, is it value in exchange, the value in use or cost to a market participant?
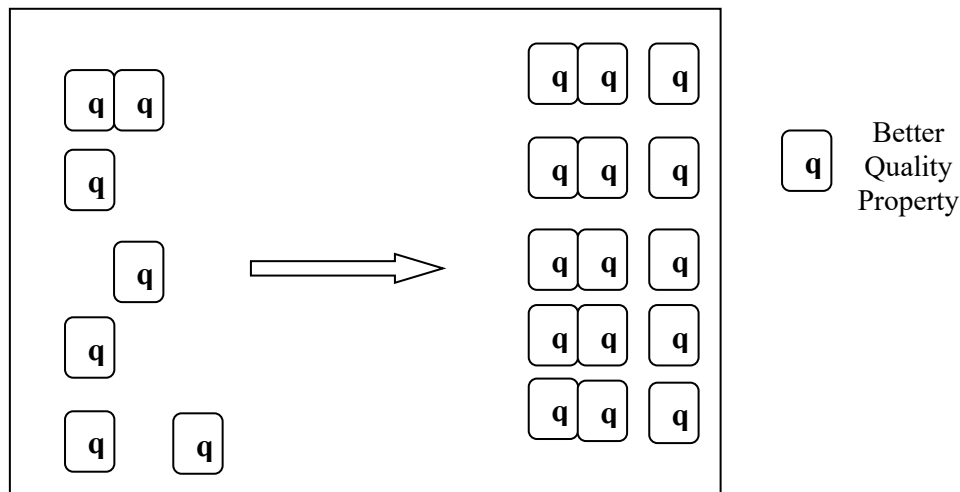
Figure 1: Ripple Effect to Induce more Quality Housing Theory (adapted from Tse 2002; Ozanne & Thibodeau 1983)

Ideally in the rental market, the basis of value in an arm's length transaction should be market rent. Which is defined as "*the estimated amount for which an interest in real property should be leased on the valuation date between a willing lessor and a willing lessee on appropriate lease terms in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion*" (International Valuation Standards Council, 2017: p.21).

In this research however, the focus is on perceived value. Perceived value is value as observed by a particular market participant (or stakeholder) based on interactions within the housing market. Zeithaml (1988) describes four categories of perceived value, namely:

1. Value is low price,
2. value is whatever I want in a product,
3. value is the quality I get for the price I pay, and

4. value is what I get for what I give.

Explanatory variables of the price build-up of real estate units show a particular trend in developed countries (Sirmans et al., 2005). Sirmans et al. identify a list of 20 housing characteristics appearing most often in hedonic pricing model studies. They assert that bathrooms, bedrooms, public rooms, garages, fireplaces, pools, and area of the real estate unit are key explanatory variables that consistently show a positive sign across various regions when a hedonic pricing model is adopted. A careful consideration of variables provided by Sirmans et al. suggests that structural variables appear to be dominant in the discourse. This is interesting and offers a one-sided picture as locational and neighbourhood variables are missing in this list. There is however vast empirical research that suggests that locational and neighbourhood variables that affects rental values may vary across social and economic groups (De & Vupru, 2017). In a developing country context like Ghana, variables like a fireplace, air-conditioning and pool, which are absent in many homes, may not be relevant factors to determine rental values.
This research draws conclusions from market stakeholder perceptions on both the formal and informal rental housing markets in Ghana. The available literature shows that there is limited recorded research on how these variables have been modelled and variables that are significant in one market may be different in another.

The influence of location attributes on rental value may not be as simplistic as previously envisaged. For example, location may be influential in determining rental values in both developed and developing countries. The seminal works of Wilson (1992; 2012) and Connolly (2014) address the issues of origins of residential segregation, problems of ghetto neighbourhoods, inner city poverty, out-migration in inner-city neighbourhoods and problems of rural-urban migration in America. These examples give credence to the fact that negative neighbourhood problems lead to worsening rental conditions. Which in effect influences rental values negatively. These problems are not only confined to developing countries but developed countries as well.

Table 1 shows the list of explanatory variables that have been utilised in both developed and developing country contexts for illustrative purposes. It can be noted that various researchers have utilised different variables to explain the determinants of rental value. In a developing country context, the number of bathrooms and location of property seem to be the predominant variables (Arimah, 1992; Asabere, 2004; Knight et al., 2004; Asabere, 2007; Gulyani & Talukdar, 2008; Anim-Odame et al., 2010a, 2010b; Owusu-Ansah, 2012b; Adegoke, 2014; Choumert et al., 2015; Abidoye & Chan, 2016). The location variable is not defined and lumped together as one variable. This actually masks the different aspects of location that could be modelled. However, there seems to be some convergence with variables used in the developed country context (Malpezzi, 2002; Sirmans et al., 2005) (i.e. the age of the property, floor area, number of storeys, number of bathrooms and bedrooms).

Other African case studies further expand on these variable relationships. In Kenya, a multivariate analysis of what drives rental values in Nairobi's

informal rental housing market suggests that factors such as: the number of rooms, building quality, permanent walls, permanent floor, electricity and water availability, reasonable access to toilet, and the presence of public school in the neighbourhood are critical in rent determination (Gulyani & Talukdar, 2008). The authors posit that the informal market mimics the formal market in that rental values are determined by the unit's size, location, construction quality and access to infrastructure.

The modelling of Uganda's real estate market shows different determinants of rental value. Using the Uganda National Housing Survey data, Knight et al. (2004) show that electricity and water availability, toilet facility, construction quality, number of rooms, location, distance from the CBD and type of land tenure are significant determinants of rent.

Table 1: Key Explanatory Variables Used in Extant Literature (Especially in Developing Countries in Africa)

		Developing Country Evidence														
Category	Dimension	Sirmans et al. 2005	Malpezzi 2002	Arimah 1992	Asabere 2004	Knight et al. 2004	Asabere 2007	Gulyani & Talukdar 2008	Anim-Odame 2010a	Anim-Odame 2010b	Owusu-Ansah 2012	Adegoke 2014	Choumert et al. 2015	Abidoye and Chan 2016	meqasa.com 2018	Total
Structural	Real estate type								X	X					X	3
	Age of rental property	X	X				X				X			X		5
	Lot size				X		X			X					X	4
	Total floor area in sqm.	X	X	X					X	X				X		6
	Number of floors/ storeys	X	X				X			X						4
	Public room	X									X	X				3
	Number of bedrooms	X	X	X		X	X		X	X			X			8
	Number of WC/ toilet					X						X				2
	Type of toilet facility							X					X			2
	Number of bathrooms	X	X								X	X				4
	Floor finish							X					X			2
	Fence wall availability										X					1
	Parking space (Garage or outhouse) available?	X	X							X	X					4
	Construction quality					X	X									2
	Quality of landscaping								X	X						2
	Property condition/ Physical deterioration													X		1
	Pool area (swimming pool)	X									X					2
	Fireplace	X														1
	Burglar alarm											X				1
	Air-conditioning	X														1
	Security of Tenure				X					X	X					3
	Tenure type (leasehold or freehold)					X	X			X						3
	Shared facility			X												1

Location	Location of property			X			X	X	X		X	X	6
	Near to market or shopping centre				X								1
	Near to CBD	X	X	X									3
	Near to educational facilities	X			X								2
	Near to police station (security)									X			1
	Access and time variable		X										1
Neighbourhood	Neighbourhood class		X									X	2
	Neighbourhood characteristics									X	X		2
	Electricity connection	X	X	X	X								4
	Water availability			X	X								2

Source: Authors' Construct, 2018.

In the Nigerian literature, Arimah (1992) asserts that floor area, number of bedrooms, electricity connection, proximity to educational facilities and CBD, and whether the property is a shared facility or otherwise, are the significant determinants of rent in Ibadan. Adegoke (2014) posits that different critical factors influence RRVs of different building types in different residential densities. The findings show that the number of toilets, number of bathrooms, living rooms and presence of burglar alarm are key determinants of rent in Ibadan in Nigeria. Also, Abidoye and Chan's (2016) findings (based on perceptions of professional valuers in Nigeria) reveal that property location, neighbourhood characteristics, state of property repair, size of the property, neighbourhood security, age of property are most highly significant influence on residential property value.

In Ghana, Buckley and Mathema (2007) use household income and household size to model housing demand. Asabere (2004) considers lot size, distance to CBD, neighbourhood class, electricity and water availability, type of tenure, access and time variables to price leasehold and freehold interests using hedonic analysis. In another study, Asabere (2007) utilises the number of storeys, plot size, age and location to model the market in Tema.

Anim-Odame et al. (2010a; 2010b) and Owusu-Ansah and Abdulai (2014) use similar datasets from the Land Valuation Division of the Ghana Lands Commission to develop housing price indices for Accra. The explanatory variables are sale price/rent, number of bedrooms, number of storeys, plot size, floor area, tenure or tenancy term certainty, the presence of a garage or outhouse, quality of landscaping, real estate type (detached or semi-detached), and security of tenure. Anim-Odame et al. use a hedonic model to analyse the influence of residential attributes on price and rent and also to test submarket performance. They conclude that the number of bedrooms and an unexpired term are not statistically significant, while all other variables have expected signs for the rental market. Using cross-sectional data, Owusu-Ansah (2012a) establishes that the number of bedrooms, bathrooms, living rooms, the age of the property, the location of the property, availability of a garage, fence wall, swimming pool, and land registration influences real estate values in urban Ghana. The number of floors was found to have the least impact on price.

All the aforementioned country-specific examples give credence to the assertion that it is not possible to compare value determinants on a standardised basis. This is due to the paucity of data in Africa's rental housing market. And also due to the fact that different variables are utilised to disaggregate value. There is, however, another construct that has been developed to analyse explanatory variables in housing market analysis. The Brand, Beauty and Utility (BBU) model, developed by Stephen Roulac, is discussed in the next paragraph.

The BBU concept examines the role that brand, beauty and utility play in defining property value with a place construct (Roulac, 2001). On a broader conceptual level, the value of a property is determined by its use. This concept seems to align with the Marxist theory of rent that suggests a dialectical relationship between use and exchange in value. Owusu-Ansah et al. (2018) mention that the Marxist theory of rent offers relevant theoretical insights in that it suggests a strong link between use and exchange in value. The BBU model builds on the location theory of economic activities by focusing on what real estate practitioners mean when they say location and neighbourhood factors determines the value of property. Roulac (2001: p.429) explains that "*the price that a property commands in the market place effectively is a payment for the right to rent and control the sensory experiences of utility, brand and beauty*." For rental property, a (prospective) tenant assesses the worth of the whole value package of brand, beauty and utility. Quantifying the 'correct' set of independent variables that determine rental value may be a daunting task. There are some perceived challenges in quantifying variable effects (Anim-Odame et al., 2010b; Helbich et al., 2013; Gilbert, 2016). These are outlined below:

1. It may be difficult to identify and measure those factors that are important variables in determining value. The question here is what is important to be measured and how do we identify them?

2. Some of the effects may not be readily noticeable or may be non-linear. The question here would be how do we account for factors that we may not be aware of?

3. It may be difficult to separate or draw a fine line between individual property characteristics (that affect value), location and neighbourhood factors, and how these individual factors contribute to price in the real estate market. How do these interrelationships interact to determine rental value in the market?

The failure to adequately address these questions in the methodology may yield results that may understate or overstate the effects of explanatory variables on rental value. Rental values affect household expenditure and spending patterns through the Wealth Effect in the broader macro economy. When explanatory variables that cause changes in value from one location to another are uncovered it can help improve the underlying constituents of differential rents from key stakeholder perspectives. When the effects of location or locational attributes are separated from rental values, two effects are envisaged. Firstly, rental values can be analysed on a standardised basis. Secondly, the contribution of location and neighbourhood attributes can be analysed to estimate its impact on rental values.

How rental systems operate has been widely theorised and shapes the ways in which rent phenomena are understood. It must be noted that the Georgist analysis of rent argue that landlords continue to wield power over both tenants and the state; whereas Marxists theories of rent suggests a didactical relationship between use and exchange in value (see Obeng-Odoom 2015 for a full discussion). In other words, Marxists advocate the nationalisation of land, whereas Georgists taxing land rent. However, Ghana's market follows a free market model (likened to the neoliberal ideology). As Owusu-Ansah et al. (2018) rightly opine, rental housing provision in Ghana has switched from state-led development to market-based development. It is argued that the Ghanaian market is unique in itself and that a more grounded, context-specific understanding of the rental market would be the preferred theory that explains the conceptualisation of rent. A full discussion of how these theories are operationalised are outside the scope of this paper[1]. The foregone discussions lead to the next section which presents an overview of the peculiar situation of the rental housing market in Ghana. This is to allow readers to appreciate the local housing context within which the research is based.

3. The Nature of the Residential Rental Housing Market in Ghana – An Overview

The residential rental housing market in Ghana, just like other housing markets within the Sub-Saharan African (SSA) region is characterised by high demand over available supply; high rental values coupled with generally low incomes; and government policy focus on homeownership with less attention to the rental housing market. Ghana's market follows a free-market model with the active participation of the private sector as the main suppliers of new developments (Tipple & Korboe, 1998; Arku, 2009a, 2009b). The current role of government is as a policy regulator that provides an enabling environment to developers for housing supply. Many attempts by the government of Ghana, policy-wise, promote home-ownership. However, not everyone can afford property; thus, rental housing is on the ascendency. UNESCAP and UN-Habitat (2008) underscore the need to holistically analyse the housing market and posit that *"it is a common misperception that everyone wants to own a house. For many people, rental housing is a better option"* (2008: p.1).

Ghana's national housing policy is aimed at *"creating viable and sustainable communities through the provision of adequate, decent and affordable housing that is accessible and sustainable to satisfy the needs of Ghanaians"* (Government of Ghana, 2015: p.14). To reduce the over 1.7 million housing deficit (Salifu Osumanu et al., 2018) the government's approach has been to provide an 'enabling environment' by extending key infrastructure for the private sector to lead the way in housing supply.

---

[1] Anne Haila presents an interesting exposition on the theories of land rent (see chapters 2 to 5 Haila, 2016)

Anecdotal evidence suggests that the real estate market is segmented and highly heterogeneous in terms of property type. The Ghanaian rental market is generally of two typologies: a formal and informal market (Figure 2). The formal market is more structured and consists of gated communities and estate buildings. These areas have access to basic infrastructure, and developers conform to required planning and building standards. A greater number of the housing stock is exclusively for sale with rents priced in United States Dollars (Arku et al., 2012).

The informal market is part of the urban fabric because of the phenomenon of urban sprawl. The urban poor occupy such areas as they cannot afford rents in neighbourhoods where better housing exists. The informal market is utilised by the majority of the population for housing supply due to low incomes. This market is generally of poor quality and lacks access to basic infrastructure. Landlords in this market operate outside the legal regime and are believed to exploit tenants because of housing shortages. Arku et al. (2012) explain that most houses in the informal market are overcrowded, without planning permits, poorly sited and with no access for emergency services when disaster strikes. The informal market is dominated by what is known as traditional compound houses (see Figure 3) which is home to the majority of the population. A compound house is a single or multi-storey, semi-detached building, where occupants share and utilise a common compound.
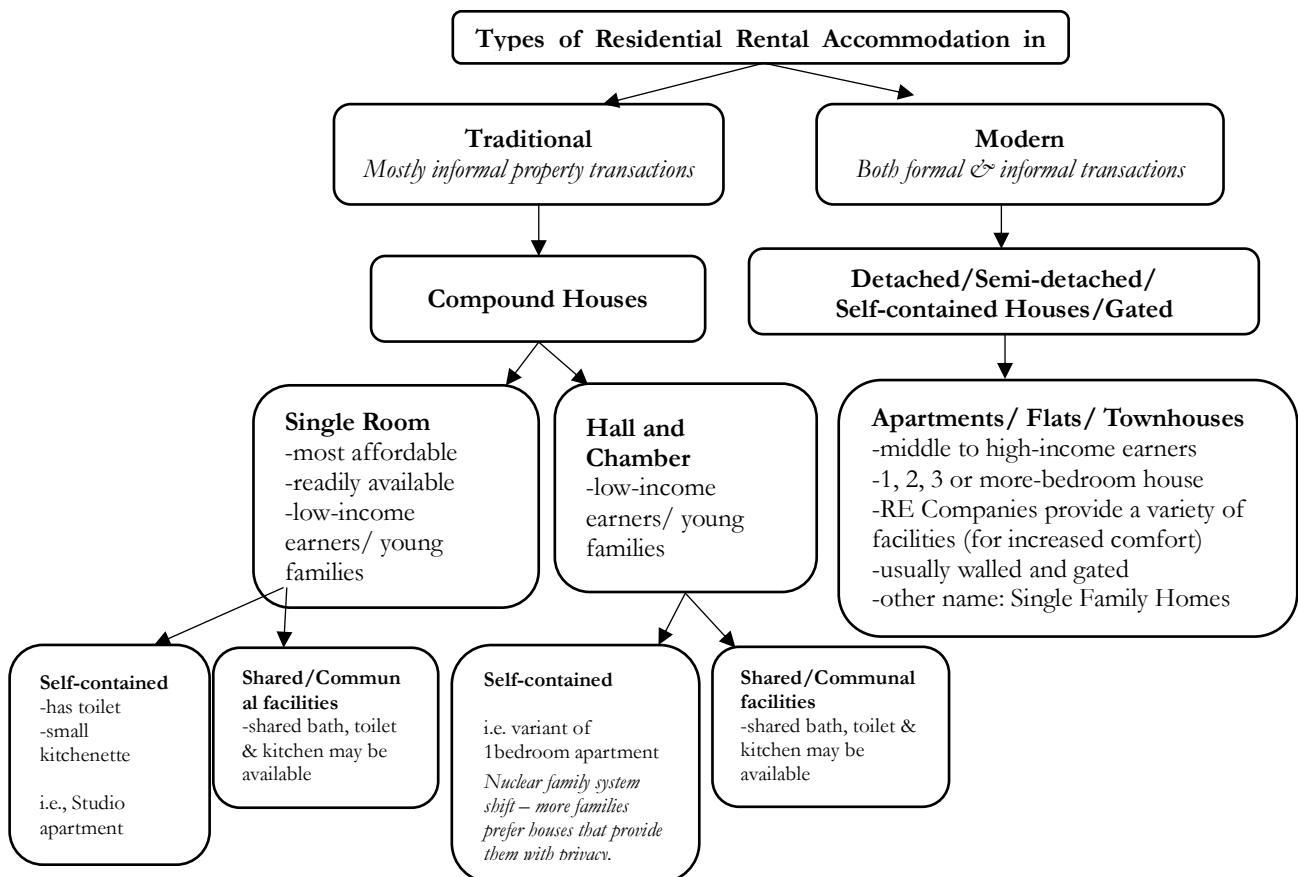

Figure 2: Residential Rental Accommodation Types in Ghana
Source: Authors' Construct, 2018.

Two main types of houses are available for low-income earners in compound houses; '*single rooms*' and '*hall-and-chamber units*'. The '*single rooms*' consist of one room that serves as both a living area and bedroom for an occupant. '*Hall-and-chamber*' units have two rooms, one used as a living room (which can be converted to a bedroom based on family size) and the other as a bedroom.
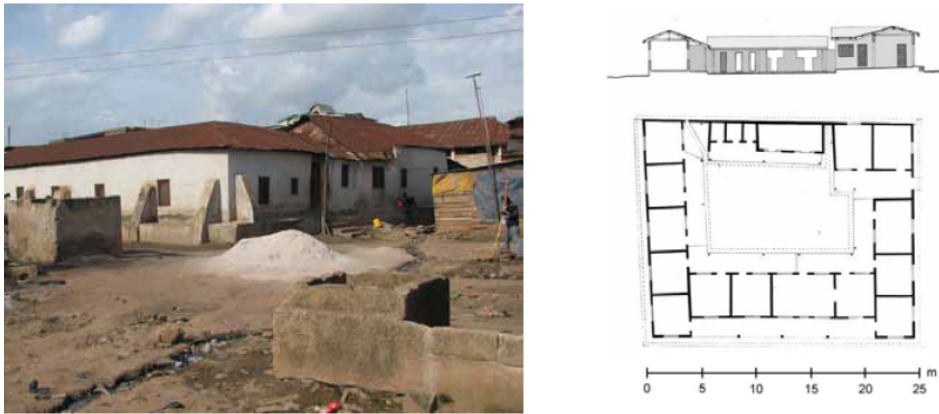

Figure 3: Traditional Compound House and Plan
Source: UN-Habitat, 2011a (Photo Credit: G Tipple & Royal Danish Academy of Fine Arts)

4. Methodology

4.1 Survey Design

Real estate, like other sectors of the economy, has different mechanisms for setting prices in the market. These may differ from the theoretical framework of demand and supply. As a heterogeneous good, how different factors interact to fix prices may be perceived differently by stakeholders in the market (Kibunyi et al., 2017). Therefore, using a stratified sampling technique, the population of experts and stakeholders with knowledge in the rental market space were identified and divided into six distinct homogeneous strata. Each respondent was assigned to only one stratum, which were mutually exclusive. The stratified technique has the advantage of providing greater precision in terms of responses from each stratum, and as such can guard against an unrepresentative sample (Jewell, 1985; Thompson, 2012). Each stratum was identified based on their direct or indirect interaction with the rental housing market.

The web link to the questionnaires was sent out to these groups via email groups, WhatsApp platforms and personal interviews to elucidate responses within each stratum. The purposive sampling technique was used to identify respondents within each stratum since other means of identifying the same was not possible. However, every effort was made to ensure that the downsides of completing the questionnaires were mitigated through constant reminders. The sample frame was drawn from landlords; tenants; real estate agents (REAs) (within Accra); academic staff in real estate departments from Universities (Kwame Nkrumah University of Science and Technology Kumasi and University for Development Studies Tamale); as well as

valuation and estate surveyors of the Ghana Institution of Surveyors (GhIS) and a group labelled as 'others' all in Accra (see Figure 4). It must be noted that developers, who are active market participants that would want to maximise returns through client satisfaction are not part of the analysis. Questionnaires were sent out to a group of developers but only 1 developer responded. The rest did not return the questionnaires though it would have been interesting to identify property attributes that possess effective demand from developers' perspective. A number of questionnaires were sent out, and the data analysed in this research was obtained from a response rate of 113 respondents who are perceived to be acquainted with both the formal and informal rental markets in Ghana. The survey was carried out between January and February 2017.
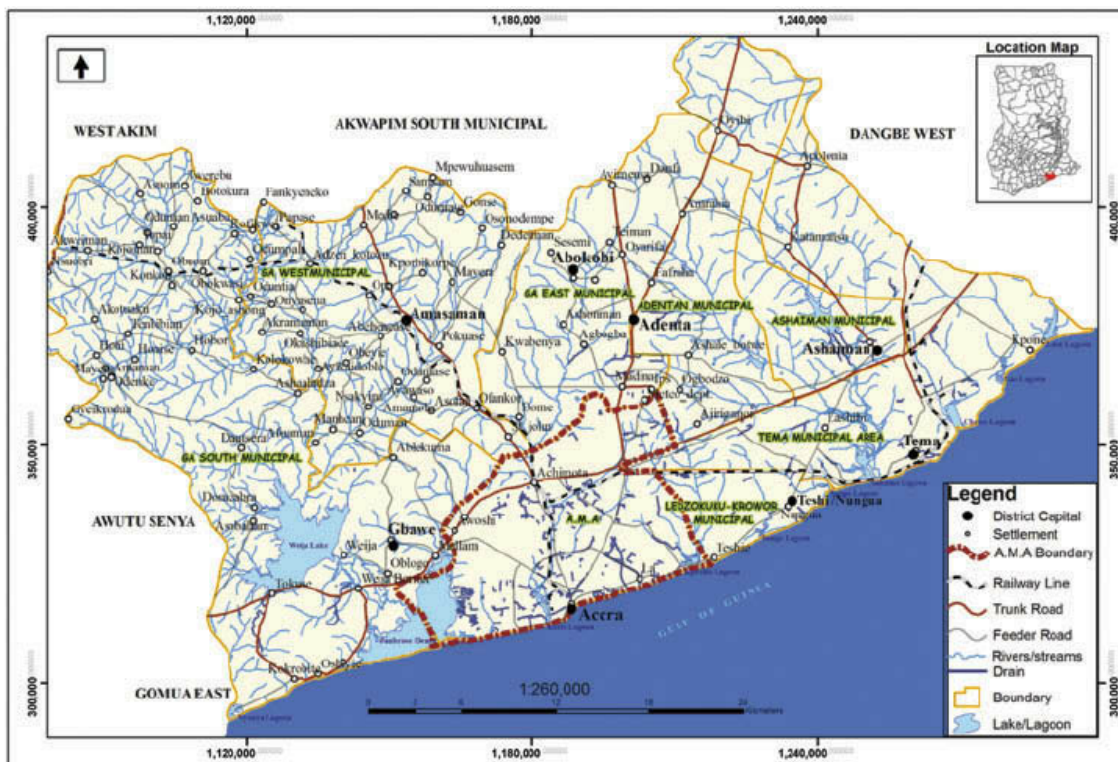
Figure 4: Map of the Greater Accra Region
Source: Centre for Remote Sensing and GIS (CERGIS) University of Ghana, 2013

Both closed and open-ended questions were included in the questionnaire after the pilot test was undertaken to identify potential problems and the feasibility of the following research methodology. The questionnaire[2] was administered to experts, namely: Academics and Valuation and Estate Surveyors (VES) (members of the Ghana Institution of Surveyors), and stakeholders (landlords, tenants, real estate agents). Academic staff from real estate departments provide the VES, as do other market players with the

---

[2] The web-link to the questionnaire is provided here:
https://docs.google.com/forms/d/e/1FAIpQLScIJXgdUf9KU0nwSWhbFfFRml2F3NGz6-OVqHgVmgc3YG8v5A/viewform?usp=sf_link

The "Google forms" online platform was used to collect the data. All respondents filled and submitted the questionnaires online. Once the form is submitted the authors received an alert.

requisite expertise and knowledge (both directly and indirectly). All academic staff respondents are practitioners are also members of the GhIS. VES is the professional body mandated to carry out property valuations (and property management). Their experience and in-depth knowledge about the rental market is critical in understanding how the market operates. In Ghana, the majority of transactions in the rental market is informal and landlords mostly determine rents (seldom with the help of real estate professionals). Landlords have greater control in determining rental values for their properties; hence their inclusion. Anecdotal evidence suggests that most landlords in the informal rental market do not engage the services of estate agents to avoid paying commission. REAs on the other hand act as middle-men for either the landlord and/or the tenant. Some landlords and developers rely on REAs in the sales and letting of properties at a commission. These agents could be differentiated by the kind of properties they manage – high end, middle end and low-end agents. There is currently no licensing regime to certify them or regulatory controls for REAs in Ghana. It should be however noted that professional REAs are regulated by the GhIS. Tenants decide on their location choice based on their perceptions about value in the rental market as such their inclusion. Lastly, there was a respondent group known as 'others'. These did not identify with the categories above but provided useful insights in understanding the phenomenon under study.

A number of explanatory variables were identified through the literature review, and the role of experts and stakeholders were to rank these variables based on their perceptions about how the explanatory variables could be incorporated in defining what is relevant from a purely theoretical perspective. This was seen as a first step to put the research in its relevant local context.

The type of data collected during the survey includes the category of respondents, years of contact with the real estate market, a ranking of variables that determine rental values and a brief description of the rental market in Accra. Accra was selected as the case study area because it is the capital city, has a higher percentage of rentals and a better developed rental market than other parts of the country.

5. **Determinants of Residential Rental Values: Evidence from Key Stakeholder Survey**

From the perspective of a developing country, there is little consensus as to which specific variables determine rental values (Megbolugbe 1989; Anim-Odame et al.*,* 2010b; Adegoke 2014). This research takes the approach by first developing a questionnaire for key stakeholders in the rental market in Ghana. The approach utilises a large spectrum of 38 variables identified through the literature review, which may be relevant in identifying key determinants of rental value. Respondents ranked these variables, and the findings are presented in this section.

The data consists of 113 responses from experts and stakeholders. From the sample, landlords, tenants, REAs, academia, VES and the group labelled

'others' constituted 5%, 35%, 4%, 20%, 30% and 4% respectively. The questionnaire made available an option known as 'others' for respondents who did not identify themselves with any of the categorised groupings. This group from the survey could be made up of owner-occupiers, sharers and rent-free occupiers of rental property (which include children and relatives of both landlords and tenants).

5.1 Reliability Analysis – Cronbach Alpha

To test how reliable the ranked data is, the Cronbach Alpha analysis is used. Theoretically, the values can range between 0 and 1. Higher values suggest internal consistency and therefore valid conclusions from the data. Nunnally and Bernstein (1979) believe that values between 0.50 and 0.60 and above show strong consistency. However, Hair et al. (2010) posit that ≥0.70 is preferred.

An overall alpha value of 0.963 was realised. This suggests that the data can be relied on to draw valid conclusions. The Cronbach Alpha for each variable, when each variable is deleted, is computed in Table 2. Oyedele (2013) posits that this measures the significance of each variable compared to the overall Cronbach Alpha. The value of a variable equal to or less than the overall alpha value (0.963) suggests a significant contribution of that variable; whereas a value higher than the overall alpha value signifies insignificant contribution. From the data analysed all Cronbach alpha values (when each variable is deleted) is either below or equal to the overall Cronbach alpha value; hence they contribute significantly to internal consistency and retained in the further analysis.

Table 2: Cronbach Alpha Scores for Variables

Overall Cronbach alpha reliability 0.963		
Category of factor	**Name of Variable**	**Cronbach alpha when the variable is deleted**
Structural Characteristics	Type of house (*e.g. apartment, hall & chamber, single room*)	0.962
	Quality of construction (& materials)	0.962
	Age of building	0.962
	Plot size	0.962
	Size of building (*floor area*)	0.962
	Number of bedrooms	0.962
	Number of wc	0.962
	Number of baths	0.962
	Floor finish (*screed, concrete, tile, terrazzo*)	0.962
	Number of storeys (*floors*)	0.963
	Kitchen available (*separate or shared*)	0.962
	Toilet available (*separate or shared*)	0.961
	Bathroom available (*separate or shared*)	0.961
	Property condition (*physical deterioration*)	0.961

	Fence or wall availability	0.961
	Parking space or garage availability	0.962
	Storeroom availability	0.963
	Quality of landscaping	0.962
Neighbourhood characteristics	Near to suitable vehicular access	0.961
	Has electricity connection	0.961
	Has piped-water connection or well	0.961
	Waste disposal or garbage collection available	0.961
	Area considered safe *(security)*	0.962
	Streetlighting present	0.962
Locational characteristics	Presence of suitable surface drainage	0.962
	Near to traffic congestion	0.962
	Near to market or shopping centre	0.961
	Near to CBD	0.962
	Near to job opportunities	0.962
	Near to educational facility	0.961
	Near to healthcare *(medical)* facilities	0.962
	Near to recreational facilities *(parks & green spaces)*	0.962
	Near to squatter settlements	0.963
	Near to Police station *(security post)*	0.962
	Near to place of worship	0.962
	Population density	0.962
	Near to bus stop *(public transport)*	0.962
	Quality of property view	0.962

Source: Author's Construct, 2018.

5.2 Perceived Effects of Ranked Variables by Stakeholders

Table 3 provides a summary of the perceived significant effect of each of the ranked variables as perceived by stakeholders. From Table 3, variables ranked as 'significant' or 'highly significant' are also perceived to have a positive effect on rental value. This suggests that when these variables are modelled the signs of their coefficients are expected to be positive and most probably statistically significant. Another group of variables are ranked as neutral in terms of significance and effect on rental value. These are number of storeys (floors), storeroom availability and rental units near to recreational facilities. This result also suggests that these variables may not be statistically significant and may not have any effect on rental value when modelled. This suggests that the effect may be 0.

The next group of variables are perceived to have a positive effect but no significance on rental value. These variables include: 'age of building', 'plot size', 'number of baths', 'quality of landscaping', 'near to CBD', 'near to job opportunities', 'near to police station', 'near to bus stop' and 'quality of property view'. So, it presupposes that when these variables are modelled in

a hedonic equation the expected sign of the coefficients may be positive but may not be statistically significant. This seems at variance with the literature on the effects of some of these variables, especially plot size and number of baths. The literature suggests that the coefficients of these variables normally have a positive sign when modelled in a hedonic equation or regression analysis (see Sirmans et al. 2005).

These next set of variables are perceived to have an adverse effect but no significance on rental value. These variables are: 'near to traffic congestion' and 'near to squatter settlements'. Since many residents will generally want to avoid these areas, the perception is that it has a negative effect on rental values, and as such, a negative sign is expected in terms of the coefficient sign when modelled. It may also imply that these variables may not be statistically significant.

Table 3: Perceived Significant Effect of Variables that Determine RRVs by Stakeholders – Overall

Category of factor	Name of Variable	Significance	Effect on rental value (expected sign)	Comment
Structural Characteristics	Type of house (*e.g. apartment, hall & chamber, single room*)	Highly Significant	+	
	Quality of construction (& materials)	Significant	+	
	Age of building	Neutral	+	Inconclusive
	Plot size	Neutral	+	
	Size of building (*floor area*)	Significant	+	
	Number of bedrooms	Significant	+	
	Number of wc	Significant	+	
	Number of baths	Neutral	+	
	Floor finish (*screed, concrete, tile, terrazzo*)	Significant	+	
	Number of storeys (*floors*)	Neutral	Neutral	Inconclusive
	Kitchen available (*separate or shared*)	Significant	+	
	Toilet available (*separate or shared*)	Significant	+	
	Bathroom available (*separate or shared*)	Significant	+	
	Property condition (*physical deterioration*)	Significant	+	Effect could be negative
	Fence or wall availability	Significant	+	
	Parking space or garage availability	Significant	+	
	Storeroom availability	Neutral	Neutral	Neutral
	Quality of landscaping	Neutral	+	Effect could be neutral
Neighbour hood characteris tics	Near to suitable vehicular access	Significant	+	
	Has electricity connection	Highly Significant	+	
	Has piped-water connection or well	Highly Significant	+	

	Waste disposal or garbage collection available	Significant	+	
	Area considered safe *(security)*	Significant	+	
	Streetlighting present	Significant	+	
Locational characteristics	Presence of suitable surface drainage	Significant	+	
	Near to traffic congestion	Neutral	_	Inconclusive
	Near to market or shopping centre	Significant	+	
	Near to CBD	Neutral	+	Effect could be neutral
	Near to job opportunities	Neutral	+	Effect could be neutral
	Near to educational facility	Significant	+	
	Near to healthcare *(medical)* facilities	Significant	+	
	Near to recreational facilities *(parks & green spaces)*	Neutral	Neutral	Effect could be positive
	Near to squatter settlements	Neutral	_	
	Near to Police station *(security post)*	Neutral	+	
	Near to place of worship	Neutral	+ / _	Inconclusive
	Population density	Neutral	+ / _	Inconclusive
	Near to bus stop *(public transport)*	Neutral	+	
	Quality of property view	Neutral	+	

Note: "+" is positive, "-" is negative

Source: Expert/Stakeholder Survey, 2017.

The final set of variables in terms of significance are neutral but could have either positive or negative impacts on rental value. These variables are: 'near to place of worship' and 'population density'. The observed effect here is inconclusive and suggests that when modelled in a hedonic equation the variable coefficient could be positive or negative depending on the empirical data analysed and is probably insignificant.

