



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

**SCHOOL OF ENVIRONMENTAL TECHNOLOGY  
INTERNATIONAL CONFERENCE (SETIC) 2018**

# **CONFERENCE** *Proceedings*

**CONTEMPORARY ISSUES  
AND SUSTAINABLE PRACTICES  
IN THE BUILT ENVIRONMENT**

**EDITORS:**

**Asimiyu M. JUNAID  
Olatunde F. ADEDAYO  
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(SETIC) 2018**

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**Volume 1**

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# Conference Proceedings of the School of Environmental Technology International Conference (SETIC) 2018

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10th – 12th APRIL 2018

School of Environmental Technology,  
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# FOREWORD

The organising committee of the 2<sup>nd</sup> School of Environmental Technology International Conference is pleased to welcome you to Federal University of Technology Minna, Niger State Nigeria.

The conference provides an international forum for researchers and professionals in the built and allied professions to address fundamental problems, challenges and prospects that affect the Built Environment as it relates to Contemporary Issues and Sustainable Practices in the Built Environment. The conference is a platform where recognised best practices, theories and concepts are shared and discussed amongst academics, practitioners and researchers. The scope and papers are quite broad but have been organised around the sub-themes listed below:

- Architectural Education and ICT
- Building Information Modeling
- Construction Ethics
- Energy efficiency and Conservation
- Environmental Conservation
- Facility Management
- Green Construction and Efficiency
- Health and Safety Issues
- Information Technology and Building Maintenance
- Information Technology and Construction
- Information Technology and Design
- Innovative Infrastructure Development
- Resilient Housing Development
- Smart Cities Development
- Social Integration in Cities
- Sustainable Building Materials Development
- Sustainable City Growth
- Sustainable Cost Management
- Sustainable Property Taxation
- Sustainable Architectural Design
- Sustainable Urban Transportation Systems
- Theory and Practices for Cost Effectiveness in Construction Industry
- Urban Ecology Management
- Urban Land Access
- Disasters, Resilient Cities and Business Continuity

We hope you enjoy your time at our conference, and that you have the opportunities to exchange ideas and share knowledge, as well as participate in productive discussions with the like-minded researchers and practitioners in the built environment and academia.

**Local Organising Committee**  
**School of Environmental Technology International Conference (SETIC) 2018**  
**APRIL 2018**



## ACKNOWLEDGEMENTS

We have tried to build on the success of the maiden of SETIC held in 2016 which came with good feedbacks and memories. The success of the 2<sup>nd</sup> School of Environmental Technology International Conference holding at the Main Campus of the Federal University of Technology Minna, Nigeria is predicated on the support and goodwill from Vice-Chancellor of Federal University of Technology, Dean School of Environmental Technology and many other highly motivated people.

I sincerely wish to appreciate you for attending this Second edition of SETIC and to warmly welcome you to the city of Minna the capital of the *POWER STATE*. It is a great honour to have you in the beautiful campus of Federal University of Technology Minna, Nigeria. I am aware of the great sacrifices made by many of you to be present in this occasion and I will definitely not overlook the long distances some of you have had to cover to get to the conference venue. We genuinely appreciate all your efforts. It is our singular hope and desire that this 2<sup>nd</sup> edition of the conference (SETIC 2018) meets your expectations and gives you unquantifiable experience and tremendous developmental networking opportunities for a life fulfilling career.

We are grateful for the presence of the Vice Chancellor of the Federal University of Technology Minna Professor Abdullahi Bala whose leadership and distinguished academic career has served as inspiration and encouragement to many academics within and outside Nigeria. His desire to continue on the path of greatness for this Humble University of ours has seen the University become a destination for International conferences, Public lectures, Book Development, Presentations and Seminars that meet International standards. We are happy to have you as the Chief host to declare the conference open and deliver the welcome address.

We are grateful to the former Dean of School of Environmental Technology, Federal University of Technology Prof A.M. Junaid and the Ag. Dean of School of Environmental Technology Prof. S.N. Zubairu for providing the healthy platform, academic backing, management and guidance for the organisation of the conference. You increased the level of challenge from 2016 and provided the required resources, direction, energy and strategies for achieving its success, it is a great honour of having the opportunity to work closely with you and learning never to give up.

I wish to thank also all the special guests particularly leaders of the Industry, Built Environment and Academia.

A special thanks goes to the Bursar of Federal University of Technology, Mrs. Hajara Kuso for the timely responses to all our requests regarding the financial aspects of access to funds for the conference.

SETIC is beginning at the foundation this year and for this I wish to thank all those who have supported us through various forms of participation. Specifically I wish to thank the delegates and the partners for contributing significantly to the conferences. I wish to thank Prof. S.N. Zubairu Prof. A.M. Junaid, Prof. O. O. Morenikeji and Prof. Y.A Sanusi, who all genuinely and consistently monitored the progress of the conference preparations. My desire in 2016 was for SETIC to become a constant feature in the calendar of the University and global conference listings, am a happy person today seeing this desire fulfilled with the SETIC 2018 edition.

Delegates to SETIC 2018 are from different academic and research institutions that are spread across different countries. This offers participants a wonderful opportunity for exchange of cultural, social and academic ideas during the conference periods. It is also an opportunity to create awareness about programmes and events at the participants' individual institutions. I encourage you all to make good use of the networking opportunities that are available.

In this 2<sup>nd</sup> edition we received 258 abstract submissions because we had a wide distribution outlet as compared to the 1<sup>st</sup> edition which is an indication of growth. Using a rapid review system we accepted a total of 209 abstracts and the authors were communicated on what issues they were to examine while developing the full papers based on their titles and aim of the paper. Two hundred (200) full papers were received and reviewed. We sent back the reviewed papers and reviewers comments forms to each of the prospective authors to assist

in the preparation of the revised papers. It was after this rigorous and time consuming process that we were able to accept 172 papers for presentation at the conference. It gives me great joy therefore to congratulate all the authors whose papers made it to the conference. It is my sincere believe that the presentation of the different ideas in your paper would go a long way in improving the knowledge of the participants and also generate meaningful discussions over the tea beaks, lunch and beyond.

