

# ATBU

Journal of  
Environmental  
Technology

# A'JET

**Vol. 10 No. 1**

**June, 2017**

[www.ajol.info/index.php/atbu](http://www.ajol.info/index.php/atbu)

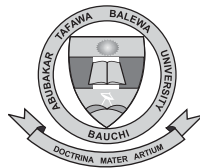


# **ATBU Journal of Environmental Technology (A'JET)**

**Volume 10, Number 1**

**June, 2017**

[www.ajol.info/index.php/atbu](http://www.ajol.info/index.php/atbu)



A Publication of the  
Faculty of Environmental Technology (FET)  
Abubakar Tafawa Balewa University (ATBU) Bauchi

EDITORIAL BOARD MEMBERS

**Prof. Y. O. Sadiq** *Department of Industrial Design, ATBU, Bauchi - **Chairman/ Editor-In-Chief***

**Prof. J. B. Kaltho** *Department of Urban & Regional Planning, ATBU, Bauchi*

**Prof. A. A. Umar** *Department of Industrial Design, ATBU, Bauchi*

**Dr. A. S. Bustani** *Department of Building, ATBU, Bauchi*

**Dr. U. A. Jalam** *Department of Architecture, ATBU, Bauchi - **Managing Editor***

**Dr. I. I. Inuwa** *Department of Quantity Surveying, ATBU, Bauchi*

**Dr. A. C. Abdullahi** *Department of Environmental Management Technology, ATBU, Bauchi*

**Dr. Y. L. Gambo** *Department of Estate Management and Valuation, ATBU, Bauchi - **Editorial Secretary***

**Dr. Mohammed Shuaibu Ade** *Department of Surveying & Geoinformatics - **Editorial Assistant I***

EDITORIAL ADVISORY:

**Prof. D. A. Mu'azu** *Dept. of Building, Federal University of Technology, FUT, Minna, Niger State*

**Prof. A. Q. Ibrahim** *Dept. of Chemistry, Faculty of Science, Nigeria Police Academy, Wudil, Kano State*

**Dr. Abdullahi Abubakar** *Department of Architecture, ABU, Zaria, Kaduna State*

**Prof. Ahmed A. Musa** *Department of Surveying and Geoinformatics, Federal University of Technology, FUT, Minna, Niger State*

EDITORIAL DESK CLERK:

**Mohammed Usman Adekunle** - *Department of Estate Management and Valuation, ATBU, Bauchi*

Published by Faculty of Environmental Technology, ATBU Bauchi, Bauchi State, Nigeria

© Faculty of Environmental Technology, ATBU Bauchi

**ISSN: 1596-6305**

All Rights Reserved. No part of this journal may be reproduced or published in any form without the written permission of the Faculty of Environmental Technology, Abubakar Tafawa Balewa University, Bauchi, Nigeria

**Cover Photo/Design:** "ATBU Recreational Sit-outs" - Y. O. Sadiq and R. S. Garba

**Text Layout:** R. S. Garba

## Contents

Editorial Board Members	ii
Subscription Guidelines	v
List of Contributors	vii
Acknowledgments	viii
Editorial	ix
 A. A. Jimoh, N. T. Surajudeen-Bakinde, N. Faruk, and O. W. Bello Assessment of Multipath and Shadowing Effects on UHF Band in Built-Up Environments - - - - -	     1
A. Adeyemi, D. Martin, R. Kasim, and A. I. Adeyemi Facilities Improvement for Sustainability of Existing Public Office Buildings in Nigeria - - - - -	     12
O. Lawal and A. O. Asimiea Suitability of gas flare locations for Mini Gas-To-Liquid Technology Deployment in Nigeria - - - - -	     35
A. I. Anunobi, O. F. Adedayo and A. J. Adedokun Housing Data Base for Sustainable Housing Provision - - - - -	     53
I. A. Olatunji, B. M. Wahab, M. T. A. Ajayi and <a href="#">H. S. Liman</a> Influence of Macroeconomic Factors on Residential Property Returns in Abuja, Nigeria - - - - -	     67
A. S. Adeogun, Y. L. Gambo and I. Luqman Comparative Analysis of Direct and Indirect Property Investment Returns in Abuja, Nigeria - - - - -	     84
W. Babatunde, O. Gbenga, A. Sunday, D. Wasiu and S. Oyewale Risk-return Performance of Residential Property Investment in Abuja, Nigeria - - - - -	     95



T. T. Dugeri				
Sustained Forced Sale Value Opinion Advice in Nigerian				
Valuation Practice: The Recurring Face of a Bad Coin	-	-	-	109
N. Gambo, I. Said and I. I. Inuwa				
Client Financial Support for Mitigating Cost Factors Affecting				
Performance of Small Scale Contractors in Nigeria	-	-	-	119
P. S. Nimlyat, A. A. Isa and N. C. Gofwen				
Performance Indicators of Indoor Environmental Quality (IEQ)				
Assessment in Hospital Buildings: A Confirmatory Factor				
Analysis (CFA) Approach	-	-	-	139
H. B. Bwala, V. Istifanus and A. M. Isa				
Sanitation Health Risk and Safety Planning in Urban				
Residential Neighbourhoods	-	-	-	160

## Subscription Guidelines

### **Aim and Scope of the Journal**

The Journal of Environmental Technology is devoted to the publication of papers which advance knowledge of practical and theoretical issues of the environmental technology.

Selection of papers for publication is based on their relevance, clarity and individuality. Importantly too will be the extent to which they advance knowledge and understanding, as well as their prospect for inspiring development and further research. The aim of the Journal is to provide an avenue for dissemination of academic research findings in the environmental and allied technologies; and on the flipside, provoke meaningful discussions and debates between academics and field practitioners of the natural and the built environments. The Journal will therefore accept for publication research results of both the natural; the technological; and the built environment.

### **Assessment**

All papers submitted for publication are referred by a maximum of three (3) selected specialists, as appropriate to the subject matter of the paper.

### **Submission of Articles**

Articles are to be typewritten, double spaced on one side of good quality A4-size paper. Three (3) copies of the article along with N6, 000.00 processing/ review fee should be sent to: The Editor-In-Chief, ATBU Journal of Environmental Technology, School of Environmental Technology, Abubakar Tafawa Balewa University, ATBU, P.M.B, 0284, Bauchi. (Please note: a maximum of 15 pages is advised for article submitted, i.e. N1, 000.00 will be surcharged for every page in excess of 15 pages).