In general, it must be noted that there is a convergence with some of the variables presented by Sirmans et al. (2005) who are also of the opinion that the number of bathrooms, bedrooms, public rooms, garage and size of rental unit predominantly have a positive effect on rental values. These assertions are based on empirical evidence. It is realised that although respondents' choices are only perceived to be the effects without any empirical basis, it does present a starting point to examine which variables may be relevant in modelling the rental market in a developing country context. It was mentioned earlier that researchers in this field need to be able to identify the 'correct set of variables' that must be incorporated in the rental market analysis.

To conclude, in Table 3, it is realised that most of the variables identified throughout the literature and presented here are perceived to be significant and may have a positive coefficient sign when modelled. This is the first step in identifying variables that may be selected and utilised in empirical data collection. The empirical data will give a strong indication as to the

conclusions that may be drawn from the selection of these variables, especially in a developing country context.

In the next section, the variables are ranked based on the Relative Importance Index.

5.3 Relative Importance Index (RII)

The RII is used to evaluate each variable in order to determine their relative contribution to rental value. This index is computed by utilising all individual variable scores and ranking variables against each other. The frequently cited RII formula as presented by Holt (2014) is adopted:

$$RII = \frac{\Sigma W}{A*N} \qquad (1)$$

Where $0 \leq RII \leq 1$

Where:　　　　W is the sum of scores awarded a variable V_i from N number of respondents.

The sum of N respondents selecting a response point multiplied by the point's integer value, for an option on the scale term.

A is the largest integer response scale (A_{max}, in this case, will be 5).

The index has a value between 0 and 1. When the value of the index is close to 1, it suggests that respondents rank that particular variable high, and a rank close to 0 suggests that the variable has a low ranking. The RII computes the 'relative importance' of (independent) variables by comparing the rank attributed to the variable by respondents and also by comparing with other variables that are computed.

Respondents were asked to rank each variable based on a 5-point Likert scale from 1 (*highly insignificant*) to 5 (*highly significant*). These RII rankings are computed from the raw scores as provided by respondents and values ranged between 0.48 and 0.97 (see Table A1 in the appendix). Based on the RII computed, each variable is ordered from 1 (highest RII score) to 38 (least RII score) – see Table 4. Colour coding is used to differentiate the categories of variables measured. From Table 4, the median scores for all respondents are provided. The median is utilised as it is resistant to outliers and better represents a measure of central tendency. Although the mean is one of the common measures of central tendency, it cannot be used in this instance because the data are ordinal in nature (i.e. rankings from 1 to 5).

Table 4: Ranking of the Variables Based on the Relative Importance Index (RII) by Category

Name of Variable	Academics N = 23	VES N = 34	REA N = 5	Tenant N = 40	Landlord N = 6	Others N = 5	Overall Ranking N = 113	Median Score
Has electricity connection	1	1	3	1	1	1	1	5
Type of house (*e.g. apartment, hall & chamber, single room*)	1	2	1	2	6	2	2	5
Has piped-water connection or well	3	3	3	3	1	2	3	5
Property condition (*physical deterioration*)	4	4	1	3	10	11	4	4
Number of bedrooms	5	8	6	5	1	4	5	4
Area considered safe (*security*)	6	4	3	8	4	4	6	4
Toilet available (*separate or shared*)	8	6	8	5	6	4	7	4
Bathroom available (*separate or shared*)	8	6	13	5	6	4	7	4
Kitchen available (*separate or shared*)	12	10	13	9	9	8	9	4
Quality of construction (& materials)	11	9	8	13	35	16	10	4
Size of building (*floor area*)	8	10	8	15	10	11	11	4
Near to suitable vehicular access	7	14	6	10	21	11	11	4
Floor finish (*screed, concrete, tile, terrazzo*)	12	12	13	10	24	28	11	4
Waste disposal or garbage collection available	14	13	8	14	4	16	14	4
Fence or wall availability	19	18	25	12	10	8	15	4
Presence of suitable surface drainage	15	15	29	26	10	8	16	4
Near to healthcare (*medical*) facilities	23	16	8	20	10	22	16	4
Number of wc	23	26	18	20	10	11	18	4
Parking space or garage availability	22	26	19	18	30	11	18	4
Streetlighting present	16	24	33	20	21	22	18	4
Near to squatter settlements	23	20	19	16	24	34	18	3
Number of baths	30	33	19	20	10	16	22	3
Near to educational facility	23	20	13	31	10	20	22	4
Near to CBD	16	26	13	26	37	20	22	3
Near to market or shopping centre	18	24	33	20	24	22	22	4
Quality of property view	32	20	25	16	10	34	22	3
Near to traffic congestion	19	20	25	26	21	34	22	3
Age of building	30	30	32	18	24	22	28	3
Near to bus stop (*public transport*)	23	35	19	20	30	16	29	3
Near to job opportunities	29	26	25	32	24	22	29	3
Near to Police station (*security post*)	36	16	36	30	10	28	29	3

Plot size	23	19	19	36	33	28	29	3
Population density	33	34	19	26	24	33	33	3
Number of storeys *(floors)*	19	30	29	32	33	34	33	3
Quality of landscaping	33	30	37	34	35	34	35	3
Near to place of worship	38	37	33	37	10	28	36	3
Near to recreational facilities *(parks & green spaces)*	35	35	29	38	32	28	37	3
Storeroom availability	36	38	37	35	38	22	38	3

Source: Expert/ Stakeholder Survey, 2017.

☐ Structural characteristics
☐ Neighbourhood characteristics
☐ Locational characteristics

Note:
'Academic' represents – academic (real estate and related fields)
'VES' represents – Valuation and Estate Surveyor (GhIS)

It can be realised from Table 4 that the following variables are generally ranked very high: electricity connection, piped-water connection, type of house, property condition and number of bedrooms. For example, it is striking to notice that among the category landlords, a variable like property condition, which was expected to be ranked probably among the top 5, rather had a rank of 10th position. The same can be realised from the quality of construction material which ranks 35th. Could it mean that landlords generally do not extend much importance to the quality of construction materials and property conditions when they decide on rental value? If this assertion is right, then it could also suggest that the motive of landlords would be to rent out their properties irrespective of the condition or quality of construction materials and still expect to make higher returns.

It should also be observed that within the tenants' stratum, availability of basic utilities (electricity and water connection), property type, property condition and the number of bedrooms are topmost determinants of rental value. The availability of basic utilities seems to cut across all groups. A general trend realised is that neighbourhood, and structural characteristics are ranked higher followed by locational characteristics.

5.4 Omitted Variables

In order to ensure that no variables have been possibly omitted, respondents were asked to indicate whether any variables may have been omitted. The results to the question, '*Are there other variables that may have been omitted?*' are presented below.

It was realised that majority of the respondents (47%) were not sure whether some variables were omitted or otherwise. It is acknowledged that it may be difficult to identify the '*correct set of variables*' that together make up the rental value. Although this may be the case, we are of the view that most of the relevant variables have been identified in this research. About 31% of respondents are of the opinion that no variables had been omitted. Twenty three percent of respondents felt that there were omitted variables that ought to be included. These included the following;

-   availability of telecommunication infrastructure,
-   whether location or neighbourhood is flood prone,
-   the presence of landlord in the same facility,
-   environmental pollution levels in the neighbourhood,
-   type of tenant (e.g. government, private company or individual),
-   type of land tenure arrangement, and
-   quality of property management.

In terms of further research into this phenomenon, other researchers are encouraged to consider their inclusion and test how stakeholders will rank these variables in terms of the effect on rental value.

5.5 Which Variables Drive Residential Rental Values?

Based on the foregoing, an attempt has been made to discuss stakeholder perceptions of rental value determinants. The research provides a summary of the effects of structural, neighbourhood and locational characteristics in giving guidance as to which of these broad categories determine residential rental values in Ghana. Figure 5 shows the median values of RII for each category of respondent as computed from raw scores. The median is preferred in this instance as it is robust and not affected by skewed data. Respondents are in general agreement and suggest that in terms of ranking from the highest to the lowest (based on median RII), neighbourhood characteristics are ranked highest, then followed closely with structural characteristics and then locational characteristics rank third.
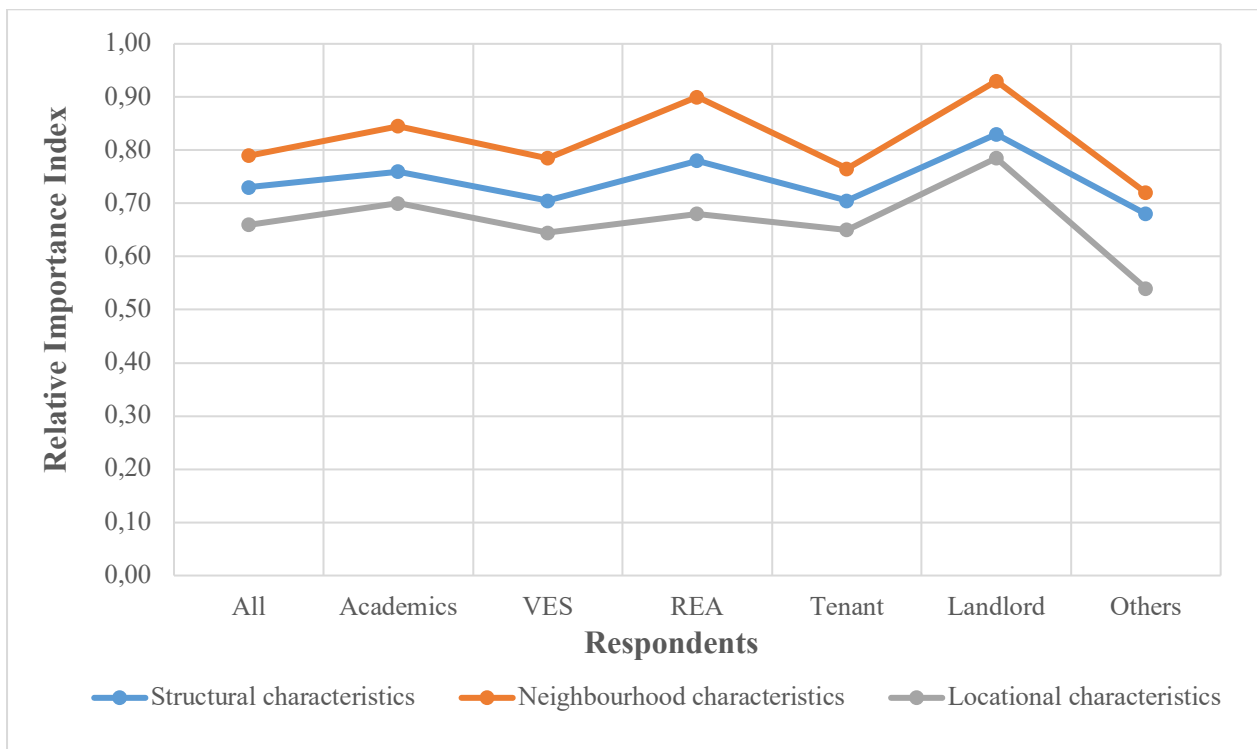

Figure 5: Relative Importance Index of Structural, Neighbourhood and Locational Characteristics
Source: Expert/ Stakeholder Survey, 2017.

6. Conclusions and Implications

This paper contributes to the discussion on rental value determinants by extending the spatial scope in a developing country context. The paper bridges the gaps in previous studies by incorporating a broader spectrum of stakeholders in the quest to identify rental value determinants based on expert and stakeholder perceptions.

Respondents agreed that the variables, such as: 'electricity connection', 'piped water connection', 'type of house', 'property condition' and 'the number of bedrooms' ranked among the most significant variables per the RII computed. Respondents also perceived that the variables, such as: 'storeroom availability', 'rental units near to recreational facilities', 'near the place of worship', 'quality of landscaping' and 'number of storeys' ranked among the least significant variables based on the RII computed. These responses suggest that the presence or absence of these intrinsic and extrinsic characteristics may not have any significant effect on rental values. The results suggest that when variables are grouped and ranked from the highest to the lowest (based on median RII), neighbourhood characteristics are ranked highest, followed by structural characteristics, and then locational characteristics rank third. Thus, anecdotal evidence suggesting that location is a key determinant of value is not supported in this research.

Although these findings represent experts and stakeholders' perception about the price decomposition of the residential rental market, these results in themselves are not conclusive unless empirical studies are undertaken to ascertain the veracity of the findings. This research acknowledges this limitation and suggest further empirical research to test key rental value determinants.

In terms of policy direction, the relevant district assemblies and government agencies responsible for housing and infrastructure planning must ensure that there is adequate provision of basic infrastructure to ensure that the objective of the national housing policy aimed at '*creating viable and sustainable communities through the provision of adequate, decent and affordable housing that is accessible and sustainable to satisfy the needs of Ghanaians*' is achieved (Government of Ghana, 2015: p.14). Further studies can explore how these perceptions of value feed into actual rental values observed in the housing market and the interrelationships that may exist.

7. Acknowledgement

8. References

Abidoye, R.B. & Chan, A.P.C. (2016). Critical determinants of residential property value: professionals' perspective. *Journal of Facilities Management*, *14*(3), pp.283-300. https://doi.org/10.1108/JFM-02-2016-0003

Adegoke, O.J. (2014). Critical factors determining rental value of residential property in Ibadan metropolis, Nigeria. *Property Management*, *32*(3), pp.224-240. https://doi.org/10.1108/PM-05-2013-0033

Amenyah, I.D. & Fletcher, E.A. (2013). Factors determining residential rental prices. *Asian Economic and Financial Review*, *3*(1), pp.39-50.

Anim-Odame, W.K., Key, T. & Stevenson, S. (2010a). Residential market development in sub-Saharan Africa. *International Journal of Housing Markets and Analysis*, *3*, 308-326.

Anim-Odame, W.K., Key, T. & Stevenson, S. (2010b). The Ghanaian transaction based residential indices. *International Journal of Housing Markets and Analysis*, *3*(3), 216-232. Available at: http://dx.doi.org/10.1108/17538271011063889

Arimah, B.C. (1992). Hedonic Prices and the Demand for Housing Attributes in a Third World City: The Case of Ibadan, Nigeria. *Urban Studies*, *29*(5), 639-651. https://doi.org/10.1080/00420989220080601

Arku, G. (2009a). Housing and development strategies in Ghana, 1945-2000. *International Development Planning Review*, *28*, pp.333-358. https://doi.org/10.3828/idpr.28.3.3

Arku, G. (2009b). Housing Policy Changes in Ghana in the 1990s. *Housing Studies*, *24*(2), pp.261-272. https://doi.org/10.1080/02673030902719763

Arku, G., Luginaah, I. & Mkandawire, P. (2012). You Either Pay More Advance Rent or You Move Out: Landlords/Ladies' and Tenants' Dilemmas in the Low-income Housing Market in Accra, Ghana. *Urban Studies*, *49*(14), pp.3177-3193.

Asabere, P. (2007). The demise of the rent-controlled public housing programmes of ghana: The story of the Tema Development Corporation. *Urban Studies*, *44*(10), pp.1919-1935. https://doi.org/10.1080/00420980701471893

Asabere, P.K. (2004). The pricing of the emergent leasehold (possessory) estates of Ghana. *Real Estate Economics*, *32*(4), pp.673-694. https://doi.org/10.1111/j.1080-8620.2004.00107.x

Asante, L.A., Gavu, E.K., Quansah, D. P. O. & Osei Tutu, D. (2018). The difficult combination of renting and building a house in urban Ghana: analysing the perception of low and middle income earners in Accra. *GeoJournal*, *83*, pp.1223-1237. https://doi.org/10.1007/s10708-017-9827-2

Baffour Awuah, K.G., Proverbs, D., Lamond, J. & Gyamfi-Yeboah, F. (2016). *An Evaluation of Property Valuation Practice in Sub-Saharan Africa: A Case Study of Ghana*. London. Available at: http://www.rics.org/Global/Property_Valuation_Ghana_180216_dwl_aa.pdf

Ball, M. (1977). Differential rent and the role of landed property. *International Journal of Urban and Regional Research*, *1*, pp.380-403.

Ball, M. (1985a). Land rent and the construction industry. In M. Ball, V. Bentivegna, M. Edwards, & M. Folin (Eds.), *Land Rent, Housing and Urban Planning: A European Perspective*. London: Croom Helm.

Ball, M. (1985b). The Urban Rent Question. *Environment and Planning A: Economy and Space*, *17*(4), pp.503-525.

Buckley, R.M. & Mathema, A. S. (2007). *Is Accra a Superstar City? World Bank Policy Research Working Paper Series* (Vol. 4453).

Choumert, J., Kere, E.N. & Laré, A.L. (2015). *The impact of water and sanitation access on housing values: The case of Dapaong, Togo*. Available at: https://halshs.archives-ouvertes.fr/halshs-00939267v2/document

Connolly, N.D.B. (2014). *A World More Concrete: Real Estate and the Remaking of Jim Crow South Florida. Volume 114 of Historical Studies of Urban America* (illustrate). Chicago and London: The University of Chicago Press.

De, U.K. & Vupru, V. (2017). Location and neighbourhood conditions for housing choice and its rental value: Empirical examination in an urban area of North-East India. *International Journal of Housing Markets and Analysis*. https://doi.org/10.1108/IJHMA-10-2016-0072

Ghana Statistical Service. (2014). *Ghana Living Standards Survey Round 6 (GLSS 6)*. Accra.

Gilbert, A. (2016). Rental housing: The international experience. *Habitat International*, *54*, pp.173-181.

Gough, K. & Yankson, P.(2000). Land Markets in African Cities: The Case of Peri-urban Accra, Ghana. *Urban Studies*, *37*(13), pp.2485-2500. https://doi.org/10.1080/00420980020080651

Gough, K.V. & Yankson, P. (2011). A Neglected Aspect of the Housing Market: The Caretakers of Peri-urban Accra, Ghana. *Urban Studies*, *48*(4), pp.793-810. https://doi.org/10.1177/0042098010367861

Government of Ghana. (2015). *Ghana National Spatial Data Framework (2015-2030), Volume I: Conditions and Main Issues*. Available at: https://www.ghanalap.gov.gh/files/NSDF-Final-Report-Vol-I-Final-Edition-TAC.pdf

Gulyani, S. & Talukdar, D. (2008). Slum Real Estate: The Low-Quality High-Price Puzzle in Nairobi's Slum Rental Market and its Implications for Theory and Practice. *World Development*, *36*(10), pp.1916-1937. https://doi.org/10.1016/j.worlddev.2008.02.010

Haila, A. (2016). *Urban Land Rent: Singapore as a Property State*. (J. Robinson, M. Aalbers, D. Brantz, P. Le Gales, C. Pickvance, A. Roy, & F. Wu, Eds.), *Studies in Urban and Social Change Series* (First). Chichester: John Wiley & Sons, Ltd.

Hair, J.F., Anderson, R.E., Tatham, R.L. & Black, W.C. (2010). *Multivariate Data Analysis: A Global Perspective (7th Edition)*. *Pearson Prentice Hall, New Jersey*.

Harrison, D. & Rubinfeld, D.L. (1978). Hedonic housing prices and the demand for clean air. *Journal of Environmental Economics and Management*, *5*(1), pp.81-102. https://doi.org/10.1016/0095-0696(78)90006-2

Harvey, D. (1973). *Social Justice and the City*. Baltimore: The Johns Hopkins University Press. https://doi.org/10.1111/j.1467-8330.1974.tb00606.x

Helbich, M., Brunauer, W., Vaz, E. & Nijkamp, P. (2013). Spatial Heterogeneity in Hedonic House Price Models:The Case of Austria. *Urban Studies*, pp.1-22.

Holt, G.D. (2014). Asking questions, analysing answers: relative importance revisited. *Construction Innovation: Information, Process, Management*, *14*(1), pp.2-16. https://doi.org/10.1108/CI-06-2012-0035

International Valuation Standards Council. (2017). *International Valuation Standards (2017)*. *IVSC*. London: IVSC. Available at: http://www.cas.org.cn/docs/2017-01/20170120142445588690.pdf

Jewell, N.P. (1985). Least squares regression with data arising from stratified samples of the dependent variable. *Biometrika*, *72*(1), pp.11-21. https://doi.org/10.1093/biomet/72.1.11

Kibunyi, D., Wagura Ndiritu, S., Carcel, H. & Gil-Alana, L.A. (2017). Real estate prices in Kenya: is there a bubble? *Journal of Housing and the Built Environment*, *32*(4), pp.787-804. https://doi.org/10.1007/s10901-017-9541-x

Knight, J.R., Herrin, W.E. & Balihuta, A.M. (2004). Housing Prices and Maturing Real Estate Markets: Evidence from Uganda. *Journal of Real Estate Finance & Economics*, *28*(1), pp.5-18.

Lancaster, K.J. (1966). A New Approach to Consumer Theory. *Journal of Political Economy*, *74*(2), pp.132-156. Available at: http://www.jstor.org/stable/1828835

Lipietz, A. (1985). A Marxist Approach to Urban Ground Rent: the case of France. In M. Ball, V. Bentivegna, M. Edwards, & M. Folin (Eds.), *Land Rent, Housing and Urban Planning: A European Perspective*. London: Croom Helm. https://doi.org/10.4324/9781351026147-7

Lundgren, B. (2013). Customer-perceived Value in Residential Developments: the Case of Hornsberg Strand, Sweden. *International Real Estate Review*, *16*(1), pp.1-27. Available at: https://www.um.edu.mo/fba/irer/papers/past/vol16n1_pdf/01.pdf

Mahama, C. & Adarkwa, K. (2006). Land and Property Markets in Ghana. In *A discussion paper prepared by the Royal Institution of Chartered Surveyors for presentation at the 2006 World Urban Forum*. London: Royal Institution of Chartered Surveyors.

Malpezzi, S. (2002). Hedonic Pricing Models: A Selective and Applied Review. In T. O'Sullivan & K. Gibb (Eds.), *Housing Economics and Public Policy* (pp. 67-89). Oxford: Blackwell Science Ltd, Oxford, UK. https://doi.org/10.1002/9780470690680.ch5

Megbolugbe, I.F. (1989). A Hedonic Index Model: The Housing Market of Jos Nigeria. *Urban Studies* , *26*, pp.486 - 494.

Nunnally, J.C. & Bernstein, I.H. (1979). Psychometric theory. *PsycCRITIQUES*, *24*, pp.275-280. https://doi.org/10.1037/018882

Obeng-Odoom, F. (2011a). Private Rental Housing in Ghana: Reform or Renounce? *Journal of International Real Estate and Construction Studies*, *1*(1), pp.71-90.

Obeng-Odoom, F. (2011b). Real estate agents in Ghana: A suitable case for Regulation? *Regional Studies*, *45*(3), pp.403-416. https://doi.org/10.1080/00343400903241550

Obeng-Odoom, F. (2015). The Social, Spatial, and Economic Roots of Urban Inequality in Africa: Contextualizing Jane Jacobs and Henry George.

American Journal of Economics and Sociology, *74*(3), pp.550-586. https://doi.org/10.1111/ajes.12101

Owusu-Ansah, A. (2012a). Examination of the Determinants of Housing Values in Urban Ghana and Implications for Policy Makers. *Journal of African Real Estate Research*, *2*(1), pp.58-85.

Owusu-Ansah, A. (2012b). The Dynamics of Residential Property Values in Developing Markets. The case of Kumasi, Ghana. *Journal of International Real Estate and Construction Studies*, *2*(1-2), pp.19-35.

Owusu-Ansah, A. & Abdulai, R.T. (2014). Producing hedonic price indices for developing markets: Explicit time variable versus strictly cross-sectional models. *International Journal of Housing Markets and Analysis*, *7*(4), pp.444-458.

Owusu-Ansah, A., Adolwine, W.M. & Yeboah, E. (2017). Construction of Real Estate Price Indices for Developing Housing Markets. Does Temporal Aggregation Matter? *International Journal of Housing Markets and Analysis*, *10*(3), pp.371-383. https://doi.org/10.1108/IJHMA-06-2016-0047

Owusu-Ansah, A., Ohemeng-Mensah, D., Abdulai, R.T. & Obeng-Odoom, F. (2018). Public Choice Theory and Rental Housing: An examination of rental housing contracts in Ghana. *Housing Studies*, *33*(6), pp.938-959. https://doi.org/10.1080/02673037.2017.1408783

Oyedele, L.O. (2013). Avoiding performance failure payment deductions in PFI/PPP projects: model of critical success factors. *Journal of Performance of Constructed Facilities*, *27*(3), pp.283-294.

Ozanne, L. & Thibodeau, T. (1983). Explaining metropolitan housing price differences. *Journal of Urban Economics*, *13*, pp.51-66. https://doi.org/10.1016/0094-1190(83)90045-1

Predöhl, A. (1928). The Theory of Location in Its Relation to General Economics. *Journal of Political Economy*, *36*(3), pp.371-390. Available at: http://www.jstor.org/stable/1822752

Ratcliff, R.U. (1961). *Real Estate Analysis*. McGraw-Hill, USA.

Roulac, S.E. (2001). *Stephen Roulac on place and property strategy*. San Francisco: Property Press.

Roulac, S.E. (2007). Brand + beauty + utility = property value. *Property Management*, *25*(5), pp.428-446.

Salifu Osumanu, I., Aigbavboa, C.O. & Thwala, D.W. (2018). Examining the Relationship Between Lean Adoption and Housing Finance in Ghana. In S. Fukuda (Ed.), *Proceedings of the AHFE 2018 International Conference on Affective and Pleasurable Design, July 21-25 2018* (pp.301-311). Orlando Florida: Springer.

Sirmans, G.S., Macpherson, D. & Zietz, E.N. (2005). The Composition of Hedonic Pricing Models. *Journal of Real Estate Literature*, *13*(1), pp.1-44.

Thompson, S.K. (2012). Stratified Sampling. In W.A. Shewhart & S.S. Wilks (Eds.), *Sampling; Wiley Series in Probability and Statistics* (3rd ed., pp.139-156). Hoboken, New Jersey: John Wiley & Sons.

Tipple, G.A. & Korboe, D. (1998). Housing policy in Ghana: towards a supply-oriented future. *Habitat International*, *22*(3), pp.245-257. https://doi.org/10.1016/S0197-3975(98)00009-5

Tse, R.Y.C. (2002). Estimating Neighbourhood Effects in House Prices:

Towards a New Hedonic Model Approach. *Urban Studies*, *39*(7), pp.1165-1180. https://doi.org/10.1080/00420980220135545

UN-Habitat. (2011a). *Ghana Housing Profile*. Nairobi. Available at: https://unhabitat.org/books/ghana-housing-profile/

UN-Habitat. (2011b). *Rental Housing: A Much Neglected Housing Option for the Poor*. Nairobi.

UNESCAP, & UN-HABITAT. (2008). *Housing the poor in Asian cities, Quick Guides for Policy Makers 7* (7). Bangkok and Kenya. Available at: http://www.iut.nu/Literature/Asia/HousingThePoorAsia_UNHabitat_2008.pdf

Wilson, W.J. (2012). *The Truly Disadvantaged: The Inner City, the Underclass and Public Policy*. *University of Chicago Press Economics Books* (2nd ed.). Chicago and London: The University of Chicago Press.

Wilson, William Julius. (1992). Another Look at The Truly Disadvantaged. *Political Science Quarterly*, *106*(4), pp.639-656.

Yankson, P.W.K. (2012). Rental Housing and Tenancy Dynamics with particular focus on Low-Income Households in Greater Accra Metropolitan Area. In E. Ardayfio-Schandorf, P.W.K. Yankson, & M. Bertrand (Eds.), *The mobile city of Accra: Urban families, Housing and Residental practices* (pp. 183-206). Dakar: Council for the Development of Social Science Research in Africa (CODESRIA). Available at: www.codesria.org

Zeithaml, V.A. (1988). Consumer Perceptions of Price, Quality, and Value: A Means-end-chain Model and Synthesis of Evidence. *Journal of Marketing*, *25*, pp.2-22. https://doi.org/10.2307/1251446

9. Appendix

Table A1: Relative Importance Index of Variables by Category

Category of factor	Name of Variable	Academics N = 23	VES N = 34	REA N = 5	Tenant N = 40	Landlord N = 6	Others N = 5	Total N = 113
Structural Characteristics	Type of house (*e.g. apartment, hall & chamber, single room*)	0.92	0.89	0.96	0.85	0.90	0.80	0.88
	Quality of construction (& materials)	0.80	0.79	0.84	0.72	0.63	0.64	0.76
	Age of building	0.67	0.61	0.60	0.67	0.77	0.56	0.65
	Plot size	0.70	0.66	0.72	0.58	0.67	0.52	0.64
	Size of building (*floor area*)	0.82	0.76	0.84	0.69	0.83	0.68	0.75
	Number of bedrooms	0.89	0.83	0.88	0.81	0.97	0.76	0.84
	Number of wc	0.70	0.62	0.76	0.66	0.83	0.68	0.67
	Number of baths	0.67	0.60	0.72	0.66	0.83	0.64	0.66
	Floor finish (*screed, concrete, tiled, terrazzo*)	0.79	0.74	0.80	0.74	0.77	0.52	0.75
	Number of storeys (*floors*)	0.73	0.61	0.64	0.62	0.67	0.44	0.63

	Kitchen available *(separate or shared)*	0.79	0.76	0.80	0.77	0.87	0.72	0.78
	Toilet available *(separate or shared)*	0.82	0.84	0.84	0.81	0.90	0.76	0.82
	Bathroom available *(separate or shared)*	0.82	0.84	0.80	0.81	0.90	0.76	0.82
	Property condition *(physical deterioration)*	0.90	0.85	0.96	0.83	0.83	0.68	0.85
	Fence or wall availability	0.73	0.67	0.68	0.73	0.83	0.72	0.71
	Parking space or garage availability	0.71	0.62	0.72	0.67	0.73	0.68	0.67
	Storeroom availability	0.59	0.49	0.48	0.59	0.57	0.56	0.55
	Quality of landscaping	0.64	0.61	0.48	0.60	0.63	0.44	0.60
Neighbourhood characteristics	Near to suitable vehicular access	0.83	0.71	0.88	0.74	0.80	0.68	0.75
	Has electricity connection	0.92	0.92	0.92	0.87	0.97	0.84	0.90
	Has piped-water connection or well	0.91	0.88	0.92	0.83	0.97	0.80	0.87
	Waste disposal or garbage collection available	0.78	0.72	0.84	0.70	0.93	0.64	0.74
	Area considered safe *(security)*	0.86	0.85	0.92	0.79	0.93	0.76	0.83
	Streetlighting present	0.75	0.64	0.56	0.66	0.80	0.56	0.67
Locational characteristics	Presence of suitable surface drainage	0.77	0.69	0.64	0.65	0.83	0.72	0.69
	Near to traffic congestion	0.73	0.65	0.68	0.65	0.80	0.44	0.66
	Near to market or shopping centre	0.74	0.64	0.56	0.66	0.77	0.56	0.66
	Near to CBD	0.75	0.62	0.80	0.65	0.60	0.60	0.66
	Near to job opportunities	0.69	0.62	0.68	0.62	0.77	0.56	0.64
	Near to educational facility	0.70	0.65	0.80	0.63	0.83	0.60	0.66
	Near to healthcare *(medical)* facilities	0.70	0.68	0.84	0.66	0.83	0.56	0.69
	Near to recreational facilities *(parks & green spaces)*	0.60	0.55	0.64	0.53	0.70	0.52	0.56
	Near to squatter settlements	0.70	0.65	0.72	0.68	0.77	0.44	0.67
	Near to Police station *(security post)*	0.59	0.68	0.52	0.64	0.83	0.52	0.64
	Near to place of worship	0.58	0.54	0.56	0.57	0.83	0.52	0.57
	Population density	0.64	0.59	0.72	0.65	0.77	048	0.63
	Near to bus stop *(public transport)*	0.70	0.55	0.72	0.66	0.73	0.64	0.64
	Quality of property view	0.66	0.65	0.68	0.68	0.83	0.44	0.66

Source: Expert/Stakeholder Survey, 2017.

N.B.
Academic represents – academic (real estate and related fields)
VES represents – Valuation and Estate Surveyor (GhIS)
REA represents – Real Estate Agent

Causal Relationship between N-REIT's Dividend Yield and Money Market Indicators

Olusegun O. Olanrele[1,3], Tomisi O. Adegunle[1,2], Oluwatosin B. Fateye[1,2], C. A. Ajayi[2], and Rosli Said[3]

[1] Department of Estate Management and Valuation, Moshood Abiola Polytechnic, Nigeria.
[2] Department of Estate Management, Obafemi Awolowo University, Ile-Ife, Nigeria.
[3] Department of Estate Management, University of Malaya, Kuala Lumpur, Malaysia.

This article was presented at the 2018 African Real Estate Society Conference in Abeokuta, Nigeria.

Abstract

This paper examined the relationship between the Nigerian Real Estate Investment Trusts (N-REITs) and Money Market Indicators (MMIs) which comprise of: Currency in Circulation (CIC), Broad Money Supply (BMS), Corporate-private Sector (CPS), Prime Lending Rate (PLR) and Treasury Bill Rate (TBR). Data for the N-REITs were sourced from the annual published report of SkyeREIT (an indirect real estate investment vehicle of Skye Shelter Fund Plc), while that of the MMI were sourced from the quarterly published bulletins of the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS) for the period 2008-2017. The study adopted the Co-integration test, Vector Autoregressive (VAR) and Vector Error Correction Model (VECM). The data collected passed the stationary test at p-value of $p<0.05$ which implies that the data is fit for Granger Causality Model (GSM) in a VAR environment. The co-integration test at 5% confidence level shows the existence of a partial long-run relationship at p-values of 0.0003, 0.0292 and 0.0297 respectively at the first three orders, while the Max-Eigen rank test was significant at the first order (none) with a p-value of 0.005. The results of the VAR and VEC models showed that CPS, PLR and TBR, with chi-square values of 11.748; 16.589; and 34.778 respectively, significantly affected the performance of N-REITs, while the PLR (4.5798) had a long-run significant effect. The findings provide decision caution for investors, analysts and capital market players when considering investment on securitised real estate assets.

Keywords: Causality; Dividend Return; Money Markets Indicators; REITs; Nigeria

---

[1] olanrelesegun@yahoo.com

1. Introduction

Monetary policy is part of (and a tool of) macroeconomic policy. It is a set of measures and policies that is used to influence money supply through various adjustments of requirements for bank reserves, interest rates, open market operations and sale of government investment options and foreign exchange. The Central Bank of Nigeria (CBN), which was established in 1958, has been saddled with the responsibility of creating monetary policy for Nigeria. Through the CBN Monetary Policy Committee (MPC), the bank has been making such policy from its inception. A regime of direct control was adopted till 1986 after which indirect control was adopted using several measures (Bodunrin, 2016). The monetary policy instruments of the CBN include the Broad Money Supply (BMS), usually referred to as M_2, Prime Lending Rate (PLR) (interest rate), Open Market Operation, Credit to Corporate Sector, among others (CBN, 2016). Monetary policy is designed towards two objectives; price stability and sustainable economic growth (Ezema, 2009). The monetary policy of a nation is either an expansionary or contractionary economic measure taken by the central bank or other agencies to administrate the supply of money and interest rates so as to influence output, employment and prices, with a view to achieving the macroeconomic objectives of the government. Expansionary policy tries to stimulate economic activity and reduce unemployment while contractionary policies are geared to limit the money supply to mitigate against inflation (Hall, 2010 *cited* in Adegbite & Alabi, 2013). The CBN is primarily responsible for the management of the monetary policy in the country.

