



**SCHOOL OF ENVIRONMENTAL TECHNOLOGY,  
FEDERAL UNIVERSITY OF TECHNOLOGY  
MINNA, NIGER STATE, NIGERIA**

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R. E. Olagunju

B. J. Olawuyi

E. B. Ogunbode

**SETIC  
2020  
INTERNATIONAL  
CONFERENCE**

**BOOK OF PROCEEDINGS**

**MAIN THEME:**

**Sustainable Housing And Land Management**



**3RD -5TH MAY, 2021**



**SCHOOL OF ENVIRONMENTAL TECHNOLOGY COMPLEX,  
FUT, MINNA, NIGER STATE, NIGERIA**

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Vice-Chancellor:  
Federal University of Technology Minna, Nigeria

**Host:**

**Prof: R.E. Olagunju mnia**  
Dean, School of Environmental Technology  
Federal University of Technology Minna, Nigeria

**School of Environmental  
Technology International  
Conference  
(SETIC 2020)**

**3RD – 5TH MAY, 2021**

**Federal University of Technology Minna, Niger  
State, Nigeria**

**CONFERENCE PROCEEDINGS**

**EDITORS IN CHIEF**

**R. E. Olagunju**

**B. J. Olawuyi**

**E. B. Ogunbode**

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SETIC 2020 International Conference:

“Sustainable Housing and Land Management”

School of Environmental Technology, Federal University of Technology, Minna  
3<sup>rd</sup> – 5<sup>th</sup>, May 2021.

# Proceedings of the 3rd School of Environmental Technology International Conference (SETIC 2020)

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SETIC 2020 International Conference:

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3<sup>rd</sup> – 5<sup>th</sup>, May 2021.

## **PREFACE**

The School of Environmental Technology International Conference (SETIC 2020) is organised by School of Environmental Technology, Federal University of Technology Minna, Nigeria. In collaboration with Massey University New Zealand, Department of Civil Engineering Faculty of Civil Engineering and Built Environment Universiti Tun Hussein Onn Malaysia, Malaysia Centre For Professional Development and Industrial Project Development School of Professional and Continuing Education (SPACE) UTM-KL Malaysia, Global Academia, Department of Architecture, Faculty of Engineering and Architecture, Istanbul Gelisim University Istanbul Turkey, Sustainable Environmental and Technology (SET) Research Group, Department of Architecture, Universiti Sains Islam.

The main theme for this year conference is “SUSTAINABLE HOUSING AND LAND MANAGEMENT”. This promotes and encourage innovative and novelty for policy issues for inclusive and sustainable housing; access to finance for housing and land development; sustainable building materials; building cost management; sustainable and resilient cities; geoinformatics for land management; rapid urbanization; sustainable land use and spatial planning and gender issues in access to land.

The responses from participants for this conference are overwhelming, well attended, and successful. The operation mode was virtual for all participants who choose the oral presentation mode and physical for all poster medium presenters. Our participants are from various Universities and other sector across the globe, from countries like United State of America (USA), Turkey, Malaysia, China, Saudi Arabia, Kenya, New Zealand and South Africa just to mention a few. Hence, this conference provides a good platform for professionals, academicians and researchers to widen their knowledge and approach on latest advances in research and innovation. Papers presented in this conference cover a wide spectrum of science, engineering and social sciences.

Finally, a note of thanks must go to SETIC 2020 Local Organizing Committee (LOC) for their remarkable dedication in making this conference a success. We hope the event will prove to be an inspiring experience to all committee members and participants.

## ACKNOWLEDGEMENTS

The effort put together in achieving the success of SETIC 2020 is predicated on the feat of the first and second edition of School of Environmental Technology International Conference held in 2016 and 2018, respectively. The support and goodwill from Vice-Chancellor of Federal University of Technology, Dean School of Environmental Technology, Dr Dodo Y. A., Dr Moveh S. and many other highly motivated people are highly appreciated.

It is also my privilege and honour to welcome you all, on behalf of the Local Organizing Committee (LOC) to the 3rd edition of the Biennial School of Environmental International Conference (SETIC 2020). This Conference which was earlier schedule for 7th to 11 April, 2020 is holding now (3rd to 5th May, 2021) due to the challenges of COVID-19 Pandemic and the ASUU-FGN crisis which made our public Universities in Nigeria to be closed for about one year. We thank God for keeping us alive to witness the great SETIC2020 event, in an improved form exploiting the new-normal situation posed by the Pandemic for a hybrid (i.e. both physical and virtual) form of Conference participation.

The conference provides an international forum for researchers and professionals in the built environment and allied professions to address fundamental problems, challenges and prospects Sustainable Housing and Land Management. The conference is a platform where recognized best practices, theories and concepts are shared and discussed amongst academics, practitioners and researchers. This 2020 edition of SETIC has listed in the program a Round Table Talk on Housing Affordability beyond COVID-19 with selected Speakers from across the globe available to do justice on the topic of discussion.

Distinguished Conference participants, permit me to warmly welcome our Keynote and Guest Speakers:

- Prof. Ts. Dr. Mohd Hamdan Bin Ahmad, *Deputy Vice Chancellor (Development) Universiti Technology Malaysia (UTM)*;
- Assoc. Prof. Dr. James O.B. Rotimi, *Academic Dean Construction, School of Built Environment, College of Sciences, Massey University of New Zealand*;
- Assoc. Prof. Sr. Dr. Sarajul Fikri Mohammed, *General Manager, Centre for Professional Development and Industrial Project Development School of Professional and Continuing Education (SPACE), UTM-KL*.
- Prof. Ts. Dr. Zanail Abidin Akasah, *Visiting Professor on Sustainable Solar Integrated Design Building Design, International Micro Emission University (IMEU)/HIMIN Ltd. China & Senior Research Fellow, The Architects Resourcery, Jos, Nigeria*;
- Ar. Dr. Elina Mohd Husini, *Department of Architecture, Faculty of Engineering & Built Environment, Universiti Sains Islam*;
- Asst. Prof. Dr. Yakubu Aminu Dodo, *Department of Architecture, Faculty of Engineering and Architecture Istanbul Gelisim University, Istanbul Turkey*

and the five Speakers for our Round Table Talk on “Housing Affordability beyond COVID-19”

- Dr. Muhammad Mustapha Gambo, *Manager, Policy, Research and Partnerships, Shelter Afrique, Nairobi, Kenya*;

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SETIC 2020 International Conference:

“Sustainable Housing and Land Management”

School of Environmental Technology, Federal University of Technology, Minna

3<sup>rd</sup> – 5<sup>th</sup>, May 2021.

- Prof. Dr. Soumia Mounir, *Department of Architecture Ecole Nationale d'Architecture d'Agadir [The National School of Architecture of Agadir], Morocco*
- Dr. Said Alkali Kori, *General Manager, Projects and Portfolio management, Family Homes Fund, Federal Ministry of Finance, Abuja;*
- Ts. Dr. Sasitharan Nagapan, *Department of Civil Engineering, Faculty of Engineering and Built Environment, Universiti Tun Hussein Onn Malaysia, Malaysia;*
- Dr. Mercy Nguavese Shenge, *AIA Assoc. Historic District Commissioner, City of Rockville, MD, USA.*

for accepting to share from their knowledge, wealth of experience and be available to interact with participants on varied issues on “**Sustaining Housing and Land Management**”.