I wish to express my utmost gratitude to each of the Seventy-three (73) reviewers for a wonderful job done well and for tolerating our deadlines and Oliver Twist syndrome. It is your dedication and expertise that has ensured that the conference is a success.

Special thanks to all our keynote speakers, Arc. Umaru Aliyu, (ficiArb, fnia, ppnia) (*President, Architects Registration Council of Nigeria (ARCON)*), Prof. Stella N. Zubairu (*Former Dean Postgraduate School, Federal University of Technology Minna*), Dr. Julius A. Fapohunda, (*Editor-in-Chief: International Journal of Sustainable Energy Development & Leader: Sustainable Building and Urban Growth Research Unit, Cape Peninsula University of Technology*).

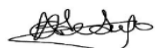
It is important to appreciate the roles and efforts of the following people for their selfless and very significant contributions made towards the successful organization of the conference: Oyetola Stephen, Alonge Olubunmi, Lynda Odine, Adedokun John, Idowu Oqua, Bamidele Eunice and Muhina Lami (for being available to run around at very short notice),

The organisation of this conference would not have been this easy without dedicated individuals offering to serve. My heartfelt gratitude goes to Dr. Taibat Lawanson, Dr. R.A. Jimoh, Dr. L.O. Oyewobi, Dr. N.I. Popoola, Dr. Lekan Sanni, Dr. I.B. Muhammad, Dr. A.A. Shittu and Dr. A. Saka for their unflinching support all through the process.

It is our sincere hope that this conference will serve as a forum for the advancement of research in the urban sphere towards achieving a sustainable environment. It is our sincere believe that academics and professionals in practices will continually participate in this forum.

Worthy thanks goes to the members of the Local Organising Committee for the tireless effort. The success of the conference goes to these wonderful people. You have made SETIC 2018 to ROCK.

Once again I wish to thank you all for creating time out of your busy schedule to attend this conference. Please do enjoy your stay at Federal University of Technology Minna, and the city as a whole. Ensure that you make use of the different fora created throughout the conference to build new relationships for the future and strengthen existing relationships. I look forward to seeing you all in future.



Olatunde Folaranmi ADEDAYO  
SETIC 2018 LOC Chairperson  
APRIL 2018



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# DECLARATION

## PEER REVIEW AND SCIENTIFIC PUBLISHING POLICY STATEMENT

10th APRIL 2018

TO WHOM IT MAY CONCERN

I wish to state that all the papers published in SETIC 2018 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

Names and individual affiliation of members of Review and Scientific Committee for SETIC Conference 2018 are published in the SETIC 2018 Conference Proceedings and made available on [www.futminna.edu.ng](http://www.futminna.edu.ng)

Olatunde Folaranmi ADEDAYO  
Chairman SETIC 2018  
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Papers in the SETIC 2018 Conference Proceedings are published on [www.futminna.edu.ng](http://www.futminna.edu.ng).

## REVIEW PANEL

We wish to express our deepest and sincere gratitude to the following people in no particular order who provided comprehensive scientific reviews and made commendable suggestions towards improving the over 258 abstracts and 182 full papers submitted to SETIC 2018. They provided constructive comments to authors regarding their papers, it is necessary to state that there was no reported case of conflict of interest by any of the reviewers or the authors.

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## PROFILE OF KEYNOTE SPEAKERS

SETIC 2018 organisers wishes to thank our keynote 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.

**Prof. ZUBAIRU, Stella Nonyelum**  
**Federal University of Technology, Minna**

**Academic Qualifications:** PhD (Building Maintenance, 1999); MSc (Facilities Management, 1989); BArch (Architecture, 1980).

**Professional Registration:** Registered Architect with Architects Registration Council of Nigeria (F/483, 1985); Member, Nigerian Institute of Architects; Member, International Federation of Facilities Managers.

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Prof Stella Nonyelum Zubairu is a lecturer in the Department of Architecture, School of Environmental Technology, at the Federal University of Technology, Minna, Niger State, Nigeria. She obtained a second class upper division degree (BArch) in Architecture from the University of Nigeria, Enugu Campus in 1980. She served in the National Youth Service Corps in Niger State Housing Corporation, Minna, after graduation (1980 -1981), then she worked briefly for a private architectural firm, SWACON, in Lagos before joining the Niger State Ministry of Housing and Environment in 1983 as an architect II. The Ministry later merged with the Ministry of Works and was renamed Ministry of Works and Housing. She rose through the ranks in the Ministry and reached the position of principal architect. During this time, she was involved in many projects in the State including the design and construction of the Government House, extension of the Governor's office, supervision of all health projects in the State and later the design and construction of the Old Peoples' Home and other social welfare projects in the State. In 1988, she was granted study leave to go to Strathclyde University, Glasgow, where she obtained an MSc degree in Facilities Management in 1989. In 1991 she left the Ministry to join the Federal University of Technology, Minna as a lecturer I. In 1995 she was granted a study fellowship to study for her PhD at the University of Lagos which she completed in 1999 with a PhD in Building Maintenance. She was appointed Head of the Department of Architecture, Federal University of Technology, Minna (1999 – 2006). She was promoted to the rank of professor in October 2006. She served as Deputy-Dean Postgraduate School (2008); then she was appointed as Director, Centre for Human Settlements and Urban Development (2008 – March 2011) in the same University. She was then appointed Dean of the Postgraduate School (March 2011 – March 2015).

