

1ST INTERNATIONAL CONFERENCE OF ENVIRONMENTAL SCIENCES

ICES 2019

THE PROCEEDINGS OF INTERNATIONAL CONFERENCE OF ENVIRONMENTAL SCIENCES

ICES 2019

EDITORS

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2019

FACULTY OF ENVIRONMENTAL SCIENCES,
UNIVERSITY OF ILORIN, ILORIN, NIGERIA



ICES2019

INTERNATIONAL CONFERENCE OF ENVIRONMENTAL SCIENCES

COLLABORATION FOR SUSTAINABLE
DEVELOPMENT IN THE BUILT ENVIRONMENT

Editors:

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Faculty of Environmental Sciences, University of Ilorin, Ilorin, Nigeria

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COLLABORATION FOR SUSTAINABLE DEVELOPMENT IN THE BUILT ENVIRONMENT

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FOREWORD

It's my privilege and pleasure, on behalf of the Vice Chancellor of this great institution, Prof. Sulyman Agenjolola AbdulKareem, to welcome you all here today. It has been a long journey since the idea of the first *International Conference of Environmental Sciences* (ICES) was mooted. It looks then that we cannot do it, what with many other problems we have to cope with as a very young Faculty.

Being the very first academic outing of our fledgling faculty, we are all aware that it cannot be our best effort. We just needed to start somewhere, hoping that in subsequent years, as we develop capacity, we will continue to build on gains of today. So feel free to tell us areas we can improve upon because in years to come, the goal is to make ICES a flagship biennial national dialogue.

The encouragement for the university administration, particularly our Leader and Vice Chancellor, Prof. Abdulkareem and the doggedness of faculty staff and students have made today a reality. I therefore want to appreciate our Vice-Chancellor and my colleagues in the faculty for making today possible. .

The goal of sustainable development is to meet the needs of today, without compromising the needs of tomorrow. This implies that we cannot continue using current levels of resources as this will not leave enough for future generations. Therefore, stabilising and reducing carbon emissions is key to living within environmental limits as this will create a truly sustainable built environment that is fit for the future.

The theme, *Collaboration for Sustainable Development in the Built Environment*, captures our focus as academia and professional in the larger society and the broader Sustainable Development Goals (SDGs). Beyond that, it gives exciting opportunities to several of our professionals like Quantity Surveyors, Architects, Geologists, Geo informatics, Town Planners, Land Surveyors, Estate Valuers, Engineers etc to express themselves and their activities at ICES.

Collaboration is essential for development in today's world because real life challenges require researches that are multidisciplinary in nature. When you want to control flooding for instance, you need Civil Engineers, Soil Scientists, Geographers, Geologists, even Public Relations Professionals etc for diverse roles.

For robust development of built environment in a sustainable ways, **geographers**, who are concerned with the study of places and relationships between people and their environments; **Surveying and Geo-Informatics Professionals** who are concerned with geo-data and geo-information about locations in relation to the earth and **Urban and Regional Planners** who will develop and design use of land are essential partners.

Furthermore, **Architects** helps with planning, designing, and construction of buildings and any other structures that made up the environment while based on the structural performance of different materials and geometries the **Structural Engineers** design the 'bones and muscles' that create the form and shape of the structures designed by the Architect. **Services Engineers** strive to achieve a safe and comfortable indoor environment whilst minimizing the **environmental impact** of buildings through collaboration with **Chemical Engineers** and other specialists. Then **the Quantity Surveyors**, who are the construction cost experts, will predict and manage construction cost from inception to completion.

So evidently, we must all collaborate to make possible the attainment of Sustainable Development Goals (SDGs). And as if to emphasize the need for collaboration, the drafters of the Seventeen (17) Sustainable Development Goals made goal Seventeenth, perhaps the ultimate goal- partnership for all the previous 16 goals. Besides, the University authorities here have always emphasize multidisciplinary collaboration among researchers.

We are honoured to have Prof. Adeniyi Suleiman Gbadegesin, our Keynote speaker, in our midst this morning. He is a colossus and mentor to many professors of Geography. As an international scholar of repute with wide and varied experience, this gathering will benefit immensely from his paper.

Similarly, we have with us Prof. Ahmad Doko Ibrahim of the Department of Quantity Surveying and Project Construction Management, Ahmadu Bello University (ABU) Zaria who had done a lot to bring ABU into reckoning. I salute you sir and welcome you heartily.

The 1st International Conference of Environmental Sciences (ICES 2019) received a total of 150 abstract, accepted 72 and today we have a total of 49 full papers to be presented by authors in 6 parallel sessions. Students' competition on the theme of the conference will be conducted to conclude the activities of the conference.

Let me express the warm appreciation of staff and students of this faculty and the entire university to all our professional colleagues who are gracing this occasion in the spirit of town and gown mandate.

"It's therefore my pleasure to extend a cheerful welcome to you all! Your presence makes us very happy."

Thank you for coming

Dr. Ganiyu Amuda-Yusuf
Ag. Dean Faculty of Environmental Sciences

ACKNOWLEDGEMENTS

The First International Conference of Environmental Sciences (ICES 2019) organized by the Faculty of Environmental Sciences, University of Ilorin, Nigeria owes its success to the hard work, commitment and support of individuals both in the academia and the general public. These individuals provided the technical, financial and logistic supports that enable the Faculty realize the objectives of this epoch making academic event.

First, the Local Organizing Committee (LOC) sincerely appreciates the Vice Chancellor of University of Ilorin – Professor Sulyman Age Abdulkareem, who provided huge moral and logistic support for the Faculty to make the conference possible. We are grateful to the Vice Chancellor and the entire University Management for providing accommodation and transport logistics for the Guest Speakers and for the general smooth running of the conference. This singular support demonstrates the commitment of the Vice Chancellor and his Management team to academic excellence which enhances the visibility of University of Ilorin both nationally and internationally.

The LOC is grateful for the dynamic leadership of the Acting Dean of the Faculty of Environmental Sciences – Dr. Ganiyu Amuda-Yusuf, whose vision and relentless efforts saw to the conception, planning and execution of this conference. Your support and encouragement have, in no small measure, assisted in the realization of the objectives of this conference. The support of the Acting Dean of Faculty of Communication and Information Sciences (CIS) – Dr. Jimoh R.G. at the conceptual and implementation stages of the conference is quite commendable. His inputs help crystallize the conference concept notes while the provision of venues for the technical and plenary sessions addressed our logistic needs. We are also grateful to the Dean, Students Affairs – Prof. L.T Ajibade who assisted the LOC in the review of conference papers and in the mobilization of the Students for the conference.

The keynote speakers at this international conference delivered thought provoking papers that served as the conference ice breaker and they have made us proud. We are grateful to Prof. Adeniyi Gbadegeshin, the immediate past Vice Chancellor of Ladoke Akintola University (LAUTECH), Oghomosho and Prof. Ahmad Doko Ibrahim of Ahmadu Bello University for accepting our invitation and for delivering the lead papers for the conference.

We recognize the contributions of Dr. Bolaji Sulieman, the Sub-dean of the Faculty of Environmental Sciences who coordinated conference planning and execution activities on behalf of the Faculty. The secretariat operations of the conference were adequately handled by the Faculty Officer –Mrs. Azeizat Ibrahim. The LOC is grateful to her and other administrative staff of the Faculty for their immense contributions.

At the preparatory stage of this conference, the Faculty reached out to individuals and corporate organizations for financial support. In response, many donated substantial amounts of money which assisted a lot in procuring materials for the conference. The Faculty appreciates the well-meaning individuals and management of all corporate organizations for this kind gesture.

This conference could not have been a success without the dedication and untiring efforts of the LOC and other sub-committees that handled the conference planning and implementation. On behalf of the LOC, I sincerely thank **all those** who served in the LOC and all other sub-committees. I am specifically grateful to the Chairmen of all sub-committees in person of Dr. N.A Bello (Technical Sub- committee); Dr. Maimuna O. Abdulraheem (Logistic Sub-committee); Dr. A.I Bako (Publicity and Linkage Committee) and Mr. Ahmadu Hussein (Student Competition Sub-committee).