### **Title of Paper**

The title of paper should be about 15 words, in title case letters. It should unambiguously reflect the contents of the paper.

### **Name and Address of Author(s)**

The name of author(s), emphasizing surname, should follow below title of the article, with *active* address. (Provide footnote to indicate any change in address).

### **Abstract**

The study abstract should be clear, concise and not more than 200 words; reflecting aim, objective/s, method/s, major findings, conclusion and recommendation or implication of the research.

### **Introduction**

The introduction should contain the purpose of the study being reported. Literature cited must be discussed to show the relationships between the study report and body of existing *relevant* knowledge.

### **“Research Method”/“Experimental Procedure”, etc.**

Generally acceptable (scientific) terms should be used. Details should refer to literature cited. clarify the research design, procedures adopted, problems encountered and the solutions as they apply to the study.

### **Units, Symbols and Abbreviations**

Only S. I. units as defined by the International Standards Organization would be accepted. Abbreviation or acronym should be written in full at first mention.

### **Tables**

Tables should be numbered consecutively throughout the paper (with Arabic numerals), referring to them in the text as Table 1, Table 2, etc. The use of vertical rules should be avoided. Tables should not duplicate results presented in graphs.

### **Illustrations**

Illustrations in the form of maps, diagram and graphs/ charts should be sequentially numbered and given brief titles, which should be written below the illustration, in Arabic numerals (e.g., Figure 1, Figure 2, etc.); Plates to be numbered in Roman numerals (e.g., PLATE I:, PLATE II:, etc).

### **References**

References should be made at the end of the paper and should adopt the following APA format: Author/s - year of publication - title of paper/edition or volume (for book and journal) - publisher & town of publication.

### **Final Submission/ Fee**

Contributors will receive copies of their referred manuscripts for amendments by assessor/s. Corrected version of the paper shall be returned together with the assessor's amended manuscripts to the Editor-in-Chief. When finally accepted, soft/ electronic version of the paper will be submitted by author/s with N20, 000.00 page charge/ publication fee (as currently reviewed).

### **Entitlement to Journal Copy**

Every article (NOT every author) shall receive a copy of the Journal. (Re-prints may be ordered from the Editor, prior to publication). The journal sells for N1, 200.00 per copy.

All fees are subject to review please.

## List of Contributors

- A. A. Jimoh**, Department of Electrical and Electronics Engineering, University of Ilorin  
**N. T. Surajudeen-Bakinde**, Department of Electrical and Electronics Engineering, University of Ilorin  
**N. Faruk**, Department of Telecommunication Science, University of Ilorin  
**O. W. Bello**, Department of Information and Communication Science, University of Ilorin  
**A. Adeyemi**, Faculty of Environmental Technology, Abubakar Tafawa Balewa University, Bauchi  
**D. Martin**, Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, Batu Pahat  
**R. Kasim**, Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, Batu Pahat  
**A. I. Adeyemi**, Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, Batu Pahat  
**O. Lawal**, Department of Geography & Environmental Management, University of Port Harcourt  
**A. O. Asimiea**, Department of Crop and Soil Science, University of Port Harcourt  
**A. I. Anunobi**, Department of Architecture, Federal University of Technology, Minna, Niger State, Nigeria  
**O. F. Adedayo**, Department of Architecture, Federal University of Technology, Minna, Niger State, Nigeria  
**A. J. Adedokun**, Department of Architecture, Federal University of Technology, Minna, Niger State, Nigeria  
**I. A. Olatunji**, Department of Estate Management and Valuation, Federal University of Technology, Minna  
**B. M. Wahab**, Department of Estate Management and Valuation, Federal University of Technology, Minna  
**M. T. A. Ajayi**, Department of Estate Management and Valuation, Federal University of Technology, Minna  
**H. S. Liman**, Department of Estate Management and Valuation, Federal University of Technology, Minna  
**A. S. Adeogun**, Department of Estate Management, University of Ilorin  
**Y. L. Gambo**, Department of Estate Management & Valuation, Abubakar Tafawa Balewa University Bauchi  
**I. Luqman**, Department of Estate Management & Valuation, Federal University of Technology Minna  
**B. Wahab**, Department of Estate Management and Valuation, Federal University of Technology, Minna  
**G. Omorenikeji**, Department of Estate Management and Valuation, Federal University of Technology, Minna  
**S. Adekunle**, Department of Estate Management, University of Ilorin  
**W. Durosinmi**, Department of Estate Management, University of Ilorin  
**O. Shittu**, Department of Estate Management, Federal Polytechnic, Birnin-Kebbi  
**T. T. Dugeri**, Department of Estate Management, Kaduna State Univeristy  
**N. Gambo**, Department of Quantity Surveying Abubakar Tafawa Balewa University, Bauchi  
**I. Said**, Project Management Programme UniversitiSains Malaysia, Pulau-Pinang, Malaysia  
**I. I. Inuwa**, Department of Quantity Surveying Abubakar Tafawa Balewa University, Bauchi  
**P. S. Nimlyat**, Department of Architecture, Faculty of Environmental Sciences, University of Jos, Nigeria  
**A. A. Isa**, Department of Architecture, Faculty of Environmental Technology, Abubakar Tafawa Balewa University, Bauchi, Nigeria  
**N. C. Gofwen**, Department of Architecture, Faculty of Environmental Sciences, University of Jos, Nigeria  
**H. B. Bwala**, Department of Urban and Regional Planning Abubakar Tafawa Balewa University, Bauchi  
**V. Istifanus**, Department of Urban and Regional Planning Abubakar Tafawa Balewa University, Bauchi  
**A. M. Isa**, Department of Urban and Regional Planning Abubakar Tafawa Balewa University, Bauchi



## Acknowledgements

Our acknowledgment this time is climaxed on the Tertiary Education Trust Fund (tetfund), which has adjudged the journal and granted *maiden* financial intervention in aid of its publication! This is 14 years after the faculty journal was floated to publish, in the 2002/2003 academic session.