# MICRO-HOUSING DEVELOPMENT AS FEATURE OF CLASS STRATIFICATION IN THE JOS METROPOLIS OF PLATEAU STATE, NIGERIA

Sulyman, A.O and Kudu, S.E

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In every human society social classes exist and most often identified by the kind of food they eat, the clothes they wear, their means of transportation, and the kind of houses in which they live. This paper identifies housing as one of the commonest features by which social classes in the Jos metropolis can be identified. In this direction, attempt is made to link micro-housing with low and middle-income groups in the Jos metropolis. In this process, the metropolis was divided into ten clusters, using road networks as boundary lines, after which, one neighbourhood was selected at random in each of the clusters and a systematic sampling method was used to decide the number of questionnaires to be administered in each neighbourhood depending on the number of micro-housing in each of the selected neighbourhoods. A total of 244 questionnaires were administered to household heads who happen to be the owners of the micro houses. This was followed by data cleaning and compilation through the use of Statistical Package for the Social Sciences (SPSS) and frequencies and percentages were used for descriptive statistical results which were presented in tables and charts. Findings show that the micro housing occupants are predominantly the low and middle income groups. The majority of the houses are compound type and multiple row housing which are characterized by shared kitchens, bathrooms and toilets. Some of the houses are developed without building plans and building permits or approvals by the urban development authorities. It is recommended that government or housing authorities concerned can help solve this problem by reviewing these procedures and as well reduce the fees payable for the approval of building plans and other related documents. Standards too should be reviewed to incorporate micro housing design elements into the overall set of building standards. Finally the improvement in technological ideas of manufacturing building materials like locally made burnt bricks will also reduce cost of production and increase quality and durability of micro housing.

**Key words:** Housing, Micro-Housing, Household, Socio-Economic Characteristics

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## INTRODUCTION

Rapid urbanization and population growth have caused many problems in developing cities in Nigeria. Cities grow too rapidly; infrastructures are not able to keep up with the swelling population. Housing is one of the major problems these cities are facing today. The continuous influx of people from rural to urban areas has drastically increased urban population. Hence, these migrants who cannot afford proper housing resolve to build micro-housing without adequate basic utilities and services. With a population of over 160 million people, Nigeria is Africa's most populous nation and the leading oil and gas producers in Africa (Maren, 2011). With a combination of push and pull factors, urban migration to these developing cities within Nigeria economy as the case may be, accounts for over 55% of population growth (World Bank, 2013). This has led to a serious shortage of proper housing. Nigeria's housing deficit is estimated around 16 million units and it requires more than N56 trillion to provide the 16 million housing units to bridge the housing deficit at a conservation cost of N3.5 million per unit in the country (World Bank, 2013).

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Sulyman & Kudu, (2018). MICRO-HOUSING DEVELOPMENT AS FEATURE OF CLASS STRATIFICATION IN THE JOS METROPOLIS OF PLATEAU STATE, NIGERIA. Contemporary Issues and Sustainable Practices in the Built Environment. School of Environmental Technology Conference, SETIC, 2018

The population figures above, points to the degree of housing shortfall in the country, and because of the desire of the large population to live in cities, they have little or no option but to reside in some form of the overcrowded neighbourhoods. Some of the open spaces within these neighbourhoods have been sold out by landlords and small units of houses have been built on them most of which are informal and without proper title to such lands. In Nigeria, the low income people are identified as wage earners or self-employed people whose income is below the maximum annual income of the highest salary grade level within the civil services structure (Federal Ministry of Works and Housing, 2012). Several housing programmes have been carried out in Nigeria with the principle of low income housing. For instance, the Civil Service Homeownership Scheme, the Prototype and Mass Housing Schemes. have all been targeted to the low income. However, one basic reality is that units produced under these schemes are often not accessible to the low income groups due to stiff competition for the available houses among the low and medium income groups. Where the so called low income houses are available in the market, they are often not affordable since the average housing price ratio to average household annual income is generally low in Nigeria (Omole, 2001).

One may ask the question - What exactly qualifies as a micro-housing? According to Urban Land Institute of the United States of America (2014), micro-housing might be 300 square feet in New York City or 500 square feet in Dallas. They conducted a study to evaluate from multiple perspectives, the market performance and market acceptance of micro and small units and the learnt that no standard definition exists for the subject.

Cavallary (2012) as cited in Bello (2014), established that no official definition exist, though most homes that are smaller than 500 square feet (approximately 45.5 square meters) are considered to fall into this category. He discussed the issue further noting that a micro house is usually suitable as a living space for two people, and construction of such house can be much lower than that of a full-size house. Micro houses are designed to be minimal structures, but they are not lacking in normal features such as bedrooms and bathrooms.

For the purpose of this research, micro-housing is defined as development of housing at an incremental bases, that is housing been built on a piece meal basis – the foundation may be done completely but the entire structure might not be raised all at once. A section of the building is being built, roofed and occupied by the household while the rest of the structure is built incrementally.

## **Conceptual Clarification and Literature Review**

### **Concept of Housing**

In order to understand the concept of housing, it is necessary to distinguish between shelter, house and housing. Shelter is a physical structure with a covering which originally is meant for protection from harsh elements of climate such as rain, wind and sun. It is a physical space enclosed for the protection of man from elements of weather. Shelter was provided in pre-historic ages under trees, in caves and later in tents made from animal skin (Sulyman, 2015). However, there is a concept of shelter which was defined by Habitat Agenda (2003) to mean more than a roof over one's head. It also means adequate security, security of tenure, structural stability and durability, adequate lighting, heating and ventilation; adequate basic infrastructure, such as water-supply, sanitation and waste-management facilities, suitable environmental quality and health related factors and adequate and accessible location with regard to work and basic facilities all of which should be available at an affordable cost.

Housing all over the world has remained a phenomenon that affects every facet of mankind. Its importance is so pronounced that it reflects the social, physical and mental wellbeing of man irrespective of his socio-economic status, color or creed. It represents the most basic human needs and has no doubt considerable impact on the health, welfare and productivity of the individual (Ademiluyi, 2010).

Housing literally is defined as Buildings or shelters in which people live, a place to live, a dwelling. and to Nations a critical component in social and economic fabric. As a unit of the environment, it has a profound influence on the health, efficiency, social behavior, satisfaction and general welfare of the community (Onibokun 1985). To most groups housing means shelter but to others it means more as it serves as one of the best indicators of a person's standard of living and his or her place in the society (Nubi, 2008).