The money market, under the regulation of the country's monetary policies, is central to both debt and equity finance of capital projects like Real Estate Investment Trusts (REITs). Some measurable variables used as representation of the money market, identified by the CBN, comprise the Central Bank indicative rate, monetary policy rate, Treasury bill, BMS, Currency in Circulation (CIC) and other short-term interest rates in the financial market. These include inter-bank call rates, savings, and other fixed deposit and lending rates. Whereas, BMS comprises savings and time deposits (quasi money), narrow money supply refers to CIC; including non-bank public and demand deposits. The identified MMIs have been proven to have effects on investment return including property securities and REITs, as shown in a similar investigations in other markets (developed and emerging). See, for example: Onyewu (2012); Unus (2012); Adegbite and Alabi (2013); Ito (2013); Fatnassi et al. (2014); Lee and Lee (2014); Udude (2014); Ngerebo-A (2016); Yan (2019).

The relevance of money market instruments and policies to securitised investment in stock exchange markets has been a subject of interest in recent years. Previous studies that investigated the factors responsible for REIT return performance established that beyond the external dynamics of government policies and other operating environments, there are macroeconomic factors that influence relationships in real estate investment return performances (Olanrele, Said, & Daud, 2014; 2015). A study by Oyewole and Ajayi (2013) identified GDP, interest rates, and employment

rates as the most significant macroeconomic factors influencing the performance of office real estate. However, the study did not consider the REIT market. Daud et al. (2012) also concluded that any factor that affects property income will affect REIT dividend performance. Inflation is another macroeconomic factor that has been investigated. The common perception of real estate investment as a good hedge against inflation, making real estate an attractive investment option, has been subjected to discussion in the literature with diverse results emanating thereto (Hoesli, 1994; Barkham, Ward & Henry, 1996; Hamelink & Hoesli, 1996; Hoesli, Matysiak & Nanthakumaran 1996; Newell, 1996; Hamelink, Hoesli & MacGregor, 1997; Bello, 2005; Manni & Teng, 2007; Wurstbauer & Schafers, 2015; Ma'in et al., 2016).

Most studies have limited their investigations to macroeconomic variables of inflation, interest rate, GDP, capitalisation, exchange rate or global oil price volatility (Oyewole & Ajayi, 2013; Dabara, 2015; Diala, Kalu & Igwe-Kalu, 2016). However, Oni, Emoh and Ijasan (2011) found that inter-bank call rate, Monetary Policy Rate (MPR) and inflation were the major principal components influencing real estate investment. There is also a consensus that the stock market (equities) suffers from lower performance as inflation rises (Bruegeman, Chen & Thibodeau, 1992; Bello, 2000) and this suggests that real estate equities like REITs will not be an exception. A study conducted in Nigeria by Ajide (2014) investigated the nation's economic growth in the face of capital formation and population. GDP was used as a proxy for economic growth, while the factors of capital formation include Foreign Direct Investment (FDI) and Economic Freedom (EF).

Other economic factors of concern in this study are regarded as MMIs under the regulation of the country's monetary policy as dictated by the CBN. These factors are central to both debt and equity finance of capital projects like REITs. Rigobon and Sack (2004) and Bernanke and Kuttner (2005) revealed that the sharp response of asset prices, and REITs in particular, to the fluctuations of money market components gives serious cause for concern for investors, analysts and policymakers. Bredin, O'Reilly and Stevenson (2006) opined that changes in aggregate monetary policy have an significant impact on general economic activity. The rate of changes in monetary policy tends to influence the value of the underlying portfolio and the rental income of property either in the direct and indirect real estate investment market.

2. Global Outlook on REITs

The signing of the REIT Act into Law by the 34th President of the United States, Dwight Eisenhower, in 1960 marks a significant turn of event in the history of REITs (Ong et al., 2011) leading to the creation of the first REIT in 1961 and its subsequent listing on the New York Stock Exchange (NYSE) in 1965 (Ling, Naranjo & Ryagaert, 2000). Following the creation of the US-REIT, different countries across the globe have established REIT regimes at one time or another, resulting in a global REIT market. Currently there are 1 044 REITs in 30 countries around the world. The global REIT capitalisation is €1.51tn ($1.78tn) as shown in Table 1. The average global REITs return is

5.1%. REITs in the developed market account for 55% of listed capitalised stock, but only 7.2% in developing markets (EPRA, 2018).

Table 1: Continental Outlook of Global REITs and their Ranking

Continent	No. of REITs	Capitalisation (€'billion)	Global Market Share (%)	Rank/Position
North America (USA& Canada)	247	985.702	65.27	1
Asia Pacific	249	274.50	18.18	2
Europe	209	197.12	13.05	3
South America (Brazil & Mexico)	274	25.64	1.70	4
Africa – South Africa	31	21.372	1.42	5
Middle East	34	5.77	0.38	6
Total	**1 044**	**1 510 104 (US$1,780bn)**	**100**	

Source: Authors' compilation from EPRA Global REIT Survey, 2018

2.1. Importance of Nigeria REITs Market

With a population estimated at 193 392 517 people (NBS, 2018) and being the African largest economy, Nigeria is increasingly becoming competitive in the African business environment as noticeable improvements in transparency are gradually being exhibited in the Sub-Sahara African real estate market. Nigeria's real estate market has moved from its opaque low transparency zone and is now ranked 67 out of 100 countries, ahead of Ghana and Rwanda. Lagos city is ranked 124 out of 158 cities ahead of Accra and Kigali for cities considered as regional hubs of attraction for international commercial property investments in Africa (JLL, 2018). On the subject of ease of doing business, Nigeria is now ranked 146 out of 190 nations and the Transparency International Corruption Index placed the country in 148th position out of 180 countries in consideration.

Although these are not the rankings one would expect from Africa's largest economy, they are marked improvements from the nation's 2014 rankings. As a potential real estate investors' destination, the Nigerian real estate market was ranked 40th in term of size. The REIT industry in Nigeria falls within the construction/real estate subsector of the Nigerian Stock Exchange with three REITs (Skye Shelter Fund Plc, Union Homes REIT and UPDC REIT); one property company (UACN Property Development Company-UPDC Plc); and five construction companies (ARBICO Plc, Costain West Africa Plc, G. Cappa Plc, Julius Berger Plc, Roads Nigeria Plc) listed in the Nigerian Stock Exchange (NSE).

The REIT sector has a total capitalization of NGN37.21bn (US$ 101.89 million) as at 2018, representing 0.33% of the stock market capitalization. Nigeria has three REIT companies having investment in both commercial and residential property sectors but predominantly in medium and high-income housing (Table 2).

Table 2: Nigeria REIT Profile as at 31ˢᵗ August, 2018

REIT	Year Listed	Units	Price (NGN)	Capitalisation (NGN in millions)	Sector Share (%)	Property Types
Skye Shelter	2007	20 000 000	100	1 900	5.37	Residential and Commercial
Union Homes	2008	250 000 000	45.22	11 301	30.38	Residential and Commercial
UPDC	2013	2 668 269 500	9	24 014	64.25	Residential, Commercial and Hotel
Total Capitalisation				**37 216 ($101.89m)**		
NSE Capitalisation				**11 255 455.23 ($30,829.12)**		

Source: Authors' Compilation from the Nigerian Stock Exchange Daily Trading data

3. Literature Review

In Nigeria, empirical studies have shown that the performance of the real estate investment market is sensitive to the nation's economic outlook and this, by extension, may be applicable to many developing countries (Nzalu, 2013; Ojetunde, 2013; Oyewole & Ajayi, 2014; Dabara, 2015). Whereas Pham (2013) had described the REIT market as being a thriving venture in the global market. Other authors, including Hardin and Hill (2008); Hamzah and Rozali (2010); Ong, The and Chong (2011); Newell, Adair, & Nguyen (2013), have corroborated this in their outlined analysis of REIT performance, its associated benefits and inter-relationship with capital, stock and general investment market, especially in the emerging Nigeria REITs market, which is yet to be investigated. In Asia, Newell and Osmadi (2009) and Rozman, et al. (2015) appraised the performance of REITs either as a market-mix asset or property portfolio and they concluded that REITs stand out as superior property investment vehicles. In a study of REIT characteristics and REIT return, Goebel et al. (2013) found that interest rates heavily influenced REIT returns, but size (capitalisation) did not have a strong association with REIT's returns. Asteriou and Begiazi, however, found the magnitude and market maturity of real estates as significant factors influencing REIT's returns. Other studies have also assessed the relationship between the economic variables and the equity market. Firth (1979) found that capital market investments possess an effective hedge against inflation. Fama and Gibbons (1982), and Marshall (1992) reported that investors have shifted attention from cash deposit investments to the equities market in order to benefit from the inflation hedge capacity of stock and bond investments.

The sensitivity of REIT returns to the maturity rate of short and long-term Treasury bills was documented by Swanson, Theis and Casey, (2002) in their study of REIT risk premium sensitivity and interest rates. The study by Islam (2003) found that macroeconomic variables have a statistically significant relationship with stock exchange returns with REITs presenting a better

diversification to common stock (Bhuyan et al., 2015). In a regression study of equity, REIT returns with secondary market return, Kryzanowski and Tcherednitchenko (2007) reported REITs showing more sensitivity to interest rates ahead of other factors of the market in Canada. This result was corroborated by Nittayagasetwat and Buranasiri (2012) in the US capital market and the study showed that REIT returns was insignificantly sensitive to bond and stock information.

Quite a number of studies have examined the impact, relationship and effects of monetary policy and its instruments/tools on stock, real estate sector and REIT returns, under the broad macroeconomic variables of which monetary policy is a subset. Bredin, O'Reilly and Stevenson (2011) for example, assessed the effect of drastic changes in US monetary policy on REITs, using future market to decompose unexpected changes in policy rates. REITs were found to have a significant negative response to changes in monetary policy. The US monetary policy consistently impacted on REIT returns with dividend showing the manifestation of these influences. In a recent study, Yan (2019) appraised the mechanism of monetary policy on real estate development and real estate prices. The study identified money supply and interest rates as instruments of monetary policy and found that an increase in interest rates increases the cost of real estate development, leading to higher prices and discouraging mortgage institutions to lend to home buyers, which in turn results in a lower performance of the real estate sector. The study limits itself to two of the numerous instruments of monetary policy, exerting influences on the market simultaneously. Interest rates and credit to the corporate sector were also found to be the most influencing variables on house prices in China by Cai and Wang (2018). In the view of Fatnassi et al. (2014), monetary policy instruments are ordinarily expected to affect REIT returns with expansionary policy having an impact in the boom, while the possibility of remaining in the bust market decreases with increases in inflation.

Adopting an Auto Regressive Distributed Lag (ARDL) bound test, (Fang et al., 2016) found a long-run equilibrium exists between REIT's index and interest rates, inflation and stock markets for China and Singapore. The Granger Causality (G-Causality) test shows an unidirectional relationship in Japan and Singapore indicating that a shift in interest rates results in changes in REIT indices. Tsai (2015) examined the dynamism between the US real estate and stock markets and found a short-term causal relationship, but no trace of a long-term relationship. Bernhard (2017) investigated the effect of non-traditional monetary policies on Swiss asset prices and reported a great impact on long-term government bonds (7-10 years), while the expansionary monetary policies reduced yield from both government and corporate bonds in Switzerland. Expansionary monetary policies promote the Swiss currency (Swiss Franc) appreciation, but devastate stock prices.

In a study of the relationship between commercial real estate return and economic, fiscal and monetary factors and inflation in US and UK, Hoesli et al. (2008) found a negative relationship of real estate return with inflation, both anticipated and unexpected, while assets (stocks) portrayed a long-run

positive relationship with inflation. Muller and Pauley (1995) found a low correlation of REIT prices and interest rates exhibiting a stronger negative correlation in a falling environment and minor negative correlation during rising interest rates. The study called for further research to ascertain REIT price movement predictors such as GDP, inflation and employment. Crossland (2007) observed the sensitivity of Australian Listed Property Trusts (LPT) to interest rate dynamics. The results shows a weak negative (inverse) relationship to short-term interest rates and a stronger inverse relationship to long-term interest rate fluctuations, therefore indicating a high debt ration contributing to the negative effect. Yunus (2012) studied securitised property markets, stock markets and macroeconomic factors for developed countries and found that co-integration amongst the variable stocks of the stock market, GDP, money supply and inflation, caused a positive effect in property returns, whilst interest rates recorded a negative impact on property returns. A low frequency but a strong and positive association was reported to have existed between macroeconomic risks and real estate securities volatility (Lee, Stevenson & Lee, 2018).

In Nigeria, the study of the effect of monetary policy variables focus on economic growth in terms of GDP. Adegbite and Alabi (2013) studied the relationship between monetary policy and economic growth in Nigeria. The variables considered were money supply, inflation, exchange rate, interest ratea and GDP, with the data spanning from 1970 to 2010. The study found the variables to have had a significant effect on economic growth and reported a stable exchange rate keeping inflation low, while the interest rate influences the economic activity and prices. The money supply and prices were found to be stable and predictable. The study adopted Ordinary Least Squares (OLS) regression model and made money supply to be independent rather than the GDP which is a better measure of growth. The results showed that money supply was 61% dependent on the predictor variables. Contrarily, Ekwe, Ogbonnaya and Omodero (2017) represented economic growth with GDP as the dependent variable on the monetary policy instruments of BMS and Credit to Private Sector (CPS). The study found no significant impact of monetary policy on the Nigerian economy represented by its GDP. This indicates improper regulation of BMS tools resulting in a high rate of lending to the corporate sector. A distinct fundamental observation between the studies of Adegbite and Alabi (2013) and Ekwe et al. (2017) is that BMS is the measure of economic growth and dependent variable in the former, while GDP is the dependent variable in the latter.

Onyeiwu (2012) found a significant direct impact of money supply on GDP using OLS method for a dataset ranging from 1981 to 2008. Udude (2014), employing an Augmented Dickey-Fuller (ADF) Unit Root Test and Johansen Co-integration test with VECM, found a non-significant impact of money supply on the GDP (economic growth). Abdulazeez (2016) reported a marginal impact of all economic growth indices on GDP, including money supply. Nwoko, Iheneje and Anumadu (2016) also found money supply to have no influence on GDP. The CPS effect was investigated in relation to interest rates and inflation by Ngerebo-A (2016) who found CPS to be significant to changes in the inflation rate. The study used inflation as a proxy

for the economy. Oluwofeso, Adeleke and Udoji (2015) adopted the Co-integration Test earlier and found a significant impact of CPS on GDP. Ayodeji and Oluwole (2018) in their study of the impact of monetary policy on economic growth in Nigeria, proxied monetary policy variables with money supply, interest rates, exchange rates and liquidity ratio to predict economic growth represented with GDP. Their study found money supply and exchange rates to have a positive but fairly significant impact on GDP. Other factors exhibited a significant negative impact on economic growth. The study adopted ADF Unit Root Test, Johansen Co-integration test and VECM from data for the period of 1981 to 2016.

Victoria et al. (2016) used multiple linear regression analysis to investgate monetary policy's effectiveness on Nigerian economic development, where the predictor variables (exchange rate, interest rate, inflation and money supply) significantly impact on GDP. Using a data span of 1981 to 2015, an investigation of the impact of fiscal and monetary policies was carried out by Bodunrin (2016), the study found the monetary policy tool of money supply, exchange rates and taxes to have a negative permanent effect on growth. The study adopted VAR and GSM. Ufoeze et al. (2018), in their study of monetary policy's effect on Nigerian economic growth, used variables like money supply, exchange rates, lending rates and investment as predictor variables. Using OLS, Unit Root Test and Co-integration Test, the results show a long-run relationship among the variables with only money supply having a significant positive impact on economic growth (GDP). Nzomoi and Rutto (2012) studied the effect of CPS on economic performance represented with GDP in Kenya using panel data analysis and found a significant positive influence of CPS on economic performance. Olaleye, Bello and Ayodele (2015) examined the determinants of the listed property stock prices in Nigeria, where the macroeconomic factors considered in the study include GDP, Consumer Price Index (CPI), Gross National Product (GNP) (as GDP deflator), inflation, interest rates, unemployment and exchange rates. Nigeria REITs were excluded from the study as the listed property sector was represented by the only listed property development company in Nigeria (the UACN property development company) at the time of their study. The results showed that interest rates and inflation are inversely related to property stock price. Despite the available literature on monetary policy of the CBN, the focus was on economic development proxies by GDP or inflation or money supply. The available study of these instruments on REITs focused on index return, market prices or real estate pricing. No study to the best of our knowledge has investigated these monetary policy instruments on the Nigerian REITs market and on REIT dividend returns. The result of the existing studies also did not point to a consensus as contradicting views have been reported. This study therefore considers the MMIs as variables of interest towards REIT dividend performance having observed that no similar investigation has been carried out in Nigeria despite the 13 years of REIT establishment in the country. The focus therefore is the analyses of the causal relation between the N-REIT and MMIs.

4. Methodology

4.1. Data Description

The study used Sky Shelter REIT (SKY REIT) (equity) as a proxy for REIT dividend returns. The selection of Sky Shelter REIT was based on the fact that the REIT was the first of its type to be launched on the NSE in 2007. Also, the REIT have since inception been consistently publishing its annual financial statements. In order to avoid data distortion for the study period (2008-2017), other REITs in operation in Nigeria, including UnionHome and UPDC REIT, established in 2010 and 2013 respectively, were excluded from this study based on their short period of existence and the inconsistency in the availability of their annual financial statements. Thus, SKY REIT's data was converted into quarterly data prior to analyses so as to ensure data uniformity with the exogenous data.

The datasets for this study are time series data of Skye REIT dividend returns (SKY REIT) (see Table 3) as a dependent variable and the selected variables of the money market regarded as MMIs comprising 5 predictor elements: The existing literature, such as Simo-Kengne (2015), Lee and Lee (2014), Fatnassi et al. (2014), Yunus (2012) and Bredin et al (2010) have identified instruments of monetary/macroeconomic policy, to include BMS (BMS) usually regarded as money supply or M_2. PLR is the same as interest rate; CPS, as used in other literature; CIC and TBR are the monetary policy variables. Only interest rates and money supply had featured more in literature and this study felt other less researched variables equally have influences on investment return and were worth consideration.

The quarterly data of the predictor variables were extracted from the published statistical bulletin of the CBN and NBS for the period 2008 to 2017. The study deployed Skewness, Kurtosis and Jarque-Bera for Normality Test; Multicollinearity Test; Johansen Co-integration Test for time dynamic relationship; and GSM to investigate the relationship.

4.1.1 Normality of Data Distribution

Normality Test, as required statistically for regression and econometric analysis of this nature, is conducted to check if the distribution of the datasets is normal. A non-normal distributed data will not be suitable for the G-Causality Test. The study deployed Jarque-Bera Test. The test measures the significant difference of the skewness and Kurtosis for the series with those of the normal distribution. The statistic is computed as:

Skewness (SK) $\qquad E(R_{i,t} - \mu)^3 / \sigma^3 \dots\dots\dots\dots\dots\dots (i)$

Kurtosis (KUR) $\qquad E(R_{i,t} - \mu)^4 / \sigma^4 \dots\dots\dots\dots\dots\dots (ii)$

Where **μ** is the mean and **σ** is the Standard Deviation

Jarque-Bera Test $T(SK^2/6 + (KUR - 3)^2/24 \dots\dots\dots (iii)$

4.1.2 Data Screening and Model Fitness

To ensure the reliability of the independent variables (MMIs) employed in the prediction of variable explained (REIT dividend returns), the study conducted a model fitness test for the dataset. The tests are Unit Root Test, Multicollinearity Test, and Lag Length Criteria Selection Test. Dickey and Fuller, (1979) expressed the hypothesis testing in Augmented Dickey-Fuller Test statistic (ADF) model as:

$$Y_t = \alpha Y_{t-1} + X_t \delta + \epsilon_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots . \ldots (iv)$$

4.2 Cause-effect Relationship Methods

There are different econometric analyses that had been adopted in literature to analyse influences and causal relationship of interactions between variables. Nittayagasetwat and Buranasiri (2012) used CIR model to check sensitivity of bond coupon (return) to stock market (index) return; Fei, Ding and Dang (2008) adopted a Multivariate Generalized Autoregressive Conditional Heteroskedasticity (MGARCH) model in their work; Ma'in et al. (2015) and Kryzonowski and Tcherednitvhenko (2007) employed a regression model to estimate the relationship between variables of interest in their studies. The current study adopted GSM because it is regarded as a reliable econometric model to establish the form of the relationship between MMIs and equity REIT returns in Nigeria. The adoption of G-Causality, developed by Granger (1969), was recommended in the work of Asghar and Abid (2007). A number of similar studies have adopted the ADF Unit Root Test of stationarity of data, Ganger Causality Test, ARDL, VAR and VECM in their investigations (Udude, 2014; Tsai, 2015; Bodunrin, 2016; Fang et al., 2016; Ayodeji & Oluwole, 2018; Ufoeze et al., 2018; Yan, 2019). The G-Causality Test also shows the statistical significance of each factor and the combined effect of all factors/indicators following a series of statistical tests to confirm the data fitness to model for a reliable prediction.

4.2.1 Granger Causality Model (GSM)

The development of GSM emerged out of an idea conceptualised by Norbert Wiener (Wiener, 1956). The model explains the interactive relationship between two stationary data series. Granger (1969) and Bressler and Seth (2010) posited that, the need for a practical approach to cause-effect dependency among variables of interest birthed the GSM. Bressler and Seth (2010) explain the GSM as a situation of having two variables A and B, in an attempt to predict A_{t+1} using only past terms of A. In this study, we attempt to predict A_{t+1} using past terms of both A and B. If the second prediction is significantly more successful, then the past term of B contains information useful for predicting $A_{t+1,}$ that is not in the past. In this case, B is said to Granger-Cause A. Thus, the generalised GSM is expressed as:

Given two stationary time series X = $\{X_{(t)}\}_{t \in Z}$, and Y = $\{Y_{(t)}\}_{t \in Z}$ with the following information sets:

(i) $I^*_{(t)}$, the set of all information in the universe up to time t, and

(ii) $I^* - X_{(t)}$, the set of all information in the universe excluding X up to time t.

X is defined to Granger cause Y if $\mathbb{P}$ [Y $_{(t+1)}$ $\in$ A[$I^*_{(t)}$] $\neq$ $\mathbb{P}$[Y $_{(t+1)}$ $\in$ A[$I^*_{-X(t)}$]

Where:

Y represents the Equity REIT Dividend Yield Returns (in Unit)

X represents the Money Market Indicators which comprises of:

Currency in Circulation (CIC: % change)
Corporate Private Sector (CPS: % change)
Prime Lending Rate (PLR: % change)
Treasury Bill Rate (TBR: % change)
Broad Money Supply (BMS: % change)

Therefore, Vector Error Correction Model (VECM) model for multiple time series $X_1,.....,X_V$, for each time series X_j , is given as:

$$X_j\ (t) = \sum_{i=1}^{V} \beta_j, X_i^{t,Lagged} + \epsilon_i\ (t)\ ....(v)$$

where $X_i^{t,Lagged} = [X_i(t-L),.....,X_i(t-1)]$ is the history of Xi up to time t, L is the maximal time lag, and β j,;i = [βj;i(1),.....,βj;i(L)] is the vector of coefficients modelling the effect of time series Xi on the target time series (Granger, 1969; Engle & Granger, 1987).

4.3 Co-integration of REIT's Dividend Returns and MMIs

Co-integration Test shows the forms (short or long) of the relationship existing between the variables. The study deployed Johansen Co-integration Test to conduct time dynamic relationships between the dependent and independent variables. Johansen Co-integration Test conducts two tests: Trace Statistics and Max-Eigen Statistics. They are computed as follows ((Johansen, 1985)

Trace Rank Test

$$\Delta RE_t = \gamma_1 + \sum_{i=1}^{n} \varphi_1 \Delta RE_{t-i} + \sum_{i=1}^{n} \tau_1 \Delta X_{t-i} + \delta_1(RE_{t-1} - \beta X_{t-1} - \alpha) + \varepsilon_{3t}. \ ...(vi)$$

Max-Eigen Ranks Test

$$\Delta X_t = \gamma_2 + \sum_{i=1}^{n} \varphi_2 \Delta RE_{t-i} + \sum_{i=1}^{n} \tau_2 \Delta X_{t-i} + \delta_2(RE_{t-1} - \beta X_{t-1} - \alpha) + \varepsilon_{4t} \ ......(vii)$$

5. Results

The analysis performed on the data involved the data normality screening and Unit Root Test, followed by Multicollinearity and Co-integration Test. The

G-Causality relationship analysis was performed to establish the causal relationship between the predictor variables and REIT returns. The result of the analysis is presented in the following sections in return.

5.1 Result of Statistical Analysis and Tests

The summary of test and analysis for Normality ADF-Unit Root Test, Vector Auto Regression and Vector Error Correction is presented in Table 3. Descriptive statistics of the normality test show that, SKR and TBR were negatively skewed having -0.2315 and -0.2745 values respectively. These imply that more of the values in the SKR and TBR datasets are lower than their mean value. On the other hand, indicators such as BMS, CIC, CPS and PLR are positively skewed showing the dataset to have more values higher than their mean values. However, the values of negative or positive skewness associated with the dataset were within the critical region of normality (±1.96), which indicates that the dataset passes the Normality Test required for this analysis.

Kurtosis measures the sharpness of the peak or flatness of the series distribution. All the data series exhibited leptokurtic nature of data distribution around the mean value with the peak above the normal distribution curve. Jarque-Bera Statistical Test for the dataset confirmed the normal distribution of the data over the study period having the calculated values for all the variables lower than the critical value (5.99) for a small sample size and the insignificant probability values ($p > 0.05$).

Table 3: Summary of Tests and Analysis (Normality, ADF, VAR & VEC)

MMI	Normality Test			ADF-URT		VAR		VECM	
	Skewness	Kurtosis	Jarque-Bera	Level		Skewness	Kurtosis	Jarque-Bera	Level
CIC	0.1156	2.4043	0.6125	-0.2099	CIC	0.1156	2.4043	0.6125	-0.2099
CPS	0.0544	1.8577	1.9751	-0.4374	CPS	0.0544	1.8577	1.9751	-0.4374
PLR	0.6720	3.2330	2.7917	-3.9472*	PLR	0.6720	3.2330	2.7917	-3.9472*
TBR	-0.2745	2.1806	1.4592	-1.5110	TBR	-0.2745	2.1806	1.4592	-1.5110
BMS	0.2856	1.9600	2.1120	0.7153	BMS	0.2856	1.9600	2.1120	0.7153
Skye	-0.2315	1.7700	2.5189		Skye	-0.2315	1.7700	2.5189	
Adjusted R^2						0.955620(95.56%)		0.543928 (54.39%)	

* VAR and VECM Significant at P<0.05

The Augmented Dickey-Fuller test statistic (ADF t-statistic) Unit Root Test (Table 3) revealed that PLR is significant at both levels (I0) and 1st difference with t-statistics value of (-3.9472 and -4.6019) respectively, less than critical value (-2.9484) confirming the stationarity of the predictor- PLR. Other predictor variables are stationary at 1st difference with their t-statistics (-4.7099, -4.7010, -4.7652 and -6.0667 respectively) lower than the critical value of -2.9511 which further strengthens the data stationarity.

5.2 Multicollinearity

The Multicollinearity Test (Table 4) showed that, the highest (absolute) correlation coefficient among the independent variables (MMIs) is 0.8224 (82.24%), which exists between BMS and CIC. The correlation co-efficient is lower than the cut off value of 0.9 (90%) or greater value. This implies that the independent variables have no serial correlation problem that can adversely affect prediction and reliability. The dataset of the indicators (explanatory variables) passed the Multicollinearity and Unit Root Tests and are suitable for further analysis of the causal relation.

Table 4: Multicollinearity Test of Independent Variables (MMIs)

	X_1	X_2	X_3	X_4	X_5
X_1	1.0000				
X_2	0.8224	1.0000			
X_3	0.7771	0.7989	1.0000		
X_4	-0.1097	-0.1796	-0.0462	1.0000	
X_5	0.4717	0.5645	0.5512	-0.4239	1.0000

X_1: BMS; X_2: CIC; X_3: CPS; X_4: PLR; X_5: TBR
Sever correlation at ≥90%

5.3 Cointegration Test

Table 5 presented the time dynamic relationship of REIT dividend returns and MMIS. The Trace statistics (t-stats) showed that, at most, three co-integrations exist among REIT dividend returns and MMIS, having the hypothesised: None*, at most 1* and at most 2*, with their t-stats of 120.8278, 72.64862 and 50.18463 and p-values (0.0003, 0.0292 and 0.0297) respectively showing significance at p< 0.05.

The results indicate the existence of a co-integration between REIT dividend returns and MMIs. Trace Rank Test (at most 4 and at most 5) is insignificant, indicating no presence of co-integration.

Complementary analysis of Max-Eigen statistics showed that, at most, one co-integration exists among REIT dividend returns and MMIs. The hypothesized None* Max-Eigen value of 48.17914 being more than the critical value of 40.07757 with a significant probability value (p=0.005) indicating the presence of co-integration. The Johansen Co-integration Test of Trace and Max-Eigen statistics conducted confirmed both long and short-run relationships exist between REIT dividend returns and MMIs.

Table 5: Johansen co-integration test

Hypothesized No. of CE(s)	Trace Rank Test			Maxi-Eigen Rank Test		
	t-Stats	CV (0.05)	P-Value	M-E Stats	CV (0.05)	P-Value
None	120.8278	95.75366	0.0003	48.17914	40.07757	0.0050
At most 1	72.64862	69.81889	0.0292	22.46399	33.87687	0.5717
At most 2	50.18463	47.85613	0.0297	21.33066	27.58434	0.2567
At most 3	28.85397	29.79707	0.0639	17.51178	21.13162	0.1492
At most 4	11.34219	15.49471	0.1913	11.26784	14.26460	0.1413
At most 5	0.074343	3.841466	0.7851	0.074343	3.841466	0.7851

At 5% confidence Level

5.4 Causality Relationship of REIT Dividend Returns and MMIS

The predictive power of G-Causality largely depends on, and influenced by, lag length structure (Asghar & Abid, 2007). Schwarz (1978) expressed the Schwarz Information Criterion (SIC) lag length selection criterion as follows:

$$SIC = n\text{In}(\sigma^2) + n^{-1}p\text{In}(n) \quad \text{………………}(viii)$$

Predictions of GSM for short and long-term relationship were conducted using VAR model and VECM (Table 3). For short-run analysis, MMIs such as TBR, PLR and CPS (with p<0.05 Granger) cause N-REIT dividend returns while CIC and BMS (having p>0.055) do not Granger cause N-REIT dividend returns in the VAR model. The result of VAR indicates that TBR, PLR and injection to CPS have statistically significant explanatory power to the prediction of the variance in the N-REIT's dividend returns. VECM model for long-run analysis (Tables 3) suggests only PLR can Granger cause N-REIT dividend returns, this being the only indicator with a significant p-value (0.03) in a long-run relationship.

6. Discussion of Findings

This paper studied the relationship, direction and significance of the effect of monetary policy instruments (regarded as Money Market Indicators- MMIs) on the Nigeria REIT's dividend return. The data for this study exhibited normality of distribution. The dataset for all variables passed Unit Root Test (ADF) confirming stationarity. There is no multicollinearity in the dataset (free from serial correlation) making the data suitable for the method adopted. The results show that the instruments of Nigerian monetary policy considered in this study had a short-term relationship with REIT dividend returns, and by extension, with performance and growth. The findings of a short-term relationship in this study corroborate the study of Tsai (2015) who reported a similar finding of a short-term relationship. The current study however found a long-term relationship of PLR with REIT returns; showing that PLR had both short-run and long-run effects on REIT returns. This is in agreement with results of Ufoeze et al. (2018), Bernhard and Ebner (2017) and Fang et al. (2016) that interest rate possessed a long-term relationship with economic growth.

The results further show that only three indicators; PLR, CPS and TBR have a significant effect on REIT yields, but in different directions. PLR was significant both with the VAR and VECM but with negative estimates. This implies that the regime of lending rate over the years has not been favourable to the REIT market. This finding aligns with Swanson et al. (2002), Yunus (2012), Olaleye et al. (2015); Bodunrin (2016) and Ayodeji and Oluwole (2018). The outstanding effect of PLR both in the short and long-runs on REIT dividend returns also echoed the results of Kryzanowski and Tcherednitchenko (2007) and Ma'in et al (2016); that REITs are sensitive to interest rates but with insignificant effect, as reported by: Adegbite and Alabi (2013), Cai and Wang (2018), Ufoeze et al. (2018), and Yan (2019). The findings further show CPS as having a significant negative relationship; suggesting an inadequacy of the credit to the corporate sector. This is not surprising as it supports the PLR relationship. It is obvious that financing projects or businesses, including real estate development, is difficult in Nigeria where interest rates are high. This result contradicts earlier findings of a positive CPS relationship to growth (Were et al., 2012; Cai & Wang, 2018). Ngerebo-A (2016) and Oluwofeso et al. (2015) did not indicate the direction of the significant relationship of CPS found in their study. However, the result is in opposition to Ekwe et al. (2017) who found no significant relationship of CPS to economic development. TBR also shows a significant relationship to REIT returns and is unexpectedly positive in nature. This finding suggests an increase in TBR will lead to an increase in REIT dividend returns.

BMS and CIC have no significant relationship with REIT returns. CIC is considered a part of BMS and it is not surprising that both go the same way having insignificant positive relationships with REIT returns in the short-run. This finding is supported by Yunus (2012); Udude (2014); Abdulazeez (2016); Nwoko et al. (2016); Ekwe et al. (2017); and Ayodeji and Oluwole (2018), who reported a fairly significant relationship. The current study disagrees with Victorial et al. (2016), Onyeiwu (2012), and Yan (2019), who found BMS as having a significant impact on economic development in Nigeria. Again, the CIC in the long-run exhibits a negative influence, indicating that at a point an increase in CIC can lead to inflation with its consequential negative effect on investment return. Although this is insignificant in contrast to inflation rate, which has a significant effect on REIT returns as reported by Oni et al. (2011) and Ma'in et al. (2016). The finding however agrees with Firth (1979), Fama and Gibbons (1982) and Marshall (1992) where there is no significant inflation effect on REITs. The Johansen co-integration test result by both Trace and Max-Eigen values in Table 3 shows a co-integration (relationship) between REIT returns and MMIs suggesting that MMIs can significantly predict the REIT dividend returns in both the short (PLR, CPS and TBR) and long-run (PLR) respectively.

TBR exhibited a similar finding to bond coupon rate effect on REITs portrayed by Nittayagosetwat and Buranasiri (2012) and supported by Astrious and Bogiazi (2013). In effect, the short-run prediction effect of

MMIs is significant, while in the long-run only PLR shows a significant prediction.

7. Conclusion

This is a pioneering study on the predictive effect of MMIs on REIT dividend returns in Nigeria adopting the Co-integration Test and G-Causality Test. The Johansen Co-integration Test confirmed the existence of a relationship between REIT returns and the MMI variables both in the short-run (through Trace) and long-run (using Max-Eigen values). The Causality Test using VAR analysis indicates that TBR, PLR and CPS Granger Cause the dividend return in the short-run, suggesting a significant prediction power of the factors on REIT dividend returns. The VECM further indicated that only one MMI variable (PLR) has significant predictive power over REIT returns in the long-run. The study concluded that the causal effect of MMIs on REIT dividend returns is more significant in the short-run and less significant (one factor only) in the long-run. Also, PLR is a money indicator of great causal effect on REIT returns and needs greater consideration by property investors and property investment managers. The authors acknowledge the limitation of the small dataset in this study. However, said limitation has not had any devaluing effect on our findings as the dataset passed all the tests for the adoption of the method used and the results are similar to other studies.