Worthy of singular mention and appreciation is a member of the LOC - Mr Rasheed Abdulkadir Shehu who was a wonderful and reliable partner in progress. His calm and confident deportment to all knotty issues coming from any of the sub-committees translated in several ways to the accomplishment of this conference

The list of contributors to the success of this conference is almost endless. We are grateful to all Heads of Department and academic staff in the Faculty of Environmental Sciences who assisted in one way or the other to make the conference a resounding success. We hold all our paper reviewers, plenary chairpersons and rapporteurs in high esteem and thank them for their selfless services. Finally, I thank all the non-teaching staff and students of the Faculty for their roles. May God reward you all for your contributions.

Dr. Maimuna O. Abdulraheem
Chairperson, Local Organizing Committee

CONFERENCE CENTRAL ORGANISING COMMITTEE

Dr. Maimuna O. Abdulraheem - Department of Urban & Regina Planning – Conference Chair
Dr. N. A. Bello - Department of Estate Management - Conference Secretary
Dr. Ranti T. Adebisi - Department of Quantity Surveying - Member
Dr. A. I. Bako - Department of Urban & Regional Planning – Member
Mr. S.Y. Suleiman - Department of Architecture - Member
Mr. A.S. Rasheed - Department of Quantity Surveying - Member

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Mr. H.A. Ahmadu - Chairman
Mr. A.S. Rasheed
Mr. Idris Soliu
Mr. O.T.B Aduloju
Mr. H.A.Tanimu - Secretary

Conference Advisory Committee

Prof. L.T. Ajibade - Dean of Student Affairs, Department of Geography & Environmental Studies - University of Ilorin, Ilorin - Nigeria
Prof. N.B. Tanimoowo - Department of Urban & Regional Planning, LAOTECH, Ogbomoso - Nigeria
Prof. A.D. Ibrahim - Department of Quantity Surveying, Ahmadu Bello University, Zaria - Nigeria
Prof. A.A. Adedeji - Department of Civil Engineering, University of Ilorin, Ilorin - Nigeria
Dr. R.G. Jimoh - Ag. Dean of Faculty of Communication & Information Studies, University of Ilorin, Ilorin - Nigeria

Paper Review Panel

Prof. A.A. Adedeji – Department of Civil Engineering, University of Ilorin.

Prof. L.T. Ajibade – Department of Geography, University of Ilorin

Prof. V. A. Bello - Department of Estate Management, Federal University of Technology, Akure- Nigeria

Prof. N.B. Tanimowo – Department of Urban and Regional Planning, LAUTECH

Prof. A.D. Ibrahim- Department of Quantity Surveying, Ahmadu Bello University, Zaria

Dr. Ganiyu Amuda-Yusuf - Department of Quantity Surveying, University of Ilorin, Ilorin -Nigeria

Dr. I. O. Orire - Department of Geography, University of Ilorin, Ilorin - Nigeria

Dr. N. A. Bello - Department of Estate Management, University of Ilorin, Ilorin - Nigeria

Dr. Bolaji Sulaiman - Department of Quantity Surveying, University of Ilorin, Ilorin - Nigeria

Dr. A. I. Bako - Department of Urban & Regional Planning, University of Ilorin, Ilorin - Nigeria

Dr. A. B Ola - Department of Urban & Regional Planning, University of Ilorin, Ilorin - Nigeria

Dr. K. B. Bolayemi - Department of Estate Management, Federal Polytechnic, Ilaro - Nigeria

Dr. Ranti. T. Adebisi - Department of Quantity Surveying, University of Ilorin, Ilorin - Nigeria

Dr. O. O. Olanrele - Department of Estate Management, University of Malaya, Malaysia - Nigeria

Dr. I. E. Wallace - School of Architecture, Victoria University of Wellington, New Zealand

Dr. Ayo Babalola - Department of Surveying & Geo-Informatics, University of Ilorin, Ilorin - Nigeria

Peer Review Process

The papers submitted to this conference were subjected to a rigorous peer review process which involved an initial review of abstract. A total of 150 abstracts were reviewed and 72 accepted. Afterwards, the authors of accepted abstracts were provided with the reviewers' comments and were advised to proceed to full paper submission, incorporating all suggested amendments in the reviewed abstracts.

Blind reviews of full manuscripts by minimum of two reviewers were carried out on the submitted manuscripts. A total of 72 full papers were received and the reviewer's comments were then sent to the authors of accepted papers with the request that they should address all of the issues raised by the reviewers. Tracked changes made by reviewers on authors' original papers were also sent to authors to help with revising their papers. A compliance check of authors returned corrected papers was further done to ensure that all the reviewer's comments were followed.

During the review process, members of the paper review panel, editors and conference organisers were not involved with the review of any paper they authored or co-authored.

A total of 52 papers of all authors who have demonstrated sufficient evidence that all reviewers' comments had been addressed were accepted into the conference proceedings.

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CONFERENCE PROGRAMME

DAY 1

MONDAY 29TH APRIL, 2019

PROGRAMME FOR THE OPENING SESSION

8:00 am - 9:30 am	Registration <i>Venue: University Main Auditorium</i>
9:30 am - 9:40 am	National Anthem & Unilorin Anthem / Introduction of Guest
9:40 am - 9:50 am	Opening Remarks by the Conference Chair. <i>Dr. Maimuna O. Abdulraheem, Chairperson, Organizing Committee</i>
9:50 am - 10:00 am	Welcome Address by the Host. <i>Dr. Ganiyu Amuda - Yusuf -Ag. Dean Faculty of Environmental Sciences</i>
10:00 am - 10:20 am	Vice Chancellors Address. <i>Prof. Sulyman Age Abdulkareem - Vice Chancellor University of Ilorin</i>
10:20 am - 11:00 am	Keynote Address 1. <i>Prof. Adeniyi Gbadegesin - Professor of Geography, Immediate Past Vice- Chancellor, LAUTECH, Ogbomosho.</i>
11:00 am - 11:40 am	Keynote Address 2 <i>Prof. Ahmad Doko Ibrahim - Professor of Quantity Surveying, Ahmadu Bello University, Zaria.</i>
11:40 am - 12:00 pm	Questions/Contributions/Responses
12:00 pm - 12:10 pm	Address by the Special Guest of Honour <i>Arc. M. J Faworaja. (MICIARB, MFIMS, FNIA, PPNIA) MD/CEO ARCHCON NIG. LTD</i>
12:10 pm - 12:30 pm	Launching of the Maiden Edition of Faculty of Environmental Sciences Journal - (Journal of Environmental Spectrum)
12:30 pm - 12:40 pm	Goodwill Messages
12:40 pm - 12:50 pm	Closing Remarks <i>Prof. N. B Tanimooowo - Pioneer Dean, Faculty of Environmental Sciences</i>
12:50 pm - 1:00 pm	Vote of Thanks <i>Dr. N.A Bello - Conference Secretary</i>

DAY 1

MONDAY 29TH APRIL, 2019

PROGRAMME FOR THE TECHNICAL SESSIONS

1:00 pm - 1:30 pm	Tea Break/Snacks/Small Chops
<u>PRE-CONFERENCE WORKSHOP</u> <i>Venue: University Main Auditorium</i>	
RESEARCH CLINIC	Chairperson: Prof. Titilayo A. Alabi
1:30 pm - 2:10 pm	Research Lecture:

*Prof. Ahmad Doko Ibrahim - Professor of Quantity Surveying,
Ahmadu Bello University Zaria.*

2:10 pm - 2:30 pm

Questions & Answers

2:30 pm - 3:00 pm

Lunch Break

FIRST PARALLEL SESSION

FIRST PARALLEL SESSION DAY 1 - MONDAY 29TH APRIL, 2019

VENUE: FACULTY OF COMMUNICATION AND INFORMATION SCIENCES [CIS]

GROUP 1

GROUP 2

**INFORMATION TECHNOLOGY
ADOPTION IN CONSTRUCTION**

**REMOTE SENSING & DIGITAL
INFORMATION SYSTEMS**

CHAIRPERSON: Dr. Saudat S. Baki

CHAIRMAN: Prof. J.F Olorunfemi

RAPPORTEUR: Dr. N. A Musa

RAPPORTEUR: Dr. Ayo Babalola

Paper 1:

Paper 1:

Bim Adoption Challenges in Malaysia:
Expert Opinion.