The totality of ideas and views expressed about what housing entails brought about two clear definitional dimensions of the term housing. First, housing is seen as an economic process and product. Second, it is also seen as a social symbol. As an economic product, housing represents a commodity traded in the housing market. It is a product of investment and a means of income generation, (Jinadu, 2007). As an economic process, housing is described as the ways and means by which housing goods and services are produced through the interactive construction processes of land acquisition, housing finance mobilization, material assemblage and actual construction Tuner, (1992).

The Housing sector can be considered in the context of production of housing goods and services for consumption by various classes of consumers ranging from individuals, families, corporate bodies, etc. The housing sector is the buyer of intermediate goods such as brick, cement, iron etc. from other sectors of the economy, and uses other forms of labour (both skilled and unskilled) for the production of housing goods and services. There is a strong relationship between the construction sector and broader economy, and the sector supports stronger multiplier effects than many other sectors. In addition to the above case, the housing sector is also a supplying sector. Thus, from this stand, the housing sector makes inputs of various forms, from preliminary stages of project initiation, drawing of building plans, construction of buildings and so on, which in the long run brings forth considerable value in terms of output (Jinadu, 2007).

Adequacy should be determined together with the people concerned, bearing in mind the prospects for gradual development. On the other hand, a house is a physical structure which human beings use for shelter. It has all the facilities, equipment, services and devices needed or desired for healthy living. Therefore it can be concluded that all houses are shelter but not all shelters are houses. This is because shelter which does not have all the facilities, equipment, services and devices needed for healthy living is not a house but mere shelter (Sulyman, 2015).

### **The Concept of Micro-Housing**

It is generally accepted that no standard definition exists regarding the term – micro-housin. A micro unit is a somewhat ambiguous term that covers anything from a relatively small studio or one-bedroom apartment to a short-term lease, Single Room Occupancy (SRO) unit with communal kitchen and common room areas. In fact, many in the industry are moving away from branding their units as micro because the term has begun to arouse negative connotations associated with higher density, overcrowding, and transient populations (Keivani, 2008).

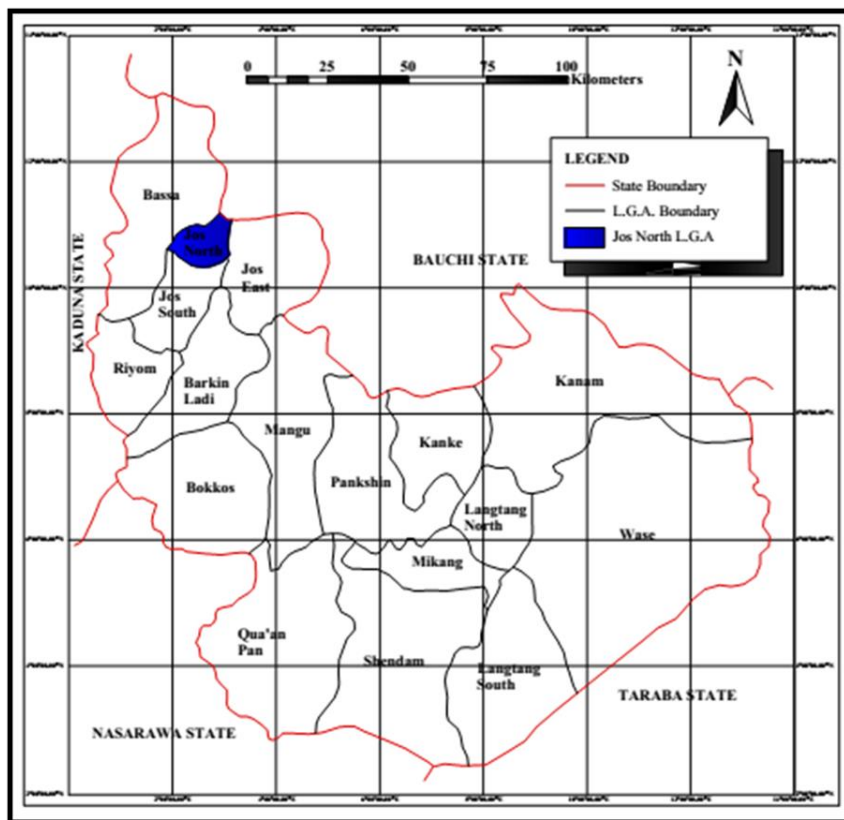
In New York City and Philadelphia, the minimum size requirement for a new dwelling unit is 400 square feet. However, former New York City mayor Bloomberg waived this requirement for the adapt NYC competition, which defined micro apartments as studio apartments that range between 275 and 300 square feet and include fully functioning kitchens and accessible bathrooms (Turner 1992). In the city of San Francisco, new legislation was passed allowing apartments as small as 220 square feet, so long as 70 square feet of this space is allocated to a bathroom and kitchen (Turner 1992). In the District of Columbia, the minimum size for an apartment is also 220 square feet but with no prescription regarding allocation of space within the unit. In Boston, the minimum size for a dwelling unit is 450 square feet within one mile of public transit, but again this requirement was waived for a demonstration project in the Innovation District to allow development of smaller units. In some Midwestern and Texas housing markets, units ranging between 400 and 500 square feet are described as micro units. Seattle and Portland have no minimum size requirements for their markets, which probably explain why their markets are two of the best examples of cities demonstrating a tremendous amount of experimentation with very small units, including a wide range of communities offering SROs and micro units (Gbadeyan, 2011).