(Also warmly acknowledged in retrospect therefore are the pioneering spirit and courage of Prof D. A. Mu'azu and Dr. A. S. Bustani who *buoyed* the float then, when there was no semblance of funding. The sacrificing spirit too of successive faculty administrators of the journal's affair kept it further afloat till date).

Tetfund intervention sustained, the impact will be far reaching; further upgrading A'JET's quality, lowering (if not phasing out) peer-review fee, page charges and even unit price of published journal. (We virtually doubled above charges to meet the release of this edition, just prior to the *signal* of tetfund aid).

While registering tetfund's intervention in the annals of A'JET with gratitude, we reiterate appreciation to the ATBU management for bridging hitherto gap between the duo; we do same to Dr. Y. L. Gambo (Editorial Secretary) for dogged follow up; as we do to Zakari Ibrahim of Bursary department and, the like desk facilitators of the office of DVC (Academics), ATBU, Bauchi.

**Y. O. Sadiq**

Editor-in-Chief

## Editorial

Eleven articles earmarked for volume 10 number 1 are herein published - in the June 2017 edition. It is a heave of sigh - for *forthcoming* volume 10 (2) of December 2017 - to keep afloat A'JET's projection of biannual editions.

Ten out of the eleven articles are more or less field-reported entries; from Construction, Housing, Architecture, Real Estate enquiries to Environmental Management Technology. And, one article is a literature-informed review.

Ultra-High Frequency (UHF) telecom signal obstacles in the built-up environment were empirically investigated and analyzed by Jimoh, Surajudeen-Bakinde, Faruk, and Bello. The building design features of a cosmopolitan public office building in Abuja were examined – toward sustainability of the built environment, by Adeyemi, Martin, Kasim, and Adeyemi. A sight suitability analysis for mini Gas-to-Liquid (MiniGTL) Technology deployment to Gas Flaring locations, in order for prospective commercialization of the “flared gas” was the expedition of Olanrewaju and Asimiea. Establishing occupier-sensitive data base for sustainable mass housing provision in Nigeria was explored by Anunobi, Adedayo and Adedokun. The *statement of problem* of Olatunji, Wahab, Ajayi and Liman concerned the adverse influence exerted on residential property returns in Abuja, Nigeria, by economy/macro-economic factors. In similar clime was a comparative analysis of direct and indirect property investment returns in Abuja, by Adeogun, Gambo and Luqman. Also examined was the performance of residential property market in Abuja to determine its stability, amidst associated risks, by Wahab, Omorenikeji, Adekunle, Durosinmi and Shittu. In his own article, Terzungwe sought to expose the incessant “Forced Sale Value” practice in the Nigeria Mortgage Valuation arenas, in spite of International Valuation Standards. Assessment of relationship between cost factor/client financial support and the performance of small scale construction firms in Nigeria was ex-rayed by Gambo, Said and Inuwa. The article of Nimlyat, Isa and Gofwen identified and validated the key indicators of Indoor Environmental Quality parameters of assessment in public hospital buildings. The eleventh (review) article by Bwala, Istifanus and Isa examined sanitation health risks and safety planning for sustainable management of urban environment.

Y. O. Sadiq  
Editor-in-Chief

## **Risk-return Performance of Residential Property Investment in Abuja, Nigeria**

**WAHAB Babatunde<sup>1</sup>, OMORENIKEJI Gbenga<sup>2</sup>, ADEKUNLE Sunday<sup>3</sup>,  
DUROSINMI Wasiu<sup>4</sup> and SHITTU Oyewale<sup>5</sup>**

<sup>1&2</sup>**Department of Estate Management and Valuation, Federal University of  
Technology, Minna**  
(Corresponding author: [wahabbabatunde2@gmail.com](mailto:wahabbabatunde2@gmail.com)).

<sup>3&4</sup>**Department of Estate Management, University of Ilorin.**

<sup>5</sup>**Department of Estate Management, Federal Polytechnic, Birnin-Kebbi.**

### **Abstract**

The paper examined the performance of residential property market in Abuja with a view to determining the most performed market and the level of associated risk. The study utilized both descriptive (average rate of returns and coefficient of variation) and inferential methods (ANOVA and HSD). The results of descriptive analyses across twelve markets showed that Gwarimpa 3B/R and 4B/R markets performed better than other locations and it is the least volatile markets at 35% and 43% respectively, on every comparable average rate of property returns for 3B/R AND 4B/R at 11.05% and 12.5% respectively. The result of ANOVA revealed that the F-statistics at 3.1061 and 2.6401 for 3B/R and 4B/R are statistically significant at p-value of 0.0127 and 0.0288 (p-values < 0.05). The result of honest significant difference (HSD) revealed that the bulk of significant differences in property returns were found in Maitama markets. Therefore the study concludes that returns from Gwarimpa markets are relatively stable and having the least risk per unit of 3B/R and 4B/R property investment with comparable average returns with other markets for any prudent investor.

**Keywords:** *property investment performance, risk-return analysis, ANOVA and HSD-tukey test.*

## Introduction

Investment performance is an examination of annual total returns produced by an investment; it is basis of making comparative analysis among investment options. Return on capital investment is a good measure of performance of investment portfolio, in that, it represents success or otherwise of the investment and the return on investment is referred to the amount of money earned or produced over the property investment period per the amount invested (Kalu, 2001).

The most fundamental unit of measurement of performance is the returns, and portfolio manager refers to this unit of measurement as holding period of return (HPR) (Baum, 2002). Holding period of return is important in calculating the rate of return on investment. Udobi *et al.*, (2013) referred to this return as capital appreciation in addition to net rental income over a given period of consideration as expressed as the value of original purchase price. Real property return as a measure of performance is a constituent of two elements, income and capital appreciation (Hargitay & Yu, 1993).

Furthermore, income from property investment is referred to as rent and capital appreciation is referred to as the appreciation of property value over time (Hoesli & MacGregor, 2000). More importantly the need to measure the performance of property investment leads to

analysis of risk factor to which the return is exposed (Kalu 2001; Udobi *et al.*, 2013). Risk is simply the variability in return around its expected return. Therefore, relative performance of property investment is a function of risk and returns inherent in property investment. The most prudent investors usually diversify their investment portfolio as way of minimizing the effect of risk, therefore return to risk ratio is a measure of relative performance of different property investment portfolio in the market (Amidu *et al.*, 2007).