8. References

Abdulazeez, M.N. (2016). Impact of monetary policy on the economy of Nigeria. *Pyrex Journal of Business and Finance Management Research*, *2*(10) pp.163-179.

Adegbite, T.A. & Alabi, W.O. (2013). Monetary policy and economic growth: The Nigeria Experience (1970-2010). *Prime Journal of Business Administration and Management*, *3*(1), pp.822-833.

Ajide, K.B. (2014). Determinants of Economic Growth in Nigeria. *CBN Journal of Applied Statistics, 5*(2), pp.147-170.

Asghar Z. & Abid I. (2007). *Performance of lag length selection criteria in three different situations*. Islamabad: Quaid-i-Azam University.

Asteriou, D. & Begiazi, K. (2013). Modeling of daily REIT returns and volatility. *Journal of property Investment and Finance*, *31*(6), pp.589-601.

Ayodeji, A. & Oluwole, A. (2018). Impact of Monetary Policy on Economic Growth in Nigeria. *Open Access Library Journal, 5*(2). Doi: 10.4236/0alib.1104320.

Barkham, R. J., Ward, C.W.R. & Henry, O.T. (1996). The Inflation Hedge Characteristics of UK Property. *Journal of Property Finance, 7*(1), pp.62-76.

Bello, O.M. (2000). Risk Management in the Process of Property Development Construction in Nigeria. *Journal of the Federation of Construction Industry, 15*(3), pp.15-23.

Bello, O.M. (2005). The Inflation Hedging Attributes of Investments in Real Estate, Ordinary Shares and Naira Denominated Deposits between 1996 and 2002. *Journal of Banking, 1*(1), pp.1-28.

Berhard, S. & Ebner, T. (2017). Crossborder spill over effectof unconventional monetary policies on Swiss asset prices. *Journal of International Money and Finance*, *75*, pp.109-127.

Bernanke, B.S. & Kuttner, K.N. (2005). What explains the stock market's reaction to Federal Reserve policy? *The Journal of Finance*, *60*(3), pp.1221-1257.

Bhuyan, R., Kuhle, J., Al-Deehani, M.T. & Mahmood, M. (2015). Portfolio diversification benefits using real estate investment trusts: An experiment with US common stocks, equity real estate investment trusts, and mortgage real estate investment trusts. *International Journal of Economics and Financial, 5*(4), pp.922-928.

Bodunrin, O.S. (2016). *The Impact of Fiscal and Monetary Policy on Nigerian Economic Growth*. MPRA Paper No.92811. Available at: https://mpra.ubs.uni-muenchen.de/92811/

Bredin, D., O'Reilly, G. & Stevenson, S. (2011). Monetary policy transmission and real estate investment trusts. *International Journal of Finance & Economics, 16*(1), pp.92-102.

Bruegeman, W.B., Chen, A.H. & Thibodeau, T.G. (1992). Some Additional Evidence on the Performance of Commingled Real Estate Investment Funds 1972-1991. *Journal of Real Estate Research, 7*, pp.433-448.

Cai, W. & Wang, S. (2018). The Time Varying Effect of Monetary Policy on House Price in China: An Application of TVP-VAR Model with Stochastic Volatility. *International Journal of Business Management, 13*(4), pp.149-157.

CBN (2016). Monetary Policy. *Education in Economic Series, No.2.* CBN Research Department.

Crossland, A.J. (2007). Interest rate effects on Listed Property Trust's Performance. A paper presented at the 13th Pacific Rim Real Estate Society's Annual Conference held at Freemantle, West Australia, January 21-24

Dabara, I.D. (2015). The inflation-hedging performance and risk-return characteristics of residential property investments in Gombe, Nigeria. *Advances in Research, 3*(1), pp.71-83

Daud, S.Z., Mohd, A.H., Sipan, I.A. & Wilson, A.J. (2012). The Impact of location attributes on REITs' Return. 3rd International Conference on Business and Economic Research Indonesia. pp.311-332.

Ekwe, M.C., Ogbonnaya, A.K. & Omodero, C.O. (2017). Monetary Policy and Nigeria Economy: An Impact Investigation. *International Journal of Economics and Finance, 9*(11), pp.218-222.

EPRA (2018). Global REIT Survey. European Public Real Estate Association.

Ezema, C.C. (2009). Monetary Policy Framework in Nigeria: Formulation and Implementation challenges. A paper Presented at African Institute of Applied Economics Monthely Seminar, August.

Fama, E.F. (1981). Stock returns, real activity, inflation, and money. *The American Economic Review, 71*(4), pp.45-565.

Fama, E.F. & M.R. Gibbons (1982). Inflation, real returns, and capital investment. *Journal of Monetary Economics, 9*, pp.297-323.

Fei, P., Ding, L., and Deng, Y. (2008). *Correlation and volatility dynamics in REIT returns: performance and portfolio considerations.* Working Paper Series. Singapore: Institute of Real Estate Studies.

Falnassi, I. Slim, C., Ftiti, Z. & Maatoug, A.B. (2014). Effect of monetary policy on REIT returns: Evidence from the United Kingdom. *Research in International Business and Finance, 32,* pp.15-26.

Fang, H., Chang, T.Y., Lee, Y.H. & Chen, W.J. (2016). The Impact of macroeconomics factors on the real estate investment trusts index return on Japan, Singapore and China. *Investment Management and Financial Innovation, 13*(4)*,* pp.242-253.

Firth, M. (1979). The relationship between stock market returns and rates of inflation. *Journal of Finance, 34*(3), pp.743-749.

Goebel, P.R., Harrison, D.M., Mercer, J.M. & Whitby, R.J. (2013). REIT Momemtum and Characteristics-Related REIT Returns. *Journal of Real Estate Finance and Economics, 47*, pp.564-581.

Hamelink, F. & Hoesli, M. (1996). Swiss Real Estate as a Hedge against Inflation: Evidence using Hedonic and Auto Regressive Models. *Journal of Property Finance, 7*(1), pp.33-49.

Granger J.W.G. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. *Econometrica*, *37*(3), pp.424-438.

Hamelink, F., Hoesli, M. & MacGregor, B. (1997). Inflation Hedging versus inflation protection in the US and Uk. *Real Estate Finance, 14*(2), pp.63-73.

Hamzah, A.H. & Rozali, M.B. (2010). Empirical investigation on the performance of the Malaysian real estate investment trusts in pre-crisis, during crisis and post crisis period. *International Journal of Economics and Finance*, *2*(2)*,* pp.62-69.

Hardin III, W.G. & Hill, M.D. (2008). REIT Dividend Determinant: Excess Dividends and Capital Markets. *Real Estate Economics, 36*(2), pp.349-369.

Hoesli, M. Liziei, C. & MacGregor, B. (2008). The Inflation Hedging Characteristics of US and UK Investments. A Multi Factor Error Correction Approach. *Journal of Real Estate Finance and Economics, 36,* pp.183-206

Hoesli, M. (1994). Real Estate as a Hedge against Inflation: Learning from the Swiss Case. *Journal of Property Valuation and Management, 12*(3)*,* pp.51-59.

Hoesli, M., Matysiak, B. & Nanthakumaran, N. (1996). The long-term Inflation Hedging Characteristics of UK Commercial Property. *Journal of Property Finance, 7*(1), pp.50-61.

Islam, M. (2003). The Kuala Lumpur Stock Market and Economic Factors: A General-to-Specific Error Correction modeling test. *Journal of Academy of Business and Economics*, *1*(1). Available at: http://jabe-journal.org/JABE-JOURNAL/Documents/Abstracts/JABE-1-1_Abstracts.pdf

JLL. (2018). Global Real Estate Transparency Index. Chicago: Jones Lang LaSalle.

Kryzanowski, L. & Tcherednitchenko, M. (2007). Performance of Canadian E-REITs. *International Real Estate Review, 10*(2), pp.1-22.

Kuttner, N.A. (2001). Monetary Policy Suprises and Interest rates: Evidence from the Federal Funds Futures Markets. *Journal of Monetary Economics, 47*(3), pp.523-544.

Lee, C.L., Stevenson, S & Lee, M.L. (2018). Low Frequency Volatility of Real Estate Securities and Macroeconomic risk. *Accounting and Finance, 58*(1), pp.311-342.

Ling, D.C., Naranjo, A. & Ryagaert, M.D. (2000). The predictability of Equity REIT Returns: Time Variation and Economic Significamce. *Journal of Real Estate Finance and Economics, 20*(2), pp.117-136.

Ma'in, M., Arifin, N.A.M., Hatta, M.F.M., Hashim, M.H. & Isa, S.S.M. (2016). Determinants of Islamic real estate investment trust performance. *Advanced Science Letters*, *22,* pp.4321-4325.

Manni, C. & Teng, X.C. (2007). *Investigation on the Real Estate Market. What are the Main Factors Influencing the Performance of the French Real Estate Investment Trust.* School of Economics, UMEA University, Sweden.

Marshall, D. (1992). Inflation and asset returns in a monetary economy. *Journal of Finance, 47*(4), pp.315-1343.

NBS (2018). Demographic Statistics Bulletin. Nigerian Bureau of Statistics.

Muller, G.R. & Pauley, K.R. (1995). The Effects of interest Rate Movements on Real Estate Investment Trusts. *Journal of Real Estate Research, 10*(3), pp.319-325.

Newell, G. (1996). The Inflation Hedging Characteristics of Australian Commercial Property 1984-1995. *Journal of Property Finance, 7*, pp.6-20.

Newell, G., Adair, A. & Nguyen, T.K. (2013). The significance and performance of French REITs (SIICs) in a mixed asset portfolio. *Journal of Property Investment and Finance, 31*(6), pp.575-588.

Newell, G. & Osmadi, A. (2009). development and preliminary performance of Islamic REIT in Malaysia. *Journal of Property Research, 26(4),* pp.329-347.

Nittayagasetwat, A. & Buranasiri, J. (2012). Real estate investment performance: The test of the impact of additional interest rate information from CIR model. *International Journal of Business and Social Science, 3*(12), pp.134-143.

Ngerbo-A, T.A. (2016). Monetary policy and inflation in Nigeria. *International Journal of Finance and Accounting 5*(2), pp.67-76

Nwoko, N.M., Ihemeje, J.C. & Anumadu, E. (2016). The Impact of Monetary Policy on Economic Growth of Nigeria. *AFrican Research Review, 10*(3), pp.192-206.

Ojetunde, I. (2013). Revisiting the interaction between the Nigerian residential property market and the macro-economy. Paper presented at the International Federation of Surveyors Working Week. Available at: http://www.fig.net/pub/monthly-articles/may

Olaleye, A., Bello, O.B. & Ayodele, T.O. (2015).Determinants of Listed Property Stock Prices in Nigeria: A Macrecomic Perspective. *Real Estate Finance, 32* (2)*,* pp.70-76.

Olanrele, O.O., Fateye, O.B. & Adegunle, T.O. (2017). *Microeconomic Determinants of Real Estate Investment Trusts (REIT's) Dividend Return in Nigeria.* A paper presented at the 17th Africa Real Estate Society (AfRES) Annual Conference. Johannesburg, South Africa.12-15 September

Olanrele, O.O., Said, R. & Daud, N.M. (2015). Comparison of REIT dividend performance in Nigeria and Malaysia. *African Journal of Business Management, 9*(16), pp.608-614.

Olanrele, O.O., Said, R. & Daud, M.N. (2014). *Real estate Investment trust (REIT) in Nigeria: The influence of external factors on return.* 14th Africa Real Estate Society (AfRES) Annual Conference. Cape Town, South Africa. 2-5 September 2014.

Oluwofeso, E.O., Adeleke, A.O. & Udoji, A.O. (22015). Impact of Private Sector Credit on Economic Growth in Nigeria. *Journal of Applied Statistics, 6*(2), pp.81-101.

Ong, T.S., The, B.H. & Chong, M.P. (2011). A Study on the Performance of Malaysian Real Estate Investment Trusts from 2005-2010 by using Net Asset Value Approach. *International Journal of Economics and Finance, 2*(1), pp.1-15.

Oni, A.O., Emoh, F.I. & Ijasan, K.C. (2011). The impact of money market indicators on real estate finance in Nigeria. *Sri Lankan Journal of Real Estate*, *6*, pp.16-37.

Onyiewu, C (2012). Monetary policy and economic growth of Nigeria. *Journal of Economic and Sustainable Development, 3*(7), pp.62-70

Oyewole, M.O. & Ajayi, C.A. (2014). Influence of macroeconomic factors on the performance of office properties in Lagos, Nigeria. *Journal of Property Research & Construction, 2*(1), pp.40-48.

Pham A.K. (2013). *An empirical analysis of real estate investment trust in Asia: Structure, performance and strategic investment implication.* PhD Thesis, University of Western Sydney.

Rigobon, R., Sack, B., (2004). The impact of monetary policy on asset prices. *Journal of Monetary Economics, 51* (8), pp.1553-1575.

Rozman, T.A., Azmi, A.N., Najib, R.N.M. & Ali, M.H. (2015). The potential of Islamic real estate investment trusts in Malaysia. *PERINTIS E-Journal, 5*(2), pp.13-30.

Swanson, Z., Theis, J. & Casey, K.M. (2002). REIT risk premium sensitivity and interest rate. *Journal of Real Estate Finance and Economics, 24*(3), pp.319-330.

Tsai, I.C. (2015). Dynamic information transfer in the United States housing and stock market. *The North American Journal of Economics and Finance, 34,* pp.215-230.

Udude, C.C (2014). Monetary policy and economic growth of Nigeria (1981-2012). *Journal of Policy and Development Studies, 9*(1), pp.234-247.

Ufoeze, L.O., Odimgbe, S.O., Ezeabalisi, V.W. & Alajekwu, U.B. (2018). Effect of Monetary Policy on Economic Growth in Nigeria: An Empirical Investigation. *Economic Series, 2*, pp.123-140.

Were, M., Nzomoi, J. & Rutto, N. (2012). Assessing the Impact of Private Sector Credit on Economic Performance. Ecidence from sectoral panel data for Kenya. *International Journal of Economics and Finance, 4*(3), pp.182-190.

Victoria, A., Babajide, A.A., Akhanolu, I.A. & Tochukwu, O. (2016). Monetary Policy and its Effectiveness on Economic Development in Nigeria. *International Business Management, 10*(22), pp.5336-5340.

Wurstbauer, D. & Schafers, W. (2015). Inflation hedging and protection characteristics of infrastructure and real estate assets. *Journal of property Investment and Finance, 33*(1), pp.19-44.

Yan, N. (2019). Study on the Influence of Monetary Policy on Real Estate Price in China. *Journal of Service Science and Management, 12,* pp.152-171.

Yunus, N. (2012). Modelling Relationship among Securitised Property Markets, Stock Markets and Macroeconomic Variables. *Journal of Real Estate Research, 34*(2), pp.127-156.

Valuation Inaccuracy: Implication on Commercial Property Investment Performance in Akure, Nigeria

Nwosu, A. E.[1]

[1] Department of Estate Management, Federal University of Technology, Akure, Nigeria.

Abstract

Issues of valuation error have become one of the most significant challenges of the valuation profession lately. The derivation of property returns from commercial income and prices actually paid has cast a lot of doubt on the reliability of valuation opinion in the commercial property investment decision process. This study investigates the implication of valuation inaccuracy on investment performance of commercial properties in Akure, Nigeria. Questionnaires were administered to 25 registered and practicing Estate Surveyors and Valuers (ESVs) in Akure and 19 duly filled questionnaires were returned for analysis. Descriptive analysis was used to assess the level of inaccuracy and the factors influencing the valuation inaccuracy, while regression analysis was used to examine the effect of this inaccuracy on investment performance. It was discovered that the most common level of valuation inaccuracy in Akure is ±11-15% which is above the acceptable range of ±5%. It was also discovered that the various assumptions made by the valuers and the market indices used in carrying out valuation have the highest influence on the inaccuracy discovered in their valuation. From the simple linear regression analysis carried out, it was found that valuation inaccuracy has negative implication, at β=-.800, t=3.873, p>.05 on the investment performance. This shows that the higher the level of inaccuracy of valuation, the lower the performance of the investment. The result, however, indicates that the effect of valuation inaccuracy on commercial property investment performance is statistically insignificant. This study recommends that valuers in Akure should be very careful in making assumptions and be more vigilant regarding their use of market indices for valuations. It also recommends that valuers should be aware that investors rely on the accuracy of their valuations for making timely investment predictions and should therefore ensure conscientious efforts are put in place for accuracy of their valuations.

Keywords: Commercial Property; Investment; Inaccuracy; Performance and Valuations

---

[1] nwosuaku@yahoo.com

1. Introduction

Valuation refers to the estimated amount (price) for which a property should exchange on the date of valuation between a willing buyer and a willing seller in an arm's length transaction after proper marketing wherein the parties had each acted knowledgeably, prudently and without compulsion (International Valuation Standards, 2017). Valuation accuracy is a measure of the difference between a value determination and group of value determinations in relation to a subsequently realised sale price (Boyd & Irons, 2002).

Valuation accuracy gained popularity in the mid 1970's, where investors became cognizant of the financial loss associated with inaccurate valuations. The challenges from inaccuracy of valuation became a matter of litigation where clients sued valuers for their financial loss. Valuation inaccuracy as posited by Millington (1985) is not expected to be outside the acceptable reasonable range to the point of grave loss to any party associated with the valuation from overvaluation or under valuation. Thus, absolute accuracy should neither be expected nor necessarily be sought for a full achievement in any valuation (Ayedu et al., 2014).

Ayedun et al. (2011) are of the opinion that there can be no reason why two or more valuers, valuing the same interest in a property for the same purpose and at the same time should not arrive at the same or insignificantly different results if they make use of the same data and follow the same valuation approach. But very often this is not the case and in some of these unfortunate cases the profession is thrown into considerable embarrassment.

Issues of demand for valuation accuracy have brewed several researches, both in the developed and developing world. These studies have been conducted in the United Kingdom, the United States, Australian and Nigeria (Drivers Jones/Investment Property Development, 1988; Matysiak & Wang, 1995; Ogunba & Ajayi, 1998; Mokrane, 2002; Boyd & Irons, 2002; Ayedun et al., 2014). This highlights that valuation inaccuracy is an area of global academic discussion, especially with focused consideration on specific implications of the accuracy/inaccuracy of valuations. Most studies on valuation accuracy have centered on the margin of valuation inaccuracy permissible in comparison with the actual sales price (Boyd & Irons, 2002; Ayedun et al., 2014; Hironen et al., 2014), factors influencing valuation inaccuracy (Ajibola, 2010; Ayedun et al., 2014; Effiong, 2015) and client's influence on valuation (Adegoke, Olaleye & Oloyede, 2013; Akerele & Thomas, 2014). This has left a research gap regarding the examination of the factors that influence valuation inaccuracy and the effect of valuation inaccuracy on real property investment performance.

Investors require valuations in aiding their investment decisions, mainly for the purpose of securing mortgages (Adegoke et al., 2013). Cases of inaccuracy in valuations constitute major constraints to the expectation of the investors and have been the subject of embarrassment to the integrity of the profession with consequent disregard of their valuations. (Adegoke et al., 2013). Having already received much research attention, studies on the

accuracy of valuation cannot be overemphasised. This is with the expectation that the more research that is aimed at the subject matter, the more the errors surrounding the problem will be unearthed. It is also of importance to examine accuracy of valuation without the exclusion of the factors that surround valuation inaccuracy such as: inadequate market indices, yield, valuation assumptions, and inappropriate techniques. These factors have peculiarities depending on the subject of consideration for the expectation of accuracy in valuation.

The majority of research on valuation accuracy in Nigeria has been conducted in Lagos, therefore there is need to extend the discussion to other parts of the country. It is also necessary to state that the existing body of literature on this subject pays little attention to the clients who utilise the valuation report, particularly the investors that rely on the valuation results for their investment analysis and decision-making. This current research therefore examines the impact that valuation inaccuracy has on the performance of investment. It also considers the factors that could influence the accuracy of valuation in aiding investment analysis and decision-making.

2. Literature Review

Studies on valuation accuracy would not have a proper footing if reference is not made to the study of Hager and Lord (1985). In the study, two properties were selected, and ten valuers carried out valuations. One of the properties was an office building, the other was a shop. The valuations were carried out using descriptive statistics of variation and a standard deviation. The results revealed that there was a deviation from sales price in the values arrived at by the different valuers. These variations range majorly from ±5% to ±10%. Some of the valuations were even found to be up to ±20% variation from the actual value of the two assets. The inaccuracy in the values arrived at by different valuers shows that they could not be absolutely relied upon when carrying out investment performance analysis. Such inaccuracy of more than ±10% could give a tenable warrant to initiate legal action against the valuer.

Bretten and Wyatt (2002) investigated the possible cause of variance as well as the acceptable margin of error in investment valuations for commercial lending. They distributed 220 questionnaires to lenders, finance brokers, valuer's, and investors. The study revealed that the main cause of variance was individual valuer's behavioural influences and that ±10% was the most acceptable margin of error for valuations.

In order to give consideration for adjustment to the changes that could happen to the market conditions, Mokrane (2002) used property data from five countries in Europe. The study considered Germany for the period of 1997 to 2000; UK for the period of 1990 to 2000; France for the period of 1999 to 2000; Sweden from the period of 1997 to 2000 and The Netherlands from the period of 1999 to 2000. In the study consideration was given to the differences in the market condition, and capital expenses between the date of valuation and transaction. The study found a statistically significant difference between the valuations and the transaction prices of the properties, showing a high

level of inaccuracy of the valuations in all the countries. This finding is contrary to the findings of Bretten and Wyatt (2002) that reveal the main cause of inaccuracy as individual valuer's behavioural influences and that ±10% was the most acceptable margin of error. However, the difference of the findings may be connected to the sample size that was used for the studies. Mokrane (2002) used property data from five different countries while Bretten and Wyatt (2002) used data from only one country. The five countries that were used by Mokrane (2002) may differ in property performance and this may affect the outcome of their result. Bretten and Wyatt (2002) captured the major causes of valuation inaccuracy but the implication of the valuation inaccuracy on the performance of the investment was not considered.

Hironen et al. (2014) worked on the need for a safety margin in property valuations for compulsory compensation in Finland. The study engaged different valuers in the country in the valuation of a particular property for compensation on compulsory acquisition. After each valuer has given their own opinion of value, standard statistical methods were applied to analyse the results. It was found from the study that the standard deviation in the market value estimate was 32%. It was also revealed that up to 50% of the valuations were within -16% and +33% of the median valuation. The results from this study suggest that most of the valuations by the valuers were far apart from the assumed sales price, which is the median valuation. This is not in tandem with the earlier findings of Bretten and Wyatt (2002) that reveals that ±10% was the most acceptable margin of error to be accepted. It conforms to the earlier finding of Ogunba and Iroham (2011) with a permissible margin of error of agreed by valuers to be ±11.1% and commercial banks agreed to a margin of ±13.16%. However, this study only looked at the margin of error but was unable to look at the implication of this margin of error on the performance of investments.

In Nigeria, Ogunba and Ajayi's (1998) study was one of the first major studies that considered the issue of the accuracy of valuation in Africa. The study analysed the capital value arrived at by 30 valuation firms in Lagos, Nigeria. Two properties were given as a sample for these firms to carry out their valuations and their values were then compared with the eventual sales price of the properties. The study made use of statistical analyses such as range, interquartile random, mean deviation, regression and correlation analysis. It was found from the study that the valuers were not accurate in their prediction of the sales price of the properties. This was because the sales prices of the properties were found to be more than ±20% of the valuations. Aluko (1998) identified the various causes of valuation inaccuracy by Estate Surveyors and Valuers (ESVs) to include; choice of valuation technique; valuation assumptions; experience of the valuer; inadequate data; and reverse yield, among others. However, the findings were not based on empirical data. It is generally acknowledged in literature that poor techniques have a major impact on the accuracy of a valuation (Ogunba, 1997). However, there is an increasing recognition that other factors like valuation assumptions, location of the valuer and market indices also play a role in the accuracy of the valuation outcome. Aluko (2000) considered the accuracy of mortgage values by valuers. The study made use of 59 firms' valuations before the execution

of the mortgage. They employed regression and ANOVA analyses. It found high a proximity between the valuations of the properties to their forced sales prices, and more than the acceptable range of ±5%. The results of Aluko (2000) that valuations are a good proxy for the eventual value of the property at a range of ±5% is in contrast to the findings of Ogunba and Ajayi (1998) that valuations are not accurate in predicting the actual sales value of properties.

Ogunba (2003) extended the area of study of Ogunba and Ajayi (1998) to the six South Western states of Nigeria. The study used 171 valuers to carry out valuations of properties and then examined the accuracy of their valuations in comparison with the sales price of the properties. The study also made use of statistical tests such as: range, inter quartile range, regression analysis and ANOVA. The findings from the study corroborated the work of Ogunba and Ajayi (1998) that the valuations were not a good proxy for sales price and there was high level of inaccuracy of the valuations.

Ogunba and Iroham (2011) examined the permissible acceptable margin of inaccuracy of valuation in Nigeria under stable market conditions. The study elicited data from 195 valuers and 25 commercial banks in Lagos. The findings from the study showed that the valuers agreed to ±11.1% and that the commercial banks agreed to a margin of ±13.16%. These ranges are however too high, and they could have negative implications on investment decisions. However, from the existing literature, it is almost impossible to expect pin point accuracy in valuations, as the majority of the studies identified deviation of the sales price of the properties from their valuation.

On the causes of valuation inaccuracy, Harvard (2001) opined that the causes include: errors in survey, insufficient depth of investigation, errors in procedure, differences arising out of different methodologies, and client pressure or influence. The possibility of having accurate valuations was found to be partially dependent on local variable factors such as: the extent of information, the variability of local cycles, and the heterogeneity of the stock. Also, Baum et al. (2001) found that the influence of valuers (the use of heuristics) and clients' influence as the main causes of valuation inaccuracy.

In Nigeria, Ajibola (2010) carried out an examination of the causes of valuation inaccuracy in Lagos metropolis. The study elicited data from 150 valuers on the causes of valuation inaccuracy. It made use of descriptive statistics for its analysis. It was found that the inaccuracy from the valuations came from a dearth of market evidence (data), the use of outdated valuation approaches, inadequate academic training, inexperience in valuation practice, and clients' influence.

Ayedun, Oloyede and Durodola (2012) later carried out an empirical study on the causes of valuation inaccuracy in Nigeria. The study gathered data from interviews conducted on sampled professionals and academic members of the Nigerian Institution of Estate Surveyors and Valuers (NIESV). The data were analysed with the use of simple statistical tools. The findings from the study showed that causes of valuation also range from a dearth of market

data and a lack of adequate training and experience of the part on the valuers. Thus, the findings from Ayedun et al. (2012) have similarity with the findings of Ajibola (2010) on the causes of valuation inaccuracy.

A study by Adegoke et al. (2013) focused on the perception of valuation clients on mortgage valuation reliability. The study made use of 50 randomly sampled lending institutions in Lagos, Nigeria which represented 57.5% of the target population. The study used descriptive statistics to analyse the perception of the lending institutions (valuation clients). It was found from the study that clients are of the opinion that valuations produced by valuers were not reliable because of the large disparity between the opinion of value of those properties on default mortgage that were foreclosed and the final sales price. However, the study of Adegoke et al. (2013) did not consider the implication of this disparity on the investment of the client, which is the focus of this study.

Oduyemi, Okoroh and Fajana (2016) examined property valuation inaccuracy in commercial office buildings. The study aimed at establishing the key causative factors to valuation inaccuracy. The study employed a questionnaire-based approach to collect data for the study. The data were analysed using mean ranking, regression and factor analysis. The key findings of the statistical analysis indicated that professionals ranked the existing valuation methodology as the most established cause, while only four of the causes make a statistically unique contribution to the valuation methodology, namely: skill, experience and judgement of the valuer, types of property, the integrity of the individual surveyor, and the lack of a standard valuation manual.

Similarly, Friday (2015: p.216) stated "*that the market has not now, nor has it ever had a monopoly of pecuniary valuation.*" Nevertheless, it is expected that the inaccuracy of the valuation should be kept to a minimum, that is where literature on this subject matter have acceptable a margin of error, mostly within ±5% (Ogunba & Ajayi, 1998). Literature has been reviewed on valuation inaccuracy, valuation variance and acceptable error margins. However, the factors responsible for valuation inaccuracy and their implications on investment performance have not been satisfactorily treated in previous research as reviewed above. The consequence of this gap is underplaying potential issues that may cause significant distortions to the expected outcome of property investment performance and the risk of litigation of valuers. This current research therefore considers the accuracy of valuation in Akure, Nigeria by identifying the factors that bring about inaccuracy in valuation as well as the implication of valuation inaccuracy on investment performance.

2.1 Study Area

The area selected for this study is Akure, the capital city of Ondo state. Akure is an evolving city in Nigeria that has in recent years, through development and rural-urban migration, been experiencing rapid commercial and residential property investments. The increased political influence of the city

as the state capital since 1976 has greatly prompted its rapid growth and increased socio-economic activities resulting in its spatial expansion from an area of about 16km^2 in 1980 to about 30km^2 in 2000. There are 25 practicing Estate Surveying and Valuation firms in Akure who participate in the service of property valuation. This study makes use of the data procured from the ESV firms for the examination of the accuracy of their valuation, which is based on the value of the property and the subsequent market (sales) transaction information as volunteered by the sampled ESVs.

3. Methodology

The study population comprises of registered and practising ESVs in Akure. ESVs are chosen because in Nigeria they are the professionals empowered by Decree No 24 of 1975 now CAP E13, Laws of the Federation of Nigeria (2007) to carry out the valuation of properties and other assets. According to the directory of the NIESV (2018), the total number of registered and practising ESVs in Akure is 25. The sample frame for the study is the 25 registered and practising ESVs in Akure and it constitutes the sample size for the study since it is within a manageable frame. Census method was adopted for this study. Primary data was used for the study and it was collected using structured questionnaires administered on the study population.

Valuers were asked to input the value opinion they originally gave prior to the investment decision process by investors as well as the eventual sales price of the properties. This data was used to analyse the margin of error that exists within the property market in Akure. Valuers were also asked to identify the level of performance of the various property investments in view of their value opinion and the eventual sales price (Table 2) with an open-ended question to indicate reason for the level of performance indicated. Finally, ESVs were asked to rate the factors responsible for the level of inaccuracy in valuations in order of their dominance. There were 19 duly completed questionnaires which were returned for analysis. This data from ESVs is very useful for this research because of their critical role before the investment decision process. ESVs opinions are sought during the execution of the investment project serving as property investment consultants on the development team as well as the property investment manager at completion of the property investment project. So, the data source is considered credible and germane to this study.

3.1 Method of Data Analysis

The main objectives of this study are to identify the level of valuation inaccuracy in the study area; to examine its causes or factors responsible for valuation inaccuracy and the implication of the identified level of inaccuracy on property investment performance.

To measure the level of inaccuracy, the deviation of valuations from actual sales price was determined from the valuation reports as prepared by ESVs. Descriptive statistics of percentages was used to derive the percentage difference between the value opinion and the eventual sales price. The

percentage difference was used because the current universally acceptable way to determine whether valuation opinion falls within an acceptable range is by the use of percentages which is currently put at ±5%. The time lag between the period of valuation and sales of the properties was held within a three-month period in order to reduce the effect of market change on the variation of the values of the properties.

The factors that influence the accuracy/inaccuracy of the valuation were assessed using the Weighted Mean Score. This is considered suitable because of the ease of using the score to rank the factors in order of their dominance. The Weighted Mean Score is given as:

$$\text{WMR} = \frac{(5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1)}{N} \dots\dots\dots\dots\dots\dots \ (1)$$

Where: n_5= number of very significant; n_4= number of significant; n_3= number of undecided; n_2= number of insignificant; n_1= number of very insignificant; N= Total number of respondents.

Simple linear regression analysis was used to examine the effect of the accuracy/inaccuracy of valuation on the performance of investment. This was used because it helps identify the effects of valuation inaccuracy on property investment performance, and hence reasonable deduction could be made regarding the implication. This was done by assessing the implication of the valuations carried out by the valuer on the outcome of the investment that the valuation was used for by the institutional based investors. The simple linear regression analysis is given as:

$$Y = a + bx + e \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \ (2)$$

Where: X is the independent variable (level of inaccuracy) b is a simple linear regression for the independent variable (the slope of the regression line relative to x-axis). "a" is the intercept. "e" is an error term.

4. Data Analysis and Discussion

This section presents the results of the study based on analysis of the data collected.

Table 1: Distribution of Error Margin in the Valuation of Commercial Properties in Akure

Distribution of Error Margin	Frequency(%)	Cumulative Frequency
0-5%	5 (26%)	26%
6-10%	3 (16%)	42%
11-15%	9 (47%)	89%
16-20%	2 (11%)	100%

Source: Field Survey, 2018

Table 1 depicts the proportion of valuations across the error distribution table. This was derived by comparing the values arrived at when the valuation was done with the eventual sales price of the properties in the market. The percentage difference was calculated to determine the class distribution the valuations belongs. The table shows that only 26% of valuer's opinion falls within the acceptable range of ±5 %. Sixteen percent (16%) of the valuations are within the range of ±6-10%, while 42% of all the valuations fall within the range of ±10%. However, 47% of the valuations were found to be within ±11% to ±15% while 11% were within ±16-20%. The results imply that the highest proportion of deviation of the valuations falls within the ±11-15%, with a percentage score of 47. Furthermore, cumulatively, 42% of the valuations have a percentage deviation of 10% and below. However, there is cumulative proportion of 58 percentage points for valuations above ±10%. This shows that the sales price of the properties varying at higher percentages are currently prevalent in the commercial property market. This is in tandem with the commercial banks margin of error of ±13.16% (Ogunba & Iroham 2011). The agreed margin of error could have a serious implications for property investors who rely on the valuation made by the valuer for making investments.

Table 2: Property Investment Performance Rating According to Margin of Error Class

Margin of Error/	Very High (5)	High (4)	Indifferent(3)	Low(2)	Very Low(1)	Weighted Mean	Mean Rank
0-5% (4)	3	2	-	-	-	1.5	1
6-10% (3)	1	2	-	-	-	0.9	3
11-15% (2)	-	1	1	5	2	1.3	2
16-20% (1)	-	-	-	1	1	0.2	4

Source: Field Survey, 2018

In Table 2, valuers identified the level of performance of the various property investments in view of their value opinion and the eventual sales price. It is noteworthy that Table 2 agrees with Table 1, as the properties that performed high or very high were the ones where the value opinion did not deviate more than 5%. The table shows the number of valuations that falls into the margin of error class, and at the same time the level of their performance rating by respondent valuers. The table depicts that property investments with an investment valuation that varied from the price within ±0-5% has the highest performance rating with a mean score of 1.5. However, properties with valuation opinions deviating from eventual sales price between ±11-15% was rated in next best performing set of investments in the experiment with a mean score of 1.3 over and above the lower margin of error class of between ±6-10% which came third with a mean score of 0.9. This suggests that apart from valuation inaccuracy, other factors- especially relating to the management of the commercial property investment portfolio- may play prominent roles in commercial property investment performance.

Therefore, in order to throw more light on the effect of valuation inaccuracy on property investment performance, regression analysis was subsequently carried out using the data from Table 2 above (the margin of error and the mean rank). Each class of margin of error was rated according to their level of desirability. A 0-5% margin of error was considered the most desirable with a rating of 4 while 6-10%, 11-15% and 16-20% were rated 3, 2 and 1 respectively. This was measured against property investment performance outcome in Table 2. The result is depicted in Table 4 and 5.