Thus, the concept of micro units is to some degree relative to the market in which they exist. For the purposes of this research effort, a distinction was made between SRO units and micro-unit apartments with fully functioning kitchens and bathrooms. Although some trading range probably exists in the square footage depending upon the market, a good definition of a micro unit is a purpose-built, typically urban, small studio or one-bedroom using efficient design to appear larger than it is and ranging in size from as little as 280 square feet up to as much as 450 square feet (which roughly equates to 20 percent to 30 percent smaller than conventional studios in a given market). Many micro units under 350

square feet feature built-in storage units and flexible furniture systems (e.g., Murphy beds, hideaway kitchen modules, convertible tables, and so on) to make these smaller spaces work. To put the size of a micro unit into perspective, a 300-square-foot micro-unit studio apartment is slightly larger than a one-car garage but considerably smaller than a two-car garage (Keivani, 2008).

## Study Area

Plateau State lies between Latitudes 6°N and 14°N and Longitudes 3°E and 10°E. Plateau State has been known for its heterogeneity with respect to ethnicity, cultural backgrounds and social groupings. The largest concentration of these ethnic groups are found in Jos the capital city of Plateau State.



**Figure 1.1 Location of Jos North Local Government Area.**

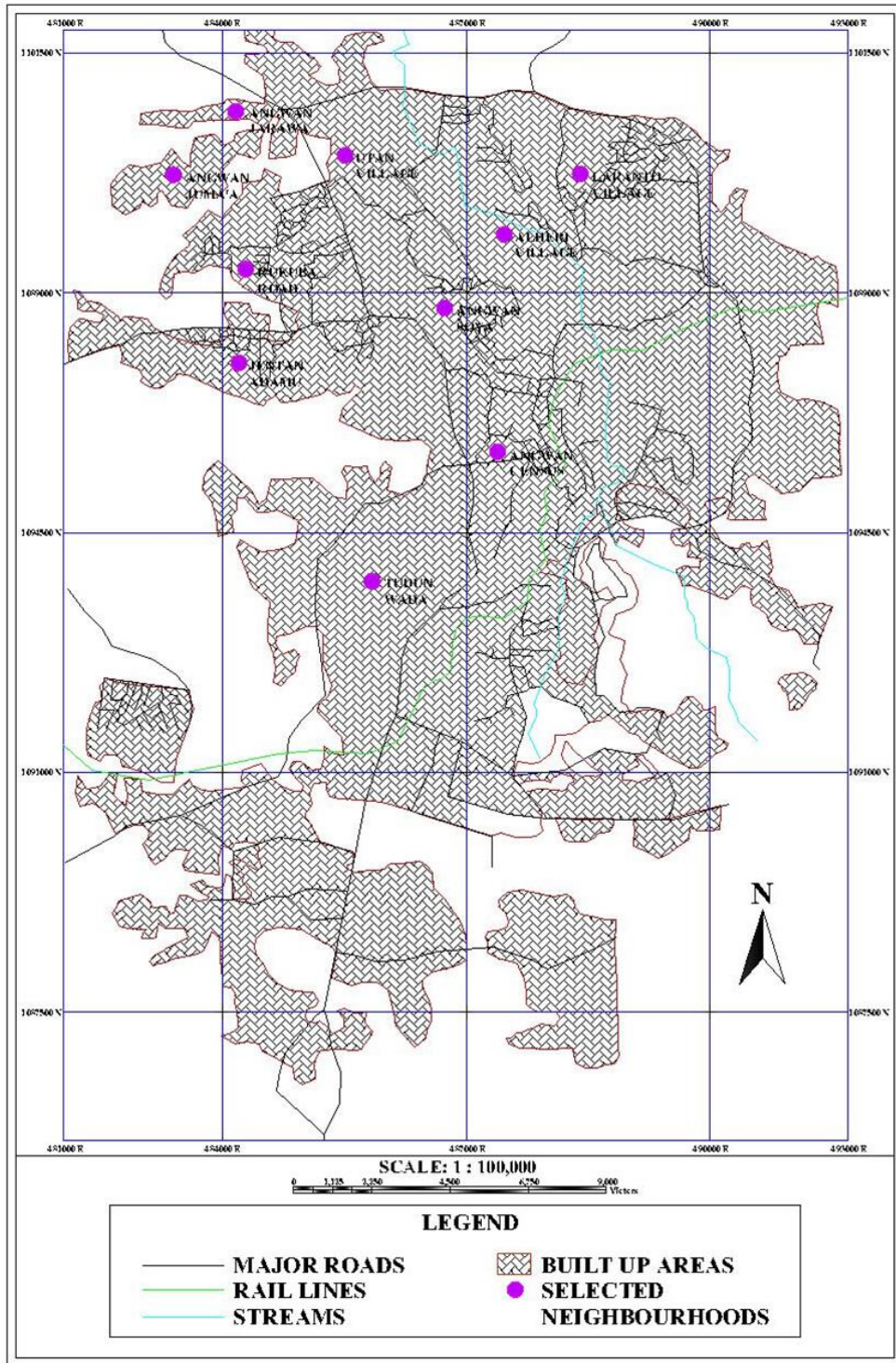
Source: Plateau State Ministry of Lands, Survey and Town Planning, Jos (2016)

Jos metropolis is the capital of Plateau state, Nigeria. It lies between latitudes 9°51'30''N to 10°02'00''N and longitudes 8°48'00''E to 9°59'00''E. Its headquarters lies in the city centre of Jos. It has an area of 291km<sup>2</sup> and a population of 821,718 as at the 2006 census. The city is located on the Jos Plateau at an elevation of about 1,238 metres or 4,062 feet high above sea level. The Jos Plateau is located almost at the centre of Nigeria. It is probably the home of the largest number of ethnic groups, with the largest concentration in the Jos town, capital of Plateau State. Here, almost every ethnic group in Nigeria is represented. The growth and development of the Jos town can be attributed to several factors, pulling populations of different socio-cultural, linguistic and religious backgrounds, creating a unique diversity in the social configuration of the area. This diversity has added beauty to the God-given attractiveness of the physical environment (Kudu, 2017).