Assessment of Users' Satisfaction on Manual &
Digital Land Information System in Kwara State,
Nigeria

*Badiru, Y. Y.; R.B Tukur.; and Abdulazeez,
A.D*

Adekoya, A. A., and Bello. M. O.

Paper 2:

Paper 2:

Sustainable Architectural Practices in
Nigeria: Benefits of Adopting Building
Information Modeling

Spatio-Temporal Analysis of Bida Housing
Market Using Geographic Information System

Elimisiemon, Monday Chris

Mohammed, J. K. & Sulyman, A. O.

Paper 3:

Paper 3:

Factors Affecting Human Resource
Management in Small Construction Firms
in Lagos Metropolis, Nigeria

Establishment of Deformation & Subsidence
Monitoring Baseline in the Coastal Environment:
A Case Study of University of Lagos

*Oluwaseyi Modupe Ajayi; Oluwasegun
Emmanuel Akinsiku & Tajudeen Olufemi
Salami*

*Alademomi Alfred Sunday, Mayaki Anthony
Omeiza, Daramola Olagoke Emmanuel & Salami
Tosin Julius*

Paper 4:

Paper 4:

Influence of Web-based Project Management
System on Project Delivery

Design and Implementation of Sustainable Built
Environment: The Role of Surveying & Geo-
Informatics towards Effective Collaboration with
Other Professionals

A.S. Rasheed & R. T Adebiyi

3:00 pm - 5:00 pm

Paper 5:

Assessment of Readiness of Nigerian Construction Firms on Adoption of Lean Construction Principles

M.L Aisha & A.M. kasimu

Paper 6:

Perceptions of Career Development among Women in Nigeria Construction Industry

Adebiyi Ranti Taibat, Amuda-Yusuf Ganiyu, Rasheed Abdulkadir Shehu, Idris Soliu & Ola-Ade Esther Oluwafolakemi

Paper 7:

Effect of implementation of E-Procurement on Corrupt Practices in Nigerian Construction Industry

Odulana, A. O. & Oyewobi, L. O.

Paper 5:

GIS as a Tool for Sustainable Development in Public Secondary School Mapping

Ipadeola A. O., Abdulyekeen A.O., Olatunde G.

Paper 6:

A Review of Intelligent Transportation System: Adaptive Management

Busayo Adebiyi, Risikat Folashade Adebiyi, Ahmed Tijani Salawudeen & Abubakar Umar

5:00 pm -

CLOSING

5:10 pm

DAY 2 TUESDAY 30TH APRIL, 2019

SECOND PARALLEL SESSION

SECOND PARALLEL SESSION DAY 2 - TUESDAY 29TH APRIL, 2019

VENUE: FACULTY OF COMMUNICATION AND INFORMATION SCIENCES [CIS]

GROUP 1

GROUP 2

**ARCHITECTURE & HOUSING
DEVELOPMENT MANAGEMENT**

**CONSTRUCTION ECONOMICS & COST
MANAGEMENT**

CHAIRPERSON: Dr. Nasmat T. Surajudeen-Bakinde

CHAIRMAN: Prof. A.M Junaid

RAPPORTEUR: Dr. A.I. Bako

RAPPORTEUR: Dr. Ranti T. Adebiyi

Paper 1:

Paper 1:

8:30 am - 10:30 am

Assessment of Crowd Control Strategies in the Design of National Stadia at Abuja and Uyo, Nigeria

Naimu M. S & Abdulrahman M. E

Paper 2:

Retrofitting Prospects for Daylight Enhancement in ‘Dark’ Corridors of an Institutional Prototype Building

O. M. Idowu, A. A. Umar, S. Humphrey & A. U. Attah

Paper 3:

Assessment of Landscape Design Elements Application for Crowd Movement Optimization in Catholic Churches in Benue State, Nigeria

David Lubem Angitso & Chukwudum J. Eze

Paper 4:

The Challenges of Placemaking of Leisure & Recreation Parks Development in Nigeria

Abdulwahab Engworo Etudaiye, Abdullahi Sadauki, Yusuf Saliu & Ibrahim Yusuf Baba

Paper 5:

Critical Assessment of Fire Safety Measures in Shopping Malls, Abuja, Nigeria

Audu Francis Eleojo & M.E Abdulrahman

Paper 6:

Hardened Property of Blended Cement Mortar for Sustainable Housing Construction

Oyejobi, D. O., Adelabu, J. K., & Abdullahi, K. O.

Paper 7:

Influence of Risk Factors on Redevelopment Projects: A Case Study of Yankari Resort & Safari Project, Bauchi State

Aminu Muhammad Bashir

Paper 2:

Risk Management Strategy in Public Private Partnership on Housing Development. A Case of Niger State

Yatsu U.M and Kasimu M.A

Paper 3:

Risk Factors Affecting Cost and Time Performance of Civil Engineering Projects in Kwara State

Idris Soliu, Awodele., O. A & Amuda-Yusuf., G

Paper 4:

Appraisal of the Causes of Ineffectiveness of Skilled Tradesmen in Building Construction Industry in Lagos State

Olanrewaju, Rauf A., Adebisi, Ranti T. & Fasasi, Abdulwaheed

Paper 5:

Drivers and Barriers to the Implementation of Green Building Development

Onososen, Adetayo Olugbenga & Osanyin Oladipupo

Paper 6:

Appraisal of Causes and Effects of Delayed Payment on Building Construction Projects Delivery in Niger State

M. N. Amina; J. E. Idiake & A. M. Kasimu

Paper 7:

Assessment of Aspect Ratio & Configuration Effects in Corporate Office Buildings Courtyard, in Abuja, Nigeria

Ofiedane J.M & Eze J. C

Evaluating Methods of Training of Mason for Productivity Improvement in Nigeria Construction Industry

Suleiman, Ayinde Elelu & John, Ebohimen Idiake

Paper 8:

Architectural Design Considerations to Enhance Security in Mixed-Use Building, Lagos, Nigeria

Ogunbayo, R. A & Akande, O. K

10:30 am -

TEA BREAK

11:00 am

THIRD PARALLEL SESSION

THIRD PARALLEL SESSION DAY 2 - TUESDAY 30TH APRIL, 2019

VENUE: FACULTY OF COMMUNICATION AND INFORMATION SCIENCES [CIS]

GROUP 1

GROUP 2

URBAN/ENVIRONMENTAL MANAGEMENT & PLANNING

REAL ESTATE DEVELOPMENT AND PROPERTY MANAGEMENT

CHAIRMAN: Prof. A.M Junaid

CHAIRMAN: Prof. B.T Aluko

RAPPORTEUR: Dr. A.B Ola

RAPPORTEUR: Dr. Ranti T. Adebisi

Paper 1:

Paper 1:

Multidimensional Approach to Flood Vulnerability Assessment in Coastal Communities of Suleja and Tafa LGA, Niger State

The Impact of Emotional Intelligence on the Performance of Consultant Estate Surveyors and Valuers in Nigeria

Abdulhakeem Salau Bello and Muhammad Ahmed Emigilati

Akinwamide, David Oluwatofunmi

Paper 2:

Paper 2:

An Assessment of Streetscape Infrastructure in Ilorin Metropolis, Nigeria

Emerging Barriers to Efficient Urban Land Acquisition Process for Real Estate and Facilities Development in Nigeria

Abdulraheem M. O., Suleiman A. R. Alao R. O. Alimi R. K. Alade A. K & Garba I.O.