As reflected on the Conference program, the Conference activities will be Virtual for power point presenters to run in four parallel sessions on the Zoon platform while the participants for Poster presentations (mostly Postgraduate students) are expected to have their Posters displayed in the Environmental Complex Building of the Federal University of Technology, Minna. With a total of One Hundred and One (101) articles captured in the Conference Proceedings covering the seven subthemes of the Conference, I have no doubt that we are all in for an impactful experience at SETIC2020 as we brainstorm, exchange ideas, share knowledge and participate in evolving more approach to sustainable housing and land management drives.

I implore us all to enjoy every moment of the deliberations and ensure we maximize the great opportunity offered by the Conference to network for better research and career development as we also make new friends.

I also on behalf of myself and the LOC express our appreciation to the Dean, School of Environmental Technology and the entire Staff of the School for giving us the opportunity to steer the ship for SETIC2020. To the Reviewers and various Committees that served with us, I say thank you for helping us through despite the pressure of work.

Thanks, and God bless you all.

**Olawuyi, B.J. (PhD)**  
**Chairman, LOC**  
**SETIC2020**

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# DECLARATION

## PEER REVIEW AND SCIENTIFIC PUBLISHING POLICY STATEMENT

3rd May 2021

TO WHOM IT MAY CONCERN

I wish to state that all the papers published in SETIC2020 Conference Proceedings have passed through the peer review process which involved an initial review of abstracts, blind review of full papers by minimum of two referees, forwarding of reviewers' comments to authors, submission of revised papers by authors and subsequent evaluation of submitted papers by the Scientific Committee to determine content quality.

It is the policy of the School of Environmental Technology International Conference (SETIC) that for papers to be accepted for inclusion in the conference proceedings it must have undergone the blind review process and passed the academic integrity test. All papers are only published based on the recommendation of the Reviewers and the Scientific Committee of SETIC

Babatunde James OLAWUYI  
Chairman SETIC2020  
Federal University of Technology, Minna, Nigeria

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AND ALSO SELECTED PAPERS WILL BE PUBLISHED IN REPUTABLE JOURNALS



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SETIC 2020 International Conference:

“Sustainable Housing and Land Management”

School of Environmental Technology, Federal University of Technology, Minna

3<sup>rd</sup> – 5<sup>th</sup>, May 2021.



# ORGANISING COMMITTEE

## CHIEF HOST

**Prof. Abdullahi Bala**  
Vice-Chancellor,  
Federal University of Technology Minna, Nigeria

## HOST

**Prof. Olagunju Remi Ebenezer**  
Dean  
School of Environmental Technology,  
Federal University of Technology Minna, Nigeria

## CONFERENCE CHAIRS

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Prof. Kemiki O.	Building Cost Management
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Prof. Nuhu M. B.	Access to Finance for Housing and Land Development
Prof. Ajayi M.T.A	Policy Issues for Inclusive and Sustainable Housing
Prof. Sanusi Y.A	Rapid Urbanization, Sustainable Land Use and Spatial Planning
Prof. Jimoh R.A.	Sustainable Building Material

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Prof. Musa A.	HOD, Department of Surveying and Geoinformatics
Dr. Umaru E. T.	HOD, Department of Urban and Regional planning

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SETIC 2020 International Conference:

“Sustainable Housing and Land Management”

School of Environmental Technology, Federal University of Technology, Minna

3<sup>rd</sup> – 5<sup>th</sup>, May 2021.

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Dr. Ogunbode E.B.	Member	Department of Building, Federal University of Technology Minna, Nigeria
Dr. Sule A. I.	Member	Department of Estate Management and Valuation, Federal University of Technology Minna, Nigeria
Dr. Akande O. K	Member	Department of Architecture, Federal University of Technology Minna, Nigeria
Dr. Adamu A.	Member	Department of Quantity Surveying, Federal University of Technology Minna, Nigeria
Dr. Ajayi O.O.	Member	Department of Surveying and Geoinformatics, Federal University of Technology Minna, Nigeria
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Dr. Hassan I.O.	Member	Department of Building, Federal University of Technology Minna, Nigeria

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Dr. Ibrahim Saidu	Member	Department of Quantity Surveying, Federal University of Technology Minna, Nigeria
Dr. Musa Haruna	Member	Urban and Regional planning, Federal University of Technology Minna, Nigeria
Dr. Odumosu J. O.	Member	Department of Surveying and Geoinformatics, Federal University of Technology Minna, Nigeria
Dr. Isah A. D.	Member	Department of Architecture, Federal University of Technology Minna, Nigeria

SETIC 2020 International Conference:

“Sustainable Housing and Land Management”

School of Environmental Technology, Federal University of Technology, Minna

3<sup>rd</sup> – 5<sup>th</sup>, May 2021.

## ACKNOWLEDGEMENT TO KEYNOTE SPEAKERS AND GUEST SPEAKERS

SETIC 2020 organisers wishes to thank our keynote speakers, and Guest speakers for accepting to create time to share from their rich wealth of knowledge and interact with delegates and participants on varied issues being examined at this year's conference. A brief profile of each keynote speaker is provided here, this would allow for future interaction and networking with them.



SETIC 2020 International Conference:

“Sustainable Housing and Land Management”

School of Environmental Technology, Federal University of Technology, Minna

3<sup>rd</sup> – 5<sup>th</sup>, May 2021.

## ROUND TABLE PANEL SPEAKERS



**Round Table Talk**  
On Housing Affordability Beyond Covid-19

**Main Theme**

**SUSTAINABLE HOUSING  
AND LAND MANAGEMENT**

**Dr. Muhammad Mustapha Gambo**  
Manager: Policy, Research and Partnerships,  
Shelter Afrique, Nairobi, Kenya.

**Prof. Dr. Soumia Mounir**  
Department of Architecture Ecole Nationale  
d'Architecture d'Agadir [The National School of  
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**Dr. Said Alkali Kori**  
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Ministry of Finance, Abuja.

**Ts. Dr. Sasitharan Nagapan,**  
Department of Civil Engineering Faculty of Civil  
Engineering and Built Environment Universiti Tun  
Hussein Onn Malaysia, Malaysia

**Dr. Mercy Nguavese Shenge**  
AIA Assoc. Historic District Commissioner,  
City of Rockville, MD. USA.

**Asst. Prof. Dr. Yakubu Aminu Dodo**  
GREN, MyCREST MAABICHES  
Istanbul Gelsim University, Istanbul Turkey  
**Moderator**

SETIC 2020 International Conference:

“Sustainable Housing and Land Management”

School of Environmental Technology, Federal University of Technology, Minna

3<sup>rd</sup> – 5<sup>th</sup>, May 2021.