Table 3: Factors that Influenced the Inaccuracy of Residential Property Valuation by the Valuers

Causes of Valuation Inaccuracy	Strongly Agreed	Agreed	Undecided	Disagree	Strongly Disagree	Mean	Ranking
Valuation Assumptions	13	2	4	0	0	4.47	1st
Inadequate Market Indices	8	7	2	2	0	4.11	2nd
Use of Inappropriate Techniques	7	8	3	0	1	4.05	3rd
Valuer's Experience/inexperience in Valuation Practice	7	6	5	0	1	3.95	4th
Problem of Irrelevant/Inadequate Data	4	11	3	1	0	3.95	5th
Reverse Yield Gap	0	10	8	0	1	3.42	6th
Valuation Irrationality	1	8	7	2	1	3.32	7th
Location of Firm	1	4	5	4	5	2.58	8th

Source: Field Survey, 2018

Table 3 shows the weighted mean score ranking of the various factors that brought about the inaccuracy found in the valuations of the valuers as in Table 1. ESVs were asked to rate the factors in order of their dominance in contributing to valuation inaccuracy. The main purpose of this table is to illustrate the level of influence the above listed factors have on valuation inaccuracy in Akure. From Table 3 it was discovered that the highest influencing factor on the inaccuracy of the valuations are the assumptions made by the valuers. Valuation is both art and science, and a valuer is expected to make different assumptions, utilising instinct, experience and subjective adjustments. This inadvertently causes some valuers to overvalue some properties and under value others. It was found from the analysis that this factor has a mean score of 4.47 and it cut across all the valuations used for this study. Other factors that were found out to be of high influence on the inaccuracy of valuation are '*inadequate market indices*' with a mean score of 4.11. This shows that most of the valuations were carried out by the valuers without considering the market condition indices like the macro economic factors that could influence the market value. Ranked third is '*the use of inappropriate techniques*'. Ranked fourth is '*valuer's experience/inexperience in valuation practice*', fifth is '*problems of relevant/inadequate data*'. Towards the bottom, there is '*reverse yield gap*'

which is ranked sixth, '*valuation irrationality*' ranked seventh, while '*the location of the firm*' ranked last.

The last ranked factor, '*location of the firm',* shows that the location of the firm has less to do with the inaccuracy of the valuation, justifying the fact that the valuer can carry out his valuation in any part of the country if the necessary information is supplied. The result implies that valuation assumptions and market indices are major factors that influence valuation accuracy of commercial property investment in Akure. The findings from Ajibola (2010) and Ayedun et al. (2012) confirm this finding. Further, the least relevant factor is the location of firm which implies that where the firm is sited does not affect the valuation accuracy of property investment.

Table 4: Model Specification of the Implication of the Valuation Inaccuracy on Residential Property Investment Performance

Model	R	R-Square	Adjusted R Square	Std Error of the Estimate
	0.800[a]	0.640	0.460	0.94868

a. *Predictors: (constant), Property Investment Performance*

Table 4 shows that the R-square value is fit enough for the valuation inaccuracy to predict the investment performance at 64%. Therefore the result of the regression is reliable for prediction based on the percentage of the closeness of the prediction to the data at 64%. However, the result of the regression shows that the equation is statistically insignificant at $p>.05$.

Table 5: Effect of Valuation Inaccuracy on the Residential Property Investment Performance

| Model	Unstandardised Coefficient	Standardised Coefficients	T	Sig.	Model
	B	Std. Error	B		
(constant)	4.500	0.162		3.873	(constant)
Property Investment Performance	- 0.800	0.424	-0.800	-1.886	Property Investment Performance

a. *Dependent Variable: Level of Inaccuracy*

Table 5 shows that there is an inverse relationship between the performance of investment and the inaccuracy of the valuation, at β=-.800, t=3.873, p>.05. This shows that the higher the level of inaccuracy of valuation, the lower the performance of the investment. This agrees, in part, with the argument of Sykes (1983) that whilst any error in the assessment of capital value may become insignificant in the measurement of longer-term performance, the inaccuracy of a valuation may play a significant part in the performance (or apparent performance) of a property asset in the short-term. Most investors, who seek valuations in guiding their investment decisions, make use of these valuations, and in a situation of inaccuracy of the valuations it has a negative impact on the performance of their investments at -.800.

The model depicted by the analysis is written thus:

$$Y = 4.500 - 0.800x$$

The above equation suggests a negatively sloped line shown below:
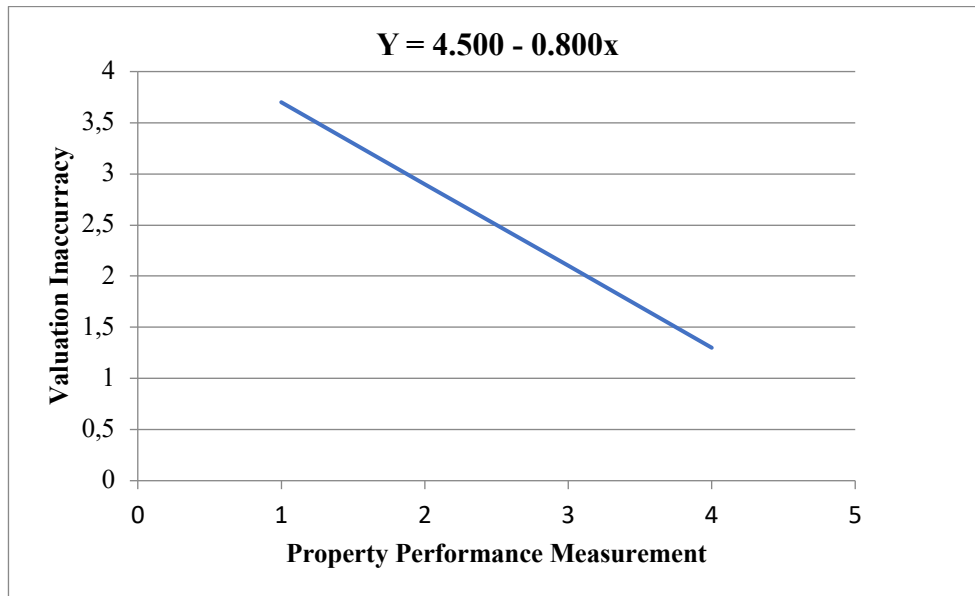
The value of application of this model in industry is that commercial property investors can use it to predict the proportion of effects that valuation inaccuracy can have on their investment outcomes, and hence may enhance the quality of their decision-making.

5. Conclusion and Recommendations

The importance of accuracy in valuations for investment decision-making cannot be overemphasised, even though it has been a subject of academic discussion on whether there could be an absolute accuracy of the valuation or not. That is why there is a need to have a margin of error for inaccuracy of valuations. This study discovered that in Akure the most common margin of error of valuation from the eventual sales price is ±11-15%, which is more than the acceptable margin of ±5%. The high inaccuracy could have serious implications for property investors who rely on the valuations for making investment decisions. The study also implies that apart from valuation inaccuracy, other factors especially relating to the management of commercial property investment portfolios also play prominent roles in commercial property investment performance.

Among the many factors that influence the inaccuracy of valuation in the study area, it was found that the assumptions made by the valuers in their valuations have the highest contribution. Therefore, valuers in Akure should be warned of unrealistic assumptions in making subjective adjustments and decisions for valuation. There should be a proper study and understanding of the market conditions by considering adequately the market indices that influence the property market before the values of the properties are ascribed.

From the simple linear regression analysis carried out, it was found that valuation inaccuracy has a negative implication (at β=-.800, t =3.873, p>.05) on investment performance. This shows that the higher the level of inaccuracy of the valuation, the lower the performance of the investment. The result, however, indicates that the effect of valuation inaccuracy on commercial property investment performance is statistically insignificant. This suggests only a limited role for valuation inaccuracy in the transmission of valuation error across property investment management processes and a potentially more important role of other factors that persist through the property investment management process. This study then concluded that bearing in mind the high level of valuation inaccuracy in Akure, valuers should be very careful in making assumptions and in their use of market indices for their valuations because of the risks that may arise. It also recommends that valuers should be aware that investors rely on the accuracy of their valuations for making timely investment predictions and should therefore ensure conscientious efforts are put in place for accuracy of their valuations.

6. Acknowledgment

8. References

Adair, A., Hutchison, N., Macgregor, B., McGreal, S. & Nanthakumaran, N. (1996). An Analysis of Valuation Variance in the United Kingdom Commercial Property Market. *Journal of Property Valuation and Investment*, *14*(5), pp.34-47.

Addae-Dapaah, K. (2001). Valuation Accuracy-A Problematic Enquiry. *Eight European Real Estate Society Conference, Alicante.* June 26-29, pp.1-20.

Adegoke, O., Olaleye, A. & Oloyede, S. (2013). A Study of Valuation Clients Perception on Mortgage Reliability. *African Journal of Environmental Science and Technology*, *7*(7), pp.585-590.

Ajibola, M. (2010). Valuation Inaccurancy: An Examination of Causes in Lagos in Lagos Metropolis. *Journal of Sustainable Development*, *3*(4), pp.187-193.

Akerele, R.O. & Thomas, O.J. (2014). Examining Valuers' Perception of the Impact of Client Influence in Residential Property Valuation in Nigeria. *The Estate Surveyor and Valuer*, *39*(1), pp.80-88.

Aluko, B.T. (1998). Property Valuation: Are Estate Surveyors and Valuers Interpreters or Creators of Value. *The Estate Surveyor and Valuer*, *21*(2), pp.9-17.

Aluko, B.T. (2000). *A Study of Appropriateness of Mortgage Valuation for Institution Lending in Nigeria*. Ife: The Department of Estate Mangement, Obafemi Awolowo University.

Ayendun, C., Durudola, O., Ajibola, M. & Oloke, O. (2014). Defective Selection and Application of Valuation Data as the Causes of Valuation Inconsistency in Metropolitan Lagos, Nigeria. *Developing Country Studies*, *4*(15), pp.62-75.

Ayendun, C.A., Ololyede, S.A. & Durudola, O.D. (2012). Empirical Study of the Causes of Valuation Variance and Inaccuracy in Nigeria. *International Bussiness Research,* 5(3), pp.71-80.

Ayedun, C.A., Oloyede, S.A., Iroham, O.C. & Olawumi, A.O. (2011). Clients' perception of the reliability of property investment valuation in Nigeria. *Mediterranean Journal of Social Sciences*, 2(3), pp.539-545.

Baum, A., Crosby, N., Gallimore, P., McAllister, P. & Gray, A. (2001). *The Influence of Valuers and Valuations on the Working of Commercial Property Investment Market.* Research Funded by the Education Trust of the Investment Property Forum, Jones Lang Lasalle and the Royal Institution of Chartered Surveyors.

Blundell, G. & Ward, C. (1997). *The Accuracy of Valuation: Expectation and Reality.* United Kingom: The University of Reading.

Boyd, T. & Irons, J. (2002). Valuation Variance and Negligence: the Importance of Reasonable Care. *Pacific Real Estate Property Research Journal*, *8*(2), pp.107-126.

Bretten, J. & Wyatt P. (2002). *Variance in Property Valuations for Commercial Lending*. RICS Foundation Research Paper, May 2002.

Crosby, N., Devaney, S., Key, T. & Matysiak, G. (2003). *Valuation Accurancy Reconciling Timing of the Valuation and Sale.* Helsinki: European Real Estate Society.

Cullen, I. (1994). The Accurancy of Valuation Revisited. *Royal Institute of Charter Surveyors Cutting Edge Conference*, pp.5. London.

Effiong, J. (2015). A Comparative Study of Valuation Variance and Accurancy between Nigeria and United Kindgom. *International Letters of Social and Humanistic Sciences*, 57, pp.94-105.

Friday, D. (1922). An Extention of Value Theory. *Quarterly Journal of Economics*, *36*(2), pp.197-219.

Hager, D. & Lord, D. (1985). The Property Market, Property Valuations and Performance Measurement. *Journal of Institute of Actuaries*, *112*(1) pp.19-60.

Hironen, J., Niukkanen, K., Ohrankammen, J. & Laitala, A. (2014). Margin of Error in Property Valuations- is there a need for Safety Margins in Compulsory acquisition? *Engaging the Challenges- Enhancing the Relevance, FIG Congress*, pp.1-14. Kuala Lumpu, Malaysia.

Hutchison, N., MaCgregor, B. & Nanthakumaran, N. (1995). Variations in the Capital Valuations of United Kingdom Commercial Property: Do Valuers get it Right? *Royal Institution of Chartered Surveyors, Cutting Edge Conference, Aberden,*. Aberden.

Investment Property Bank, & Drivers Jonas. (1988). *The Variance in Valuations.* Readings: Working papers in Real Estate and Planning Hensley Business School, University of Readings.

IVSC (2017) International Valuation Standards Council

Lizieri, C. & Venmore-Roland, P. (1991). Valuation Accurancy: A Contribution to the Debate. *Journal of Property Research*, *8*(2), pp.115-122.

Matysiak, G. & Wang, P. (1995). Commercial Property Market Prices and Valuations Analysis the Correspondence. *Journal of Property Research*, *12*(3), pp.181-202.

McAllister, P. (1995). Valuation Accurancy: A Contribution to the Debate. *Journal of Property Research*, *12*(3), pp.203-216.

Millington, A. (1985). *An Introduction to Property Valuation.* Bath: Pitman, Press.

Mokrane, M. (2002). Valuatios: Standards, Accurancy, Consistency. *Investment Property DataBank European property Strategies Conference*, *Wiesbadan*, (p. 20).

Newell, G. & Kishore, R. (1998). The Accurancy of Commercial Property Valuations. *Pacific Rim Real Estate Society Conference.* Perth, Australia.

Ogunba, O. (1997). A Study of Valuation and Pricing Practices in the Residential Property Market in Lagos Metropolis. *An Unpublished MSc Thesis*. Obafemi Awolowo University, Ile-Ife, Nigeria

Ogunba, O. (2003). Implementation Hurdles in the Search for Ratinality in Investment Valuation in Nigeria. *Journal of Property Research and Construction*, *1,* pp.14-28.

Ogunba, O. & Ajayi, C.A. (1998). An Assessment of the Accurancy of Valuations in Residential Property Market of Lagos. *Journal of Nigerian Institution of Estate Surveyors and Valuers*, 21(2), pp19-23.

Ogunba, O. & Iroham, C. (2011). A Search for an Acceptable Margin of Valuation Error: A Case Study of Valuers and Clients in Nigeria. *Sri Lankan Journal of Real Estate, 1*(4), pp.54-73.

Sykes, S.G. (1983). The Uncertainties in Property Valuations and Performance. *The Investment Analyst*, 67, pp. 25-35.

Udo-Akagha, S. (1985). *Guidance Note on Property Valuation- Forward to the Nigerian Institution of Estate Surveyors and Valuers . 1st Edition.*

Appendix 1

VALUATION(N)	EVENTUAL SALES PRICE (N)	MARGIN OF ERROR %
18,200,000	17,500,000	3.9
22,800,000	23,700,000	-4
46,700,000	45,200,000	3.2
8,190,000	7,800,000	4.8
64,100,000	62,300,000	2.8
55,000,000	59,400,000	-8
11,120,000	10,400,000	6.5
27,100,000	28,750,000	-6.1
39,120,000	34,700,000	11.3
83,106,000	72,900,000	12.3
5,800,000	6,600,000	-13.8
19,400,000	16,900,000	12.9
54,700,000	48,300,000	11.7
58,500,000	50,600,000	13.5
76,400,000	67,200,000	12
13,200,000	11,600,000	12.1
11,500,000	13,200,000	-14.8
24,500,000	20,000,000	18.4
18,700,000	21,920,000	-17.2

Reducing Property Appraisal Bias with Decision Support Systems: An Experimental Investigation in the South African Property Market

Evans, K.[1], Lausberg, C.[2], and Sui Sang How, J[3]

[1,3] Department of Construction Economics and Management, University of Cape Town, South Africa.
[2] Institute for Real Estate Information Technology, Nurtingen-Geislingen University, Germany.

Abstract

Background – Researchers have observed that valuation accuracy and valuation variation are caused by human adaptive approaches called cognitive shortcuts. Of particular interest for valuation tasks is the susceptibility of decision-makers to the anchoring and adjustment heuristic, a mental shortcut which involves deliberate and conscious adjustment of values. Various studies have shown that valuers are prone to anchoring to asking price, previous estimates, and other reference points.

Aim – The research aim is to determine the efficacy of a decision-support tool in reducing property appraisal bias.

Setting and Methods – A controlled experimental study design was used. The design in which test persons had to appraise a fictitious property is based on a German study that uses a self-written valuation software, adapted to South African conditions. The software comprises two versions, a standard software and a decision-support software. Descriptive statistics and non-parametric testing were used to interpret the results.

Findings – Despite the results not being as robust as expected, the study revealed that test subjects were susceptible to the anchoring bias and that using a decision-support tool can help reduce this and so decrease the valuation variations.

Practical implications – This study heightened the need to counter the effect of bias in valuation. Few studies have delved into debiasing methods and even fewer have used technical tools for this task. Other forms of cognitive shortcuts used by valuers should be incorporated into the decision-support tool, and a similar test run for different valuation settings.

Keywords: Appraisal Bias; Anchoring and Adjustment Heuristics; Decision Support Systems

---

[1] kathleen.evans@uct.ac.za

1. Introduction

With the advent of new technology and findings derived from computer science and other fields, interest in using computer-aided technology to improve property valuations has become the focus of much attention. Another area of increased interest is behavioural valuation research which has greatly benefitted from advances in psychology and other fields. Yet the area of overlap between using both technology and insights into human behaviour to improve valuations is largely uncharted territory. Here, decision-support systems (DSS) come into play because their purpose is to support human decision-making, including judgements and estimations, which are a core activity of property appraisals (Shim et al., 2002).

Behavioural researchers assert that valuation is a discipline of social science and must be viewed as an art not a science (Diaz & Hansz, 2007). Given that valuation is a human activity, judgement bias may occur in the form of random and systematic error, which is regarded as having a greater effect on an investor's decision than random bias would have (Yiu et al., 2006).

Valuation bias is an under or over valuation in relation to the target (Crosby, 2000). It occurs when the valuer or the valuation (i.e. the techniques, processes, systems, etc. used by the valuer) show random or systematic errors. Identifying and examining the normative descriptive gap to align with normative standards is termed 'debiasing' (Tidwell & Gallimore, 2014). Among the three main debiasing techniques Larrick (2004) identified, technological strategies such as using a DSS are perceived to be more effective than the cognitive or motivational strategies.

To mitigate or eliminate the effects of decision-making bias, DSS have been designed to assist human decision-making processes. With an improved informational display, informational search and reduced processing cost, DSS provide a cognitive incentive system that both enhances the decision-making process and reduces systematic bias. Tidwell and Gallimore (2014) and Lausberg and Dust (2017) found that decision-support technology has the potential to reduce the most prominent bias in real estate valuations: the anchoring bias. While the studies revealed the existence of anchor behaviour, they also showed that computer-based systems can be used to improve appraisal judgement, although many issues remain unresolved. Therefore, further research into the efficacy of decision-support tools presents a great opportunity, especially within the South African property valuation context.

The research question addressed in the study is:

> *To what extent can the decision support systems help*
> *reduce or eliminate property appraisal bias?*

A review of the literature indicates that no study has explored the influence of a decision-support tool in real estate valuation in the context of the South African property market. The correlation of anchoring behaviour and valuation in unfamiliar geographical locations is of particular interest (Tidwell & Gallimore, 2014). The purpose of this study, therefore, is to test

the efficacy of the decision support systems in mitigating and reducing anchoring bias in the valuation process.

2. Literature Review

2.1. Property valuation and judgement

2.1.1. The valuation process

Amidu (2011) suggests that valuation is inherently a human activity and a judgemental process due to the heterogeneous nature of property and the lack of transaction information in the market. The author recognises that despite the development of a systematic and structured approach to facilitate consideration of implicit and explicit factors, which could affect valuation outcomes, judgement bias is likely to occur throughout the valuation process.

2.1.2. Accuracy and variation in valuation

In valuation variation studies, bias occurs when a valuation produced by one valuer differs from those by other valuers based on the same information and time basis. Joslin (2005), through a questionnaire survey and valuer interviews, found that uncertainty during a valuation affects the accuracy of valuation. Uncertainty in valuation arises from the quantity and quality of comparable evidence, the market condition, the characteristics of the subject property, client pressure and a valuer's subjective opinion (Joslin, 2005; Babawale & Omirin, 2012; Awuah et al., 2016).

Tidwell and Gallimore (2014) and Awuah et al. (2016) contend that the wide dispersion of market value estimates stems from the inherent characteristics of real property such as size, design, infrastructure, etc. The deficit of open market information forces valuers to use anecdotal or unsystematic information to gather market information. In addition to the disparity in market information, behavioural contention within the valuation process may lead to valuation inaccuracy and variance.

2.1.3. Decision-making, heuristics and behaviour

Simon and Newell (1971), who pioneered the theory of human problem solving, found that due to limited processing capacity, people use heuristic methods to solve problems. According to the theory, the human information-processing system operates sequentially, with most processing activities occurring in the short-term memory. However, due to the limited capacity of short-term memory and the slow storage capacity in the long-term memory, humans adapt to cognitive shortcuts called heuristics. This adaptive approach is used unconsciously as an efficient way for individuals to reduce complex tasks to simpler judgemental operations. For valuations, the heuristic behaviour is of particular importance because human judgement is central to the process.

In the literature, various types of bias arising from heuristic adaption have been identified. Relevant for this research, drawing on findings by Simon and

Newell (1971), and Tversky and Kahneman (1974) identify three types of heuristics people use regularly when forming judgements: the representativeness, availability, and the anchoring and adjustment heuristics. Later, other researchers (Arnott, 2006; Evans, 1989; Harvard, 2001a) found many more cognitive shortcuts used by decision-makers.

The anchoring and adjustment heuristic is mainly employed in numerical predictions. Rottenstreich and Tversky's (1997) study on judgement of a disjunctive event, Kruger's (1999) research of rating of one's ability to drive and Griffin and Tversky's (1992) study of confidence judgements, suggest that people use an anchor-and-adjust strategy to solve estimation problems. However, in all cases, due to insufficient adjustment, a biased judgement emerges as the final value remains biased in the direction of the original arbitrary anchor value.

The subconscious use of cognitive shortcuts described above may lead to various forms of bias. In the context of property valuation, Yiu et al. (2006), through a desktop study of appraisal bias, identified the anchoring effect, appraisal smoothing and survival biases as common types of appraisal bias. Appraisal smoothing is classified as a random bias and it arises from a tendency of appraisers to smooth their valuations by using historic data or anchoring their values to previous estimates (Figure 1). Survival bias, put forward by various studies (Bretten & Wyatt, 2001; Hansz, 2004), relates to client influence on valuations. However, while this type of bias is more systematic in nature and can affect the result to greater extent, Kishore (2006) argues that survival bias is to some extent the result of unethical behaviour by valuers, and thus not necessarily due to cognitive shortcuts.
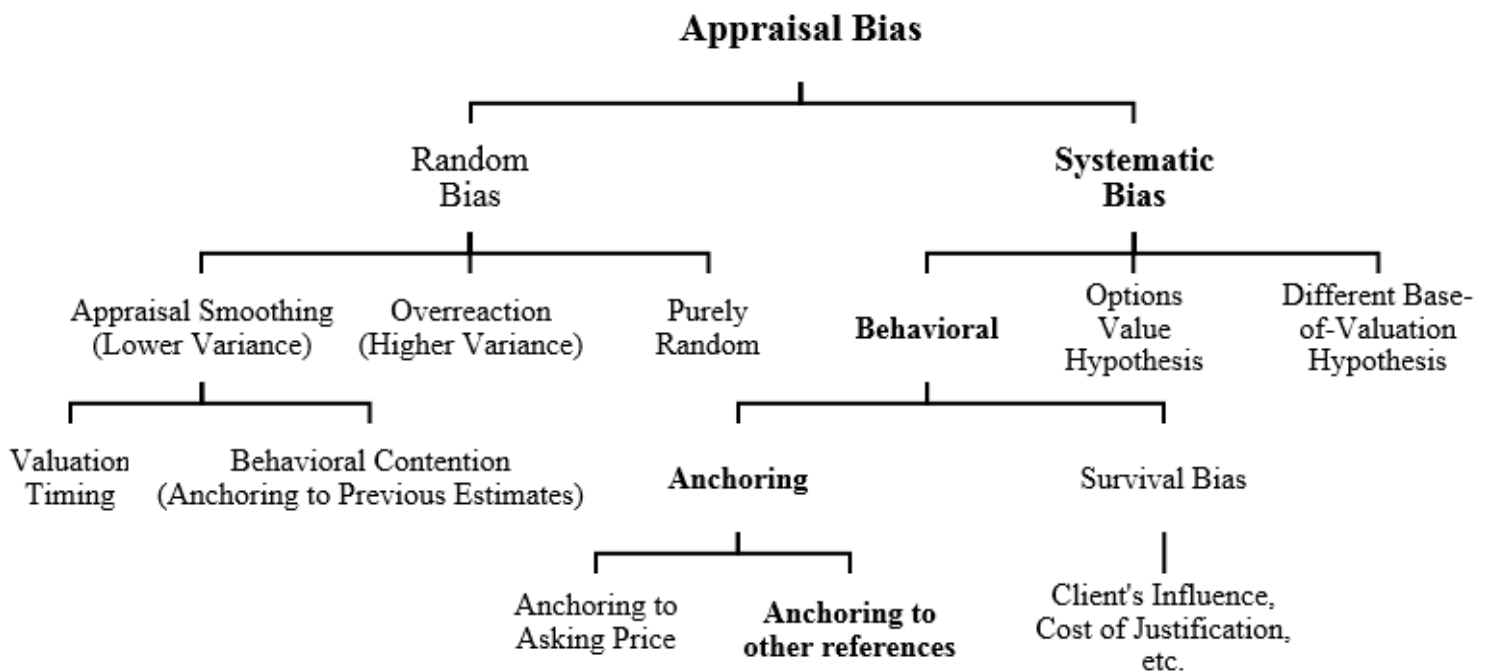

Figure 1: Appraisal bias according to Yiu et al. (2006), as depicted in Lausberg and Dust (2017, p. 334)

2.2. *Anchoring effects in valuations*

Normatively, valuers should follow valuation procedures before forming a value judgement. The valuer's task is to evaluate property-specific and market information. However, psychological theory supports the notion that valuers are also prone to mental shortcuts when carrying out a task. Anchoring effects have been observed to be prominent in real estate valuations as the market value inevitably has some subjective elements and the high need for information cannot be satisfied with low information availability (Northcraft & Neale, 1987; Tidwell, 2011).

2.2.1. Types of anchoring effects

There are two types of anchoring effects as distinguished by Epley (2004), who highlights that the anchoring effect covers almost every decision relating to the assimilation of an anchor value. The anchor value can be generated either by an external source or by decision-makers themselves. "Externally provided" anchors and "self-generated" anchors respectively lead to accessibility-based anchoring and adjustment-based anchoring. Although the anchors produce effects of similar characteristics, they are observed to be psychologically different.

Epley and Gilovich (2005) assert that "self-generated" anchors are automatically generated values that are known to be wrong but close to a right answer, and for which deliberate and conscious adjustment is required. Unlike "externally provided" anchors that produce suboptimal results due to the inconsistent retrieval of anchor-related information, "self-generated" anchors lead to adjustment-based anchoring. This heuristic behaviour arises due to insufficient adjustment resulting from a lack of attention and a "satisficing" tendency (Epley & Gilovich, 2006). An empirical study by Epley and Gilovich (2006) supports the argument of Quattrone et al. (1981) that subjects stop adjusting once a plausible result is reached. In addition, the study finds evidence that adjustment is "effortful", and it is suggested that incentives to engage in effortful thought may diminish the adjustment-based anchoring effects.

2.3. *Countering the anchoring effect in property valuations using debiasing techniques*

Various studies show that valuers do not follow the normative models of rational thinking, which explain the process and product that rational thinking should meet (Northcraft & Neale, 1987; Diaz, 1990; Quan & Quigley, 1991; Black & Diaz, 1996; Diaz & Hansz, 1997; Black, 1997; Diaz & Wolverton, 1998; Diaz et al., 1999; Havard, 2001a; Hansz & Diaz, 2001; Clayton et al.*,* 2001). It is observed that due to the limited human processing capacity, valuers have the tendency to deviate from the normative process when forming judgements. However, the normative-descriptive gap, which leads to systematic bias in valuations, has now drawn researchers' attention to find solutions to mitigate and eliminate this gap.

2.3.1. Debiasing techniques

According to Fischhoff (1982), sources of bias are faulty tasks, misunderstanding of tasks, and mismatch between decision-making and tasks. In his debiasing strategy, he suggests that the decision-maker is the main source of biased judgement rather than the task itself. The strategy is based on an escalation design that aims to improve human performance through the following steps:

(1) Warn the decision-maker of possible deviation without giving a description of the type of bias.

(2) Describe the direction (positive or negative influence) and extent of the bias.

(3) Provide feedback and relate back to the warning message.

(4) Provide support with feedback, such as a programme of training and coaching that would help to overcome the bias effect.

Arkes (1991) supports the classification of the various causes of bias into three broad categories, namely psychophysically-based error, association-based error and strategy-based error. The author argues that adaptive behaviour is characterised by costs and benefits, which reflects a rational benefit-cost calculation in decision-making. Unlike psychophysically-based errors and associated-based judgement errors, which are regarded as associative, fast, automatic and effortless, strategy-based errors are slower, serially driven and require significant cognitive capacity (Stanovich and West, 2000). Kahneman (2003) contends that the first two adaptive behaviours are intuitive, whereas strategy-based errors are based on reasoning, which is consciously monitored and deliberately controlled.

Based on the taxonomy of judgement behaviour by Arkes (1991), Larrick (2004) identifies three main approaches to address bias. Motivational strategies in the form of incentives and accountability help improve decision performance in some cases. The incentive approach encompasses the principle that people possessing the necessary cognitive capital will apply additional effort to improve outcomes. Equally, accountability, based on the principle mechanism of pre-emptive self-criticism, improves decision-making through the motivational effects of social benefits.

Another approach is called "consider the opposite". It relies on individuals applying different views that address the ill-structured processes of associated-based error (Chapman & Johnson, 1999). Mussweiler et al. (2000) support this approach as it directs attention to alternative evidence that may not have been considered, overconfidence and accessibility-based anchoring effects. Larrick (2004), however, argues that an over-reliance on this technique may affect decision-making accuracy or cause decision-makers to believe in such intentionally biased judgement. Yet another form of cognitive strategy is training to facilitate the learning and application of normative rules. Proper training can also help decision-makers understand heuristic behaviour and to develop the necessary skills to eliminate biased decisions.

Technological strategies in the forms of group decision-making tools, decision models and decision analysis can also improve the decision-making process. It is argued that while using a group decision system, synergies emerge from experts' interaction and error-checking improves the decision outcome. Similarly, using statistical techniques such as a multiple regression analysis or a decision tree is beneficial in assessing large data sets and analysing alternative outcomes where human processing capacity is limited. Of utmost importance is the use of computing technology to automate much of the decision analysis. DSS are arguably much more efficient as the systems reduce the cost of efforts, which hence improves the effort-accuracy trade-off (Edwards & Fasolo, 2001).

For valuation tasks that are complex in nature, adopting a socially administered practice (motivational techniques) or an individually administered practice (cognitive strategies) is impractical (Larrick, 2004). Apart from that, Epley and Gilovich (2005) argue that self-generated anchors are essential in forming a value judgement and that setting aside with cognitive strategies is counterproductive. While a systematic study of cognitive heuristics can provide normative recommendations, Gigerenzer (2004) contends that it will be difficult to know whether the solutions are feasible. As such, it is suggested that debiasing strategies should be geared towards refining the psychological processes (Epley & Gilovich, 2005). Technologists regard debiasing strategies in the form of DSS to be better at improving the psychological processes.

2.3.2. Decision support systems

With the advance in information technology, computerised systems have developed that attempt to improve the effectiveness of decision-making (Arnott & Pervan, 2005). The aim of decision support tools is to provide an interactive platform whereby computerised systems provide assistance by automating the structured part of the problem while the individual deals with the complex unstructured elements of the decision (Silver, 1991).

DSS have various attributes that can be tailored to the type of decision-making environments they support. Silver (1988) undertook a descriptive analysis and classified the systems into three tiers: functional capabilities, user view of system components, and system attributes. The first two tiers represent the information processing capabilities and the system configuration that comprise DSS. The system attributes represent the collective statements and the component relationships in a DSS, and it is generally characterised by the types of system design. According to Silver (1988), the system can be designed to restrict its users' decision-making processes (system restrictiveness), provide guidance in constructing and executing decision-making processes (system guidance) or provide specialised support for decision-making processes (system focus). These attributes determine the possible effect of the DSS on users' decision-making processes – what users can and will do to the system.

Hoch and Schkade (1996) observe that DSS research is technology-driven and mainly focuses on how decisions can be improved, while behavioural research focuses on the process of decision-making. The lack of understanding of the psychological effects and the incorporation of contemporary behavioural decision-making research limit the application and usefulness of decision-support tools (Elam et al., 1992). Hoch and Schkade (1996) demonstrate that incorporating cognitive aids into a traditional decision-support tools can effectively improve decisions. The empirical study shows that in a low predictable environment, the traditional DSS, which support human information processing limitations via a database of historical information, produce less reliable outcomes. When combining cognitive model-based support systems with traditional DSS, the forecasting task in uncertain settings has better outcomes. Similarly, Singh (1998) developed a conceptual framework to explore the efficacy of integrating aspects of cognitive aids into the technological tools for improving strategic execution.

2.3.3. Decision support systems and the cost-benefit framework of cognition

Theory asserts that decision-making is contingent upon the effort required to make a decision and the accuracy of the outcome (Payne, 1982). The trade-offs between accuracy and effort in decision-making are largely supported by various empirical, simulation and conceptual studies (Todd & Benbasat, 1991).

Kleinmuntz and Schkade (1993) argue that information displays affect decision makers' choice processes through an adaptive mechanism of accuracy and effort trade-off. Visual representations are mainly characterised by the form, organisation and sequence of information, and are defined as follows:

Form relates to the way individual items of information are displayed (such as numerical, verbal or pictorial representation).

Organisation refers to the way that individual items of information are shown in meaningful patterns or structures (e.g. table or list).

Sequence denotes the order that individual items or group of items appear (e.g. alphabetical or chronological order).

Schkade and Kleinmuntz (1994) found evidence that organisation has the greatest influence on information acquisition. While form displays primarily influenced information combination and evaluation, organisation was noted as requiring the largest effort requisition by decision-makers. Display sequence had fewer and smaller effects on acquisition processes.

Within the real estate literature, studies suggest that information presentation may influence decision-maker perception. Havard (2001b) examines the effect of information display on bias in commercial valuation and observes that a tabulated display can reduce bias in valuation. Although the extent of its effectiveness is inconclusive, the simple fact that data presentation changes the outcome of the valuation task is highly significant for decision processes. Similarly, Jin and Gallimore (2010) observe that information display, when

used to manipulate framing effects, can change an individual's decision making processes.