Kazeem .B. Akinbola; Taofik .I. Salau,; Nurudeen .A. Bello.

11:00 am - 1:00 pm

Paper 3:

Assessment of Spatial Changes in Coastal Ecosystem at Amuwo-Odofin, Lagos Nigeria

Alfred Sunday Alademomi, Tosin Julius Salami, Olagoke Emmanuel Daramola, Elias Adediran, & Joseph Olayemi Odumosu

Paper 4:

The Practice and Challenges of Biomedical Waste Management: A Study of Selected Medical Facilities in Ile-Ife, Osun State

Ola, A. B.; Bako, A. I.; Abdulraheem, M. O.; Raheem, W. M.; Raheem, W. A. & Adewale, Y. Y.

Paper 5:

Understanding Vulnerability and Resilience of Ilorin Central Area, Ilorin, Kwara State

A.I. Bako, O. T. B. Aduloju, A. R. Suleiman, & F. O. Lawal

Paper 6:

Effect of Informal Activities on Urban Road Network Infrastructure in Minna, Niger State

Adeogun, A. S., Idowu, O. O., Olabisi S.A, & Iroh E.

Paper 7:

Gully Erosion: Vulnerability and Impact on the Resident of Agulu-Nanka

Nwokocha Oluchi and Musa Dalil

Paper 8:**Paper 3:**

Challenges of Accessing Affordable Housing by Low-Income Civil Servants in Abuja, Nigeria

Olayinka Ezekiel Ajayi & Oyekunle Luqman Oyewobi

Paper 4:

Collaborative Working Relationship among Nigerian Built Environment Professionals: Factors and Benefits

Nurudeen Akinsola Bello, Kazeem Bolayemi Akinbola, Rasheed Olamide Alao, Sulaiman Adetoye Adepoju & Sulaiman Adesoji Olabisi

Paper 5:

Conventional Approaches and Mechanism to Housing Market Analysis

Mohammed, J. K. & Sulyman, A. O.

Paper 6:

Challenges and Opportunities of Resolving Land Use Conflicts through Mediation in Nigeria

Uwaezuoke, Ngozi Ifeanyi & Owolabi, Kayode Michael

Paper 7:

User Satisfaction of Social Housing in Kaduna Metropolis

Julius Andrew Baji, Jonah Binga, Deborah Babarinsa, Mercy Richard Auta, Yakubu Ahmed Ubangari, & David Ayock Ishaya

Paper 8:

Evaluation of Petrol Filling Stations
Against Established Standards in
Ilorin Metropolis.

*Tanimowo, N. B., Raheem, W. M.,
Owolabi, O. Q., Raheem, M. O.,
Salawu, G. O. and Onundi
Lawal, F. O.*

Effect of Public Budgeting on Neighbourhood
Quality and Rental Values in Ilorin

*W.A Durosinmi, M.T.A Ajayi, M.B Wahab, W.O
Shittu & A.O Hassan.*

Paper 9:

Child Poverty Mapping: Towards
Effective Child Poverty Reduction

*Akande Sheerifdeen Olaide,
Mohammed Ndana & Aremu Reuben*

Paper 9:

Evaluation of the Contribution of Real Estate-
based Revenue to IGR of Kwara State.

*Agava, Halim Yusuf; Adedotun, Ife Adeshola &
Gombwer, Nenrot Wuyokwe*

1:00 pm - 2:00 pm

STUDENT COMPETITION PRESENTATION

2:00 pm - 3:00 pm

LUNCH

3:00 pm - 4:00 pm

CONFERENCE COMMUNIQUE

CERTIFICATES & CLOSING

DEPARTURE

SPATIO-TEMPORAL ANALYSIS OF BIDA HOUSING MARKET USING GEOGRAPHIC INFORMATION SYSTEM

Mohammed, J. K. and Sulyman, A. O

Department of Urban and Regional Planning, Federal University of Technology, Minna- Nigeria

Abstract

Previous studies show importance of spatial distribution of housing price and its variability over time, but did not cover various types of houses with their prices over time. This study therefore focused on examining spatial and temporal changes in Bida housing market from 2008 to 2018 using Geographic Information System (GIS). In particular, it focuses on the spatio-temporal auto-correlation of spatial distribution of residential housing prices over ten year period. Ordinary Kriging (OK) model was used to carry out the analysis. This model is consistently estimated by the maximum likelihood approach and they were compared with respect to the changes that occur within the period. For each model, geospatial layers were produce in order to ascertain the changes that occur. This paper establish the benefits associated with the use of GIS technology in housing research and the substantial benefits obtained by modelling the spatial as well as the temporal dependence of the data. Specifically approaches to trends and changes in the housing market, which can also extend to various aspects of housing studies.

Keywords: *Geographic Information System, Housing market, Interpolation, Spatial, Temporal*

261.0 Introduction

The recent experience and the crisis of housing in the developing world have shown that price fluctuations and the cyclical character of the housing market are risk factors that can threaten the stability of the financial and banking sectors dynamics (Olszewski, Waszczuk, & Widłak, 2017). The accumulation of risks can lead to uncertainty in the market that can worsen the economic situation because of the links between the housing, banking, and finance sectors. Price changes can have an impact on the whole country and this is the reason why government and its agencies should monitor house price dynamics (Olszewski, Waszczuk, & Widłak, 2017). However, the housing market has provided an active application area for spatial-temporal modelling and analysis (Yao & Fotheringham, 2016; Wu, Ye, Du, & Luo, 2017; Li, Ye, Lee, Gong, & Qin, 2017).

Spatial relationships between objects that can be identified in relation to the earth are the basic tasks performed by Geographic Information Systems (GIS). These systems provide a number of tools for analysing the characteristics and relationship of spatially defined objects (Cichociński & Dąbrowski, 2013). All geographic phenomena evolve over time, both the spatial and temporal characteristics are key to the understanding of geographic processes and events. Furthermore, knowledge extracted from spatio-temporal data will help to better predict the spatial processes and events. Therefore, it is important to carry out analysis on the spatio-temporal data sets (Cichociński & Dąbrowski, 2013). This study examines the dynamics in Bida housing market using space and time approach.

2.0 Literature Review

Considerable literatures have formed spatial and geospatial housing price modelling in urban settings most especially, spatial interpolation (e.g., Dale-Johnson & Jan Brzeski, 2001; Zhang

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Mohammed, J. K. and Sulyman, A. O., (2019). SPATIO-TEMPORAL ANALYSIS OF BIDA HOUSING MARKET USING GEOGRAPHIC INFORMATION SYSTEM . Collaboration for Sustainable Development in the Built Environment. International Conference of Environmental Sciences, ICES 2019. 1st International Conference of the Faculty of Environmental Sciences, University of Ilorin, Nigeria, 29th - 30th April 2019.

& Tang, 2016; Zmólnig, Tomintz, & Fotheringham, 2015; Hill & Scholz, 2017; Chen & Li, 2017; Wang *et al.*, 2017; Battaglia, Borruso, & Porceddu, 2010; Olszewski *et al.*, 2017; Wu *et al.*, 2017; Seo, 2008; Hu, Yang, Li, Zhang, & Xu, 2016; Schernthanner, Asche, Gonschorek, & Scheele, 2016; Seo, Sohn, Choi, & Kim, 2016; McCluskey, Deddis, & Lamont, 1998; McCluskey, Deddis, Lamont, & Borst, 2000; Clauw, 2007). A fraction of which measures it using geostatistical approach (e.g. Kuntz & Helbich, 2014; Montero & Larraz, 2011; Hu, Cheng, Wang, & Xu, 2013). Importantly, the majority of the studies mentioned above did not take into account spatio-temporal analysis of housing market (e.g. Yao & Fotheringham, 2016; Li *et al.*, 2017).