S/N	Title	Author	Page
<b>A</b>	<b>SUB-THEME 1: POLICY ISSUES FOR INCLUSIVE AND SUSTAINABLE HOUSING</b>		<b>1</b>
1	Methodological Approaches to the Socio-Cultural Studies in Residential Estates	Abidoye, K.M. & Sagada, M.L.	2
2	A Critique of the Trusteeship Position of the Governor in the Land Use Act	Bokani, A.M. & Liman, Y.	10
3	E-Procurement Implementation in the Public Construction Sector in Nigeria: A Review	Abdullahi, A., Oyewobi, L., Ganiyu, B. & Shittu, A.	21
4	Assesment of the Prospects and Challenges of E-Procurement Practices on Construction Project Delivery in Abuja, Nigeria	Mobayo, J. O. & Makinde, K. J.	27
5	An Assessment of Users’ Satisfaction with the Adequacy of Security Measures in Mixed-use Buildings in Abuja	Adam A.M. & Olagunju R.E.	35
6	Allocation of Emerging Risks of E-Communication in Public Private Partnership Projects in Nigeria	Bashir, A.S. & Muhammad, A	42
7	Mechanism for Building Standards: Towards an Effective Building Control Practice in the Federal Capital Territory (FCT), Abuja	Fadare, O.A., Isa, R.B. & Bilau, A.A.	49
8	Assessment of Facility Management Practices in Selected Public Health Care Facilities in Niger State	Yusuf S., Bajere P.A. & Ogunbode, E.B.	59
9	Strategies for Disputes Reduction in the Nigerian Construction Process	Aka, A., Omotosho, A.O., & Salisu, O.I.	76
10	Assessment of Energy Conservation Measures in the Design of Postgraduate Student Hostels in Northern Nigerian Universities	Ojochegebe, I. & El-Hussain, A.	84
11	A Review of Housing Potentials in Curbing Pandemic: A Post Covid-19 Analysis	Garnvwa, J. D., Isa-Bala, C. M., Idris, H. A., Mailafiya, B. Y. & Abdulrazak, B.	92
12	Risk Assessment of Safety for Building Construction Projects in Abuja, Nigeria	Mamman, J., Yakubu M., Y., Shittu, A. & Adamu, A.	103
13	Influence of Workforce Diversity on Employee Performance In Construction Firms In Abuja, Nigeria	Anifowose, M.O. & Mohammed, M.N.	113
<b>B</b>	<b>SUB-THEME 2: ACCESS TO FINANCE FOR HOUSING AND LAND DEVELOPMENT</b>		<b>124</b>
14	Energy Pricing and Poverty in Sokoto City, North West Nigeria: A Lesion in Green House Gas Reduction	Ashiru, B., & Sabiu, B. Y.	125
15	Assessment of the Determinants of Risk Management Capabilities and Commitments in Public Private Partnerships Projects	Yamusa, M.A., Abdullahi, M., Bello, A.S.& Bello, A.K.	135



16	Conceptual Framework for an Effective Management of Public-Private Partnership Infrastructure Project Stakeholders to Minimise Project Failure in North Central, Nigeria	Yusuf, B. G., Bashir, O. G., Luqman, O. O. & Abdulganiyu, A. O.	145
17	Assessment of Factors Influencing the Various Procurement Methods in the Delivery of Commercial Building Projects in Abuja, Nigeria	Ibrahim, A. & Shittu, A.	155
18	Assessment of Procurement Risks in FIRS Building Construction Projects in Nigeria	Zubairu, H., & Saidu, I.	163
19	Assessment of the Adoption of Building Information Modelling (BIM) in the Nigerian Construction Industry	Monejo, T. B. & Makinde, J. K.	173
20	Land Use Changing Pattern and Urban Growth Felele Area, Lokoja Nigeria	Balogun J. O.	185
<b>C SUB-THEME 3: SUSTAINABLE BUILDING MATERIALS</b>			<b>197</b>
21	Sustainable Building Material for Green Building Construction and Conservation	Ninalowo, R.O. & Zubairu, S.N.	198
22	Comparative Compressive Strengths of Concrete Using Wood Ash and Cow Bone Ash as Partial Replacement for Cement	Olaleru, J., Baba, T. & Abdullahi, A.	205
23	Assessing Some Mechanical Properties of Reinforcement Bars Made from Recycled Metals as a Panacea to Sustainable Use of Reinforcement as Building Material	Bello, U. and Thabita, S.	212
24	Optimizing the Compressive Strength of Binary Mixtures of Laterite-Sand Cement Mortar	Adetona, A. & Alao, T.O.	219
25	Assessment of Lean Techniques for Building Materials Waste Minimisation in Abuja, Nigeria	Ango, A. & Saidu, I.	228
26	Evaluation of the Significance of Timber as a Source of Sustainable Building Material in Owerri, Nigeria	Emechebe, L.C., Eze, J. C. & Akande, O.K.	238
27	Evaluation of the Compressive Strength of Concrete Using Bush Gravel as Coarse Aggregates Partially Replaced with Broken Bricks	Baba, T., Olaleru, J., & Alhaji, B.	247
28	Influence of Magnesium Sulphate on the Compressive Strength of Internal Cured (IC) Rice Husk Ash based High Performance Concrete	Mudashiru, S. A., Olawuyi, B. J., Ayegbokiki, S. T., & Ndayako, S.K.	253
29	Influence of Material Waste Management on Construction Project Delivery in Abuja, Nigeria	Garba. Y. Y., Yisa. S. N. & Umar. M. I.	261
30	Effective Implementation of Health and Safety Practices on Construction Site: Barriers and Movers	Eigege, J., Aka, A. & Agbo, A.E.	266
31	Utilization of Quarry Dust as Partial Replacement of Sand in Sandcrete Blocks	Garba, A., Saidu, A., Adamu, A.I. & Dalhat, A.S.	272



32	Assessment of Shredded Waste Poly-Ethylene Terephthalate (PET) Bottles Usage as Coarse Aggregate in Lightweight SHA Based Concrete Composite	Daniya N. S., Ogunbode E. B., Yahaya T. A. & Alao T.O.	278
33	Characteristics and Properties of Rice Husk Ash Based Fibrous Concrete Manufactured with Waste Metallized Plastic Film Fibre	Ogunbode E. B., Alhaji_Minin, N., Shehu M. A. & Lukman, M.L.	286
34	Evaluation of Shear Bond Strength of Geopolymer Mortar Containing Cassava Peel Ash and Metakaolin	Wuna, M.A., Nmadu, H.G., Ogunbode, E.B. & Mohoro, I.S.	295
35	Determination of the Compressive Strength Properties of Alkali-activated Millet Husk Ash - Calcium Carbide Mortar	Onuche, G., Olawuyi, B. J. & Saka, R. O.	303
36	Compressive Strength Characteristics of Mortar Containing Pulverised Volcanic Ash and Metakaolin as Cement Replacement	Hassan, I.O., Ali, S.U. & Yunusa, A.	312
37	Piping Investigation of Kiri Dam Located in Shelleng L.G.A, Adamawa State, Nigeria, Using SEEP/W	Ahmed Bafeto Mohammed	322
38	Assessment of Sustainable Traditional Building Materials to Modern Residential Housing in Ibadan, Oyo State, Nigeria	Agboola, B.A. & Eze, J.C.	330
39	Evaluation of the impact of the Use of Roof Concrete Fascia on Embodied Carbon Emission of Residential Buildings in Nigeria	Udomiaye, E., Odom, C.U., Umuogbara, R.E., Kalu C. K., Ntaji, P. & Unyime, I.	341
<b>D</b>	<b>SUB-THEME 4: BUILDING COST MANAGEMENT</b>		<b>349</b>
40	Influence of Supervision on Labour Productivity of Finishing Works in Ibadan, Oyo State	Jibril, H.I., Saidu, I., Alhassan, M.I. & Mohammed, M. N.	350
41	Analysis of Stakeholder Management of Construction Project in Abuja, Nigeria	Alayande, A. & Ola-awo, W.	359
42	Factors Influencing Building Materials Price Fluctuation in Abuja, Nigeria	Omede, V., & Saidu, I.	369
43	Assessment of the Effect of Materials Procurement Risks Factors on Time, Cost and Quality Performance of Building Projects in Abuja, Nigeria	Muhammad, M. C., & Saidu, I.	379
44	Participation of Female Quantity Surveyors in the Nigerian Construction Industry	Nnamoko, C., & Ola-awo, W.	390
45	Effects of Skill Gap on Labour Productivity on Construction Sites in Abuja	Bilau, T.O. & Bamgbade, A.A.	398
46	Evaluation of Cost Management in Building Maintenance by Contractors	Bello, U. & Nasir, G.	405
47	Effect of Cash Flow on Contractors' Performance in Building Construction Projects in Niger State	Alhassan, I., Shittu, A., Mohammed, M. & Jibri, I. I.	411
48	Assessment of Cost Control Techniques on Road Construction Project Delivery in FCT Abuja, Nigeria	Alabi, S.S., Anifowose, M.O. & Ochepe, S.	420