2.3.4. Use of decision-support tools for real estate valuations

Property valuation can be done on two levels (individual or portfolio) and in two ways (one-by-one or mass appraisal). In mass valuation, automated valuation models (AVM) have become market standard. They often have built-in procedures and sometimes even artificial intelligence to eliminate bias by shifting decision power from humans to machines. This is not the case in individual appraisals. The majority of valuers either use Microsoft Excel or one of the many valuation software packages on the market. Unlike mass valuation, manual valuation software lacks the computational intelligence-based techniques. Lausberg and Dust (2017) contend that not even leading software packages such as Argus or Cougar, which otherwise provide sophisticated information handling abilities, provide the necessary support for decision-making. Hence, for studying the effect of decision-support on valuations, researchers have to either build their own experimental systems or to use other systems such as market information systems in combination with valuation software.

Using the experimental concept of Northcraft and Neale (1987), George et al. (2000) built a real estate appraisal DSS to examine the systems' efficacy in mitigating and eliminating the anchoring and adjustment bias. Their findings reinforced Northcraft and Neale's (1987) observation that subjects are susceptible to anchoring effects when exposed to an anchor value. Use of a computer-based DSS, however, did not support assumptions that with the assistance of an automated system, the strength of the anchoring and adjustment bias would be reduced. The authors speculate that the reason for anchoring and adjustment remaining robust lies within the design of the computer-based system. An understanding of the rationalisation of the process and better debiasing techniques are required for improvement.

Contrary to the findings of George et al. (2000), recent empirical studies by Tidwell and Gallimore (2014), and Lausberg and Dust (2017) show that a decision-support tool can be effective in debiasing valuation judgement. Tidwell and Gallimore (2014) use an existing proprietary tool, CoStar[1], to examine the efficacy of decision-support tools in debiasing valuation judgements of industrial vacant land. They use a two-factor randomised experiment comprising a previous expert's opinion and the introduction of a decision-support tool. Unlike the treatment group that had access to the software, the group exhibited evidence of asymmetric and divergent results. The experiment supports the thesis that use of a computer-based system may subdue the anchoring heuristic in the valuation task.

Another interesting finding by Tidwell and Gallimore (2014) is that decision support systems can encourage extensive consideration of available market

---

[1] CoStar is not a DSS in the narrow sense of the word. It is in essence a database of commercial real estate information such as sales comparables that comes with sophisticated analytical tools.

information during the judgement process. A previous study by Diaz et al. (2004) revealed that valuers operating in unfamiliar markets are unlikely to increase comparable sales search. The lack of sales search effort reinforces Simon and Newell's (1971) thesis that people seek cognitive efficiency and reduce cognitive effort when faced with a complex situation. This observation, however, was made without the use of easily accessible external tools. With the decision-support tool, Tidwell and Gallimore (2014) observe and support technologists' view that high informational search costs can potentially be reduced thereby encouraging subjects to use more comparable sales information during the valuation task.

Lausberg and Dust (2017) use a self-written Microsoft Excel decision-support tool to assess the market value of an office building, integrating features of decision support believed to be effective in reducing the anchoring effect. The software consists of three levels of intervention that differ in degree of support, namely:

Standard (STD) version providing no decision support.

Modified (MOD) version introducing a simple warning message with an explanation of the anchoring effect so that test subjects can adjust their value opinion with a sliding switch.

Decision Support System (DSS) version with multiple features intended to produce more reliable outcomes such as optimised information display.

The experiment shows that with a fully supported DSS, the anchoring effect and valuation variation can be reduced. The DSS version produced more accurate market values with fewer dispersed results than the standard and modified versions. Lausberg and Dust (2017) assert that variability is reduced because users are required to follow normative procedures and are forced to spend more time on decision-making. In fact, with the requirement to compare market data sources, readings and data input to make a rational opinion, it is observed that processing time is longer with the DSS version.

On the other hand, the results were less convincing using only the modified version; the frequency distribution graph shows a distribution with outliers. While Lausberg and Dust (2017) presume that the warning message may not have been explicit enough or may have caused confusion, a similar study by George et al. (2000) shows that use of a warning message only is not sufficient to address the anchoring effects.

3. Methodology

3.1. The experimental method

Experimental research is a systematic approach that studies behaviours (dependent variables), when some factors (independent variables) are manipulated under the control of the experimenter, while other factors are held constant (extraneous variables) (Goodwin, 2009). Breakwell et al. (2012) contend that independent variables must have at least two levels of condition or situations that can be used to compare the intentional manipulation of variables. One group should comprise a treatment variable

(experimental group) while the other group should have no treatment intervention (control group).

Within the valuation field, most studies on the anchoring and adjustment heuristic used experimental methods to explore the cognitive mechanisms employed by subjects. These included the works of Northcraft and Neale (1987) and Diaz et al. (1999). In the case of George et al. (2000), Tidwell and Gallimore (2014), and Lausberg and Dust (2017), computer systems were used for the experiments. The three studies used different anchors: the asking or listing price (George et al., 2000), the previous value judgement of an anonymous expert (Tidwell & Gallimore, 2014), and the book value of the property (Lausberg & Dust, 2017). The anchor was purposely set low as a previous study by Hansz and Diaz (2001) demonstrated a natural tendency to anchor towards higher values.

3.2. The research instrument

The experimental design of the research instrument used to collect data for this study, is based on the Lausberg and Dust (2017) design, with some modification to suit the South African property valuation context.

3.2.1. The subject property

For the valuation exercise, care was taken to create a case that was fictitious, but as close to reality as possible; not too complex, so it could be valued in less than 30 minutes, but with enough challenging features to make even seasoned valuers think and give them some leeway on their decisions. A Cape Town office property valuer provided information on a typical office building and current market data:

- Type and location of property: Cape Town CBD office building.
- Size and age: five units, 10 years of age with a lettable area of 1,368 sqm.
- Different lease outlet: a vacant unit and four units featuring lease terms between one and nine years.
- Tenancy information: law firms with a good credit record.
- Other attributes: aligned with law firms' particular use, e.g. close proximity to the High Court.
- Other information: current expenses and 10 outdoor parking spaces.

The subject property was assumed to have a high rental ability, normal maintenance costs and a long useful life.

To prevent results being distorted due to differences in market knowledge, all participants received a memorandum which was similar to a broker's information memorandum and included the following information:

- General information, location and site description, including briefing by the owner.
- Market information from various sources comprising:

> o comparable and multi-sourced rental data of properties within the area;
> o general office market outlook;
> o operating expenses; and
> o capitalisation rates.

Unlike Lausberg and Dust (2017), who used book value as an anchor value, this study uses the (low) asking price. In the South African property market, book value is not a good proxy for transaction price as it refers to the net worth of a property according to its financial statements. Similarly, assessed values, used to determine the value of a property for tax purposes, are inappropriate to use as an anchor value for the study (Cypher & Hansz, 2003). Therefore, the memorandum refers to the owner's pending sale price based on an unsanctioned expert valuation opinion of R11 million.

3.2.2. The software

The valuation system is an adaptation of Lausberg and Dust's (2017) experimental Microsoft Excel software, but with information relevant to the South African property market and some improvements.

As was observed under the previous study, the modified version did not produce conclusive results; therefore, this study only used the standard (STD) and DSS software versions.

When the Microsoft Excel version is activated, the first page contains general information and instructions to start the experiment (Appendix A). The second page provides an interface for calculating market value (Appendices C and D) and the last page collects statistical data (Appendix B). Figure 2 shows the calculation core for both the STD and DSS versions. The steps where estimations, judgements or other types of decisions have to be made are marked with an arrow, i.e., where decision-support is applicable. Obviously, this is the case for all steps except for the most basic mathematical calculations.
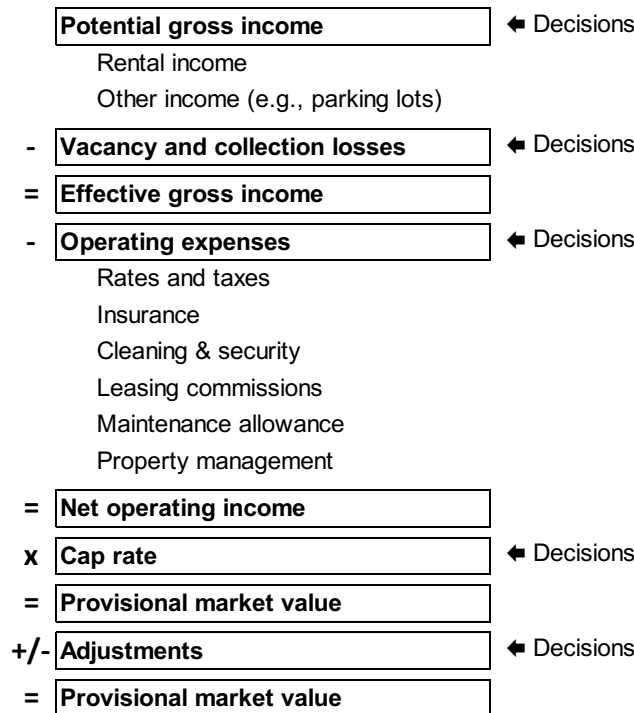
Income Approach

	Potential gross income	← Decisions
	Rental income	
	Other income (e.g., parking lots)	
-	**Vacancy and collection losses**	← Decisions
=	**Effective gross income**	
-	**Operating expenses**	← Decisions
	Rates and taxes	
	Insurance	
	Cleaning & security	
	Leasing commissions	
	Maintenance allowance	
	Property management	
=	**Net operating income**	
x	**Cap rate**	← Decisions
=	**Provisional market value**	
+/-	**Adjustments**	← Decisions
=	**Provisional market value**	

Figure 2: Calculation core for the STD and DSS versions

The standard version (see Appendices A, B and C) provides a basic setup with mandatory fields for calculating market value. The participant enters figures from the documents into the software once data has been interpreted and analysed. In this version, the programme does not support decisions arising at various levels of the decision-making process.

The decision-support tool provides various features of DSS within the basic spread sheet (see Appendices A, B and D). To avoid deviation from the normative approach, the DSS version provides a process-orientated procedure, highlighting each step to be undertaken to complete the valuation tasks. Various graphical displays, emoticons, comparable tables, explanations and data analysis features provide subjects with necessary support to evaluate the quality of market data. Warning messages and plausibility checks are incorporated into the software for attentional and correctional measures for data input that seems inappropriate. In addition to the various decision support features, the DSS version includes a final "sanity check" feature that explains the anchoring effects and allows subjects to adjust their estimate using a slider.

3.3. Hypotheses

The hypotheses to answer the research question of the extent to which decision-support systems help to reduce property appraisal bias are:

H_1: The valuation variation is lower if the valuer is de-biased and supported in his decisions.

H2: The anchoring effect is reduced if the valuer is de-biased and supported in his decisions.

The anchoring effect was not measured. It was, however, considered an indicator that the anchoring effect was present when a participant made an adjustment to the value once the alerting function in the DSS version of the experiment was displayed.

3.4. The empirical procedure

A random sampling method was used to distribute one of the two versions of the valuation tool to the treatment and control groups. The random selection method ensures that no systematic errors occur in the data collection as every member has equal probability of being selected. Both the STD and DSS versions were issued equally.

To increase response rates, participants of the study could win an iPad or one of three iPods via a random draw. In addition to the prize, an hour of continuing education and training, approved by the South African Council for the Property Valuers Profession (SACPVP), was granted to all expert participants.

Data was either received via email or through an online tool. The raw data was debugged and updated into a master Excel file. Then, a plausibility check was carried out to identify and eliminate implausible data sets such as double entries or data with obvious input errors.

4. Analysis of Data and Discussion

4.1. Data collection

The sample consists of both expert valuers and novices. Professional valuers from the SACPVP formed the expert group. The novice group, for whom formal ethical clearance was obtained, consisted of final-year undergraduate and postgraduate students in construction studies, property studies and quantity surveying degrees at the University of Cape Town (UCT).

Most participants were contacted via email using the UCT student information system or through the South African Institute of Valuers (SAIV). The Professional and Projects Register 2010 and direct telephonic contacts were also used to identify additional contacts, to whom information was sent. The information pack consisted of a covering letter, an instruction document, a Microsoft Excel file and a memorandum containing information about the subject property and the market. Direct assistance was provided during the experimental period.

The study took place over a period of 3 months for experts and 4 months for the novices. A total of 1,345 property valuers and 183 students were officially invited to the study. Ninety-three data sets were received of which 44 were from experts (3.20% response rate) and 49 were from novices (26.78%). The

response rates are in line with expectations for online surveys among these groups of respondents.

Table 1 shows that 42 experts and 46 novices were considered valid data sets. The distribution within sub-groups was fairly balanced with 52.27% being students and 47.73% being experts. The study of Lausberg and Dust (2017), on which this study is based, had a similar sample size of 43 experts and 46 novices but with a higher response rate from a lower total number of participants contacted.

Table 1 : Number of valid participants

	Standard	DSS	Total
Students	26	20	46
Experts	21	21	42
Total	47	41	88

4.2. Analysis of the data

The quantitative data was analysed using Microsoft Excel, the statistical software package SPSS Version 23, and R Studio. Three simple variation measures were used to assess the effectiveness of the decision support tools: range, standard deviation and variation coefficient.

To test the equality of variances, normality for the data sets is tested first. The Jarque-Bera test (jbtest) was used to measure the skewness (S) and kurtosis (K) of the sample for goodness-of-fit of a normal distribution (Bai & NG, 2015).

The Levene test of homogeneity of variance is performed for normally distributed data. For non-Gaussian distribution, the skewness and kurtosis are examined to determine the appropriate inferential procedure to employ. Either the modified robust Levene-type test or the modified robust Brown-Forsythe Levene-type test from the median with modified correction-method zero can be applied.

However, for unequal and small sample sizes, the modified robust Brown-Forsythe Levene-type test is preferred. This test is the Brown-Forsythe test adjusted using Noguchi and Gel's (2010) method, which uses a combined correctional factor with modified Hines-Hines structural zero removal method that applies a scaling factor of two.

For the assumption of homogeneity of variance not to be violated, a significance level of greater than 0.05 must be achieved (H0: VarSTD = VarDSS, p-value ≥ 0.05). However, the study aimed to demonstrate that the decision-support tool is more beneficial than standard tools. Hence, at the 5% significance level, the null hypothesis should be rejected, and statistically significant differences in variances between the observed groups can be concluded.

4.2.1. Testing of the first hypothesis

The first hypothesis states that the valuation variation is lower if the valuer is debiased and supported in his decisions.

H0: Variation MVSTD $\geq$ Variation MVDSS

Testing the overall sample group

Using three variation measures, the null hypothesis should be rejected if the majority of the measures show a higher variation for DSS than for STD. Table 2 demonstrates the variation measures under the two different software versions. The market values under the STD version range from R9.82 million to R21.57 million (=120%) and are higher than the DSS version, which ranges from R9.41 million to R18.9 million (=101%). Similarly, the standard deviation is slightly higher for the STD version (=2.16) than for the DSS version (=1.98) and is confirmed by the variation coefficient.

Table 2: Variation measures

	STD	DSS
n	47	41
Mean	13.91	13.37
Range (min/max/%)	9.82 /21.57 /120%	9.41 /18.9 /101%
Standard deviation	2.16	1.98
Variation coefficient	15.6%	14.8%

To test the significance level of the results, the jbtest was used to examine the normality of the data. The observed asymptotic p-value for the overall sample is summarised in Table 3. Interestingly, the DSS version was normally distributed, while the STD data and the overall sample were far from a Gaussian distribution.

Table 3: Normality test

Subsets	JB-Test p-value	Kurtosis	Skewness
Overall Sample	0.002	1.577	0.621
STD versions	0.003	2.203	0.795
DSS versions	0.632	0.566	0.333

Using the Microsoft Excel formula to calculate excess kurtosis and skewness, it was observed that all three subsets were fat-tailed and skewed to the right (Table 3). Given the unbalanced and small sample sizes of the data, the modified robust Brown-Forsythe Levene-type test from the median with modified correction-method zero was applied (Table 4). At the 0.05 level of significance, the null hypothesis cannot be rejected (p-value =0.885) and no statistically significant difference of variance between the two groups can be concluded.

Table 4: Modified Robust Brown-Forsythe Levene-type test

Hypothesis	Test- Statistic	p-value
H_1: $Var_{STD} = Var_{DSS}$	0.0212	0.885

Testing the sub-sample groups

The same variation measures and test for significance level were used to test the effectiveness of the DSS version within the expert and student sub-samples. As shown in Table 5, the variation measures for both groups were higher under the STD version than under the DSS version.

For the expert group, the market values ranged from R12.09 million to R21.57 million (=78%) with the STD version and from R11.5 million to R18.9 million (=64%) under the DSS version. The variation coefficient indicates that the spread under the STD version was higher than for the DSS version.

The market values for students were slightly lower than those in the expert group. The values ranged between R9.82 million and R16.83 million (=71%) and R9.41 million and R15.12 million (=61%) for the STD and DSS versions respectively. The variation coefficient was also greater under the STD version, indicating a higher spread of outcomes than for the DSS version.

Table 5: Variation measures for sub-sample

	Experts		Students	
	STD	**DSS**	**STD**	**DSS**
n	21	21	26	20
Mean	14.52	14.30	13.41	12.40
Range (min/max/%)	12.09 /21.57 /78 %	11.5 /18.9 /64 %	9.82 /16.83 /71 %	9.41 /15.12 /61 %
Standard deviation	2.17	1.85	2.06	1.65
Variation coefficient	14.97%	12.94%	15.37%	13.30%

The box plots (Figures 3 and 4) illustrate a similar result. The DSS version produced fewer valuation variation values, and outliers in the expert group were less frequently extreme than with the standard versions.
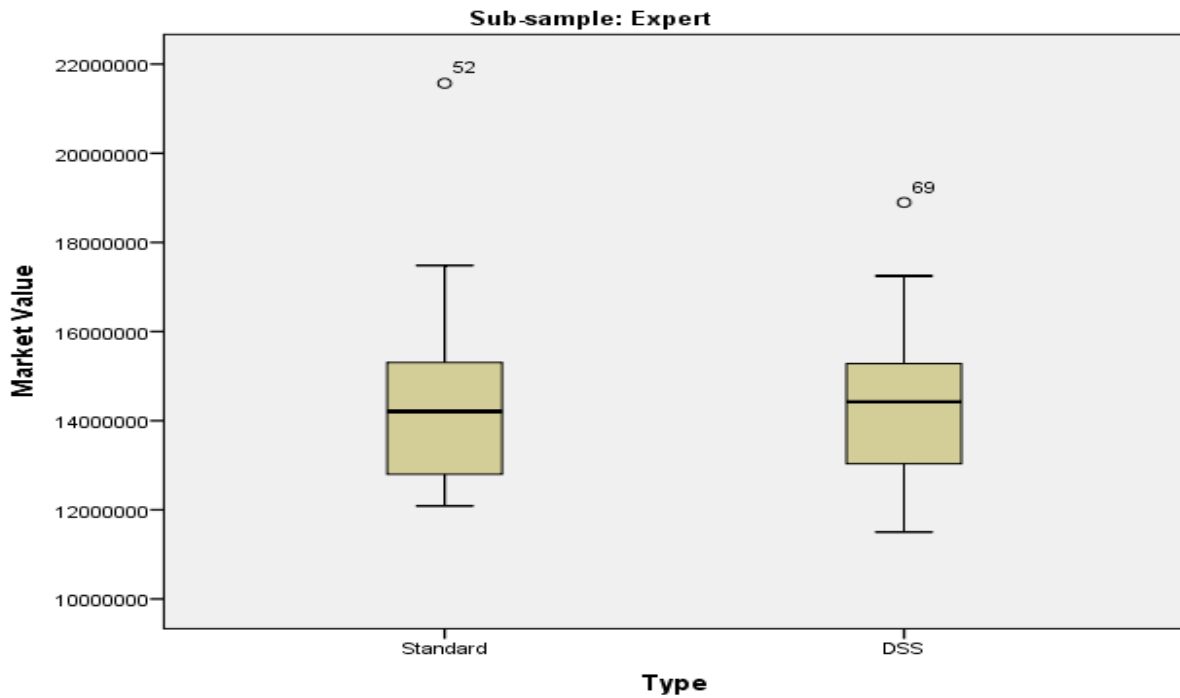
Figure 3: Boxplots comparing DSS vs STD for EXPERT sub-samples
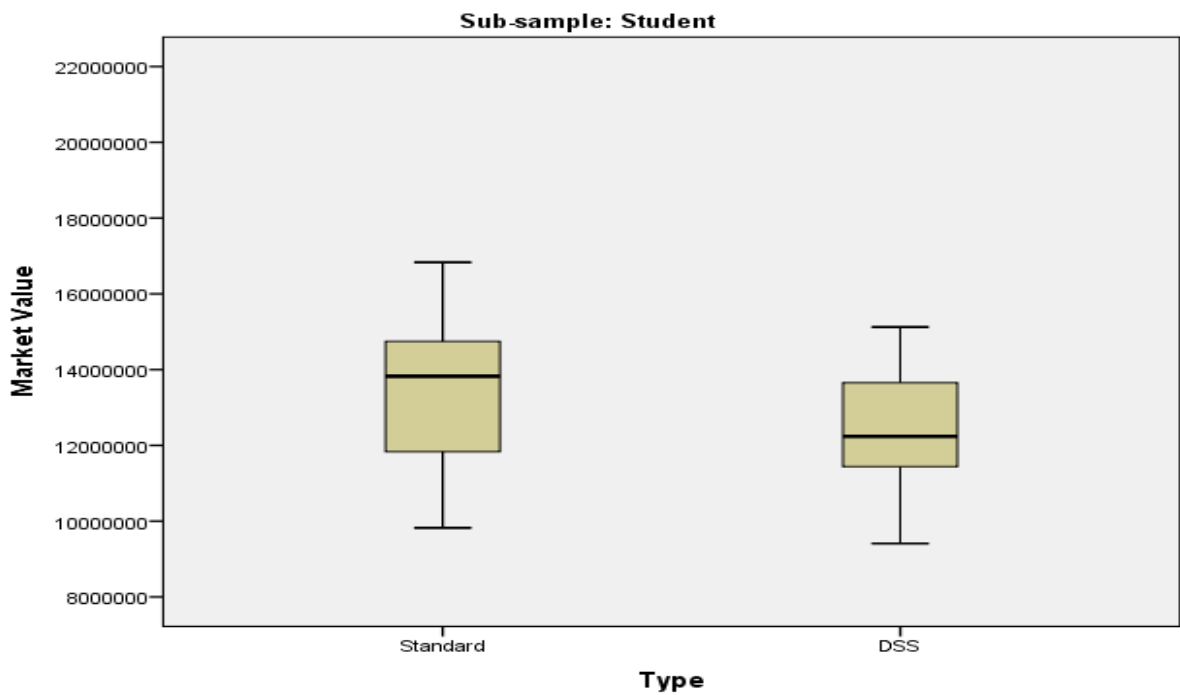
Figure 4: Boxplots comparing DSS vs STD for STUDENT sub-samples

The modified robust Brown-Forsythe Levene-type test from the median with modified correction-method zero, as shown in Table 6, produced similar statistical results to the overall groups. At the 0.05 level of significance, the null hypothesis cannot be rejected, which means that there is no statistically significant difference between the two variance groups.

Table 6: Modified Robust Brown-Forsythe Levene-type test for sub-sample

Group	Test- Statistic	p-value
Experts	0.102	0.751
Students	0.964	0.332

*4.2.2. Testing of the second hypothesis*

The second hypothesis states that the anchoring effect is reduced if the valuer is debiased and supported in his decision.

H0: Mean Unadjusted MVSTD $\geq$ Mean Adjusted MVDSS

Table 7 shows the effect of the decision support tool on market values after a warning notice was issued to participants. In the 41 DSS version, 3 experts (7%) and 13 novices (n=32) adjusted the market value. This represents a 39% (n=16) adjustment when test subjects are supported in their decision. Further observations show that in nine cases (=56%), the values were negatively adjusted towards the anchor value. Similar to Lausberg and Dust's (2017) observation, the illogical adjustment could be because the warning message was not clear enough and it may have confused the participants.

After adjusting the outcomes for valuation with positive or no adjustment, it was observed that only seven participants (=22%) adjusted the market value positively. The mean adjusted market value was 1.37% higher than the mean unadjusted market value. The results were slightly higher than in Lausberg and Dust's (2017). In a similar vein, it can be concluded that some members of the test groups were susceptible to the anchoring and adjustment effect.

Table 7: Adjustment of market values with the DSS version

		Mean market value (R)		Adjustment	
		unadjusted	adjusted	Magnitude (% of the MV)	Number and % of all valuation
All valuations	Experts	14 350 106	14 297 111	-0.37%	3 (7%)
	Students	12 448 464	12 398 557	0.40%	12 (32%)
	DSS	13 422 476	13 370 987	-0.38%	16 (39%)
Only valuations with positive or no adjustment	Experts	14 082 557	14 104 662	0.16%	1 (3%)
	Students	12 351 241	12 351 241	3.40%	6 (19%)
	DSS	13 379 210	13 562 746	1.37%	7 (22%)

5. Conclusions

The findings of the controlled experiment did not provide robust results regarding the effectiveness of the decision-support tool in relation to removing or eliminating property appraisal bias. However, the study revealed some evidence that the computerised tool can help counteract the cognitive mechanism generated during valuation tasks. In particular, the warning feature, which helps identify the psychological processes of the anchoring effect, was more beneficial for novices.

When comparing the tools, descriptive statistics showed that the spread was more frequent in the STD version than in the DSS version. Similar observations were made for individual groups and for experts both with and without market knowledge.

Statistical tests showed no significance at the 0.5 level that the valuation variations would be reduced with the given DSS tool. A similar observation, at the 0.05 level of significance, was made under Lausberg and Dust's (2017) experimental research. However, unlike the German study that demonstrated some evidence of the benefits of the DSS tool at the 1% level of significance, this study could not support similar results. This can be explained by the fact that, unlike the previous study, which shows German valuers were unaware of making decisions during valuation tasks (Lausberg and Dust, 2017), in the present situation, South African test subjects were possibly more conscious when providing value judgements.

Basic descriptive statistical measurements show some evidence that the decision-support tools can help debias decisions. Although the significance test did not fully support the efficacy of the DSS tool, it is observed that at various decision levels of the valuation process, a decision support system can produce better outcomes than the standard tool. There was also evidence of the anchoring and adjustment heuristic, and it was observed that the computerised system can help counteract the unwanted cognitive mechanism generated by inexperienced decision-makers.

6. Implications for Valuation Practice and Research

The use of technological strategies to improve the psychological processes associated with valuation tasks is still at an early stage. The experimental tool Lausberg and Dust (2017) developed has demonstrated that a specific software can to some degree improve the valuation quality. That is an important goal, but obviously the software needs to be enhanced and other measures have to be taken before the tool can be useful in practice. In our opinion, there are five areas that researchers, software developers, educators and practitioners have to work on:

Firstly, the current software only incorporates anchor values from an external source. Behavioural studies undertaken by Diaz and Wolverton (1998) and others, however, have shown that experts rely heavily on their personal experience when forming a value judgement. The internally derived value opinion is a strong determinant of the final value decision. Thus, by incorporating the valuer's initial value opinion, the cognitive features of the DSS software could "weight" the final value outcome for possible anchoring effects.

Secondly, the warning messages need to be more explicit, and statistical analysis of market data and risk valuation, as identified by Lausberg and Dust (2017), should be incorporated into the decision-support tool. Moreover

insights from ergonomics and computer science should be used to increase the usability and, thus, the effectiveness of the software.

Thirdly, the experiment needs to be replicated with experts on various levels of experience and expertise, for other types of properties and using different valuation methods. Other forms of heuristics, such as the representativeness and availability heuristics, should be included in the experiment to establish their impact on valuation outcomes. Furthermore, the experiment should be expanded to other debiasing methods, especially changes in process and training. In our view this type of software can be a useful supplement to existing procedures, it is not meant to replace the valuer.

Fourthly, the developers of valuation software should engage in the further development of their products in the direction of decision support. So far, most programmes are better calculators that do not support the appraiser in his decisions. However, we believe that decision support is both a key to improving the valuation quality and a means for traditional valuation tools to differentiate themselves from the automated valuation models, which are superior to them in efficiency, but often lack effectiveness.

Finally, the foundation of valuation decision-making processes must be reinforced. Behavioural contentions that have been addressed in the real estate property literature for many years must finally be discussed and presented both to students and to experts at large. Amidu (2011) highlights the needs for property valuation education, improvement in professional standards, a code of conduct, and accountability to help counteract and possibly overcome dysfunctional behaviour in value judgement tasks.

7. Acknowledgments

8. References

Amidu, A.R. (2011). Research in Valuation Decision Making Processes: Educational Insights and Perspectives. *Journal of Real Estate Practice and Education, 14*(1), pp.19-33.

Arkes, H. (1991). Costs and Benefits of Judgement Errors: Implications for Debiasing. *Psychological Bulletin, 110*(3), pp.486-498.

Arnott, D. & Pervan, G. (2005). A critical analysis of decision support systems research. *Journal of Information Technology, 20*, pp.67-87.

Arnott, D. (2006). Cognitive biases and decision support systems development: a design science approach. *Information Systems Journal, 16*, pp.55-78

Awuah, K.G.B., Proverbs, D., Lamond, J. & Gyamfi-Yeboah, F. (2016). *An evaluation of property valuation practice in Sub-Saharan Africa: A Case Study of Ghana.* Project Report. London: RICS.

Babawale, G.K. & Omirin, M. (2012). An Assessment of the relative impact of factors influencing inaccuracy in valuation. *International Journal of Housing Markets and Analysis, 5*(2), pp.145-160.

Bai, J. & NG, S. (2005). Tests for skewness, kurtosis, and normality for time series data. *Journal of Business & Economic Statistics*, *23*(1), pp.49-80.

Black, R.T. (1997). Expert property negotiators and pricing information, revisited. *Journal of Property Valuation and Investment*, *15*(3), pp.274-281.

Black, R.T. & Diaz, J.III (1996). The use of information versus asking price in the real property negotiation process. *Journal of Property Research*, *13*(4), pp.287-297.

Breakwell, G., Smith, J. & Wright, D. (2012). *Research methods in psychology*. London: Sage.

Bretten, J. & Wyatt, P. (2001). Variance in commercial property valuations for lending purposes: an empirical study. *Journal of Property Investment & Finance*, *19*(3), pp.267-282.

Chapman, G. & Johnson, E. (1999). Anchoring, Activation, and the Construction of Value. *Organizational Behaviour and Human Decision Processes*, *79*(2), pp.115-153.

Clayton, J., Geltner, D. & Hamilton, W. (2001). Smoothing in commercial property valuations: Evidence from individual appraisals. *Real Estate Economics, 29*(3), pp.337-360.

Crosby, N. (2000). Valuation accuracy, variation and bias in the context of standards and expectations. *Journal of Property Investment & Finance*, *18*(2), pp.130-161.

Cypher, M. & Hansz, J. (2003). Does assessed value influence market value judgements? *Journal of Property Research*, *20*(4), pp.305-318.

Diaz, J. III (1990). How appraisers do their work: a test of the appraisal process and the development of a descriptive model. *The Journal of Real Estate Research*, *5*(1), pp.1-15.

Diaz, J. III (2002). Behavioural research in appraisal and some perspectives on implications for practice. *RICS Foundation Research Review Series*. London: RICS Foundation.

Diaz, J. III. & Hansz, A. (1997). How valuers use the value opinions of others. j*ournal of Property Valuation & Investment*, *15*(3), pp.256-260.

Diaz, J. III. & Hansz, A. (2007). Understanding the behavioural paradigm in property research. *Pacific Rim Property Research Journal*, *13*(1), pp.6-34.

Diaz, J. III. & Wolverton, M. (1998). A Longitudinal Examination of the Appraisal Smoothing Hypothesis. *Real Estate Economics*, *26*(2), pp.349-358

Diaz, J. III, Gallimore, P. & Levy, D. (2004). Multicultural examination of valuation behaviour. *Journal of Property Investment & Finance*, *22*(4), pp.339-346.

Diaz, J. III, Zhao, R. & Black, R. (1999). Does contingent reward reduce negotiation anchoring? *Journal of Property Investment & Finance*, *17*(4), pp.374-379.

Edwards, W. & Fasolo, B. (2001). Decision Technology. *Annual Review of Psychology*, *52*(1), pp.581-606.

Elam, J., Jarvenpaa, S. & Schkade, D. (1992). Behavioural Decision Theory and DSS: New Opportunities for Collaborative Research. In: E. Stohr & B. Konsynski, (eds). *Information Systems and Decision Processes*. Los Alamitos, CA: IEEE Computer Science Press. pp. 51-74.

Epley, N. (2004). A Tale of Turned Decks? Anchoring as Accessibility and Anchoring as Adjustment. In: D. Koehler & N. Harvey, (eds). *Blackwell Handbook of Judgement & Decision Making*. Malden, MA, Blackwell, pp.240-257.

Epley, N. & Gilovich, T. (2005). When effortful thinking influences judgemental anchoring: Differential effects of Forewarning and Incentives on self-generated and externally provided anchors. *Journal of Behavioural Decision Making*, *18*(3), pp.199-212.

Epley, N. & Gilovich, T. (2006). The anchoring-and-adjustment heuristic: Why the adjustments are insufficient. *Association for Psychological Services*, *17*(4), pp.311-318.

Evans, J.S.B. (1989). Bias in human reasoning: Causes and consequences. Hove: Erlbaum.

Fischhoff, B. (1982). Debiasing. In: D. Kahneman, P. Slovic & A. Tversky, (eds). *Judgement under uncertainty: Heuristics and biases*. Cambridge: Cambridge University Press. pp.422-444.

George, J.F., Duffy, K. & Ahuja, M. (2000). Countering the anchoring and adjustment bias with decision support systems. *Decision Support Systems*, *29*(2), pp.195-206.

Gigerenzer, G. (2004). Fast & Frugal Heuristics: The Tools of Bounded Rationality. In: D. Koehler & N. Harvey, eds., *Blackwell Handbook of Judgement & Decision Making*. Malden, MA: Blackwell. pp.62-88.

Goodwin, C.J. (2009). *Research in psychology: Methods and design. 6th edition*. New York: John Wiley & Sons.

Griffin, D. & Tversky, A. (1992). The weighing of evidence and the determinants of Confidence. *Cognitive Psychology*, *24*(3), pp.411-435.

Hansz, J.A. (2004). The use of a pending mortgage reference point in valuation judgement. *Journal of Property Investment & Finance*, *22*(3), pp.259-268.

Hansz, J.A. & Diaz, J.III. (2001). Valuation Bias in Commercial Appraisal: A Transaction Price Feedback Experiment. *Real Estate Economics*, *29*(4), pp.553-565.

Havard, T.M (2001a). Valuation reliability and valuer behaviour. *RICS Foundation Research Paper Series* 4(1). London: RICS Foundation.

Havard, T.M (2001b). An experimental evaluation of the effect of data presentation on heuristic bias in commercial valuation. *Journal of Property Research, 18*(1), pp.51-67.

Hoch, S. & Schkade, D. (1996). A Psychological Approach to Decision Support Systems. *Management Science*, *42*(1), pp.54-64.

Jin, C. & Gallimore, P. (2010). The effects of information presentation on real estate market perceptions. *Journal of Property Research*, *27*(3), pp.239-246.

Joslin, A. (2005). An investigation into the expression of uncertainty in property valuations. *Journal of Property investment & Finance*, *23*(3), pp.269-285.

Kahneman, D. (2003). A perspective on judgement and choice: Mapping bounded rationality. *American Psychologist*, *58*(9), pp.697-720.

Kishore, R. (2006). Theory of Behavioural Finance and its Application of Property Market: A Change in Paradigm. *Paper presented at the 12ᵗʰ Pacific Rim Real Estate Society Conference, Auckland, New Zealand*, January 22-25.