This study determined the risk-return performance of residential property investment relatively across selected markets, in order to determine the most profitable market in Abuja residential market in Nigeria. The incessant failure of real investment has been attributed to the poor analysis of past and present market situations upon which the future investment decisions will be based. Therefore the need to measure performance of residential investment is more than mere watch of rental movement.

The objectives of the paper are to examine the performance of residential investment returns across Abuja markets with a view to determining the quantum of risk to be taken to earn an expected return; to establish the most secured investment market; to examine the level of variation in residential property returns across the markets; and to ascertain the market that constitutes the highest or bulk of returns.

## The Conceptual Property Market Performance Approach: Literature Review

Property investment performance is a measure of returns from real property investment market. Returns from property investment market could be total, capital and income returns. Therefore performance from property market can be determined through the returns.

Money weighted rate of return (MWRR) is otherwise referred to as total return in many literature (Hargitay & Yu, 1993; Hoesli & MacGregor, 2000; Baum 2002). Money weighted return or total return is related to internal return of an investment and can be defined as generic description applied to any calculation where income and expenditure are discounted over time. This is to arrive at either internal rate of return or present value, and thereby the return arrived at is a return for the whole period known as total return (Dubben & Sayce, 1991). Weighted money rate of return is also the discount rate which equated the total sum of all the realizable cash flows and the capital sum of the asset at the end of the holding period to the initial capital value of the investment asset at the beginning of the holding period (Hargitay & Yu, 1993). This definition provides a basic claim for weighted money rate of return as true rate of return, equated yield and redemption yield.

Hoesli and MacGregor (2000) have therefore identified weighted money rate of return (MWRR) with “total return” which is simply

the ratio of net capital sum plus net income to initial capital value at beginning of a given period. They therefore described MWRR as a measure of return for a single period. Baum (2002) regarded MWRR as effectively the same measure of internal rate of return of investment and rightly pointed out that MWRR is just an approximate to the internal rate of return (IRR). Both rates equate only when the investment is held for one period, the whole income received at end of the period and there is no further capital injection or expenditure within the period. Where there is no further capital expenditure on the investment during the measurement period, money weighted rate of return or total return is expressed according to Baum (2002) as follows:

$$\text{Total Return} = \frac{CV_t - CV_{t-1} + NI_t}{CV_{t-1}} \quad \text{equation 1}$$

( $CV_t$  is the capital value at the end of period  $t$ ,  $CV_{t-1}$  is the capital value at the beginning of period  $t$ , i.e. at end of period  $t-1$ , and  $NI_t$  is the net income received). Total returns approach is a constituent of both the capital return approach and income return approach (i.e. total return comprises of capital and income returns). It has been used as best measure of performance in many literature as compared with other approaches (Dabara, 2014; Umeh & Oluwasore, 2015).

## Literature Review

Sequel to the findings from previous studies on the performance of real property investment, analysis of average returns and risks have been



the major indicators of performance. Therefore the performance of the property market is examined in term of level of volatility in relation to average rate returns. Results of previous studies indicated different directions of performance. Bello (2003) analyzed the performance of residential and securities' investment in Lagos. The performance was measured using risk-adjusted return from income and capital growth or capital appreciation. The analysis featured standard deviation and coefficient of variation (risk parameters) to establish the risk content of the investment and risk to reward ratio (risk to return); the result showed residential investment performed below securities and yielded low risk. Oyewole (2006) examined the direct and indirect residential investment of listed companies and UACN within a given period (1999-2004), having employed relative important index, standard deviation, coefficient of variation and Sharpe ratio as performance measurement indicators.

The study showed that indirect investment performed better than direct investment in absolute term (i.e. rate of return). Conversely direct property investment performed relatively better than indirect property investment on the basis of risk-adjusted return. This finding is in line with Bello (2003) with the same method. Haw (2003) examined residential property investment performance in Malaysia, adopting coefficient of variation and Sharpe ratio, the result showed that terrace building performed

better than any other types. Ooi and Liow (2004) examined the risk adjusted return of real estate securities in developing countries of Asia, the result revealed that five out of seven countries employed for the study underperformed on the basis of risk adjusted return between the period of 1992-2002. Amidu *et al.* (2007) examined the performance of real estate security and investment asset in Nigeria Stock market. Performance indicators such as normal return and risk adjusted return were employed for the study.

The result of the study suggested that real property investment outperformed on the basis of nominal return and underperformed on the basis of risk-adjusted return. Udobi *et al.* (2013) analysed comparative performance of residential property in Anambra. Analysis of risk on residential investment was carried out using standard deviation and coefficient of variation as tools used to determine the performance. The result showed that capital and rental values appreciate overtime, and the rate of return in residential investment is more stable in relative to bank shares. This finding is consistent with that of previous studies (Bello, 2003; Oyewole, 2006).

The study concludes that property investment is therefore a preferred investment portfolio than bank shares. Oyewole (2013) examined the comparative performance of residential and commercial investment in Ilorin, the study employed standard deviation, coefficient of

variation and sharpe index as a performance measurement indicators. The result showed that residential property with higher coefficient variation (0.74) has been risky than commercial property at 0.46 coefficient. The overall sharpe index showed commercial investment outperformed residential investment. Umeh (2014) measured relative performance of real estate investment stock before and after stock market crash, having employed Modigliani analysis ( $M^2$ ). The result showed real estate performed better in the post market crash than before. Ade (2015) evaluated the performance of investment in residential properties at different locations in Ado. The study employed income return from residential property investment across locations.

The study discovered that rental and capital values grew overtime but the rate of growth was not static, therefore the return from property investment at GRA is higher than any location. Olanrele *et al.* (2015) studied the comparative REIT dividend performance in Nigeria and Malaysia between 2008-2014. Risk-return and risk-adjusted performance indicators were adopted as basis of investment performance, the result revealed that Malaysian market outperformed Nigeria market on the basis of both average return and risk-adjusted return, while Nigeria outperformed on the basis of risk-return. Bamidele (2015) carried out analysis of residential investment performance in Akure. Having analyzed two major government housing estates and employed Levee's test for

equality of variance and independent sample test to estimate variability in investment performance. The result showed that residential investment experienced continuous increasing trends over a period and no significant variability in the performance across the study areas.