49	Cost of Implementing Health and Safety Measures in Construction Projects in Abuja, Nigeria	Hassan, K.M., Mohammed, Y.D. & Nmadu, H.G.	428
50	Conceptual Framework for an Effective Management of Public-Private Partnership Infrastructure Project Stakeholders to Minimise Project Failure in North Central, Nigeria	Gognaje, Y.B., Ganiyu, B.O., Oyewobi, L.O. & Oke, A.A.	434
51	An Evaluation of the Challenges of Tendering Procedures on Building Projects in Kaduna, Nigeria	Usman, F.A.; Adamu, A.D. & Saidu, I.	443
<b>E SUB-THEME 5: SUSTAINABLE AND RESILIENT CITIES</b>			<b>451</b>
52	Integration of Passive Energy Efficient Design Elements for Office Complex, Abuja, Nigeria	Idris, M. & Muhammad, I.B.	452
53	Liveability of Public Housing in Nigeria: A Study of Residents’ Satisfaction in Some Selected Public Housing Estates in Niger State	Haruna, P.B. & Zubairu, S.N.	460
54	Assessment of Climate Responsiveness of Public Office Buildings Designs in Selected Tertiary Institutions in Niger State towards Energy Efficient Buildings in Nigeria	Adebisi, G.O. & Alonge, D.O.	470
55	The Characteristics of Kaduna Metropolitan Solid Waste Management Practices	Habila, S.K. & Rikko, L.S.	478
56	Assessment of Crime Prevention through Environmental Design (CPTED) in Shopping Malls in Nigeria: A Case of Ceddi Plaza Abuja, Nigeria	Aliyu, U. & Zubairu S. N.	488
57	Assessment of Eco-Friendly Principles in the Design of a 3 Star Hotel at Life Camp in Abuja, Nigeria.	Ogwanighie .O.A. & Abdulrahman .M.E.	499
58	Climate Change Adaptation and Sustainable Eco-Friendly Urban Mass Transit Development in Abuja, Nigeria	Dukiya, J.J.	510
59	Water Scarcity Problem and Households’ Adaptation Strategies: Evidence from Literature	Owuri, A. & Sanusi, Y.A.	521
60	Assessment of the Resilience-related Capabilities of Households in Bida Town, Niger State, Nigeria	Usman, M. Y. , Saidu, M. B. & Yahaya, S.	531
61	Appraisal of Households’ Resilience to Social Shocks in Bida Town, Niger State, Nigeria	Usman, M. Y., Aliyu, A. A. & Wanciku, Y.	540
62	A Review of Sustainable Energy Conservation for Residential Buildings	Adeniji, S.M., Muhammad, I.B. & Isah, A.D.	550
63	Assessment of an Integrating Design Approach of Passive Cooling Principles in Hotels in Minna, Nigeria	Ioron, S. & Ayuba, P.	560
64	Evaluation of Market Fire Hazard Awareness and Preparedness in Minna Metropolis	Ayinla K., Akanmu W. & Oyerinde D.	569
65	Employing Proxemics Communication Strategies in Evaluating Prototype Design in Educational Buildings	Kabir, M.A., Alkali, I.A., El-nafaty, A.S. & Dodo, Y.A.	579





67	Behaviour and Functioning of Children Hospitalized in Nigerian Conventional Hospital Ward Setting	Usman B.W., Ojobo, H., Umar, A., Isa, A.A. & Ogunbode E.B.	597
68	Indoor Occupancy Detection using Machine Learning Techniques	Aliyu, A. A., Ojobo, H., Nusa, D. J. & Dodo, Y. A.	607
69	Assessment of Factors Affecting Performance of Construction Organisations in Abuja, Nigeria	Okigbo, O. N., Saidu, I., Olawo W. A. & Adamu, A. D.	615
70	Project Managers’ Performance on Sustainable Construction of Residential Estates in Abuja, Nigeria	Belgore, U. & Makinde, J. K.	623
71	Residential Property Use Conversion and Rental Value Trends in Osogbo, Nigeria	Ankeli, A. I., Nuhu, M. B. , Sule, A. I., Popoola, N. I., & Ankeli, U. C.	633
72	Evaluation of Passive Cooling Design Considerations in Faculty of Basic Medical Science Buildings in Northern Nigeria	Usman, S. M & Ayuba, P.	642
73	Policy Issues and Integration Settlement for Sustainable Development in FCT Abuja	Unah, M. O	650
74	Assessment of Design Method on Fire Prevention Strategies for High Rise Buildings in Lagos, Nigeria	Muhammad R. & Eze, J. C.	659
75	Evaluation of Factors Influencing the Adoption of Building Information Modelling for Facility Management in Abuja, Nigeria	Adelusi, C., Adamu, A. D. & Shittu, A.	667
76	Assessment of Shared Parking in Mixed-Use Buildings in Kano State	Iklimah, S. & Salihu, S.	678
77	Influence of Urban Recreational Facilities Quality on Domestic Urban Tourists Patronage of Parks in Abuja City, Nigeria	Mohammed, B.B., Akanbi, M., & Mohammed, M.	686
78	Passive Design Strategies for Sustainable Operation of NYSC Camp Buildings, Minna, Nigeria	Adedayo D. I. & Akande O. K.	692
79	Integration of People’s Perception of Landscape in the Design of Recreational Parks, Minna, Nigeria	Aboh, M.E., Muhammad, I.B. & Isah, A.D.	700
80	Impacts of Urban Poultry Farm Activities on Water Quality in Kuje Suburbia, Abuja	Auta, F.D. & Musa, H.D.	710
81	An Analysis of the Relationship between Neighbourhood Ties and Crime Perception in Minna, Niger State	Abdullahi, M. U. & Musa, H.D.	717
82	User Centred Approach to Interactive Architectural Spaces For Sustainable School of Architecture Buildings in Nigeria	Gana, G. & Akande, O.	723
83	Integration of Interactive Spaces in the Design of an Autism Centre, in Kaduna State, Nigeria	Saliu, S.R. & Eze, J.C.	732
84	Assessment of Green Design Strategies in Tech Innovation Hubs in Abuja, Nigeria	Ndanusa, A.M. & Zubairu, S.N.	740