Kleinmuntz, N. & Schkade, D. (1993). Displays and Decision Processes. *Psychological Science*, *4*(4), pp.221-227.

Kruger, J. (1999). Lake Wobegon be gone! The "below-average effect" and the egocentric nature of comparative ability judgements. *A Journal of Personality and Social Psychology*, *77*(2), pp.221-232.

Larrick, R.P. (2004). Debiasing. In: D. Koehler & N. Harvey, (eds). *Blackwell Handbook of Judgement & Decision Making*. Malden, MA: Blackwell. pp.316-337.

Lausberg, C. & Dust, A. (2017). Reducing the Appraisal Bias in Manual Valuations with Decision Support Systems. In: M. D'Amato & T. Kauko, (eds). *Advances in Automated Valuation Modelling*. Springer: Berlin/Heidelberg. pp.331-343.

Mussweiler, T., Strack, F. & Pfeiffer, T. (2000). Overcoming the inevitable anchoring effect: considering the opposite compensates for selective accessibility. *The Society for Personality and Social Psychology*, *26*(9), pp.1142-1150.

Noguchi, K. & Gel, Y.R. (2010). Combination of Levene-type tests and a finite-intersection method for testing equality of variances against ordered alternatives. *Journal of Nonparametric Statistics*, *22*(7), pp.897-913.

Northcraft, G.B. & Neale, M.A. (1987). Experts, amateurs and real estate: an anchoring-and-adjustment perspective on property pricing decisions. *Organizational Behaviour and Human Decision Processes*, *39*(1), pp.84-97.

Payne, J. (1982). Contingent Decision Behaviour. *Psychological Bulletin*, *92*(2), pp.382-402.

Quan, D.C. & Quigley, J.M. (1991). Price formation and the appraisal function in real estate markets. *The Journal of Real Estate Finance and Economics*, *4*(2), pp.127-146.

Quattrone, G.A., Lawrence, C.P., Finkel, S.E. & Andrus, D.C. (1981). *Explorations in anchoring: The effects of prior range, anchor extremity and suggestive hints.* Unpublished manuscript, Stanford, CA: Stanford University.

Rottenstreich, Y. & Tversky, A. (1997). Unpacking, repacking and anchoring: Advances in support theory. *Psychological Review*, *104*(2), pp.406-415.

Schkade, D.A. & Kleinmuntz, D.N., (1994). Information displays and choice processes: Differential effects of organization, form, and sequence. *Organizational Behaviour and Human Decision Processes*, *57*(3), pp.319-337.

Shim, J.P., Warkentin, M., Courtney, J.F., Power, D.J., Sharda, R. & Calsson, C. (2002). Past, present and future of decision support technology. *Decision Support Systems, 33*(2), pp.111-126.

Silver, M. (1988). Descriptive Analysis for Computer-Based Decision Support. *Operational Research, 36*(6), pp.904-916.

Silver, M. (1991). Decisional Guidance for Computer-Based Decision Support. *MIS Quarterly, 15*(1), pp.105-122.

Simon, H.A. & Newell, A. (1971). Human problem solving: The state of the theory in 1970. *American Psychologist, 26*(2), pp.145-159.

Singh, D. (1998). Incorporating cognitive aids into decision support systems: the case of the strategy execution process. *Decision Support Systems, 24*(2), pp.145-163.

Stanovich, K. & West, R. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioural and Brain Sciences, 23*(5), pp.645-726.

Tidwell, O.A. (2011). An investigation into appraisal bias: the role of decision support tools in debiasing valuation judgements. Ph.D. Thesis. Georgia State University.

Tidwell, O.A. & Gallimore, P. (2014). The influence of a decision support tool on real estate valuation. *Journal of Property Research*, *31*(1), pp.45-63.

Todd, P. & Benbasat, I. (1991). An experimental investigation of the impact of computer based decision aids on decision making strategies. *Information Systems Research*, *2*(2), pp.87-115.

Tversky, A. & Kahneman, D. (1974). Judgement under uncertainty: heuristic and biases. *Science*, *185*(4157), pp.1124-1131.

Yiu, C.Y., Tang, B.S., Chiang, Y.H. & Choy, L.H.T. (2006) Alternative Theories of Appraisal Bias. *Journal of Real Estate Literature*, *14*(3), pp.321-344.

Appendix A – First page of the Valuation Tools, for both Standard (STD) and Decision Support (DSS) Programmes

Contact: Kathleen Evans
                 Phone: 021 650 2449
                 Mail: kathleen.evans@uct.ac.za

Experiment for the improvement of property valuation software

On this page structure and usage of the software are explained. On the second page you can enter the data from the information package and calculate the market value of the property. The third page collects some statistical data.

Instructions:

1) **Activation of macros.** Normally you have to click on a warning notice which appears on top of the page under the menu bar saying: "safety warning …. ". If the security settings on your computer do not allow macros, please change them or request a macro free version.

    Request help

2) **Zoom factor setting.** Font size and page width are chosen to fit in most screens. You can change the zoom factor under the menu item "view" to see the entire width of the page, if necessary.

3) **Click "Start"** to begin the valuation!

    Start

Appendix B – Third page of the <u>valuation tools</u>, for both Standard (STD) and Decision Support (DSS) Programmes

Thanks for your submission. To conclude we would like to have your evaluation and some statistical information.

	very sure ←————→ very unsure
How sure are you that your calculated value equates the probable attainable market price?	○ ○ ○ ○ ○

	very good ←————→ not at all
How good is the support you are receiving through this valuation software?	○ ○ ○ ○ ○

	very strongly ←————→ not at all
How strongly were you influenced by figures which don't relate to the market value, e.g., the alleged value of an anonymous appraiser?	○ ○ ○ ○ ○

	yes no
Do you know the so called "anchoring effect"? (also called "anchoring heuristic" or "appraisal bias")	○ ○

Comments regarding the software or the experiment:
Please write in this field!

Statistical information

	none ←————→ high
Knowledge of the real estate market in Cape Town?	○ ○ ○ ○ ○

	none ←————→ high
Knowledge of the market for office properties?	○ ○ ○ ○ ○

	up to 30 up to 40 up to 50 up to 60 60+
Age group? [years]	○ ○ ○ ○ ○

	none up to 5 up to 10 up to 20 20+
Work experience in the real estate industry? [years]	○ ○ ○ ○ ○

	none ←————→ professional valuer
Work experience in real estate valuation? [own assessment]	○ ○ ○ ○ ○

Real estate education, training or qualification? [multiple selection]
- ☐ none
- ☐ NDip Real Estate Valuations
- ☐ BSc (Hons) Property Studies
- ☐ MSc Property Studies
- ☐ MRICS or similar professional qualificati

Many thanks for you contribution!

Now you have two possibilities to send your results:

(1) If you would like to win an Apple iPad or one of three Apple iPods... **Use mailing program**

If this doesn't work, please fill in your e-mail address, press <Enter> and proceed to number (2) e-mail address

(2) If you would like to stay anonymous … **Send anonymously**

If you are not connected to the internet, please …
- *Save the file to your hard disk.*
- *When you are reconnected, please click on:* **Send anonymously (alternative)**
- *Afterwards please click on the following link:* https://docs.google.com/forms/d/1Do

Appendix C – Second page for Standard (STD) Programme Only

Please enter your values in the `dark green` **fields. The** `light green` **fields are already filled for your convenience.**

Calculation of market value as of August 1, 2015

Data und assumptions

Building

Rentable area:	1 368	m²
Parking:	10	bays

Expenses

Rates and taxes:		R/year
Insurance:		R/year
Utilities:		R/year
Leasing commissions:		R/year
Maintenance allowance:		R/year
Property management:		R/year

Income

Market rent office space:		R/m²/month
Market rent parking space:		R/bay/month
Vacancies and loss collection:		%
Capitalization rate:		%

Calculation (Income Approach)

Potential Gross Income			**R 0**
Rental income (offices):	0.00 * 1,368 * 12 =	0	
Other income (parking lots):	0.00 * 10 * 12 =	0	
		0	
- Vacancy and Collection Losses	% * 0 =		**R 0**
= Effective Gross Income			**R 0**
- Operating Expenses			**R 0**
Rates and taxes:		0	
Insurance:		0	
Utilities:		0	
Leasing commissions:		0	
Maintenance allowance:		0	
Property management:		0	
		0	
= Net Operating Income			**R 0**
÷ Capitalization Rate	0.00 %		
= Provisional Market Value			**R 0**
+/- Adjustments			**R 0**
= Market Value			**R 0**

When you have filled in all the data and if you are satisfied with the result of the calculation
please click on "End" to finish the valuation.

End

Appendix D – Second page for Decision Support (DSS) Programme Only

Please enter your values in the dark green fields. The light green fields are already filled for your convenience.

Calculation of market value as of August 1, 2015

1) Data und assumptions
In this section the program supports your data entry and calculation of market rents and other factors.

1a) Income

At first please decide which properties in the vicinity are truly comparable. Details are provided in the text. Please check the box of all properties you regard as comparables.

No.	Properties in the vicinity	Minimum (R/m²)	Maximum (R/m²)	Average (R/m²)	Compar-able?
1	Wale Street Chambers	105	110	107.5	☐
2	85 St Georges	94	94	94	☐
3	SA Reserve Bank Building	75	75	75	☐
4	Dumbarton House	40	50	45	☐
5	Buitengracht Centre	80	85	82.5	☐
6	Pinnacle, 2 Burg St	75	75	75	☐
7	33 Church Street	115	115	115	☐
8	33 Church Street	150	160	155	☐
9	47 on Strand	70	70	70	☐
	Overall average			91	

Please check at least one box!

legend
maximum
average
minimum

Maximum
Minimum
Average
Overall avg.
Overall avg. comparables

Analysis:
- The diagram shows the range of the asking prices for 9 properties in the vicinity as a vertical black line, the average as a horizontal green line. The overall arithmetic average is depicted as a dotted blue line.
- You regard 0 of these buildings as comparables. They are included in the overall average of comps (solid blue line). The other properties (in brackets) were excluded.

Quality of market data

For the next step please have a look at the market data provided in the text. You will then be asked to evaluate the different sources regarding three criteria:
- Objectivity = Is the source of information an estate agent or a neutral observer?
- Up-to-dateness = Is the data up to date or outdated?
- Relevance = Does the market data match the valuation property?

Source	Description	from R/m²	up to R/m²	avg R/m²
Own research	asking rents (B+ grade; in the vicinity; Aug. 2015)	40	160	
SAPOA	asking rents (A/B grades; whole CBD; July 2015)	80	150	108
property24.com	asking rents (all grades; whole CBD; Aug. 2015)	50	250	102
JLL/Baker Street	actual rents (grade B, whole CBD; Q1/2015)			101
Rode	actual rents (grade B, whole CBD; Q2/2015)			98
Overall average		57	187	**102**

Source	Objectivity	Currentness	Relevance	Score
Own research	☺ ☹	☺ ☹	☺ ☹	0
SAPOA	☺ ☹	☺ ☹	☺ ☹	0
property24.com	☺ ☹	☺ ☹	☺ ☹	0
JLL/Baker Street	☺ ☹	☺ ☹	☺ ☹	0
Rode	☺ ☹	☺ ☹	☺ ☹	0

Please score all sources regarding objectivity, currentness, and relevance!

Quality of property

In addition you can now evaluate the property in comparison to the market on a 5-stage scale. Criteria:
- tenant quality: personal and material creditworthiness, reliabilty, timeliness of lease payments
- building quality: interior, condition, equipment, flexibility, architecture, energy efficiency, etc.
- location quality: traffic accessibility, infrastructure, emissions, image, specific location advantages, etc.

	☺ ← ☺ → ☹					score
tenant	○	○	○	○	○	-
building	○	○	○	○	○	-
location	○	○	○	○	○	-

Analysis:
- The rents mentioned in market reports range between 57 and 187 R/m² on average with outliers between 40 and 250 R/m². The overall arithmetic average is 102 R/m².

legend
maximum
arithmetic average
minimum

Based on this analysis, please determine the adequate market rent.

Adjusted market rent: _____ R/m²/month

Average contract rent (for the sake of comparison): 112.50 R/m²/month

Next, please estimate the market rent for the parking bays.

Market rent for parking: _____ R/bay/month

Average contract rent (for the sake of comparison): 870.00 R/bay/month

1b) Vacancy and collection losses

Now please estimate vacancy and collection losses as a percentage of gross rental income.
Own estimate _____

1c) Operating expenses

In the next step the software helps you to calculate the operating expenses. At first please estimate the total expenses with the help of a cost-to-income ratio. After that you can allocate that sum to the individual expenses.

Cost-to-income ratio (based on estimated market rent for a fully-let property and actual expenses):

Rental income per year

Office: R 0 * 1,368 m² * 12 months =	0 R/year
Parking: R 0 * 10 bays * 12 months =	0 R/year
	0 R/year

Actual expenses per year   498 000 R/year

Comparison

| Actual ratio		
Market data	low	27.0%
	high	38.0%
Own estimate		

Estimated expenses per year   498 000 R/year

Now please allocate the total expenses to the various expense items by overwriting the percentage figures in the dark green boxes. If you feel that the current portions are ok you can leave them as they are. In any case the sum must equal 100%.

	Rand actual	Portion actual	Rand estimated	Portion estimated
Rates and taxes:	201 000	40%	201 000	40%
Insurance:	12 000	2%	12 000	2%
Cleaning & security:	48 000	10%	48 000	10%
Leasing commissions:	70 000	14%	70 000	14%
Maintenance allowance:	65 000	13%	65 000	13%
Property management:	102 000	20%	102 000	20%
Total	498 000	100%	498 000	100%

1d) Capitalization rate

From the information given in the documents please estimate the cap rate.

Source	Description	from	up to	average
SAPOA	office buildings, Cape Town CBD	8.10%	10.60%	8.60%
Rode-Grade A	office buildings, Cape Town CBD, grade A	8.30%	9.50%	8.90%
Rode-Grade B	office buildings, Cape Town CBD, grade B	9.20%	9.80%	9.50%
			Own estimate	

legend

maximum

arithmetic average

minimum
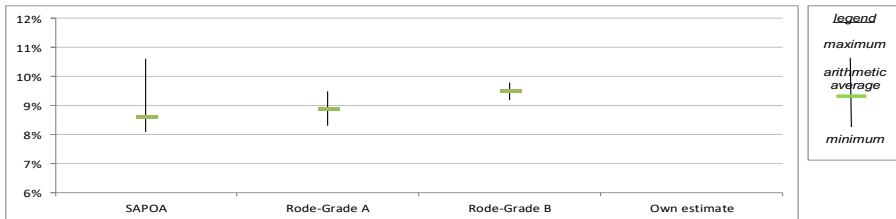
2) Calculation (Income Approach)

Potential Gross Income			**R 0**
Rental income (offices):	R 0 * 1,368 m² * 12 months =	0	
Other income (parking lots):	R 0 * 10 bays * 12 months =	0	
		0	
- Vacancy and Collection Losses		0% * 0 =	**R 0**
= Effective Gross Income			**R 0**
- Operating Expenses			**-R 498 000**
Rates and taxes:		201 000	
Insurance:		12 000	
Cleaning & security:		48 000	
Leasing commissions:		70 000	
Maintenance allowance:		65 000	
Property management:		102 000	
		498 000	
= Net Operating Income			**-R 498 000**
÷ Capitalization Rate		0.00%	
= Provisional Market Value			**R 0**
+/- Adjustments			
= Market Value			**R 0**

When you have filled in all the data and if you are satisfied with the result please click on "Continue".

Continue

3) Plausibility check

In the next paragraph the valuation software helps you to perform a final "sanity check ".

Comparison	Values in million Rand
Alleged value of an anonymous appraiser (method and data not specified):	11.0
Rough estimate of replacement costs (based on statistics of costs, deterioration, and land value):	13.0
Market value according to your valuation:	14.0
Rough estimate (gross income * gross multiplier) based on your data input:	14.9

⚓ = *Value of anonymous appraiser*
🟩 = *Your market value*
🔷 = *other values*

The range of the various values is about 36%. The lowest value was mentioned by the owner and could not be verified; experience of the appraiser, valuation method, data used, etc., are unknown. The highest value was calculated by the valuation software on the basis of your data input.

Caution: Previous valuations, price expectations of the owner, market rumors, etc., should not affect a valuation. They cannot be verified, may be outdated or based on other assumptions. However, psychologists have found out that valuers are unconsciously influenced by them. This is called the "anchoring effect" because such a value acts as an anchor and prevents an objective valuation.

Therefore please check your valuation again. If you think that the anchor value has unduly influenced you, you now have the opportunity to correct your valuation. With the help of the slider, move your value to the RIGHT, AWAY from the anchor.

Reduce market value ◄ █ ► *Increase market value*

Adjustment factor: 0%

Adjusted market value: R 14 000 000

When you are satisfied with the result, please click on "End" to finish your valuation. | **End**

Urban Expansion and Loss of Agricultural Land in Osogbo, Osun State Nigeria, using Multi-Temporal Imageries

Afolabi Francis Fatusin[1], Gbenga John Oladehinde[2], and Victor Ojo[3]

[1] Department of Geography and Planning Sciences, Adekunle Ajasin University, Nigeria.
[2] Department of Urban and Regional Planning, Obafemi Awolowo University, Nigeria.
[3] Department of Urban and Regional Planning, Osun State University, Nigeria.

Abstract

Osogbo, the state capital of Osun State is one of the rapidly urbanizing cities in Nigeria. This article examined urban expansion and the transition of agricultural land in Osogbo with the use of multi-temporal imageries between 1986 and 2018. Large amounts of cultivated land has been transformed into other land uses in the past 31 years. This paper presents the process of the loss of agricultural land and urban growth in Osogbo with the use of remote sensing and GIS. Landsat imageries for 1986, 2002 and 2018 were used to analyse land use and land cover change. Supervised image classification was applied to classify the images into different land use categories. Six land use classes were identified: built-up area, water body, cultivated area, gallery zone, dense vegetation and rocky outcrops. Built-up areas (residential, educational and industrial areas) have greatly increased while agricultural lands (i.e. farmland and wetland) have considerably decreased during the study period. Built-up area covered 7.06% in 1986 but increased to 53.61% in 2018 while agricultural land decreased from 86.28% to 41.53% in the same period. The study therefore recommends that government should integrate agricultural lands into urban land use, planning for efficient management and protection of the dwindling agricultural space.

Keywords: Urban expansion; Geographical Information Systems; Loss of Agricultural Land; Land-use; Land Cover

---

[1] gbengom@gmail.com

1. Introduction

Agriculture is an important economic activity in many parts of the world, especially developing countries in Asia and Sub-Saharan Africa (Naab et al., 2013; Enaruvbe & Atedhor, 2015). Not only does it serve as the provider of employment opportunity, but also as a means of supplying fresh food for both urban and rural dwellers. This is particularly the case in developing countries. Agriculture involves growing, processing and distributing food and other products through plant cultivation and raising livestock in rural areas and cities (Kulak et al., 2013). Cultivation of crops, especially in and around cities, is refered to as urban agriculture. According to Mougeot (2005), urban agriculture is an industry located within (intra-urban), or on the fringes (peri-urban) of a town, city or metropolis. Further, urban agriculture is responsible for growing, processing and distributing a diversity of food and non-food products, using largely human and material resources, products and services found in and around an urban area. Then, in turn, supplying human and material resources, products and services largely to that same urban area. Urban agriculture is a common phenomenon which has existed for a long time. Urban agriculture has assumed global concern and become a topic of scientific research in recent times. This is as a result of the increasing growth of hunger in most parts of the world and has presently become a huge challenge for government in most developing nations.

Studies have shown that the importance of urban agriculture cannot be underestimated. This is as a result of its contribution to global food stocks. For instance, UN-Habitat (2008) reported that urban agriculture has produced between 15% and 20% of the world's food and involved over 800 million urban and peri-urban dwellers. Out of this estimated figure, about 200 million are considered to be market producers, employing approximately 150 million people on a full-time basis. In support of this assertion, Fournier (1996) noted that urban agriculture has contributed significantly to food security and safety for approximately 50% of the world's population that are city dwellers. Similar studies in Sub-saharan Africa (Nugent, 2000; Cofie et al., 2003) have also shown that the contribution of urban agriculture is on the increase. In another dimension, urban agriculture has become a significant source of job creation for the urban unemployed, improved livelihood and sustained urban ecology. Rees (1997) observed that about a fifth to a third of families in some cities are engaged in urban agriculture with some not having alternative sources of sustenance or income. Urban agriculture has sustained the livelihood of low income dwellers in developing countries for many years (Addo, 2010).

However, despite the contribution of urban agriculture to the world's food and employment, its practice in recent years has decreased, especially in most cities in Sub Saharan Africa, including Nigeria. This is as a result of rapid environmental change, occasioned by a rapid population growth and rural-urban infrastructure inequality (Enaruvbe & Atedhor, 2015). Rapid population growth has also resulted in increased physical development on urban edible spaces such as farmland, wetland and open space along arterial roads (Ajibola, Adewale & Ijasan, 2012). This development threatens the

sustainability of urban agriculture since the practice is influenced considerably by changing land use and land cover patterns (Addo, 2010).

The integration of Geographical Information Systems (GIS) and remote sensing has been widely applied and recognised as a powerful and efficient tool in detecting agricultural change, urban land use and land cover change (Ashbindu et al., 2001). GIS is a technology which provides a flexible environment for entering, analysing and displaying digital data from various sources necessary for urban feature identification, change detection and database development (Mir et al., 2016). Satellite remote sensing collects multi-resolution, multi-spectral and multi-temporal data and turns them into information valuable for understanding and monitoring urban land process, and for building urban land cover datasets (Yuan et al., 2005). To this end, it is very important that remote sensing and GIS are used in analysing urban expansion and loss of agricultural land.

The creation of Osun State and the subsequent sitting of the capital in Osogbo have brought about an increase in population and human activities, land use dynamics, and by extension, urban expansion. The expansion and growth of Osogbo has not only impacted the socio-economic dynamics of the area, but it has also affected various land uses in the city, most especially agricultural land (i.e. conversion of wetland, farmland and other environmental resources for urban use). Significant studies have been made in different parts of the world to address land use changes using GIS (Schmidt & Kedir, 2009; Kharel, 2010; Kumar & Kumar, 2016). Nevertheless, none of these studies have combined different resolution data such as Landsat Thematic Mapper (TM); Enhanced Thematic Mapper Plus (ETM+); and Operational Land Imager and Thermal Infrared Sensor (OLI-TIRS) in measuring land use change or loss estimation in developing countries. Also, several studies in Nigeria have examined various aspects of environmental change, particularly land cover dynamics (Adeniyi & Omojola, 1999; Fabiyi, 2006; Braimoh & Onishi, 2008; Tokula & Ejaro, 2013; Oloukoi, Oyinloye & Yadjemi, 2014; Dekolo, Oduwaye & Nwokoro, 2016). However, recent and up-to-date studies on the effects of urban growth on agricultural land are scanty in the literature. There is therefore a need to examine urban expansion and loss of agricultureal land in Osogbo, Osun State Nigeria, using multi-temporal imageries.

Based on the foregoing, this study aims at analysing agricultural land use change in Osogbo over the last three decades using geo-information technologies. The specific objectives of the study is to analyse the pattern and rate of land use change in and around Osogbo using multi-temporal imageries, and determine the impact of the observed changes on agricultural land use in the study area.

2. Study Area

The study area covered Osogbo, the capital city of Osun state and its environment. Osogbo has two Local Government Areas (LGAs). These include Osogbo and Olorunda LGAs. The study area is located between latitude 7º46'N and 7.767ºN and longitude 4º34'E and 4.567ºE (see Figure 1,

2 and 3). Osogbo, which contain a population of 715 306, has become a major urban centre of since the colonial period. Osogbo is a commercial and industrial centre. This started in 1907 when the British Cotton Growing Association sited an industry for growing and ginning of cotton. In this same year the Nigerian Tobacco Company (NTC) built its first factory in Osogbo. The above was a major turning point for the city which helped trigger its industrial and commercial development. Later, railway tracks were constructed linking it to other parts of Northern Nigeria. This attracted people from far and near. Osogbo shares boundaries with Ikirun, Ilesha, Ede, Egbedore and Iragbiji and is easily accessible from any part of the state because of its central location. It is about 48km from Ife, 32km from Ilesa, 46km from Iwo, 48km from Ikire and 46km from Ila-Orangun (osun.gov.ng).

The arrival of the railway in 1970 transformed Osogbo into a commercial town which brought about the colonial government to the threshold of the town. Settlers and immigrants were attracted to Osogbo as a result of industrial and commercial development. Some of the commercial and industrial establishments which are widely spread across the study area include: a lead pencil manufacturing factory, sawmills, motor vehicle garages, Osogbo steel rolling company, wire and nails industry, plastic pipe factory, agro allied industry, and hotels and garment industries, among others.
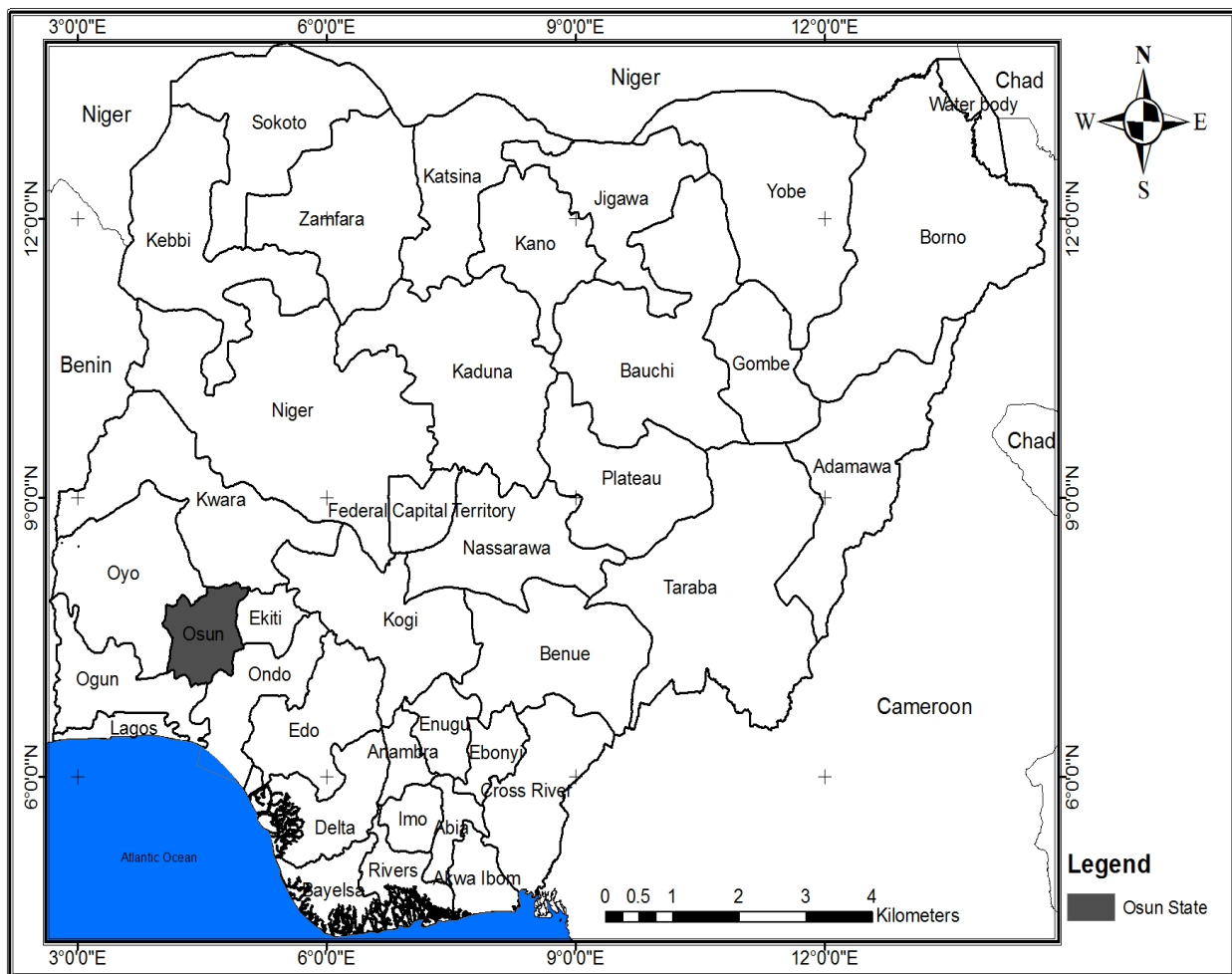

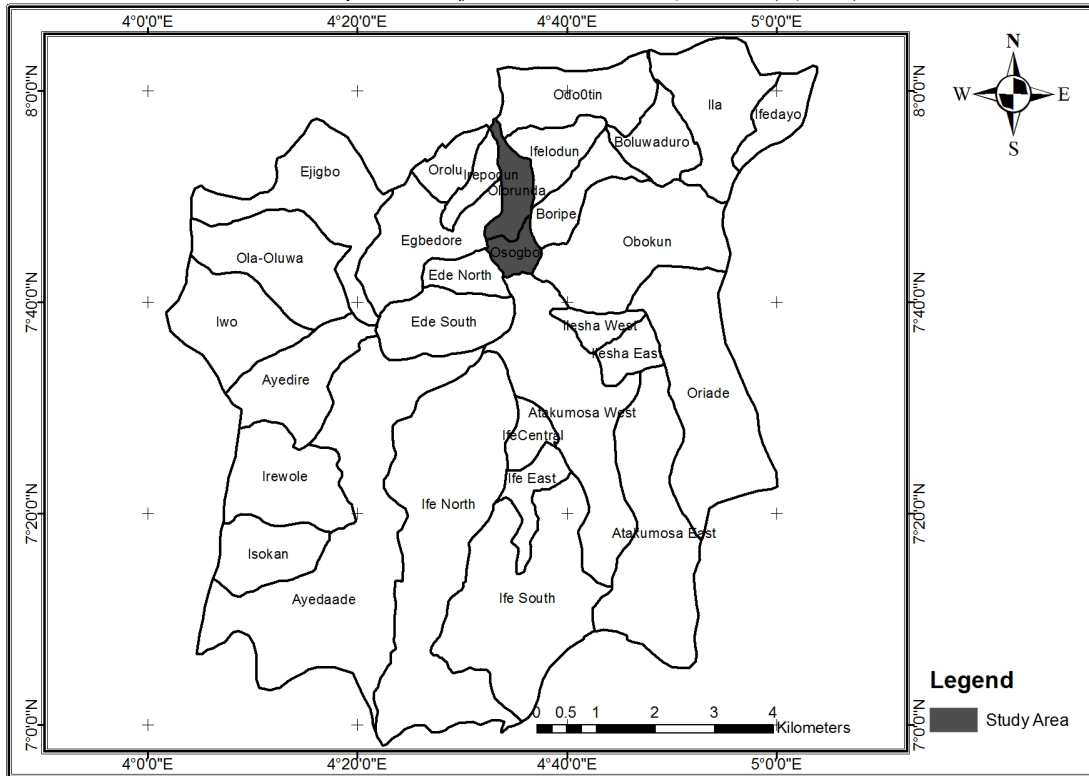**Figure 1: Osun State in the Context of Nigeria.**

Figure 2: Olorunda and Osogbo Local Government Area in the Context of Osun State.

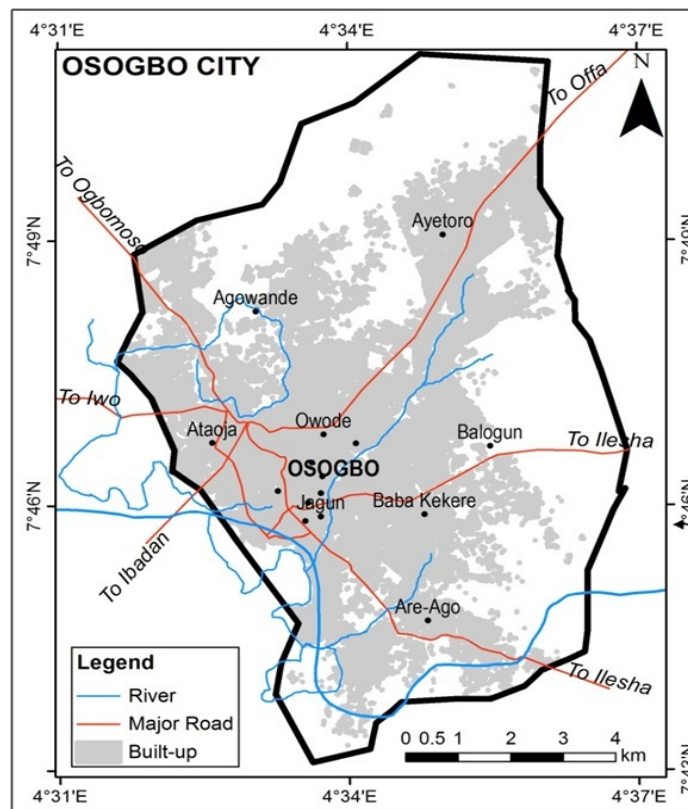*Source: Cooperative Information Network (COPINE) (2018)*

Figure 3: Map of the Study Area

Source: Cooperative Information Network (COPINE) (2018)

3. Materials and Methods

Both primary and secondary data were employed for this study. The primary data was collected on the physical attributes of six key land use types for this study. The sample sites were determined from the remotely sensed imageries that were used for the study. The secondary data sources were Landsat[1] 5 TM, Landsat 7 ETM+ and Landsat 8 OLI covering the area, and Aster Data from the United States Geographical Survey. The primary dataset was summarized for eventual integration with the spatial datasets. The processing and analysis of secondary data included: image enhancement, geometric correction, variable combination of spectral bands for land use mapping, and a creation of a database for handling the various data types. These operations were performed using ILWIS software version 3.4, Arc View 3.2 and AutoCAD Map R2 to bring out the classes of land use types currently dominant in the area. The resulting land use characteristics are compared to assess the changes that have taken place on agricultural land (wetland and farmland) in quantitative and qualitative terms.

The following land use and land cover types were identified after satisfactory visual interpretation of the images: water bodies, riparian zones/gallery forest, dense vegetation, cultivated land, rocky outcrop, built-up area. The built-up area comprises buildings and other artificial structures. Water bodies include the areas covered mainly with surface water: rivers, creeks, reservoirs and ponds. Riparian zones/gallery forests are regions covered with trees of different species with little or no human activities. Dense vegetation represents area consisting of trees of different species and sizes, shrubs and woody plants. Cultivated land includes area used for growing agricultural crops during the wet and dry season (i.e. farmland and wetlands). Rocky outcrops are exposed land, such as mountain, hill and highland. The visual interpretation was done by means of the interpretation keys such as: size, shape, pattern, texture, tone, colour and association of the features. After this, the images were classified using the supervised classification techniques. The maximum likelihood algorithm was used in order to compare the various land use features and assess them before drawing meaningful inferences (Yuan et al., 2005; Wu et al., 2006).

The data used for the extraction of the land cover information in the study area include; landsat: 1986, 2002 and 2018 and GPS observations of points of interest such as new built-up areas, farmlands, water bodies, and bare lands in the study. All these images were acquired from Global Earth Geo-systems (see Table 1).

---

[1] Landsat refers to a programme which consists of a series of optical/infrared remote sensing satellites for creating accurate and quality imagery to enable observation of the changing landscape of Earth.