The area known as Jos today was inhabited by indigenous ethnic groups who were mostly farmers. The British colonialists used direct rule for the indigenous ethnic groups on the Jos plateau since they were not under the Fulani emirates where indirect rule was used. The Fulani empire controlled most of northern Nigeria, except the Plateau province and the Berom, Mwaghavul, Ngas, Tiv, Jukun and Idoma ethnic groups. It was the discovery of tin by the British that led to the influx of other ethnic groups such as the Hausa, Igbo, Yoruba, thus making Jos a cosmopolitan city (Wikipedia). Generally speaking, the formation of the Jos Town is traceable to as far back as the pre-colonial period. This period witnessed waves of migrations from both outside and within the area to the Jos area. However, the traditions identify the earliest settlers at the area as the Du section of Berom, the Kishi village of Rukuba and the Anambi clan of Anaguta (Kudu, 2017).

The emergence of Jos as a modern city is associated with colonialism and its attendant economic policy, tin mining, Christian Missionaries, Hausa traders and Fulani cattle rearers. Although the Fulani did not live in the urban centre of Jos, the selling of their cattle for meat

gradually acquainted them with the city life, and some of them eventually abandoned their cattle for the city. Among them were those who acted as middle men in the cattle trade, the proceeds of which some of them enrolled in the literacy classes, after which they secured employment in the colonial administration as messengers (Kudu, 2017). Probably of all the factors which pulled population from across the Nigerian area to the Jos Plateau, the tin mining industry was the strongest. During the early stages of its exploitation, from 1903 to 1906, the local population remained the only source of labour, which was even supplied on a casual basis in the tin fields (Maren, 2011).



**Figure 1.2 Jos Metropolis in State Setting**  
 Source: Plateau State Ministry of Lands, Survey and Town Planning, Jos (2016)

## RESEARCH METHODS

Questionnaires were directed to household heads. On the other hand secondary data was obtained from journals, textbooks, maps, internet and other relevant documents. Information gathered were analysed using descriptive statistics such as frequency count and percentages which was used to explain the factors responsible for micro-housing development in Jos metropolis. According to the 2006 National census exercise, Jos metropolis had a population of 900,000. Thus, with a population census figure of 900,000 in 2006, the projection to 2017 is 1,021,395. Hence, from the recommended sample size for interview in the Table 4.1 below, 4% of the total micro-housing occupants will be used as sample size.

**Recommended Standard for Sample Size**

Population	Recommended Sample Size for Interview	
	Maximum %	Minimum %
Under 50,000	20	10
50,001 – 150,000	12	5
150,001 – 300,000	10	3
300,001 – 500,000	7	2
500,001 – 1,000,000	5	1
Over 1,000,000	4	1

Source: Adopted from Wells (1975)

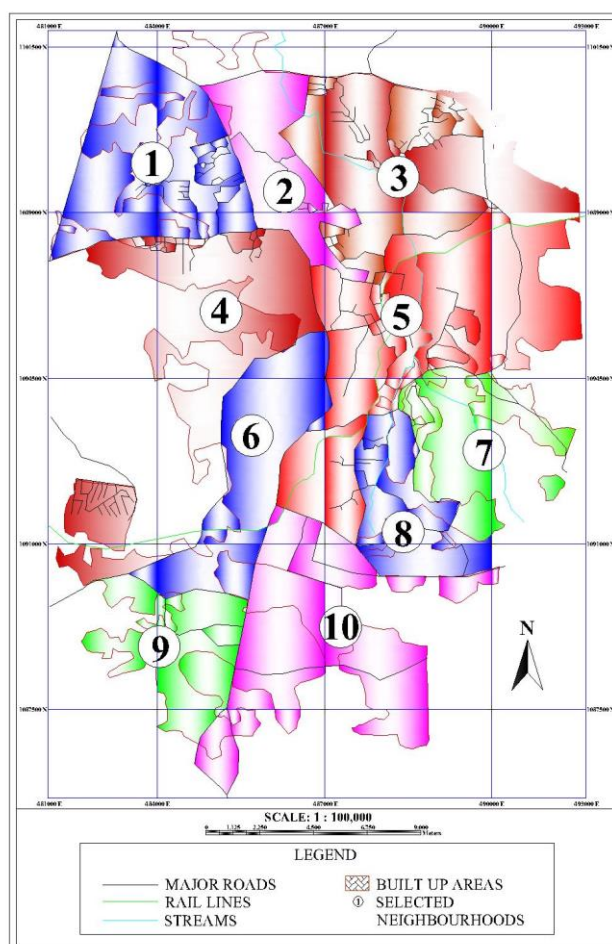
The Jos metropolis was divided into ten clusters to enhance considerable level of inclusion of all areas. From the delineation of the metropolis into ten clusters, the population of micro-housing in the selected neighbourhoods and the number of questionnaires to be administered in each neighbourhood is shown in Table 4.2 below.

**Table 4.2 Distribution of Questionnaires among the Selected Neighbourhoods**

S/N	Neighbourhoods	Population (Number of Micro Houses)	Number of Questionnaires to be Administered
1	Utan Village	822	33
2	AngwanJarawa	453	18
3	Sabongari	621	25
4	Angwan Census	779	31
5	Rukuba Road	523	21
6	JentanAdamu	652	26
7	Alheri Village	724	29
8	Angwan Soya	401	16
9	AngwanJumma'a	673	27
10	Laranto Village	456	18
	Total	<b>6104</b>	<b>244</b>

Source: Authors Field Survey, 2017.

The target population of the study is the total number of micro housing occupants in the selected neighbourhoods. The metropolis was divided into ten clusters using road networks as boundary lines, after which, one neighbourhood was selected in each of the clusters and a systematic sampling method was used to decide the number of questionnaires to be administered in each neighbourhood depending on the number of micro-housing in each of the selected neighbourhoods. The ten clusters are shown in figure 3.1 below.