However, (Li *et al.*, 2017) examine the space-time dynamics of how housing prices fluctuated from a big data perspective. The paper uses spatial data analytics and modelling techniques to identify the spatial distribution of housing prices. Yao & Fotheringham (2016) applies a mixed model approach, semi-parametric geographically weighted regression (GWR) with 3D model to explore, model and analyse the spatiotemporal variations in the relationships between house prices and associated determinants, but did not consider different types of housing prices. Also, Cichociński & Dąbrowski (2013) analyses spatial and temporal aspects of the real estate market. In particular, it focuses on the graphical presentation of the spatial distribution of price and its variability over time, but also did not consider various types of houses with their prices over time. This is the basis for this research and tends to fill the gap in the literature.

2.1 Conceptual Model

Spatial interpolation is the process of using points with known values to estimate values at other unknown points. As geographic information systems (GIS) and modelling techniques are becoming powerful tools in natural resource management and biological conservation, spatial continuous data of environmental variables are increasingly required (Collins & Bolstad, 1996; Hartkamp, De Beurs, Stein, & White, 1999). Thus, the values of an attribute at unsampled points need to be estimated, meaning that spatial interpolation from point data to spatial continuous data is necessary (Li & Heap, 2008).

Application of spatial interpolation earlier was typically based on elevations, climatic phenomena, soil properties, population densities, fluxes of matter, etc. While most of these phenomena are characterised by measured or digitised point data, often irregularly distributed in space and time, visualisation, analysis, and modelling within a GIS are usually based on a raster representation (Mitas & Mitasova, 1999). But recently applied in environmental sciences most especially, housing market analyses (Montero & Larraz, 2011; Zmólnig *et al.*, 2015). Stochastic data-driven interpolation methods are generally used to estimate the spatial distribution of geographical phenomena from the ground-based point data. However, Ordinary Kriging (OK) is relevant to this study.

Ordinary Kriging is a method of interpolation for which the interpolated values are modelled by a Gaussian process governed by prior covariances. Kriging is a stochastic interpolation technique offer important advantages over the deterministic methods, which have been extensively applied for geographical element interpolation (e.g., Moral, 2008; Delbari, Afrasiab, & Jahani, 2013; Abo-Monasar & Al-Zahrani, 2014). Kriging has been increasingly preferred because it takes into account the spatial correlation between neighbouring observations and desired location where the estimation is to be made. In this research, OK is used to model temporal sequence. The temporal sequence is converted into a spatial sequence. It is a versatile technique, suitable for use with any type of spatio-temporal data.

3.0 Materials and Methods

3.1 Study Area

Bida town is a Local Government Headquarter in Niger State, located on the A124 highway (a regional road) linked Ilorin to Minna and Abuja. The LGA has an area of 1.698 km² and a population of 266,008 (NPC, 2006) with 9°05'N, 6°01'E, 9.083°N, 6.017°E, Coordinates. Bida

is the second largest town in Niger State. It is located southwest of Minna, capital of Niger State, and is a dry, arid town. The major ethnic group is the Nupe. Bida is the headquarters of the Nupe Kingdom led by the Etsu Nupe and consisting of many districts, such as Katcha, Lapai, Mokwa, Enagi, Baddeggi, Agaie, Pategi, Lemu, Kutigi, and others. The leadership style of the ancient town of Bida is emirship, and the head of the town is addressed as Etsu Nupe. The town is known for its production of traditional crafts, notably glass and brassware. Bida is also known for its Durbar festival. It is also the home of the Federal Polytechnic, Bida (Faruk, Mohammed, & Mohammed, 2016). The locational map of the study area showing sampled houses is shown in Figure 1.

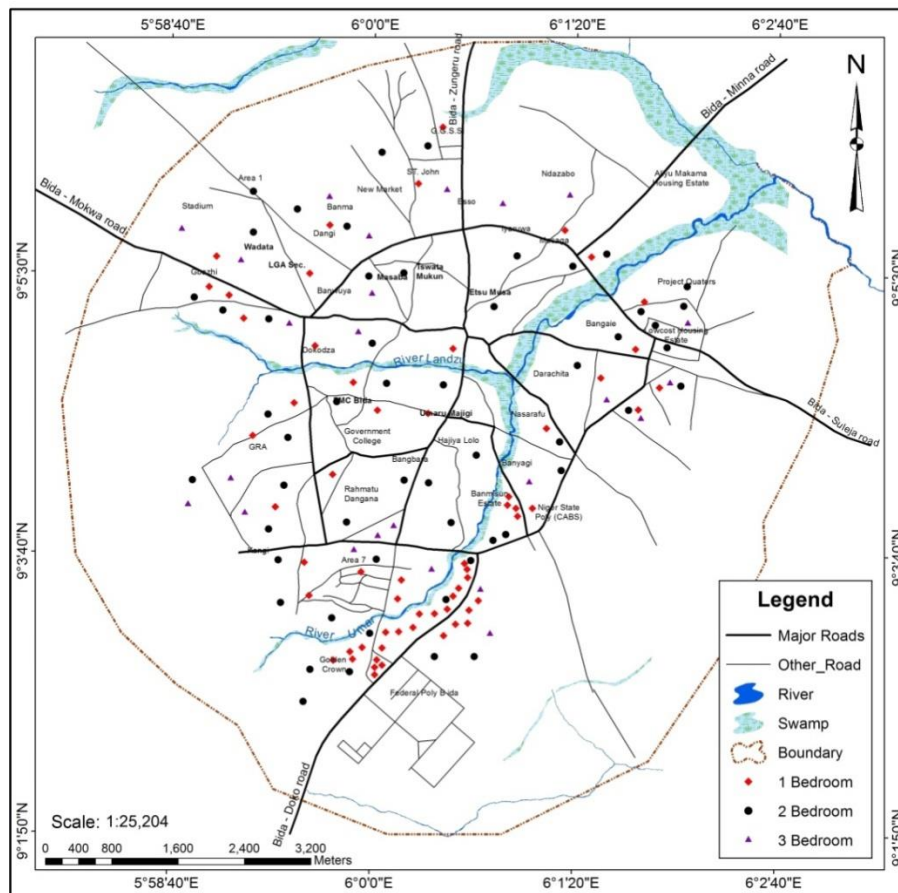


Figure 1: Bida, showing Sampled Houses
Source: Field Survey, 2018

3.2 Methodology

Total number of 138 houses managed by the 3 active estate firms in Bida; Usman Maishera & Associates, Okoh Okuoma & Co. and Pat Egbeduma & Partners was sampled. The sampled houses includes; 60 one bedroom, 54 two bedroom and 24 three bedroom (see Table 1).

Table 1: Number of Sample Houses Managed by Estate Firms in the Study Area

Estate Firms	1 Bedroom	2 Bedroom	3 Bedroom
Okoh Okuoma & Co.	9	3	2
Pat Egbeduma & Partners	8	15	5
Usman Maishera & Associates	43	36	17
Total	60	54	24

Source: Authors' Compilation, 2018

Data needed for this research were acquired through both primary and secondary sources. Primary sources include; coordinate of the sampled residential houses using hand-held GPS and their annual rent between year 2008 to 2018, while secondary sources include; satellite image from Google Earth and related historical studies on spatial and temporal analyses on housing market. However, vector data model was adopted in the mapping and building of the geodatabase.

The position of the sampled houses in terms of X and Y coordinates were taken using hand-held GPS before on-screen digitization in order to provide spatial information about the position of the study area. The coordinates were taken using the WGS 1984 with Minna as the Datum. Satellite image of the study area was georeferenced and onscreen digitization of spatial elements was also conducted using ArcGIS 10.5. Geodatabase was created where attributes of sampled houses were stored to allow interpolation. The main attribute data for this work is annual rent of the houses and stored in the relational database called theme table.

Spatial interpolation methods were used to generate models for housing market. The interpolation methods used was Ordinary Kriging (OK). Most of the tools for performing interpolation require only one value subjected to interpolation, associated with a single point. Geostatistical Wizard, a part of the Geospatial Analyst extension of Esri's ArcGIS software was used to automatically select the interpolation parameters of the examined data.