Table 1: Summary of Landsat Images Acquired for the Research

Date	Satellite Number	Band	Sensor type	UTM Zone	Datum	Scale/ Resolution	Sources and Year
1986	Landsat 5	4,3,2	TM	31N	WGS84	28.5m	USGS, 1986
2002	Landsat 7	4,3,2	ETM+	31N	WGS84	28.5m	USGS, 2002
2018	Landsat 8	4,3,2	OLI_TIRS	31N	WGS84	28.5m	USGS, 2018
	GPS observation						

Population Growth

Population figure of 1986, 2002 and 2018 were estimated from the provisional result of 1991 and 2006 population census of about 189 733 and 287 156 respectively. The result of the estimated figure was projected with the formula below:

$$Pr = P0 \ (1+r/100)^n$$

Where: Pr = the projected population
$P0$ = the existing population
r = the growth rate (3.2%)
n = the number of years
r (3.2%) is constant for all the years, n is -5 in 1986, -4 in 2002 and 12 in 2018.

Therefore population in 1986 = $189\ 733(1+3.2/100)^{-5}$ = **162 085.6**
Population in 2002 = $287\ 156\ (1+3.2/100)^{-4}$ = **253 162.3**
Population in 2018 = $287\ 156(1+3.2/100)^{12}$ = **419 058.1**

Note: The population figures were obtained by interpolation using the annual growth rate of 3.2% of Osogbo and Olorunda Local government areas (Gasu et al., 2016).

Statistical Methods

The comparative study of land use/land cover was adopted by identifying the trend and percentage of changes between 1988 to 2002 and 2002 to 2018. In achieving this, the first task was to develop the tables showing the area in hectare (ha) and percentage of change between 1988 to 2002 and 2002 to 2018. This was measured in each and every land use/land cover category. The change of percentage is used to determine the trend of change and was calculated by dividing observed changes by the sum of the changes. The second task was the use of compound growth rate (R) in the measurement of the rate of change in land use types. The compound growth rate (R) of each land use between 1988 to 2002 and 2002 to 2018 was determined using the formula below:

$$R = (U_T/U_0)^{1/T} - 1$$

Where: U_T = size of the land use at the end of the period
U_0 = size of the land use at the beginning of the period
$(U_T/U_0)^{1/T}$ = Tth root of the quotient
T = length of time

4. Results and Discussion

Results in Table 2 show the analysis of land use in hectares per year and percentage per year between 1986 and 2018 (illustrated on the grah in Figure 4). This was derived from land use and land cover comparison analysis in the study area. The main categories of land uses identified in the study area include: water body, riparian zones/gallery forest, dense vegetation, bare land/cultivated area, rocky outcrops and built-up area (Table 2). The pixel statistics of land use in Landsat TM 1986 presented in Table 2 (see Figure 5) shows that the area covered by water body and rocky outcrops were 623.56ha and 361.53ha representing 4.21% and 2.44% respectively of the study area. Riparian zones and dense vegetation accounted for 8 782.36ha (59.34%) of the entire area. Built-up areas accounted for 4.21% (1044.71ha) of the study area. The land use and land cover classes in 1986 shows that much development had not taken place in the study area. The proportion of cultivated area in 1986 shows that the majority of the residents in the study area are farmers.

In 2002, natural vegetation (gallery forest and dense vegetation) was still the dominant land cover class with 8 127.93ha covering approximately 55.09% of the study area. The pixel covering cultivated area (3 834.92ha) accounted for 25.98% of the entire area in 2002. This shows that the majority of the populace were still actively involved in farming between 1986 and 2002 (see Figure 6). The pixel representing rocky outcrops was 439.02ha (2.97%). Water bodies had reduced to 2.16% (329.864ha) while built-up area increased to 13.78% (2 033.06ha).

The 2018 imagery (see Figure 7) showed that built-up areas have increased to 53.61% (7 934.06ha) of the study area. The proportion of gallery forest and dense vegetation has reduced to 1 000.53ha and 3 110.02ha representing 6.76% and 21.01% coverage of the entire study area respectively. Water bodies, rocky outcrops and cultivated areas account for 358.83ha (2.42%), 359.64ha (2.43%) and 2 036.07ha (13.76%) respectively. This shows that between 1986 and 2002, there was not much development, as considerable numbers of the residents were involved in farming. However, between 2002 and 2018, there was a massive inflow of migrants. This contributed to urban expansion (increase in the number of the built-up areas). The consequence of this massive inflow of migrants to the study area is the declination of agricultural land. The rapid increase in urbanisation coupled with an increasing population led to the conversion of vegetation, wetland and farmland to other uses such as residential, educational, commercial and industrial development.

Table 2: LULC Distribution between 1986 and 2018

| Land Use Type	1986		2002		2018	
	Areal Extent (ha)	%	Areal Extent (ha)	%	Areal Extent (ha)	%
Water Body	623.56	4.21	319.864	2.16	358.83	2.42
Riparian Zones/gallery Forest	2 815.82	19.03	3 217.48	21.81	1 000.53	6.76
Dense Vegetation	5 966.54	40.31	4 910.45	33.28	3 110.02	21.01
Cultivated land	3 987.65	26.94	3 832.92	25.98	2 036.07	13.76
Rock Outcrop	361.53	2.44	439.021	2.97	359.64	2.43
Built-Up Areas	1 044.71	7.06	2 033.061	13.78	7 934.06	53.61
Total	**14 799.81**	**100**	**14 752.796**	**100**	**14 799.15**	**100**

Source: Authors' survey, 2018
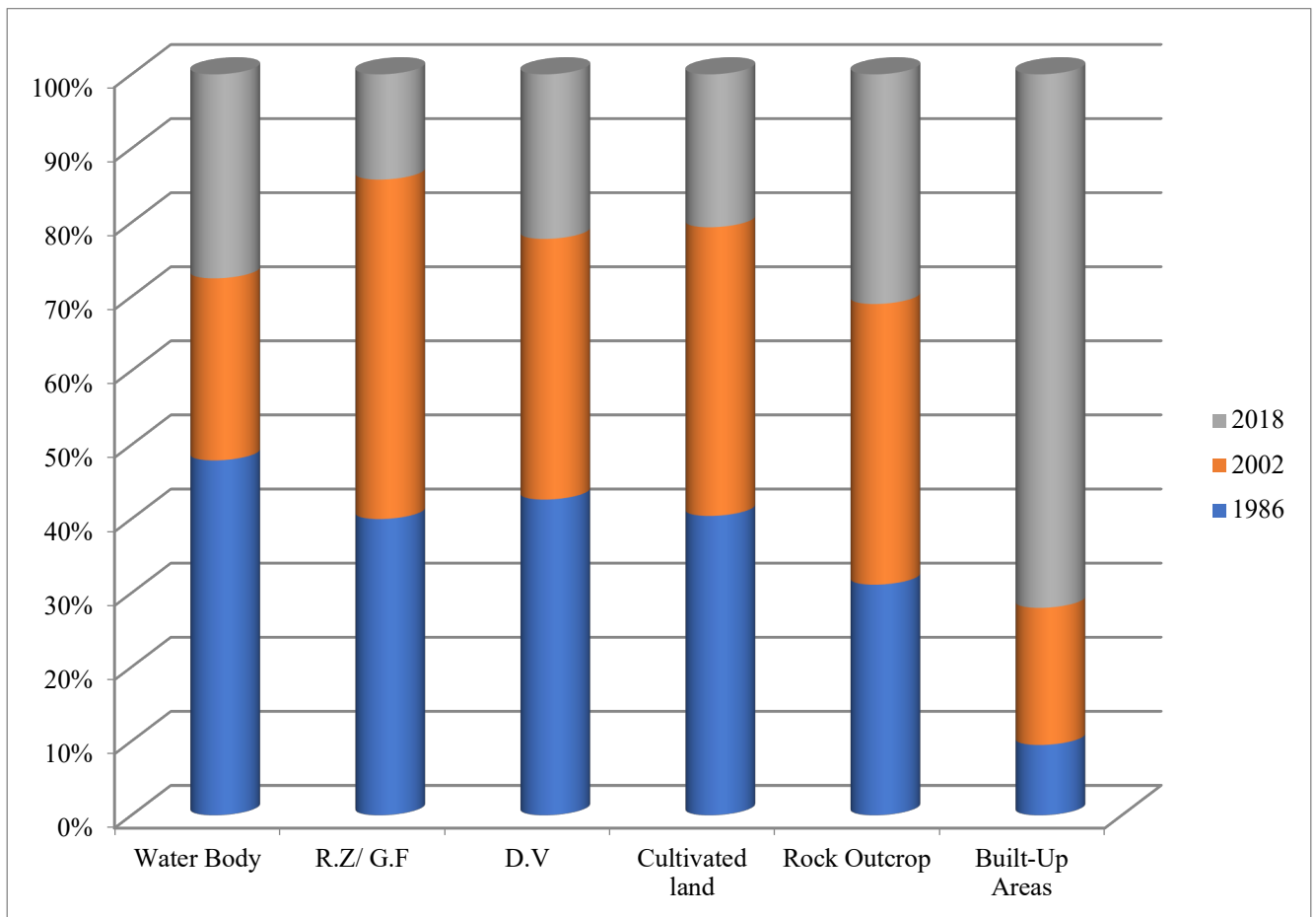
Figure 4: Comparative Gain and Loss of Land use/changes between 1986 and 2018
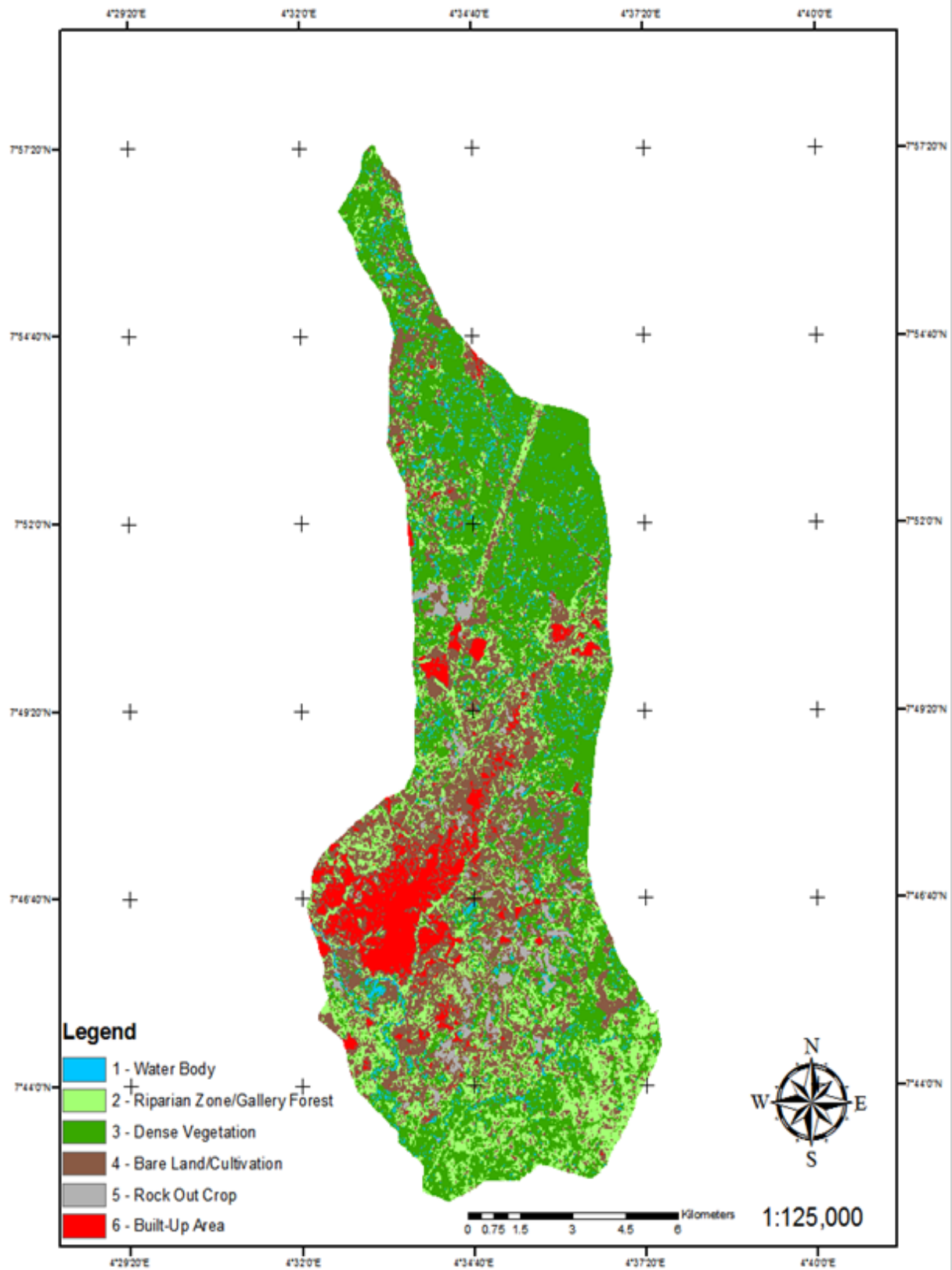*Source: Authors' survey, 2018*

Figure 5: Land use and land cover Map of Osogbo, 1986
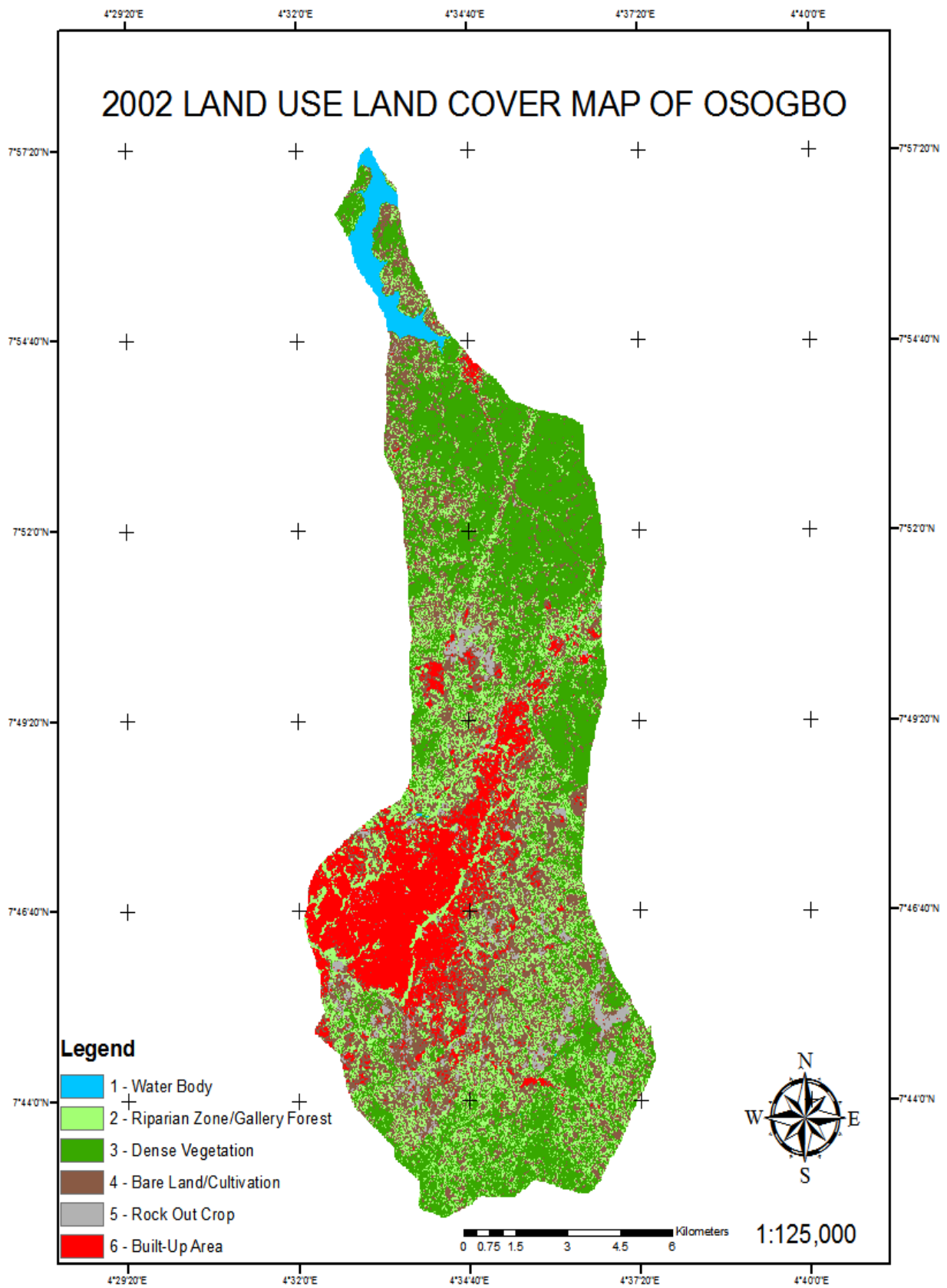*Source: Authors Lab Work, 2018.*

Figure 6: Land use and land cover Map of Osogbo, 2002
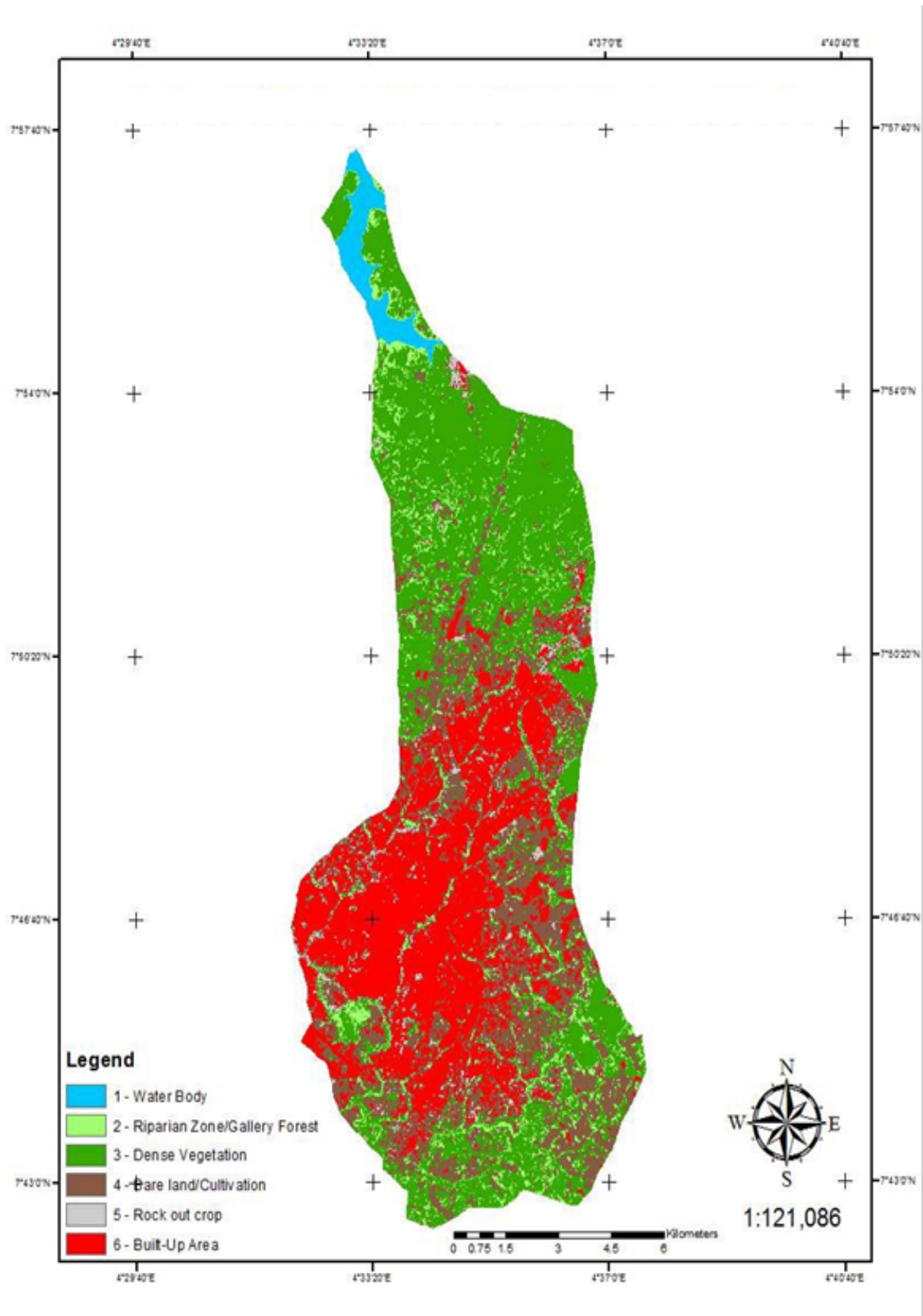*Source: Authors Lab Work, 2018*

Figure 7. Land Use/Land Cover of Osogbo, 2018
Source: Authors' Lab work, 2018

Table 3 shows the changes (in hectares and percentage) in land cover that have occurred between 1986 and 2002 (within 16 years). The result shows that the compound rate of land cover changes in hectare per year between 1986 and 2002. The compound rate of change of cultivated area between 1986 and 2002 was -9.67ha/yr at -0.25% per year. This implies that for every year, cultivated area reduced at an compound rate of -0.25%.

Table 3: LULC Change and Rates of Change between 1986 and 2002

Land Use Type	1986		2002		Changes between 1986 and 2002		Compound Rate of change between 1986 and 2002	
	ha	%	ha	%	ha	%	(ha/yr)	R (%)
Water Body	623.56	4.21	319.864	2.16	-303.696	-48.7	-18.98	-4.09
Riparian Zones/gallery Forest	2 815.82	19.03	3 217.48	21.81	+401.66	14.26	25.1	0.84
Dense Vegetation	5 966.54	40.31	4 910.45	33.28	-1 056.09	-17.7	-66.01	-1.21
Cultivated land	3 987.65	26.94	3 832.92	25.98	-154.73	-3.88	-9.67	-0.25
Rock Outcrop	361.53	2.44	439.021	2.97	+77.491	21.43	4.84	1.22
Built-Up Areas	1 044.71	7.06	2 033.061	13.78	+988.35	94.6	61.77	4.25
Total	**14 799.81**	**100**	**1 4752.80**	**100**				

Source: Authors' survey, 2018

Table 4 shows the changes (in hectares and percentage) in land cover that have occurred between 2002 and 2018 (within 16 years). The result shows the compound rate of land cover change in hectare per year between 2002 and 2018. The compound rate of change of built-up area was 393.4 ha/yr. This implies that the rate of change in built-up areas for every year between 2002 and 2018 has increased significantly at a compound rate of 393.4 ha/yr amounting to 9.5% every year. This shows that there was rapid rate of urbanization in the study area between 2002 and 2018. The table also shows an increase in water bodies +2.6 ha/yr (-0.77%). This is due to the establishment of dam at the northern part of the study area. Furthermore, the result shows a decrease in cultivated land at a compound rate of -119.79 ha/yr. It can be inferred that most of the farmland and wetland within the urban centre have been converted to other land uses which are non-agricultural in nature. The result shows a decrease in the riparian zones/gallery forest (-147.8 ha/yr) and dense vegetation (-120.03 ha/yr) in the study area.

Table 4. LULC Change and Rates of Change between 2002 and 2018

Land Use Type	2002		2018		Changes between 2002 and 2018		Compound Rate of change between 2002 and 2018	
	ha	%	ha	%	ha	%	(ha/yr)	R (%)
Water Body	319.864	2.16	358.83	2.42	+38.97	+12.2	+2.6	-0.77
Riparian Zones/gallery Forest	3 217.48	21.81	1 000.53	6.76	-2 216.95	-68.9	-147.8	-7.49
Dense Vegetation	4 910.45	33.28	3 110.02	21.01	-1 800.43	-36.67	-120.03	-3.0
Cultivated land	3 832.92	25.98	2 036.07	13.75	-1 796.85	-46.88	-119.79	-4.13

Rock Outcrop	439.021	2.97	359.64	2.43	-79.38	-18.1	-5.29	-1.32
Built-Up Areas	2 033.061	13.78	7 934.06	53.61	+5 900.9	+290.25	+393.4	9.5
Total	**14 752.80**	**100**	**14 799.15**	**100**				

Source: Authors' survey, 2018

Table 5 shows the changes in land use that have occurred between 1986 and 2018 in hectares and percentage. It was observed that between 1986 and 2002, built-up area increased by 988.35 (94.6%) and rapidly increased by 5 900.9 (290.25%) between 2002 and 2018. It can be inferred that the amount of built-up areas is on the increase. This could be attributed to population growth, urban expansion, industrialization, housing expansion, among others (see Table 7). Conversely, the riparian zones/gallery forest, dense vegetation and cultivated areas were on the decrease between 1986 and 2002; 2002 and 2018.

Table 5. Change in Land Use between 1986 and 2018

Land Use Type	Changes between 1986 and 2002		Changes between 2002 and 2018	
	(ha)	**%**	**(ha)**	**%**
Water Body	-303.696	-48.7	+38.97	+12.2
Riparian Zones/gallery Forest	+401.66	14.26	-2 216.95	-68.9
Dense Vegetation	-1 056.09	-17.7	-1 800.43	-36.67
Cultivated land	-154.73	-3.88	-1 796.85	-46.88
Rock Outcrop	+77.491	+21.43	-79.38	-18.1
Built-Up Areas	+988.35	+94.6	+5 900.9	+290.25

Source: Authors' survey, 2018

Table 6. Analysis of Urban expansion in ha/year and % per year

Year	Urban (Built-up Area)	Change		Time Span (Years)	Compound rate per change		Period
		(ha)	**%**		**(ha/yr)**	**(%/year)**	
1986	1 044.71						
		988.35	94.6	16	61.77	4.25	1986-2002
2002	2 033.06						
		5 900.9	290.25	16	368.81	9.5	2002-2018
2018	7 934.06						

Source: Authors' survey, 2018

Table 7. Urban expansion with Population Increase

Year	Population	Pop. Density per km²	Urban area (ha)	Rate of change
1986	162 085.6	1 095.187	1 044.71	0.00
2002	253 162.3	1 716.029	2 033.06	988.35
2018	419 058.1	2 743.834	7 934.06	5 900.9

Source: Authors' survey, 2018

Table 7 above shows the extent of urban area as well as the population increase between 1986 and 2018. Built-up area and population projection

analysis (Table 7) indicates that population change has great impacts on land use changes. The result shows an increase in the population of Osogbo from 162 086 to 253 162 between 1986 and 2012 led to a corresponding increase in urbanised land from 1 044.71ha to about 2 033.06ha. The result also shows that the population further increased to 419 058 in 2018. This has led to an increased urbanised area of 7 934.06ha in 2018. The rapid increase in population and urbanised areas has a greater effect on riparian zones and dense vegetation, as well as cultivated area. This means that built-up areas are rapidly expanding at the detriment of agricultural land (e.g. riparian zones, dense vegetation and bare land/cultivated area) (see Table 3).

The major reason for urban expansion of the study area is the relocation of the state capital between 1986 and 2002. The location of the state capital is also linked with the construction of the state secretariat in Abere. These shifted physical development towards Owode and Akoda. Another reason could be associated with the establishment of the Osun State University, Osogbo in the Okebaale area between 2002 and 2018. This brought about the need to build more hostels and residential houses. Furthermore, road development and social amenities across the town and the outskirts brought about a rapid population increase as most of the residents took advantage of the cheaper cost of land in order to enjoy the facilities. As a result, the population of the study area began to grow rapidly. Additionally, forested lands of nearby villages were turning to open surface while the city centre is becoming more over crowded. Uncontrolled migration and unbalanced distribution of the population were also some of the causes of the population increase. The city was not only the place where this was felt but also the nearby area which is also becoming more urbanised. All of the above have caused land use and land cover change resulting in a loss of agricultural land in the study area.

5. Policy Implications

Agricultural land within the urban centre is a vital resource that can be used for the survival of the urban poor in Nigeria and other developing countries in Africa. It can be used to improve the economic situation of the poor even in the face of urbanisation. It is a vital element for household survival strategies in urban centres of developing countries through the improvement of the economic base of the household. However, due to poor urban planning, coupled with an uncontrolled increase in population, a significant loss of agricultural land has been experienced. The problem of agricultural loss can be dealt with if there is an enabling environment that can promote sustainable agriculture land use. Programmes and legislation can be introduced to ensure that urban agriculture is sustained within the city. There is no single solution to urban agricultural planning. For planning to evolve, dialogue between different stakeholders from city officials to women farmers, among others, should be made.

6. Conclusion and Recommendations

This study examined the impact of urban expansion on agriculture land in Osogbo with the use of multi-temporal imageries between 1986 and 2018. The results revealed that urban expansion has declined agricultural land from 127 70.01ha (86.28%) to 6 146.62ha (41.53%) between 1986 and 2018, indicating a decrease of -6 623.39ha. The study also shows that population growth has influenced the expansion of the built-up area at the expense of other land uses. This shows that there is considerable land use and land cover change in the study area. Agricultural land is being rapidly converted into built-up areas (such as commercial, residential, educational, industrial and other urban uses) without any systematic development plan (such as master plan). The attraction of people towards the urban area is high and the ratio of land use and land cover change is increasing day by day.

In order to ensure the sustainable development and food security in the study area there is a need to balance urbanisation and proper consumption of the agricultural area. The study therefore recommends that government should integrate agricultural lands into urban land use planning for efficient management and protection of the dwindling agricultural space. Government should also incorporate real-time remote sensing data and geospatial technology in monitoring urban expansion. Protection measures like stricter urban plans and policies, which are essential for the protection of agricultural areas, should be made. Finally, governments in Nigeria and other developing countries in Africa should support and promote urban agriculture by formalising land use through physical planning and development regulations.

8. References

Addo, K.A. (2010). Urban and Peri-Urban Agriculture in Developing Countires studies using Remote Sensing and In Situ Methods. *Remote Sensing, 2*, pp.497-513. doi:10.3390/rs2020497

Adeniyi, P.O. & Omojola, A. (1999). Land use/Land cover change evaluation in Sokoto-Rima Basin of N.W. Nigeria based on Archival Remote sensing and GIS techniques. In P.O. Adeniyi (Ed.), *Geo-information Technology Application for Resource and Environmental Management in Africa.* AARSE, pp. 143-172.

Ajibola, M.O., Adewale, B.A. & Ijasan, K.C. (2012). Effects of Urbanisation on Lagos Wetlands. *International Journal of Business and Social Science, 3*(17), pp.310-318.

Ashbindu Singh, H.S., Foresman, T. & Eugene, A.F. (2001). Status of world's remaining closed forests: An assessment using satellite data and policy options. *Journal of the Human Environment*, *67-69,* pp.10.

Cofie, O.O., Veenhuizen, R. & Drechsel, P. (2003). Contribution of Urban and Peri-urban Agriculture to Food security in Sub-Saharan African. Paper presented at Africa session of 3rd WWF, Kyoto, 17th March, 2003.

Dekolo, S., Oduwaye, L. & Nwokoro, I. (2016). Urban Sprawl and Loss of Agricultural Land in Peri-urban Areas of Lagos. *Munich Personal RePEc Archive*. *5*(2). pp.20-33.

Enaruvbe G.O & Atedhor G.O. (2015). Spatial Analysis of Agricultural land-use change in Asaba, Southern Nigeria. Ife Journal of Science. 17(1), pp. 65-74

Fabiyi, O.O. (2006). Urban Land Use Change Analysis of a Traditional City from Remote Sensing Data: The Case of Ibadan Metropolitan Area, Nigeria. *Human and Social Sciences Journal, 1*(1), pp.42-64.

Fournier, F. (1996). The city: so human an ecosystem. *Natural Resources, 32*, pp.1-16.

Gasu, M.B., Nicholas, E., Bidmus, M.A. & Dawam, P. (2016). Geospatial Analysis of Land use Dynamics in Osogbo between 1986 and 2012. *Abuja Journal of Geography and Development, 4*(1), pp.1-18.

Kharel, G. (2010). *Impacts of Urbanization on Environmental Resources: A Land Use Planning Perspective*. M.Sc Thesis, Department of City and Regional Planning, University of Texas at Arlington.

Kulak, M., Graves, A. & Chatterton, J. (2013). Reducing greenhouse gas emissions with urban agriculture: a life cycle assessment perspective. *Landscape and urban planning,* 11(1), pp.68-78.

Kumar, V. & Kumar, V. (2016). Urban Spatial Growth and Landuse Change Detection Analysis of Aligarh City, Uttar Pradesh, India Using High Resolution Remote Sensing Data, Geographical Information System (Gis) And Global Positioning System (Gps) Techniques International *Journal of Engineering Technologies and Management Research, 3*(9), pp1-11.

Marcotullio, P.J., Braimoh, A.K. & Onishi, T. (2008). The impact of urbanization on soils. In Braimoh, A.K. & Vlek, P.L.G. (Eds.), *Land use and soil resources.* Sweden: Springer, pp.201-250.

Mir, A.A., Ahmed, P., Bhat, P.A. & Singh, H. (2016). Analyzing Land Use/Land Cover Change Using Remote Sensing and GIS Techniques in Pohru Watershed of Kashmir Valley. *Journal of Research and Development, 16*, pp.104-111.

Mougeot, Luc J.A. (2005). *ACROPOLIS. The Social, Political and Environmental Dimensions of Urban Agriculture*. London: Earthscan.

Naab F.Z., Dinye R.D. & Kasanga R.K. (2013). Urbanisation and Its Impact on Agricultural lands in growing cities in Developing Countries: A case study of Tamale in Ghana. *Modern Social Science Journal, 2*(2), pp.256-287.

Nugent, R. (2000). The impact of urban agriculture on the household and local economies. In: Bakker, N.M., Dubbeling, S., Guendel, U., Sabel Koschella, H. & de Zeeuw (eds.). *Growing Cities, Growing Food, urban agriculture on the policy agenda*. DSE Germany, pp.67-97.

Oloukoi J., Oyinloye R.O. &Yadjemi, H. (2014). Geospatial analysis of urban sprawl in ile-ife city, Nigeria. *South African Journal of Geomatics, 3*(2), pp.128-144.

Rees, W.E. (1997). *Why Urban Agriculture? Notes for the IDRC Development Forum on Cities Feeding People: A Growth Industry.* Vancouver: Canada's Office of Urban Agriculture. Available at: http://www.cityfarmer.org/rees.html

Schmidt, E. & Kedir, M. (2009). Urbanization and Spatial Connectivity in Ethiopia: Urban Growth Analysis Using GIS. International Food Policy Research Institute (IFPRI). Ethiopia Strategy Support Programe 2 (ESSP2), Discussion Paper No. ESSP2 003.

Tokula, A.E. & Ejaro, S.P. (2013). Dynamics of land use/land cover changes and its implication on food security in Anyigba, North Central Nigeria. *Conference Journal of Environmental Studies, 7*, pp.42-52.

UN-HABITAT, (2008). *State of the African Cities Report 2008: A Framework for Addressing Urban Challenges in Africa.* Nairobi: United Nations Human Settlements Programme

Wu, Q., Li, H., Wang, R., Paulussen, J., Hec, Y., Wang, M. & Wang, Z. (2006). Monitoring and predicting land use change in Beijing using remote sensing and GIS. *Landscape and Urban Planning*, *78*(4), pp.322-333.

Yuan, F., Sawaya, K.E., Loeffelholz, B.C. & Bauer, M.E. (2005). Land cover classification and change analysis of the twin cities (Minnesota) metropolitan area by multi-temporal land sat remote sensing. *Remote Sensing of Environment, 98*(2-3), pp.317-328.