**Figure 1.3 Delineated Zones for Systematic Sampling.**

Primary data was gathered by means of personal observation, interviews and questionnaire administration. The questionnaire was designed in such a way as to facilitate information regarding socio-economic characteristics such as sex, marital status, level of education, occupation and income level. Information on the characteristics of micro-housing was also collected that is, building type, type of building materials used (walls, roofing sheets, foundation, windows, doors, floor finishing and ceiling finishing), plot sizes, building sizes, duration of construction work and sources of housing finance. Data on the strategies adopted by residents in the construction of micro-housing was also collected some of these strategies included self-help, hired builders, joint efforts from family or joint efforts from friends.

## RESULTS AND DISCUSSIONS

### Socio-Economic Characteristics of Respondents

The survey conducted reveals that 88.1% of the respondents are males, while 11.9% are females. This shows that house ownership is higher on the side of males than females. 69.9% of the respondents are married while 23.8% of the respondents are single, thus presenting a fact that family size determines the need for housing. 42.6% of the respondents have attended tertiary institutions, 25.1% have primary school certificates, 21.7% have secondary school certificates while adult education and other forms of education have 5.3% percent each. It was also deduced that traders constituted 14.3% of the total respondents, civil servants and students had 12.7% of the total respondents, students constitute 12.3% of the total respondents, farmers are 5.8% while other forms of occupations comprised 54.9% of the respondents. With regards to the income level of the micro housing occupants it was deduced that 42.6% of the respondents earn above N20,000, 30.4% earn between N5,000 and N10,000. 21.7% earn between N15,001 and N20,000 and 5.3% earn between N10,001 and N15,000.

**Table 5.1 Socio-Economic Characteristics of Respondents**

Variables	Frequency	Percentage
<b>Sex</b>		
Male	215	88.1
Female	29	11.9
Total	244	100
<b>Marital Status</b>		
Single		23.8
Married		68.9
Divorced		0.8
Widow		4.9
Widower		1.6
Total	244	100
<b>Educational Status</b>		
Tertiary		42.6
Secondary		21.7
Primary		25.1
Adult Education		5.3
Others		5.3
Total	244	100
<b>Occupation</b>		
Farming	14	5.8
Trading	35	14.3
Civil Servant	134	54.9
Student	30	12.3
Others	31	12.7
Total	244	100
<b>Income (₦)</b>		
N5,000 – N10,000		30.4
N10,001 – N15,000		5.3
N15,001 – N20,000		21.7
Above N20,000		42.6
Total	244	100

Source: Field Survey, 2017.

## Housing Characteristics

The survey conducted reveals that 49.6% of the houses are compound types of housing, while flats constitutes 25.3% of the total micro houses, multiple row housing constitutes 25.1% of the total micro houses. 60.7% of the walls are constructed with sandcrete blocks, while 39.3% are constructed with mud blocks; this shows that quite a good number of this micro houses will be durable and thus have a longer life span. 90.2% of the micro houses are roofed with zinc, while 9.8% are roofed with aluminium; this is a reflection of the income of the micro housing occupants. 59.8% of the micro houses are built on sandcrete block foundation, 25.9% of the micro houses are built on stone foundation while 14.3% of the total micro houses are built on concrete foundation. These micro housing developers find the cement blocks cheaper than stones and pure concrete foundation. 61.5% of the micro houses have steel frame windows with louvers, 27.0% of the micro houses have wooden swing windows, and despite the cost of aluminium sliding windows some of the micro housing occupants could still afford them, they account for 11.5% of the total micro houses. 88.9% of the total micro houses have metal or steel doors while only 11.1% of the total micro houses have wooden doors. Results showed that 94.3% of the houses had sand/cement screed floor finishing while only 5.6% of the micro housing had floor tile finishing. 66.4% of the ceiling finishing are with Saw-dust board, 18.0% are with asbestos ceiling sheets and 15.6% are with P.V.C. The survey conducted reveals that micro-houses on plot sizes of 101 – 150m<sup>2</sup> comprise 36.9% of the houses interviewed while plot sizes of between 51 – 100 m<sup>2</sup> constitute 32.8% of the total houses. Plot sizes of 151 – 200 m<sup>2</sup> plot sizes account for 19.7% and < 50 m<sup>2</sup> sized plots account for 10.6%. Some of the plots that falls under Less than 50m<sup>2</sup> were plots which either had no definite size or no demarcations at all.

The inventory collected on the sizes of the micro houses reveals that 31.6% of the houses have an average size of less than 50 m<sup>2</sup>, 27.5% of the sampled houses have average size of between 61 - 65m<sup>2</sup>, 22.5% of the houses have an average size of between 51 - 55m<sup>2</sup>, while 18.4% of the total houses have an average size of between 56 - 60m<sup>2</sup>. Findings on the duration of time used in building these micro houses reveals that 49.2% of the respondents took more than 6 years to build their houses, 30.7% of the respondents took less than 1 year to build their houses, 11.1% of the respondents took 4 to 6 years to build their houses while 9.0% of the respondents took 1 to 3 years to build their houses.

**Table 5.2 Housing Characteristics**

Variables	Frequency	Percentage
<b>Building Type</b>		
Flat		25.3
Multiple Row Housing		25.1
Compound Housing		49.6
Total	244	100
<b>Wall Materials</b>		
Sand Crete Blocks	148	60.7
Mud Blocks	96	39.3
Total	244	100
<b>Roofing Materials</b>		
Zinc		90.2
Aluminum		9.8
Total	244	100
<b>Foundation Materials</b>		
Stone		25.9
Sand Crete Block		59.8
Concrete		14.3
Total	244	100
<b>Type of Windows</b>		
Wooden (Swing)	66	27.0
Steel Frame With Louver	150	61.5
Aluminum Slides	28	11.5
Total	244	100
<b>Type of Doors</b>		
Wooden (Swing)		11.1
Metal (Swing)		88.9
Total	244	100
<b>Type of Floor Finishing</b>		
Tiles		5.7
Sand/Cement Screed		94.3
Total	244	100
<b>Type of Ceiling Finishing</b>		
Asbestos	44	18.0
PVC	38	15.6
Saw-dust Ceiling Board	162	66.4

Total	244	100
<b>Average Plot Size</b>		
Less Than 50m <sup>2</sup>		10.6
51 – 100m <sup>2</sup>		32.8
101 – 150m <sup>2</sup>		36.9
151 – 200m <sup>2</sup>		19.7
Total	244	100
<b>Duration of Construction Work</b>		
Less Than 1 year	76	30.7
1 year – 3 years	22	9.0
4 years – 6 years	27	11.1
More Than 6 years	120	49.2
Total	244	100
<b>Sources of Housing Finance</b>		
Own Savings		74.2
Cooperative Society		14.3
Family members and Friends		11.5
Total	244	100
<b>Mode of Construction</b>		
Self-Built	40	16.4
Hired Builder	33	13.5
Family Members and Friends	171	70.1
Total	244	100

Source: Field Survey, 2017.