The study therefore concludes that good housing policies and basic supportive infrastructure have significant impact on residential property investment performance. Wahab *et al.* (2015) examined the performance of three bedroom residential investment across four location in Abuja, they adopted coefficient of variation and sharpe ratio, the result showed that Gwarimpa market outperformed others on the basis of risk-returns but under performed on the basis of sharpe index when compared with return on federal government bond. This finding is consistent with previous studies (Bello, 2003; Oyewole, 2006; Udobi *et al.*, 2013). The previous studies have therefore employed the same performance indicators such as average rate of returns, standard deviation, coefficient of variation and sharpe index to measure the performance across the choice of their locations. Investors in Abuja also need to know the most profitable area of property investment. Following the huge development of residential infrastructure across Federal Capital City (FCC), there is need for investors to achieve returns equivalent or more than capital invested. This study determines the profitability of residential

investment across the selected areas, and on what basis is the residential investment performing in the light of the presence of housing infrastructural development. This actually distinguishes this study from previous study.

### Study Area

Abuja, the Federal Capital Territory (FCT) is on the longitude  $6^{\circ} 44'$  to  $7^{\circ} 37'$  E and latitude  $8^{\circ} 23'$  to  $9^{\circ} 28'$  N. Federal capital city (FCC) is the Abuja Municipal Area Council (AMAC) having four phases of development. The map of Nigeria (Fig. 1) shows the map of the Federal Capital Territory (FCT) in Figure 2, from which the map of the Federal Capital City



### Methodology

The primary data for the study comprised of rent and actual sale data from registered estate surveying and valuation firms in Abuja from 2001-2015, which were collected through the structured questionnaires. The study utilized systematic random sampling to select residential properties that have sufficient information on rent and sales between 2001 and 2015. The information on residential properties'

transactions was primarily sourced from 78 residence Estate Surveyors and Valuers in Abuja. Only 3B/R and 4B/R residential property units with sufficient information on rent and sale transactions were sampled for study. The total population of residential transactions on rents and sales were 1,213 and 429 respectively. The sample size adopted for each of residential areas of the city was quantitatively determined using the sample

size model developed by Frankfort-Nachmias (1996) to arrive at total 436 and 286 for rent and sales respectively. The sample size model developed by Frankfort-Nachmias (1996) is described as follows:

$$n = \frac{Z^2 pqN}{e^2 (N-1) + Z^2 pq} \quad \text{equation 2}$$

Where n = sample size, N = population size p = 95% confidence level of the target population q = 1- p, e = Acceptable error Z = 1.96 (the standard normal deviation at 95% confidence level)

The method of analysis used both descriptive (average rate of returns, coefficient of variation, and Sharpe ratio) and inferential methods (analysis of variance and Honesty Significant Difference- HSD-Tukey). Annual holding period of return (total return) was determined by using total return model developed by Baum (2002) as follows:

$$AHPR = \frac{(CV_t - CV_{t-1}) + NI}{CV_{t-1}} \quad \text{equation 3}$$

Where CV<sub>t</sub> is capital value at end of the year, CV<sub>t-1</sub> is the capital value beginning of the year and NI represents net income or rent.

Average Annual Rate of Return =

$$\left( \sqrt[n]{(1+X_1)(1+X_2)\dots(1+X_n)} - 1 \right) \quad \text{equation 4}$$

Where X represents annual holding period of return (AHPR) and n represents number of year under study.

Measure of volatility in property investment adopted by Udobi *et al.* (2013) was used to

determine both standard deviation and coefficient of variation expressed in equation 5 and 6 as follows :

$$S.D = \frac{\sqrt{\sum (X_i - \bar{X})^2}}{N} \quad \text{equation 5}$$

Where X<sub>i</sub> is individual observation and  $\bar{X}$  is the mean and N is total number of observation. Coefficient of variation (C.V) which measure relative performance was determined as follows:

$$C.V = \frac{S.D}{\bar{R}} \quad \text{equation 6}$$

Where S.D is standard deviation and  $\bar{R}$  is the mean return.

Sharpe ratio adopted by Haw (2003) which measures the performance on the basis of risk adjusted return was used to determine the risk-adjusted expressed in equation 7 as follows:

$$\text{sharp index} = \frac{\bar{R} - RF}{S.D} \quad \text{equation 7}$$

$\bar{R}$  is mean, RF is the free risk return on government bond was given by Central Bank of Nigeria at 10.35% which matured between 2014-2017 and SD is standard deviation.

## Results and Discussion

The study has therefore gathered sufficient information only on both 3B/R and 4B/R residential investment. There is no insufficient information on sales and rent transactions on 2B/R and 5B/R respectively residential property units. Table 1 shows the average rate of returns on three bedroom property

investment across selected area of Abuja between 2001 and 2015. The highest rate of returns in Maitama, Gwarimpa, Wuse, Utako, Area 1 and Area 10 were observed in 2010, 2001, 2001, 2001, 2002 and 2002 at 52.9%, 21.93%, 34.66%, 38.32%, 43.25% and 27.75%

respectively. This indicated that there was boom in residential property investment between 2001 and 2002 in most the selected areas.

Table 4 shows the result of descriptive analysis of four bedroom residential market in selected

**Table 1: Average Rate of Total Returns (%) on Three Bedroom (3B/R) Properties in Selected Areas of Abuja**

Years	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>Maitama</b>	30.05	22.45	13.42	12.61	37.01	14.97	9.51	16.45	17.03	52.79	28.26	15.72	41.86	3.92	14.97
<b>Gwarimpa</b>	21.93	16.21	11.98	11.34	8.35	10.58	9.26	8.23	8.51	12.61	8.34	11.63	6.99	9.59	10.58
<b>Wuse</b>	34.66	3.75	10.03	4.81	17.03	7.07	17.45	11.06	4.23	3.53	19.07	8.12	6.72	12.98	12.98
<b>Utako</b>	38.32	23.01	9.54	8.64	9.54	3.02	16.97	10.38	6.77	6.62	20.01	3.8	19.42	3.01	6.77
<b>Area 1</b>	27.19	43.25	24.47	11.39	12.49	16.15	5.49	7.98	11.91	8.24	10.73	6.93	8.91	3.68	5.49
<b>Area 10</b>	17.36	27.75	17.21	6.32	10.02	6.67	13.64	7.39	10.56	14.77	10.19	11.16	6.68	7.34	13.64

Source: Field Survey 2015

Table 2 shows the result of performance of three bedroom residential market in selected areas of Abuja. On the basis of average rate of returns, Maitama Market outperformed others but underperformed on the basis of risk-return (coefficient of variation) at 63% (0.63). On the basis of average return, Gwarimpa market has an average return comparable to Wuse, Utako, Area 1 and Area 10 at 35% except Maitama, but outperformed other markets on the basis of risk-to-return ratio (coefficient of variation).

