

# CONFERENCE PROCEEDINGS 2

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SCHOOL OF ENVIRONMENTAL TECHNOLOGY  
INTERNATIONAL CONFERENCE (SETIC 2016)

# SETIC 2016

## *Conference Proceedings*

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**THEME:**

**SUSTAINABLE BUILT ENVIRONMENT  
AND CLIMATE CHANGE:  
THE CHALLENGE OF POST 2015  
DEVELOPMENT AGENDA**

**DATE:**  
TUE. 10TH - THUR. 12TH  
MAY, 2016

**VENUE:**  
SCHOOL OF ENVIRONMENTAL  
TECHNOLOGY COMPLEX

**TIME:**  
9:00AM - 5:00PM  
DAILY

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Conference Proceedings of the School of Environmental Technology International  
Conference (SETIC) 2016

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10th – 12th May 2016  
School of Environmental Technology,  
Federal University of Technology, Minna, Niger State, Nigeria.

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## FOREWORD

The organising committee of the 1<sup>st</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 Climate Change and Sustainable Development. The conference is a platform where recognised best practices, theories and concepts are shared and discussed amongst academics, practitioners and researchers. The papers and scope are quite broad but have been organised around the sub-themes listed below:

- Infrastructure Development and Financing
- Sustainable Practice Theories
- Urban Resilience and Energy Conservation
- Waste Management and Sanitation
- Health and Safety Issues
- Climate Change and Threat to Sustainability of the Built Environment
- Climate Change Induced Disaster
- Designing the Human Settlement for Climate Change
- Conceptual Issues on Climate Change and Sustainable Development
- Sustainable Materials
- Cross Cutting Issues

The peer review process saw us making use of 48 senior academics and specialist as reviewers drawn from institutions in Nigeria and England. There were some papers were outside the theme of the conference but we had to create a cross cutting issues to accommodate such papers this is in spirit that every knowledge is important.

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.

Professor Yekeen Adeeyo Sanusi  
Conference Chair  
School of Environmental Technology International (SETIC) 2016  
Federal University of Technology Minna, Niger State Nigeria.  
May 2016



## DECLARATION

### PEER REVIEW AND SCIENTIFIC PUBLISHING POLICY STATEMENT

10th May 2016

TO WHOM IT MAY CONCERN

I wish to state that all the papers published in SETIC 2016 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 2016 are published in the SETIC 2016 Conference Proceedings and made available on [www.futminna.edu.ng](http://www.futminna.edu.ng)

Olatunde Folaranmi ADEDAYO  
Chairman SETIC 2016  
Federal University of Technology, Minna, Nigeria

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## 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 200 abstracts and 100 full papers submitted to SETIC 2016. 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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# ASSESSMENT OF NEIGHBOURHOOD INFRASTRUCTURE CONDITIONS IN MINNA, NIGERIA

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Infrastructure provision is very vital in the overall development of any society; yet it remains a major challenge confronting many cities. Its availability in term of quantity and quality is an important yardstick in the assessment of the quality of the environment. Infrastructure in the context of this study is the physical infrastructure which are the general neighbourhood facilities supporting the existing houses. Hence this study assessed the conditions of infrastructure within the Peripheral residential neighbourhoods in Minna, Nigeria. Data for the study were sought from both primary and secondary sources. A sample size of 600 was drawn out of the total 18, 387 households in the sampled neighbourhoods using estimation method. Estimation rate of 50% and precision range of  $\pm 4$  were adopted in determining the sample size. Systematic random sampling method was adopted in the administration of the questionnaires while infrastructure conditions were assessed using eleven (11) variables which were rated on 5 point likert scale and summed up to determine the 'perfect condition' score. A summation of all scores by a particular neighbourhood was divided by the perfect condition score, to determine infrastructure quality index number. The rating scale ranges from 0 -1 (Very Poor= 0.00-0.19; Poor 0.20-0.49; Fair 0.50-0.74; Good 0.75-0.94 and Excellent= 0.95-1.00). Quantitative and descriptive methods were used in analyzing data. Results of analysis revealed that infrastructure conditions in the neighbourhoods are fair; with infrastructure indices ranging from 0.52 to 0.65. This implies that, infrastructure provided within the sampled residential neighbourhoods are not adequately meeting the household present demands due to their deplorable conditions. The study recommended government and community interventions in the refurbishing and provisions of necessary infrastructure needed to support development and for the enhancement of quality environment.