<b>F</b>	<b>SUB-THEME 6: GEOINFORMATICS FOR LAND MANAGEMEN</b>	<b>748</b>
85	Solid Waste Disposal Site Suitability Analysis within Jalingo Metropolis, Taraba State, Nigeria	Gbedu, A.M., Atenji, D. E. & Adeniyi, G. 749
86	Development of a Geospatial Information Software for Cadastral Survey Data Processing and Management	Ajayi, O.G., Ajibade, S.A. & Abdullahi, A.K. 758
87	Application of Location Based Service for flood Vulnerability Assessment of Part of Minna, Niger State, Nigeria	Adesina, E.A., Adewuyi A. I. & Berthran C. B. 768
88	Flood Inundation Mapping of Gbaganu Area Minna, Niger State	Adesina, E.A., Saka T. T., Adewuyi A. I., Ayoade S.A and Ayandeji, M.A 779
89	Spatio-Temporal Analysis of Urban Sprawl and its Impact on Economic Trees in Gidan Mangoro-Minna, Niger State, Nigeria	Hauwa Ahmed Ndagi. 783
90	Appraisal of Informal Access to Land for Housing Delivery in Karu Urban Area of Nasarawa State, Nigeria	Sulyman A. O., & Danladi A. A. 793
91	Automatic Extraction of Farmland Boundary Lines from Satellite Imagery Using Fully Convolutional Networks – A Review	Isa, A.M. & Ajayi, O.G. 804
92	Prospectivity Mapping for Gold (Au) Mineralization Using LandsAT 8 OLI Data in Part of Niger State, Nigeria	Aransiola, A. B. & Odumosu, J. O. 814
93	Assessment of Geothermal Potential Within the Basement Region of Kogi State, Using Aeromagnetic Data	Fidelis I. K. & Adetona, A. A. 823
94	Delineation of Structures for Solid Minerals within Kubil (Sheet 128) and Wawa (Sheet 159) North Central, Nigeria from Aeromagnetic Data	Kolo, Y.R., Abbas, A.A. & Salako, K. 830
95	Effects of Density of Ground Control Points on the Accuracy of Maps Produced Using UAV: A Review	Muhammad, B. & Musa, A. 837
96	Factors Influencing Land Use Changes and Conversion: A Critical Review	Gwamna, E., Usman, M., Salihu, N. & Alalade, G. 845
97	Valuation of Agricultural Properties: Empirical Evidence from OXFARMS Minna, Nigeria	Olatunji, A., Adama, U., Adoga, O., Ojetunde, I. & Shittu, A. 854
98	Application of Electrical Resistivity Method to Delineate Construction Sites at Gidan Kwano Campus, FUT, Minna, Niger State, Nigeria	Ebute, O.R., Alhassan, U.D. & Rafiu, A. A. 865
99	Computational Fluid Dynamics (CFD) Investigation of Pressure Drop across Highly Porous Metallic Structure	Muhammad, M.S. & Otaru, A.J. 875



100	Delineation of Solid Mineral Structures within Upper Part of Nasarawa State from Aeromagnetic Data	Uchenna, C. I. & Abass A. A.	881
101	Evaluation of Passenger Perception of Public Transport Hubs in Abuja-Nigeria	Aminu, B.A. & Eze, J.C.	891
102	An Empirical Approach For Determination of Building Stability Using CORS Data	Adeniyi, G., Gbedu, A. M. & Opaluwa, Y. D.	898
103	Industrial Excavation Pits and its implications on enhancing Sustainable Land Management in Nigerian Cities: A Case Study of Bida Urban Area	Tabiti, S. T., Aremu, S. & Daramola, J.	907
<b>G</b>	<b>SUB-THEME 7: RAPID URBANIZATION, SUSTAINABLE LAND USE AND SPATIAL PLANNING</b>		<b>920</b>
104	Influence of Igala Culture on Spatial Relationships and Space Distributions within Households in Anyigba Kogi state	Musa, I. A. & Muhammad, I. B.	921
105	Assessment of Fire Safety Compliance (FSC) in Nigerian Markets: Case Study of Selected Markets in Three (3) Geopolitical Zones	Longtau, P., Majidadi, T. S. & Arowolo, T.	930
106	Evaluation of Passive Security Measures for Tourism Development in Nigeria	Hayes, N.Y. & Isah, A.D.	939
107	Terrain Analysis for Effective Spatial Coverage of FM 92.3Mhz Signal in Minna Metropolis	Gbedu A.M., Adeniyi, G., & James, I.S.	947
108	Effect of Urban Land-Use Planning Regulations on Residential Property Investment Returns: Evidence From Literature	Salihu, N., Nuhu M. B., Sanni M. L., Sule I. A. & Emmanuel S. G.	954
109	Potentials of Effective Urban Planning as Tool for Disaster Risk Reduction in Nigeria	Sanni, L. M.	963
110	Analysis of Urban Densification and Housing Market in Bida, Niger State, Nigeria	Mohammed, J.K. & Sulyman, A.O.	972
111	Exploring Community-Based Facilities Management Principle Towards a Sustainable Urban Land Management in Minna	Adama, U.J., Morenikeji, G., Kemiki, O.A., Popoola, N.I. & Ajayi, M.T.A.	982
112	Management Options for Some Selected Peri-Urban Areas of Kaduna Metropolis, Kaduna State, Nigeria	Habila, S. K	989
113	Assessment of Household Knowledge and Practice of Solid Waste Characterization in Kaduna Metropolis	Yakubu, K. N. & Babagana, A.	999
114	Assessment of Indoor Thermal Performance for Sustainable Senior Housing Facility in Minna, Nigeria	Idiagi, E. & Ayuba, P.	1009
115	Nexus between Social Infrastructure and Residents Wellbeing: A Review	Ijuo, S. & Musa, H. D.	1020



- |     |  |                               |      |
|-----|--|-------------------------------|------|
| 116 | Impact of the Land Use Act on Sustainable Housing Development in Nigeria from 1978-2018                        | Bokani, A.M. & Mohammed, A.W. | 1029 |
| 117 | SQL-Driven Spatial Database Transactions in Support of Compulsory Land Acquisition for Road Expansion Projects | Ataguba, J.O. & Kemiki, O.A.  | 1040 |
| 118 | Africa’s Population Growth: Adopting the Smart City Model in Nigeria as a Blueprint for its Future Cities      | Ezeugwu, N.C. & Isah, A.D.    | 1050 |

# Impacts of Urban Poultry Farm Activities on Water Quality in Kuje Suburbia, Abuja

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## Abstract

The rapid rate of urbanisation is associated with unemployment and urban food security challenges. To address the food security challenges in cities, urban residents have embraced the practice of urban agriculture, a practice which involves the production of animals and crops in urban and peri-urban areas. Poultry farming is a vital approach toward providing urban residents with the required protein intake in form of eggs and meat. This study examines the impacts of urban poultry farms activities on water quality in Kuje suburbia. The parameters measured for water sample was carried out in a laboratory test to assess the physicochemical parameters of the water. The results show high concentration of TA, Mn, Ph, NO, and BOD above the WHO/ NESREA recommended standard in surface water, borehole, and well water sampled. In conclusion, the poultry farms activities impact the environment of the vicinity they operate by causing water pollution. The study recommends among others the need for appropriate distance between poultry farms and residences to be determined and enforced by regulatory authority. This will help to mitigate the effects of environmental pollution /health hazards on the residents.