4.0 Data Analysis and Research Findings

Using OK spatial interpolation method with combination of growing number of housing transaction database records from year 2008 to 2018 and three categories of housing (i.e. 1 bedroom, 2 bedroom and 3 bedroom), the spatiotemporal modelling of housing prices are presented as follow;

4.1 Spatiotemporal dynamics in 1 bedroom housing prices

The interpolation results in Figure 3, Figure 4 and Figure 5 revealed the pattern of space and time changes that occurred in the housing prices of one bedroom apartment in the study area. It can be observed that rental price for one bedroom apartment was lower in the Central Business District (CBD) and eastern part of the town and higher to the south in the year 2008. Changes began to manifest in the year 2013 and became obvious in the year 2018. However, in the CBD, little changes were observed.

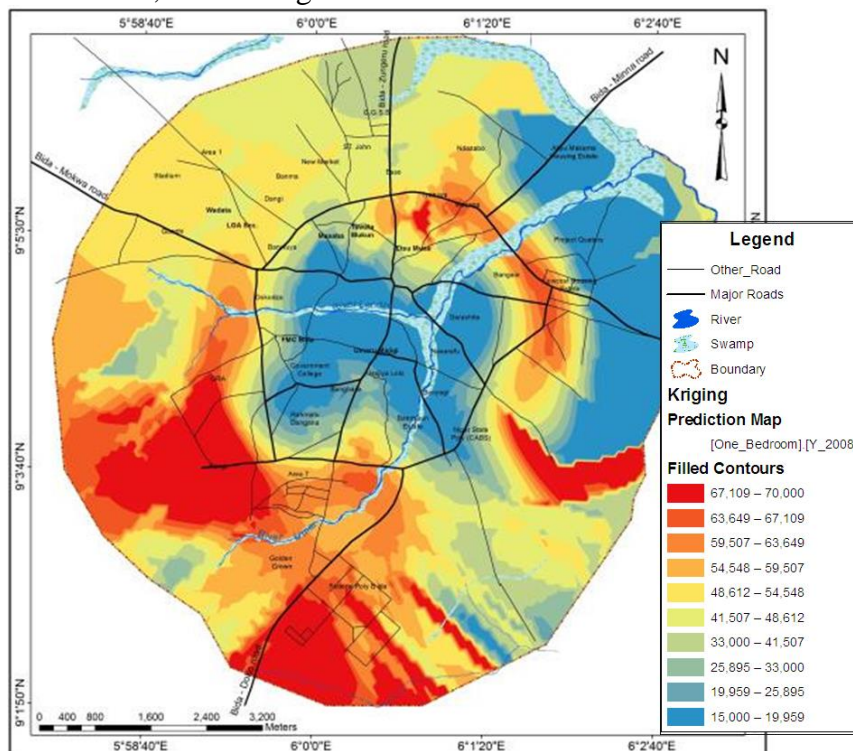


Figure 2: Spatial Interpolation of One Bedroom Housing Prices for 2008

Source: Field survey, 2018

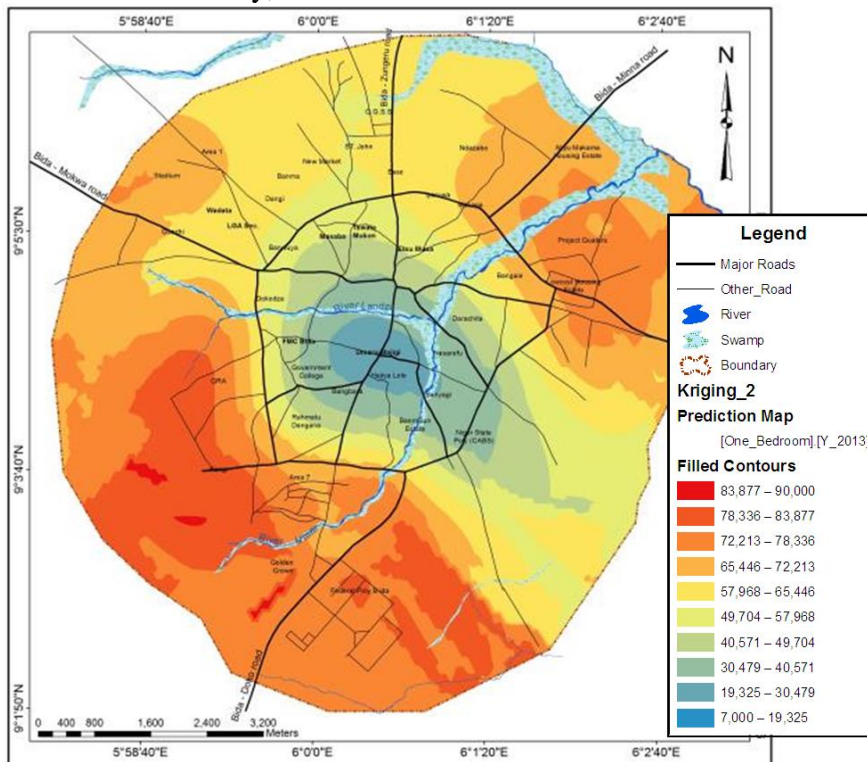


Figure 3: Spatial Interpolation of One Bedroom Housing Prices for 2013

Source: Field survey, 2018

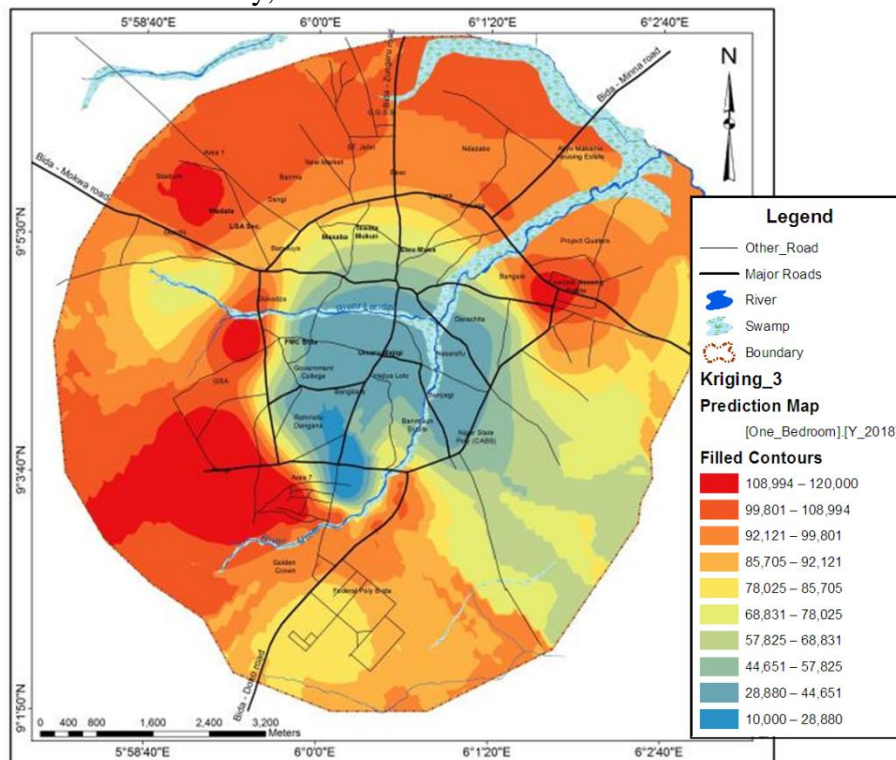


Figure 4: Spatial Interpolation of One Bedroom Housing Prices for 2018

Source: Field survey, 2018

4.2 Spatiotemporal dynamics in 2 bedroom housing prices

Spatial and temporal dynamics in the housing prices of two bedroom in the study area shows that CBD region have low rental value in the year 2008, while it increases in the area but still lower compare to other areas in the year 2018. However, to the west and south, the rental value of two bedroom apartments was high throughout the study period. These are spatially represented in Figure 5, Figure 6 and Figure 7 respectively.