Gwarimpa offered the least risk per unit of three bedroom property investment at 35% (0.35) as compared with other markets; this indicates that Gwarimpa market is the most desirable investment market that offers a comparable average return at lowest risk. On the basis of Sharpe index, Maitama market performed better than others markets. Wuse, Utako, Area1 and Area 10 four bedroom market underperformed on the basis of risk-return at 76%(0.76), 80%(0.80), 75% (0.75) and 50%(0.50).

**Table 2: Performance of Three Bedroom Residential Property Investment Returns**

Descriptive	Maitama	Gwarimpa	Wuse	Utako	Area 1	Area 10
Average rate of Return	21.89	11.05	11.18	12.41	13.77	11.79
Standard Deviation	13.75	3.92	8.50	9.95	10.71	5.92
Coefficient of Variation	0.63	0.35	0.76	0.80	0.75	0.50
Sharpe Ratio	0.89	0.19	0.13	0.24	0.36	0.15

Computed from table 1

Table 3 shows the trends in average rate of returns on four bedroom property investment across selected residential markets in Abuja. The highest rate of returns in Matama, Gwarimpa, Wuse, Utako, Area 1 and Area 10 were observed in 2013, 2001, 2001, 2001, 2001

and 2002 at 44.73%, 23.15%, and 30.52%, 33.89%, 30.84% and 39.98% respectively. This result indicated that there was boom in residential property investment between 2001 and 2002 in most of the selected areas.



**Table 3: Average Rate of Total Returns (%) on Four Bedroom (4B/R) Properties in Selected Areas of Abuja**

Years	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>Maitama</b>	23.72	14.93	18.96	25.35	22.65	21.07	7.85	20.06	16.51	36.85	12.39	30.61	44.73	3.38	7.86
<b>Gwarimpa</b>	23.15	17.21	14.75	8.25	16.36	12.71	6.23	9.21	10.04	14.61	6.33	20.78	10.02	6.99	9.22
<b>Wuse</b>	30.52	3.98	5.74	4.13	19.93	7.39	19.59	6.12	16.02	5.17	11.64	6.99	11.05	11.94	19.91
<b>Utako</b>	33.89	3.24	14.63	3.84	16.89	6.65	18.6	10.78	12.41	3.85	11.47	16.56	8.21	11.47	10.78
<b>Area 1</b>	30.84	30.42	12.16	8.32	18.52	7.13	7.57	7.86	10.63	11.84	7.65	5.14	13.85	4.84	8.32
<b>Area 10</b>	33.38	39.98	13.19	17.01	15.05	9.77	1.58	12.09	6.84	3.72	11.47	15.42	13.35	3.35	15.05

Source: Field Survey 2015

areas of Abuja. On the basis of average rate of returns, Maitama outperformed other investment location but underperformed on the basis of risk-return. On the average rate of returns, Gwarimpa has a comparable return with other locations except Maitama, and outperformed other locations on the basis of risk –return ratio (coefficient of variation), Gwarimpa is the least risky market at 43% (0.43) as compared with other markets, this

indicates that Gwarimpa market is the most desirable investment market that offers higher return in relation to risk. On the basis of Sharpe performance indicator, Maitama market outperformed others. Wuse, Utako, Area 1 and Area 10 four bedroom market showed highest level of volatility in the rate of return at 67%(0.67), 66%(0.66), 72%(0.72) and 77% (0.77) respectively.

**Table 4: Descriptive Analysis Of performance of Four-Bedroom Residential Property Investment Returns**

Descriptives	Maitama	Gwarimpa	Wuse	Utako	Area 1	Area 10
Average Rate of Return	20.91	12.50	11.21	12.07	12.35	13.57
Standard Deviation	10.93	5.39	7.69	7.98	8.85	10.80
Coefficient of variation	0.52	0.43	0.67	0.66	0.72	0.77
Sharpe ratio	1.01	0.42	0.14	0.25	0.26	0.34

Table 5 Performance measurement indicators were used to rank the various residential investment markets. On the basis of both risk-return ratio (coefficient of variation) therefore Gwarimpa three and four bedrooms were ranked as first and second the most performed residential investment markets respectively,

followed by Maitama 4B/R and 3B/R. On the basis Sharpe performance index, therefore Maitama 4B/R and 3B/R were ranked as first and second the most comparable residential investment respectively with other alternative investment in Federal Government Bond (gilt-edged securities).

**Table 5: The Performance of Residential Property Investment markets in Selected Areas**

Location and Property type	Average Returns (%)	Risk (%)	Risk-return	Ranking	Sharpe Index	Ranking
Maitama 4B/R	20.91	10.93	0.52	4 <sup>RD</sup>	0.97	1 <sup>ST</sup>
Maitama 3B/R	21.89	13.75	0.63	5 <sup>TH</sup>	0.84	2 <sup>ND</sup>
Wuse 3B/R	11.18	8.50	0.76	9 <sup>th</sup>	0.10	12 <sup>RD</sup>
Wuse 4B/R	11.21	7.69	0.69	7 <sup>TH</sup>	0.11	11 <sup>TH</sup>
Gwarimpa 4B/R	12.50	5.39	0.43	2 <sup>ND</sup>	0.40	3 <sup>TH</sup>
Gwarimpa 3B/R	11.05	3.92	0.35	1 <sup>ST</sup>	0.18	10 <sup>TH</sup>
Utako 4B/R	12.07	7.98	0.66	6 <sup>th</sup>	0.22	8 <sup>th</sup>
Utako 3B/R	12.41	9.95	0.81	12 <sup>th</sup>	0.21	9 <sup>th</sup>
Area1 4B/R	12.35	8.85	0.71	8 <sup>th</sup>	0.23	7 <sup>th</sup>
Area1 3B/R	13.77	10.71	0.78	10 <sup>th</sup>	0.32	4 <sup>th</sup>
Area10 4B/R	13.57	10.80	0.80	11 <sup>th</sup>	0.30	5 <sup>th</sup>
Area10 3B/R	11.79	5.92	0.50	3 <sup>th</sup>	0.24	6 <sup>th</sup>

Extracted from Table 2 and Table 4.