**Keywords:** Urban agriculture, Community health, Residents Perception, Environmental Pollution

## 1.0 INTRODUCTION

The rapid rate of urbanisation is associated with unemployment and urban food security challenges. To address the food security challenges in cities, urban residents have embraced the practice of urban agriculture – a practice which involves the production of animals and crops in urban and peri-urban areas (Tornaghi, 2014).

Poultry farming is one of the major urban agricultural practices in Nigeria. It is a vital approach toward providing urban residents with the required protein intake in form of eggs and meat. FAO (2006), observed that the poultry industry globally has made tremendous changes to meet the increasing demand for inexpensive and safe supply of meat and egg. This increasing demand has been accompanied by structural changes within the sector characterised by the emergence and growth in commercial and industrial farming establishments as well as the intensification of poultry operations (Shashank, 2013; FAO, 2006). Poultry farming is capable of addressing the four core dimensions of food security, vis-a-vis food availability, food access, food utilisation and food stability (Sassi, 2018). However, poultry farming has been associated with a plethora of health and environmental impacts (Foeken, 2006).

The effects of poultry farms have been studied from various perspectives. Delgado et al., (2016) in their research indicated that the growth in meat consumption worldwide, has led to an increase of waste by livestock systems that pose dangers to the environment. Kalhor et al. (2016), specifically focused their studies on airborne pollutants, poultry production releases significant emissions of ammonia (NH<sub>3</sub>), methane, and sulfur dioxide. Li *et al.*, (2018) posited that between 30 and 90% of the antibiotics administered to livestock are excreted non-metabolized into the environment through manure. Xie *et al.*, (2018a), also confirmed that contamination of antibiotics in the environment by anthropogenic activities increases the competitive advantage of antibiotic resistant bacteria by gradually reshaping the resistant in the environment. Livestock farming systems are major source of trace gases contributing to atmospheric pollution locally and globally (Appuhamy *et al.*, 2016). The greenhouse gas emissions of livestock production and its by products accounted for 18% of global total emissions (IPCC, 2014). Other studies focused on the rate of waste generation and nutrient

contents of poultry waste production which are affected by a number of factors (Adedayo, 2012; Adeoye *et al.*, 2014).

A large number of studies have been conducted investigating various aspects of the environmental pollution and human health impacts of poultry farms, but no review has attempted to systematically explore the major pollutants emitted from poultry farms, their environmental impacts, and the potential human health risks from exposures to them. This study therefore aims at assessing the impact of poultry farms on water quality in Kuje suburbia. The important major impacts of poultry farms will be identified on the environment and human health. This paper therefore, prove indispensable to urban policy makers, planners, health and environmental organizations on environmental impacts of poultry farms.

## **2.0 LITERATURE REVIEW**

### *Urban Sustainability: Environmental and Health Implications of Poultry Farming*

Cities are considered as complex adaptive socio-biophysical systems (Childers *et al.*, 2014). James *et al.*, (2015) noted that cities are currently the habitat and ‘zone of survival’ of humanity in the 21<sup>st</sup> century. They identified the need to shift emphasis from the growth-based narrative to a more holistic consideration of cities as ecological systems whose alterations are capable of threatening human existence. Childers *et al.* (2014) observed that the urban sustainability is a result-based and solution-oriented theory that considers humans as ‘ecological stewards’. In other word, urban sustainability is concerned with the development and consumption of healthy and liveable cities (Steiner 2011, 2014; Wolch *et al.* 2014). As James *et al.* (2015) argued, “Cities are at the heart of the problems facing this planet, but developing a positive and sustainable mode of urban living is the only way that we will be able to sustain social life as we know it past the end of this century”. Rapid development of urban agriculture is associated with greenhouse gases (GHGs) and ammonia (NH<sub>3</sub>) emissions and climate change contributing to atmospheric pollution locally and globally (Piha *et al.*, 2007; Broto and Bulkeley, 2013). Livestock farming systems are major source of trace gases contributing to atmospheric pollution locally and globally (IPCC ,2014; Appuhamy *et al.*, 2016; van der Weele *et al.*, 2019). The greenhouse gas emissions of livestock production and its by-products accounted for 18% of global total emissions, suspended solids, nutrients, metals and pharmaceutical compounds (Pimentel *et al.*, 2005; Rodić *et al.*, 2011; Sabiha *et al.*, 2016). Application of Livestock manure has the consequence of nutrients and antibiotics which seep from soils into ground and surface waters, having a devastating effect on water quality, favouring the growth of algae, accelerating eutrophication and promoting the spread of antibiotic resistant bacteria (Hooda *et al.*, 2000; Martinez, 2009; Girard *et al.*, 2014; Sabiha *et al.*, 2016; Almeida *et al.*, 2017). Alabi *et al.*, (2014), in their research found out that chicken droppings generally contaminate the litter spread in poultry houses and poses great environmental threats during the process of disposing the litter. This is because improper disposal leads to air pollution from unpleasant odours, breeding of flies, and water pollution. The effects of poultry farms have been studied from various perspectives. Delgado *et al.*, (2016) in their research indicated that the growth in meat consumption worldwide, has led to an increase of waste by livestock systems that pose dangers to the environment. Kalhor *et al.* (2016), specifically focused their studies on airborne pollutants, poultry production releases significant emissions of ammonia (NH<sub>3</sub>), methane, and sulfur dioxide. Li *et al.*, (2018) posited that between 30 and 90% of the antibiotics administered to livestock are excreted non-metabolized into the environment through manure. Xie *et al.*, (2018a), also confirmed that contamination of antibiotics in the environment by anthropogenic activities increases the

competitive advantage of antibiotic resistant bacteria by gradually reshaping the resistant in the environment. In view of the above-mentioned studies, emphasis is primarily on waste generation, environmental pollution from poultry production on human health. There is little research on issues related to the assessment of major pollutants released from poultry farms and the impacts on water quality on residents of the host farms. Therefore, this study attempt to examine the impact of urban poultry farm activities on water quality in Kuje Suburbia, Abuja.