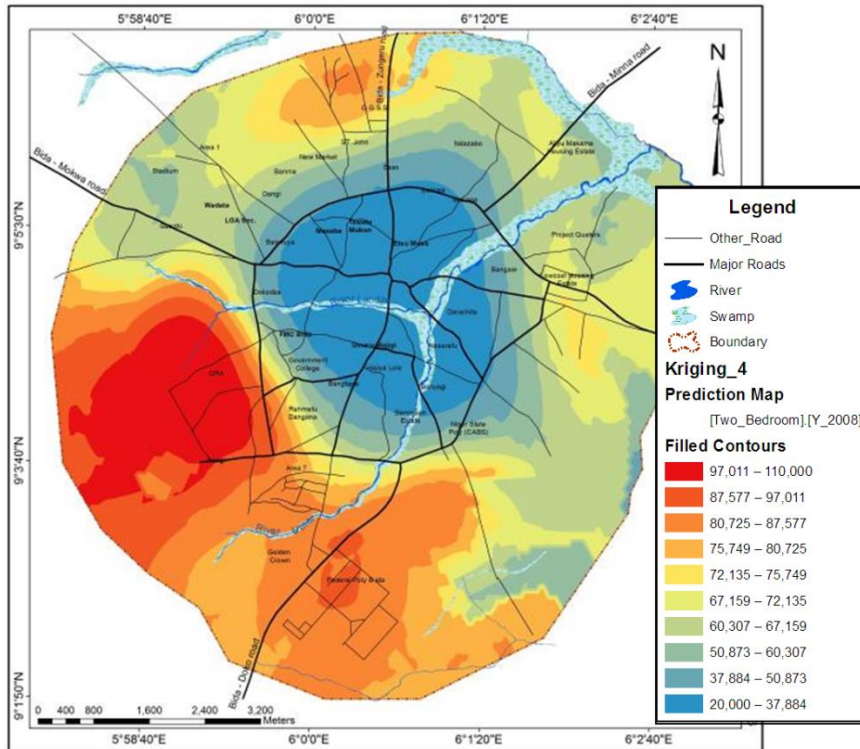


Figure 5: Spatial Interpolation of Two Bedroom Housing Prices for 2008
Source: Field survey, 2018

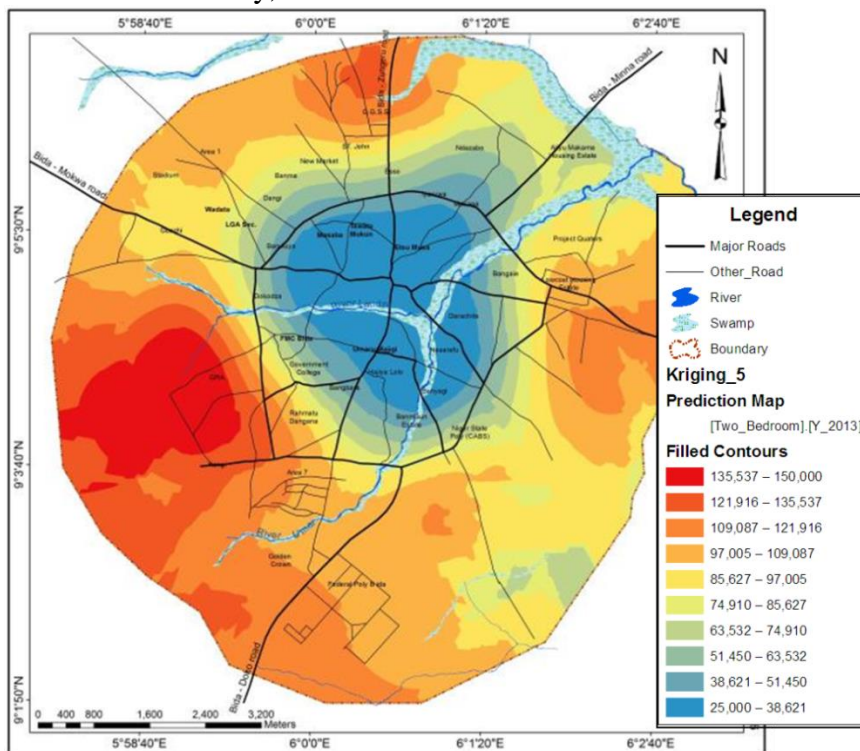


Figure 6: Spatial Interpolation of Two Bedroom Housing Prices for 2013
Source: Field survey, 2018

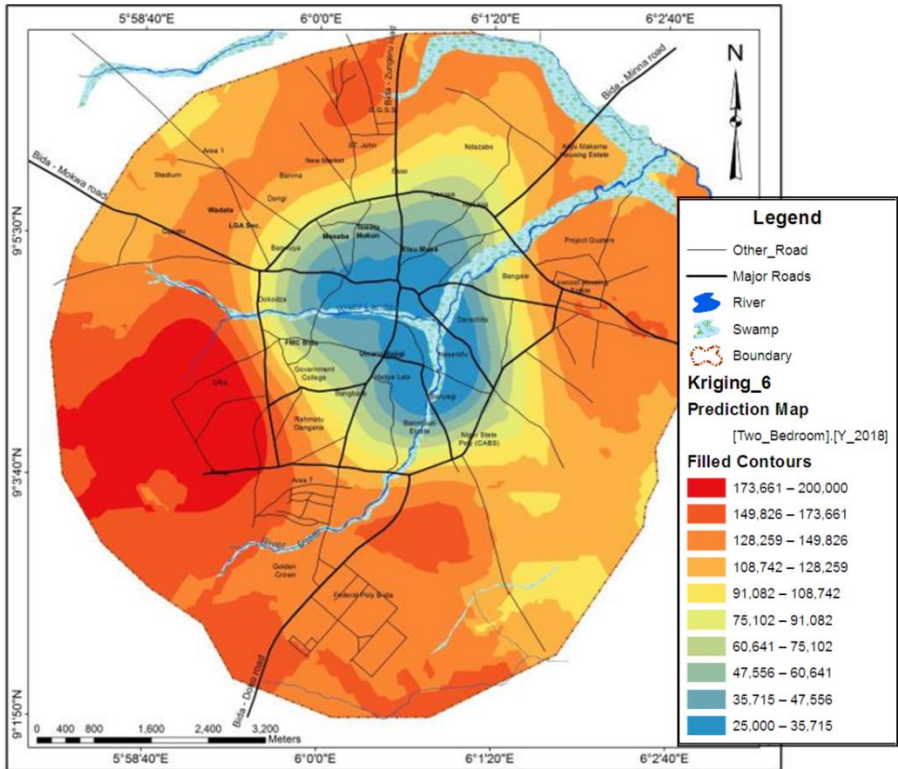


Figure 7: Spatial Interpolation of Two Bedroom Housing Prices for 2018

Source: Field survey, 2018

4.3 Spatiotemporal dynamics in 3 bedroom housing prices

For three bedroom apartments, space and time series analysis of rental prices records little changes between the year 2008 and 2013 while in 2018 significant changes have been observed. However, CBD and other regions surrounding it records lower rental value in 2018. This is graphically presented in Figure 4.8, Figure 4.9 and Figure 4.10 respectively.