### Facilities and Services within the House

The survey conducted reveals that all respondents have kitchens, however some occupants who don't use the shared kitchens prefer to cook outside or in their living rooms. All respondents claim to have toilets. All respondents have bathrooms to take their bath. 35.7% of the respondents have in-built stores to store either food stuff or any other valuable properties, but 64.3% of the total respondents do not have in-built stores, this implies that they either use the kitchen or empty passages to keep their food stuff or other valuable things. The survey conducted reveals that 79.9% of the respondents do not have dining areas or dedicated space for eating, they eat their food either in the living room, bedrooms or even outside. 1 respondents.

#### Facilities and Services within the House

Availability of Facilities									
Kitchen		Toilet		Bathroom		Store		Dining	
Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
100%	0%	94.3%	5.7%	94.3%	5.7%	35.7%	64.3%	20.1%	79.9%

Source: Field Survey, 2017.

### Location of Facilities and Services

59.0% of the respondents have their bathrooms outside the house within the compound while 35.3% have their bathrooms within the house others claimed they don't take their bath in the house rather the bath either in their friends' houses or neighbouring compound, they account for 5.7% of the total respondents. 64.8% of the respondents have their toilets located outside the house while 29.5% have their toilets located inside the house. However, others claimed they do not use the toilets in the house rather they use the toilets in the neighbouring compound, accounting for 5.7% of the total respondents. Respondents who have their kitchens located within the house and those who have their kitchens located outside the house both constitute 47.1% of the total respondents, while those who use other forms of kitchen facilities constitute 5.8% of the total respondents.

**Table 5.4** Location of Facilities and Services

Bathroom		Toilet		Kitchen	
Inside the House	35.3%	Inside the House	29.5%	Inside the House	47.1%
Outside the House	59.0%	Outside the House	64.8%	Outside the House	47.1%
Others	5.7%	Others	5.7%	Others	5.8%

Source: Field Survey, 2017.

## RECOMMENDATIONS

A general improvement in housing provision for the ever increasing population will definitely improve the standard of living in the Jos metropolis. Housing being one of the most basic needs of man must be a subject of utmost concern to the government. However

when the citizens begin to improvise certain measures to meet this need, the government should also play a vital role which will help in the successful development of these houses and at the same time ensure that acceptable standards are adhered to in the course of development which will in the long-run improve health and safety of its occupants. The following recommendations are geared towards improving micro-housing development in this study area and on a larger scale, to make housing affordable and accessible to all.

1. **Standards** – this study found out that most of these houses have been erected without following the conventional procedures for development. Some of the houses are built without building plans, without building permits or approvals by the authorities. This is because of the financial implications and cumbersome procedures of obtaining all these documents. The government or housing authorities concerned can help solve this problem by reviewing these procedures and reducing the fees payable for the approval of building plans and other related documents. Standards should be relaxed instead of being too rigid so as to incorporate micro housing design elements into the overall set of building standards.
2. **Loan facilities** – the study shows that developers of micro housing hardly rely on mortgage institutions and other financial institutions for loans. This is simply because of the stringent conditions as well as the high interest attached to accessing loans for housing development. Financial institutions can play a very significant role in this regard by reducing the interest rates on loan facilities as well as eliminating some of the stringent conditions that a prospective developer must meet before gaining access to loans.
3. **Building materials subsidy** – the housing market that is saddled with either the production or importation of building materials should be supervised by the housing authorities in order to check the costs of building materials, this is because greedy manufacturers and importers of building materials have high tendencies of inflating prices of building materials and housing goods. Another measure that can be taken by the government in this regard is to also involve in partnership with manufacturers of building materials to buy these products directly from the manufacturers and make them available to developers at subsidized rates.
4. **Technological improvements** – locally made building materials will be able to perform as well as the foreign materials if the technology involved in their production is improved. Houses built with burnt bricks have the capacity to withstand very harsh weather conditions even when not plastered. Therefore the locally manufactured clay when subjected to heat will also serve the same purpose. Well treated and polished wood can also serve as materials for floor finishing as well as ceiling finishing. Doors and windows too can be made from hard wood in an aesthetic way to look good and serve the purpose of security at the same time.

## CONCLUSION

Micro units have generated considerable interest and some controversy in the minds of people as well as in the housing industry in the past several years. Research has shown that the migration toward smaller average unit size housing such as one-bedroom units and rental of small apartment with shared facilities and common kitchens, bathrooms and toilets within communities are a growing trend. Whether this turns out to be a lasting phenomenon or a passing fad, micro units have renewed the focus on efficient layouts and innovative design solutions. Many of these smaller units are designed and configured to feel larger to potential renters than older conventional units by virtue of higher ceiling heights, larger windows, built-in storage, and in some cases, shared toilets and bathrooms. Evidence from the housing markets indicates that smaller units tend to outperform conventional units as far as low and middle income earners are concerned.

Micro units are not for everyone and micro units may not be the solution for every location, hence there is need for the housing authorities and agencies concerned to integrate designs of micro housing units in their housing programmes especially low-income housing schemes. There should be some degree of adjustments and review of housing standards to create opportunity for development on smaller plot sizes for housing. Micro housing units should not be seen only from the negative point of view but from a more positive angle.



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