### 3.0 METHODOLOGY

#### *The study Area*

The study was conducted within the geographical boundary of Kuje Area Council. Chukuku Kiyi and Chibiri of Kuje suburban forms the basis of analysis for the study. The Kuje Area Council covers a total land of about 1,800 square kilometres about 22.5% of the FCT (Ojigi *et.al*, 2012). It has an estimated population of about 270,000 people comprising Gbagyi, Gude, Bassa and Fulani with other ethnic group that have migrated from other parts of Nigeria and the world at large (Ojigi *et.al*, 2012). Kuje Area Council is bounded on the West of Gwagwalada Area Council, North and East of Abuja Municipal Area Council and the South of Abaji Area Council.

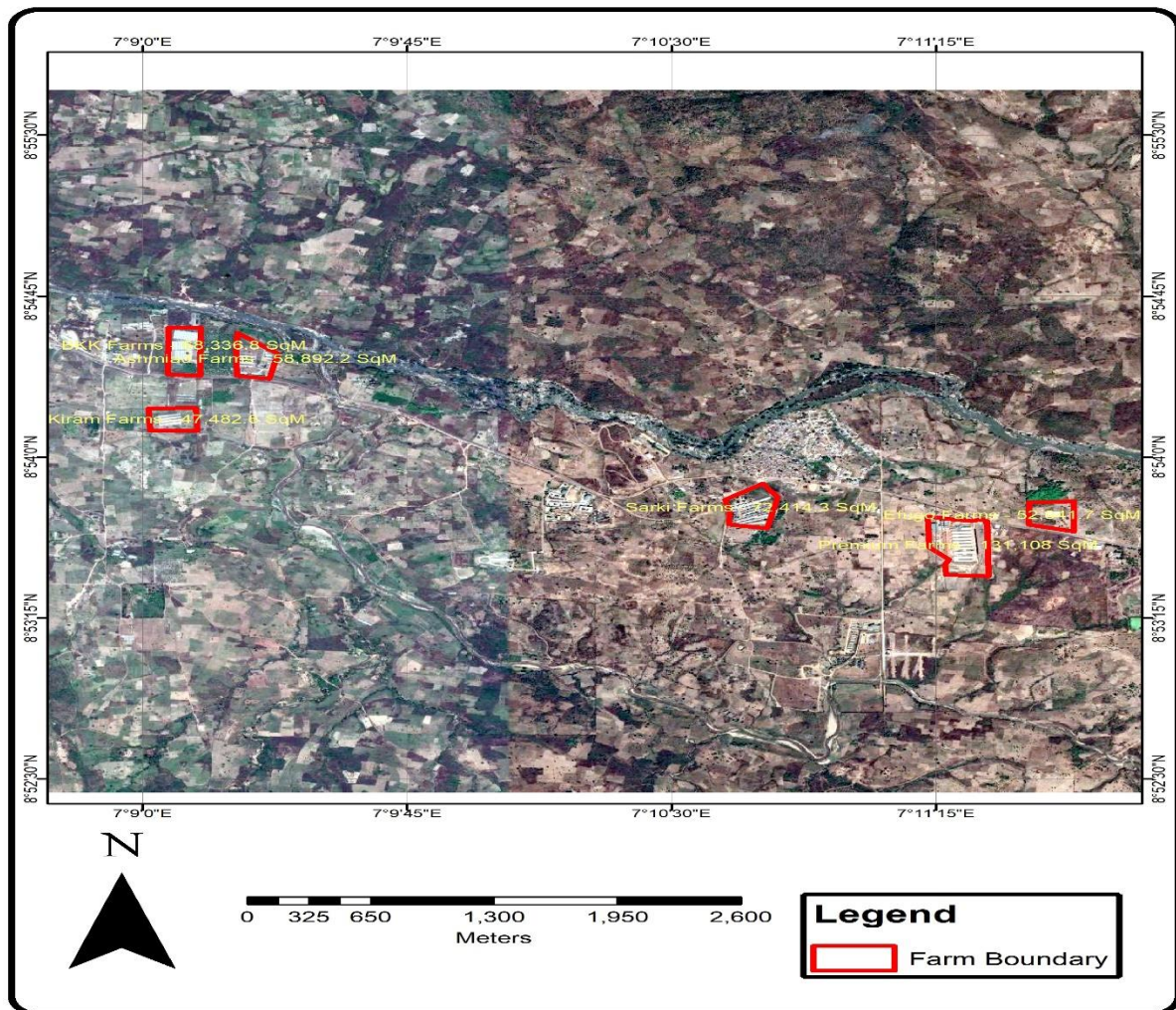
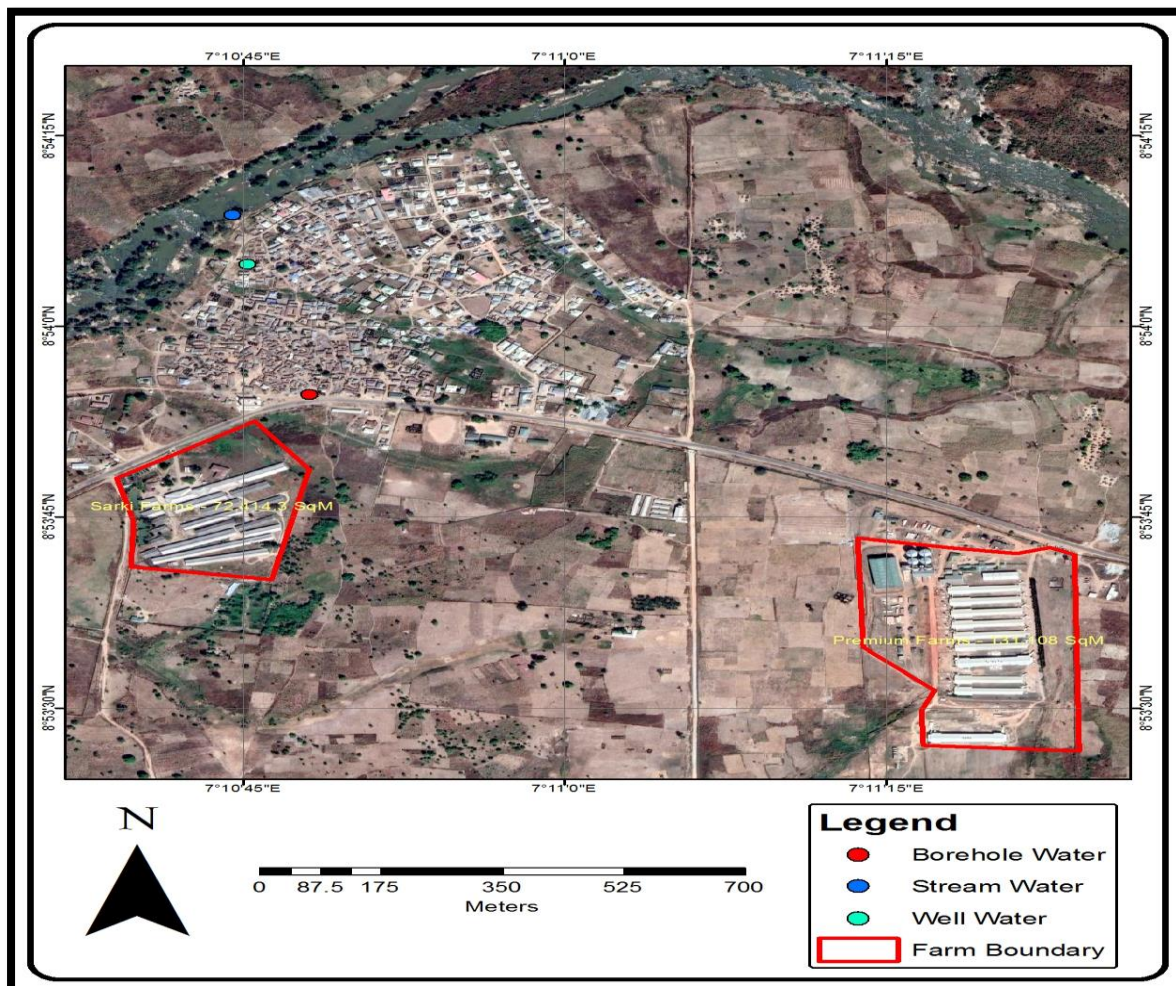