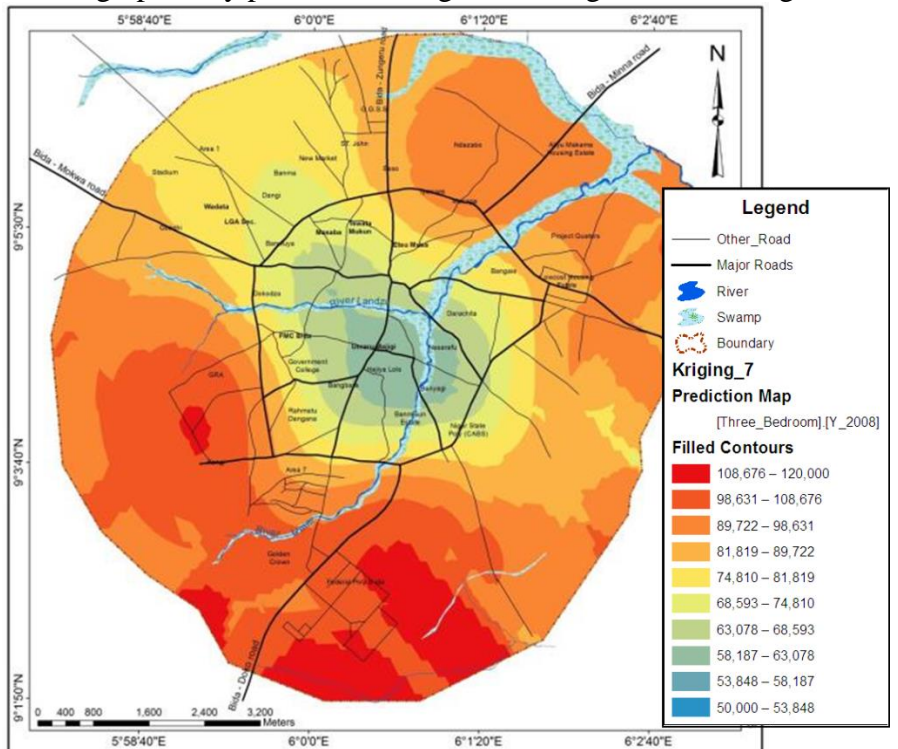


Figure 8: Spatial Interpolation of Three Bedroom Housing Prices for 2008

Source: Field survey, 2018

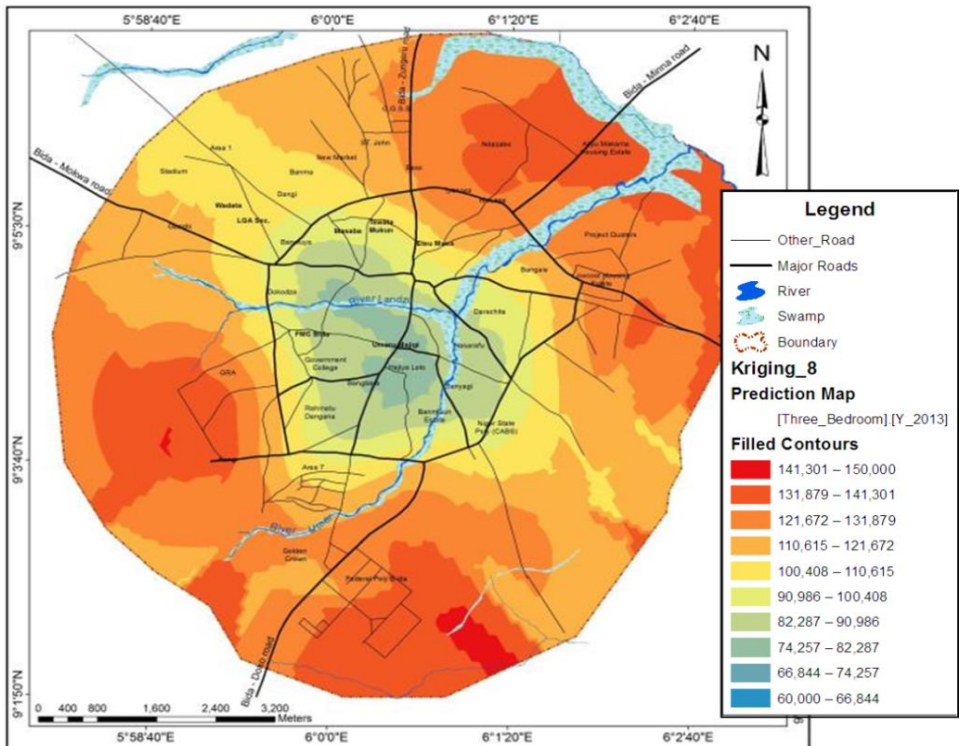


Figure 9: Spatial Interpolation of Three Bedroom Housing Prices for 2013
 Source: Field survey, 2018

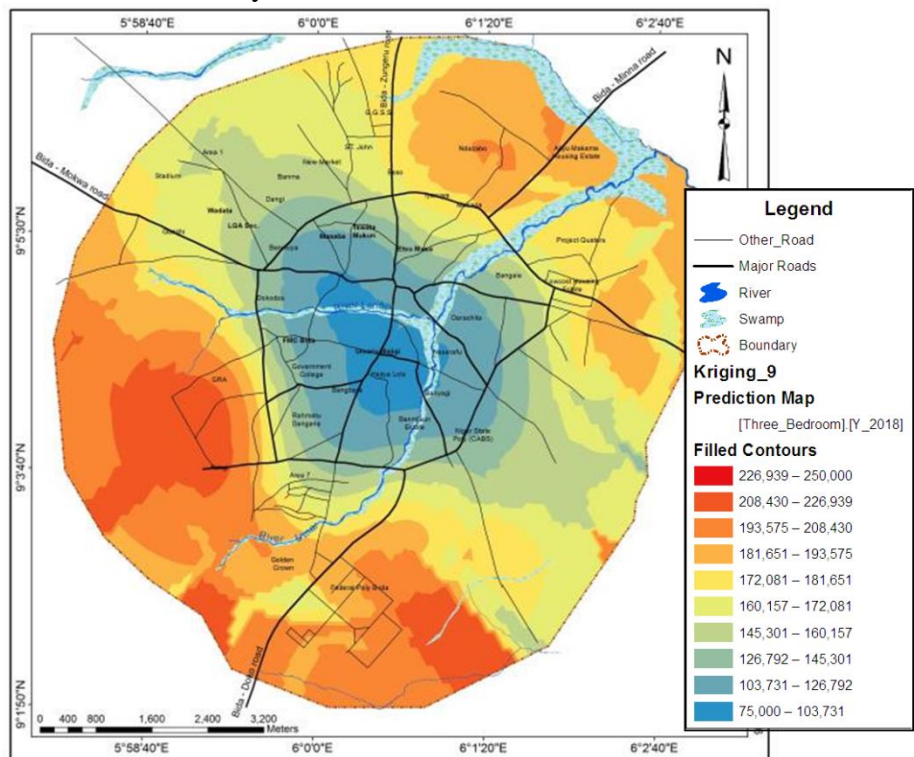


Figure 10: Spatial Interpolation of Three Bedroom Housing Prices for 2018
 Source: Field survey, 2018

5.0 Discussion of Findings

Findings of this study revealed that there is unique pattern of housing prices across the study period in most part of the town. The city centre which is referred to the CBD in this study have the lowest rental value through the study period. The study also shows the differences in rental value of apartments between the CBD and other neighbourhoods continue to widen. For

example, One bedroom apartments, in the year 2008 commands rental value of around ₦70,000 in GRA area and in the CBD it was around ₦15,000 to ₦20,000. Ten years later, rental value for one bedroom apartment increases to around ₦120,000 in GRA area and ₦28,000 around the CBD. This conform with the result by Cichociński and Dąbrowski (2013) but contrary to findings by D'Acci (2018) whose findings shows that housing value decreases with the increase of the distance from the city centre. D'Acci' findings confirms Alonso's monocentric model. However, general pattern from the geospatial model of this study demonstrate a unique housing prices pattern for the CBD while a divergence pattern for other areas. The model shows that housing prices in the Polytechnic region increases more than other regions for all types of houses under study and throughout the study period. Consequently, the model disconfirm Alonso's monocentric model which suggest that housing prices decreases with increasing distance to the city centre.

6.0 Conclusion

This study demonstrate the benefits associated with the use of GIS technology in housing research and the substantial benefits obtained by modelling the spatial as well as the temporal dependence of housing price data. Specifically approaches to trends and changes in the housing market, which can also extend to various aspects of housing studies. The knowledge gap filled in the study is that it considered various types of houses with their prices over time. The study therefore recommends the use geospatial techniques such as Ordinary Kriging in modelling housing market studies, particularly, trends in the housing market.

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