Table 6 shows the result of analysis of variance on three bedroom revealed that the F-statistics (3.1061) is significant at p-value (0.0127) less than 0.05 level of significant, this indicates that variation in the returns across the study locations are statistically significant difference. On the other hand, analysis variance on four bedroom property return also revealed similar result

that the F-statistic (2.6401) is significant since the p-value (0.0288) is less than 0.05 level of significant. The significant difference in mean across areas may be due to locational factors. Post hoc test of honesty significant difference presented in Table 5 and 6 identify the market where these bulk of differences in both 3B/R and 4B/R property investment returns actually lie.

**Table 6: Analysis of Variance in Returns on Residential Property Investment**

Markets	Source of Variation	SS	Df	MS	F	P-value	F crit
3B/R	Between Groups	1288.117	5	257.6235	3.1061	0.0127	2.3231
	Within Groups	6967.053	84	82.94111			
	Total	8255.171	89				
4B/R	Between Groups	1050.249	5	210.0499	2.6401	0.0288	2.3231
	Within Groups	6683.287	84	79.56295			
	Total	7733.537	89				

Source: Computed from Table 1 and Table 3

Table 7 and 8 shows the result of post hoc test of honesty significant difference (HSD). HSD identified where the significant difference in 3B/R and 4B/R property returns computed in Table 4 actually lie within the study locations. Therefore the result showed that the significant differences actually lie between Maitama and Gwarimpa, Maitama and Wuse, Maitama and

Area 1, Maitama and Area 10 but not between Maitama and Utako. Therefore significant difference could not be found among other locations. This further implies that Maitama 3B/R and 4B/R property investment returns constitute higher return than any selected location in Abuja.

**Table 7: Multiple Comparison for 3B/R Property Investment Return (Tukey HSD).**

(I) Location	(J) Location	Mean Difference (I-J)	Std. Error	Sig.	95% Conf. Interval	
					Lower Bound	Upper Bound
MAITAMA	GWARIMPA	11.46429*	3.52991	.021	1.1507	21.7779
	WUSE	11.11000*	3.52991	.027	.7964	21.4236
	UTAKO	9.78571	3.52991	.073	-.5279	20.0993
	AREA 1	10.37429*	3.52991	.049	-1.9393	18.6879
	AREA 10	10.64214*	3.52991	.039	.3286	20.9557
GWARIMPA	MAITAMA	-11.46429*	3.52991	.021	-21.7779	-1.1507
	WUSE	-.35429	3.52991	1.000	-10.6679	9.9593
	UTAKO	-1.67857	3.52991	.997	-11.9921	8.6350
	AREA 1	-3.09000	3.52991	.951	-13.4036	7.2236
	AREA 10	-.82214	3.52991	1.000	-11.1357	9.4914
WUSE	MAITAMA	-11.11000*	3.52991	.027	-21.4236	-.7964
	GWARIMPA	.35429	3.52991	1.000	-9.9593	10.6679
	UTAKO	-1.32429	3.52991	.999	-11.6379	8.9893
	AREA 1	-2.73571	3.52991	.971	-13.0493	7.5779
	AREA 10	-.46786	3.52991	1.000	-10.7814	9.8457
UTAKO	MAITAMA	-9.78571	3.52991	.073	-20.0993	.5279
	GWARIMPA	1.67857	3.52991	.997	-8.6350	11.9921
	WUSE	1.32429	3.52991	.999	-8.9893	11.6379
	AREA 1	-1.41143	3.52991	.999	-11.7250	8.9021
	AREA 10	.85643	3.52991	1.000	-9.4571	11.1700
AREA 1	MAITAMA	-10.37429*	3.52991	.049	-18.6879	1.9393
	GWARIMPA	3.09000	3.52991	.951	-7.2236	13.4036
	WUSE	2.73571	3.52991	.971	-7.5779	13.0493
	UTAKO	1.41143	3.52991	.999	-8.9021	11.7250
	AREA 10	2.26786	3.52991	.987	-8.0457	12.5814
AREA 10	MAITAMA	-10.64214*	3.52991	.039	-20.9557	-.3286
	GWARIMPA	.82214	3.52991	1.000	-9.4914	11.1357
	WUSE	.46786	3.52991	1.000	-9.8457	10.7814
	UTAKO	-.85643	3.52991	1.000	-11.1700	9.4571
	AREA 1	-2.26786	3.52991	.987	-12.5814	8.0457

Computed data in Table 1. \*. The mean difference is significant at 0.05 level.