Figure 2: Poultry Farms and adjoin community in 2020 Satellite Imagery

### *Data Collection and Analysis*

Water samples for physical and chemical properties were collected with clean pre-washed three (3) litre bottles for surface water, borehole and well water using hand sampling method. purposive sampling was applied to create the sampling points of borehole water and well water based on nearness to residents while the river/surface water is the only existing one. During the sampling, the bottles were first rinsed with the sampled water before the actual sampling. Samples of water were collected one (1) litre each making total of three (3) bottles labelled surface water, borehole water and well water respectively (Figure 2 and table 1). The following parameters were measured using (Standard Methods) 19<sup>th</sup> edition APHA, AWWA, WEF, 1995 for water analysis. The pH, Conductivity, Calcium, Total Alkalinity (TA), Total Hardness (TH), Nitrate (NO<sub>3</sub>), Phosphate (PO<sub>4</sub>), Sodium (Na), Potassium (K), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) Manganese (Mn) and Total Dissolved Solids (TDS) of the water samples were determined according to standard methods in the Central Services Laboratory of the Department of Water Resource and Soil Sciences, Federal University of Technology Minna. The average means of the parameters measured were compared with the WHO/ NESREA and Federal Ministry of Environment (FMENV; 2008) regulatory standards and guidelines to determine extent of water pollution.



*Figure 2: Satellite Imagery of Water Sampled Locations*



*Table 1: Water Sampled Points with Coordinates*

s/n	Sample code	Coordinates
1	Surface water	0299850°E; 0984437°N
2	Borehole water	0299930°E; 0984011°N
3	Well water	0299875°E; 0984320°N

Source: Authors Field Survey, 2020

#### 4.0 RESULT AND DISCUSSION

##### Impact of poultry farm on surface water Quality

The impact of poultry farms on water quality in Kuje sub-urban was assessed through laboratory test analysis of sampled surface water, borehole water and well water to determine the physiochemical parameters. The result is compared using the World Health Organization (WHO; 2011), National Environmental Standard and Regulation Enforcement Agency (NESREA ;2011) and Federal Ministry of Environment (FMENV; 2008) standards and guidelines.

Table 2 present the result of the test analysis on the samples - surface water, borehole water and well water. The analysis results reveal the presence of some concentration of heavy metals above the WHO/NESREA recommended standard. The laboratory test results show presence of high concentration of Total Alkalinity in surface water with average mean score of 82mg/l, Borehole water (MS=169mg/l and well water (MS = 45mg/l), all above the WHO benchmark of <5.5mg/l. Similarly, high concentration of Manganese was observed in the sampled water above the recommended 0.05-0.5mg/l. The surface water shows 7.12mg/l concentration of Manganese, Borehole water (MS=6.64mg/l and well water (MS = 6.80mg/l). Also, high concentration Phosphate was observed in the sampled water above the recommended 0.5mg/l. The concentration of Phosphate in surface water is 0.13mg/l, Borehole water (MS=2.24mg/l) and well water (MS = 1.94mg/l). Similarly, concentration of Nitrate in the surface water is 2.19mg/l, Borehole water (MS=3.44mg/l and well water (MS = 5.6mg/l) above the 0.2mg/l recommended standard for water quality. Biochemical Oxygen Demand (BOD) are significantly above the WHO/NESREA standard. The BOD was found in surface water (6.76mg/l) and well water (8.27mg/l) above the benchmark of <5mg/l.

The study findings reveal the potential toxic of water contaminants including TA, Mn, ph, and NO<sub>3</sub><sup>-</sup>, resulting from the impact of poultry farms activities in Kuje Suburbia. The findings are in line with other studies (Soldatova et al.,2018; Kalhor et al.,2016).

*Table 1: Physiochemical the Analysed Result of Water Quality in Kuje Suburbia*

Parameters	Mean Sample Score			WHO/NESREA Guidelines
	Stream Water	Borehole Water	Well Water	
pH	6.73	6.82	6.76	6.5-8.5
Conductivity	148uSiemen	304uSiemen	388uSiemen	1000uSiemen
Total Hardness (TH)	50 mg/l	65mg/l	70mg/l	50-200mg/l
Total Alkalinity	<b>82mg/l</b>	<b>169mg/l</b>	<b>45mg/l</b>	<5.5mg/l
Calcium	21.09mg/l	37.82mg/l	42.1mg/l	75mg/l
Manganese	<b>7.12mg/l</b>	<b>6.64mg/l</b>	<b>6.80mg/l</b>	0.05-0.5mg/l
Sodium	2.83mg/l	5.96mg/l	3.54mg/l	200mg/l
Potassium	0.66	1.44mg/l	0.78mg/l	200mg/l
Phosphate	<b>0.13mg/l</b>	<b>2.24mg/l</b>	<b>1.94mg/l</b>	0.5mg/l
Nitrate	<b>2.19mg/l</b>	<b>3.44mg/l</b>	<b>5.6mg/l</b>	0.2mg/l
BOD	<b>6.76mg/l</b>	3.50mg/l	<b>8.27mg/l</b>	5mg/l
COD	9.23mg/l	16.65mg/l	16.65mg/l	80mg/l
TDS	31.46mg/l	64.71mg/l	93.63mg/l	500-2000mg/l

Source: Authors Field Survey, 2020.

## 5.0 CONCLUSION

The study has shown that the poultry farms activities have adverse impacts on their environment in Kuje sub-urban. Findings reveals high concentration of heavy metals in water by activities of the poultry farm in Chibiri community. Thus, the poultry farms are source of environmental pollution in the area and constitute public health challenge. Water quality (drinking, domestic purposes, food production or recreational purposes) has an important impact on public health. Water of poor quality can cause disease outbreaks and it can contribute to background rates of disease manifesting themselves on different time scales (WHO, 2020). Initiatives to manage the safety of water do not only support public health, but often promote socioeconomic development and well-being as well. The study therefore, suggests the need for appropriate authority to determined and enforced distance between poultry farms and residences to mitigate the effects of environmental pollution /health hazards especially with the experience of the COVID 19 global pandemic. Government and the Poultry farms should embark on public enlightenment campaigns to the residents around the poultry farms, with a view to educate them about the negative impacts of their operations to the health and wellbeing. In addition, review of the existing planning approval system and development environmental management plan to reduce negative impacts of the poultry farms and ensure compliance to good management practice.

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