**Table 4.8: Multiple Comparison Of 4B/R Property Investment Return (Tukey HSD)**

(I) Location	(J) Location	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MAITAMA	GWARIMPA	12.74429	3.30728	.019	-.9188	18.4074
	WUSE	9.91786*	3.30728	.051	.2548	19.5810
	UTAKO	9.04071	3.30728	.080	-.6224	18.7038
	AREA 1	12.93500	3.30728	.010	-.9281	18.3981
	AREA 10	10.34714	3.30728	.040	-2.3160	17.0102
GWARIMPA	MAITAMA	-12.74429	3.30728	.019	-18.4074	.9188
	WUSE	1.17357	3.30728	.999	-8.4895	10.8367
	UTAKO	.29643	3.30728	1.000	-9.3667	9.9595
	AREA 1	-.00929	3.30728	1.000	-9.6724	9.6538
	AREA 10	-1.39714	3.30728	.998	-11.0602	8.2660
WUSE	MAITAMA	-9.91786*	3.30728	.051	-19.5810	-.2548
	GWARIMPA	-1.17357	3.30728	.999	-10.8367	8.4895
	UTAKO	-.87714	3.30728	1.000	-10.5402	8.7860
	AREA 1	-1.18286	3.30728	.999	-10.8460	8.4802
	AREA 10	-2.57071	3.30728	.971	-12.2338	7.0924
UTAKO	MAITAMA	-9.04071	3.30728	.080	-18.7038	.6224
	GWARIMPA	-.29643	3.30728	1.000	-9.9595	9.3667
	WUSE	.87714	3.30728	1.000	-8.7860	10.5402
	AREA 1	-.30571	3.30728	1.000	-9.9688	9.3574
	AREA 10	-1.69357	3.30728	.996	-11.3567	7.9695
AREA 1	MAITAMA	-12.93500	3.30728	.010	-18.3981	.9281
	GWARIMPA	.00929	3.30728	1.000	-9.6538	9.6724
	WUSE	1.18286	3.30728	.999	-8.4802	10.8460
	UTAKO	.30571	3.30728	1.000	-9.3574	9.9688
	AREA 10	-1.38786	3.30728	.998	-11.0510	8.2752
AREA 10	MAITAMA	-10.34714	3.30728	.040	-17.0102	2.3160
	GWARIMPA	1.39714	3.30728	.998	-8.2660	11.0602
	WUSE	2.57071	3.30728	.971	-7.0924	12.2338
	UTAKO	1.69357	3.30728	.996	-7.9695	11.3567
	AREA 1	1.38786	3.30728	.998	-8.2752	11.0510

Computed from Table 3. \* The mean difference is significant at 0.05 level

## Conclusion and Implication of Findings

Gwarimpa market performed better, it has the least unit of risk at 35% and 43% for 3B/R and 4B/R respectively, as compared with other areas and also offered a comparable average rate of return at 11.05% and 12.5%. This finding is consistent with previous studies (Udobi *et al.*, 2013; Wahab *et al.*, 2015). Maitama market is also found to constitute significantly the major differences in 3B/R and 4B/R property returns across the study areas. Maitama market is the most volatile market at 13.75% and 10.93% respectively and offered the highest rate of return at 21.89% and 20.91% for both 3BR and 4BR respectively and also performed comparably with alternative investment in Federal Government Bond (FGB) at 0.89 and 1.01. The implication of this finding is that Gwarimpa market offered the most stable and steady returns on property investment. Only a prudent investor can invest in such market because the market has the least risk per unit of residential investment and has comparable returns with other markets. Unlike Maitama, the most volatile market but has attractive returns only a risk-loving investor who desires higher and quick returns can invest in such market. The market is not secured because it has the highest risk per unit of investment. This may lead to loss of capital invested. This study recommends that a prudent investment who desires long term steady returns on residential property investment is better advised to invest in Gwarimpa, in that, it is the most desirable residential investment with least risk per unit of residential investment having a comparable returns.

## References

- Ade, .A. (2015). Performance evaluation of residential real estate properties in Ado Ekiti. *International Journal of Management And Commerce Innovation*. 3(1), 569-578.
- Amidu, A., Aluko, B.T, Nuhu, M.B. and Saibu, M.O. (2007). Real Estate Securities and Other Investment Assets. *Journal of Property Investment And Finance* 26(2),151-161.
- Bamidele, M. O. (2015). Analysis Of Investment Performance Of Residential Property In Government Hosuing Estate In Akure Nigeria. *Journal Of Emerging Trends In Economics And Management Science* 6(3): 193-201
- Baum, A. (2002). *Commercial Real estate Investment*. Estate Gazette, London.
- Bello, O.M. (2003). Comparative Analysis of Performance of Residential Investment And Investment in Securities in Lagos, Nigeria. *Journal of Estate Surveyor And Valuer*. 26(1) 7-14
- Dabara, D. I. (2014). Inflation Correlation with Commercial Real Estate' Investment Returns in Akure, Nigeria. *Journal of Scientific Research & Reports* 3(23): 2998-3017
- Dubben, N. and Sayce, S. (1991). *Property Portifolio Management*. Routledge, London.
- Hargitay .S and Yu .S (1993). *Property Investment Decision*. A Quantitative Approach. London
- Haw, K. T. (2003). Investment Characteristics of Malaysia Residential Market Sector. 9<sup>th</sup> *Pacific Rim Real Estate Society Annual Conference Brisbane*, Queensland Australia. 20-22 January, 2003.
- Hoesli, M. and MacGregor, B. (2000). *Property Investment: Principles and Practice Of Portfolio Management*. Longman Essex.
- Umeh, O. L. (2014). Relative Performance Of Real Estate Equities And Other Selected Stocks: The Nigeria Market Situation. *ATBU Journal of Environmental Technology* 7(1) 22-32.



- Kalu, I.U. (2001). *Property Valuation and Appraisal*. Owerri: Bon Publications.
- Olanrele, O. O, Said, R. and Daud M.N. (2015). Comparative of RELT Dividend Performance in Nigeria and Malaysian. *African Journal of Business Management*. 9(16) 608-614.
- Ooi, T.L. and Liow, K.H. (2004). Risk –adjusted Performance of Real Estate Stock. Evidence from Developing Markets. *Journal of Real Estate Research*. 26 (4):371-395.
- Oyewole, M. O. (2006). A Comparative Analysis of Performance of direct and indirect property investment in Lagos. *Journal of environmental science*, university of Lagos.
- Oyewole, M. O. (2013). A Comparative Analysis of Residential and Retail Commercial Property Investment Performance in Ilorin, Nigeria. *Journal of Economics and Sustainable Development*. 4(3) 199-208.
- Udobi, A. N., Ugonabo, L. U. and Kalu, I. U. (2013). An Analysis of Performance of Real Estate Investment in Onitsha Metropolis and Investment In Bank Shares. Department of estate management, Awka, Anambra State. *Civil and Environmental Research* 3 (8) 11-18
- Umeh, O. L. & Oluwasore, O. A. (2015). Inflation Hedging Abilities of Residential Properties in Selected areas of Ibadan Metropolis, Nigeria. *ATBU Journal of Environmental Technology* 8(2) 93-106
- Wahab, M. B., Durosinmi, W. A. Mustapha, A., Olatunji I. A. and Ajayi, M.T.A. (2015). Examination of housing Investment Performance in Abuja, Nigeria: *Being a paper presented at School of environmental technology international conference on Sustainable Built Environment and Climate Change: the challenge of post 2015 development Agenda*.