*Keywords: Environmental Quality, Infrastructure Condition And Peri-Urban Neighbourhoods.*

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## INTRODUCTION

The presence and quality of infrastructure is now widely appreciated by the government and populace due to the challenges of unprecedented rates of urbanization. Even though many studies have highlighted the importance of infrastructure for growth and development, many of the developing worlds are still plagued by deteriorating and inadequate infrastructure (Holly, 2014). Infrastructure is important in the improvement of living standards of citizens and in the attainment of a well functioning economy (Arunma, 2010).

Availability of infrastructure is important and of equal importance is also the adequacy of the infrastructure provided. Adequate infrastructure in term of quantity and quality for urban needs helps in prolonging the useful life of the infrastructure and enhances environmental quality. Jacoby (2000) observed that infrastructure increases assets values. This encourages investment due to increase in initial capital invested. Quality infrastructure ensures the delivery of goods and services that promote economic growth and contribute to quality of life, including social well-being, health and safety, and the sustainable conservation of the environment (Holly, 2014). The availability of infrastructure facilities is therefore very critical to the economic, industrial, technological and social development of any country (Arunma, 2010).

However, access to infrastructural facilities is relatively very low most especially in the developing countries (Holly, 2014). Nigeria is not exempted from these problems of infrastructure availability and adequacy. Otegbulu (2014) rightly observed that infrastructure provision and quality have remained a major challenge and as a result, there has been a general public outcry over the poor conditions of the urban infrastructure in Nigeria. This has been attributed to high cost of providing urban infrastructure, inadequate budgeting by the government, poor national maintenance policy, undue political interference, public attitude to urban infrastructure, unwillingness of government to liberalize policies towards urban infrastructural services, corruption in the public sector of the economy and poor conditions of services in the public services (Iseh, 2003; Udoka, 2013).

UN-Habitat (2003) observed that cities attract new migrants each year who, together with the increasing native population, will continue to compound the problems of urban congestion and hampering of local authorities attempts to improving basic infrastructure and delivery of essential services. Minna the capital of Niger State is experiencing growth that is unplanned and uncontrolled, most especially at the peripherals. The most visible evidence of this development is the large and rapidly growing informal and squatter settlements at the peripheral areas without increase in the provision of supporting infrastructure such as roads, security, water supply and waste disposal facilities amongst others.

This study assessed the conditions of infrastructure within the Peripheral residential neighbourhoods in Minna, Nigeria. This knowledge will help planners in decisions relating to planning, development and management of urban fringes.



## Concept of infrastructure

There is no standard definition of infrastructure across economic studies (Gianpiero, 2009). It was viewed in the World Development Report, (1994) as an umbrella term for many activities referred to as "*social overhead capital*". The report viewed infrastructure as including services from public utilities, public works and transport sectors such as power, telecommunications, piped water supply, sanitation and sewerage, solid waste collection and disposal, and piped gas, roads and major dam and canal works for irrigation and drainage, urban and interurban railways, urban transport, ports and waterways and airports (World Bank, 1994). Infrastructure is defined as the physical framework of facilities through which goods and services are provided to the public (Deepika, 2002). Infrastructure is a heterogeneous term and it includes physical structures of various types used by many industries as inputs to the production of goods and services (Chan, Forwood, Roper, and Sayers, 2009). This description encompasses social infrastructure (schools and hospitals) and economic infrastructure (network utilities such as energy, water, transport and digital communications (Stewart, 2010).

Presence of infrastructure is a major determinant of economic growth while lack of it hinders sustainable growth and poverty reduction (Sahoo, Dash and Nataraj, 2010). Infrastructure can deliver major benefits in economic growth, poverty alleviation, and environmental sustainability, but only when it provides services that respond to effective demand and does so efficiently (World Bank, 1994). The role of infrastructure in economic development has been well explored and documented in literature (Jacoby, 2000; Deepika, 2002; Sahoo and Dash, 2009). However, the challenges of providing adequate infrastructure to cater for the needs of the teeming urban populace remains evident across the globe, most especially in developing countries. This probably is due to the fact that, Infrastructure provision is dominated by the public sector and requires huge capital investments. This makes it difficult for planners to match the availability of supply of infrastructure with demand at all times (World Bank, 1994).

Infrastructure is an indispensable asset in nation's integration and development. Its adequacies in term of quantity and quality are an important yardstick in the assessment of the quality of the environment. There is therefore the need to give it utmost attention in urban planning and management for the achievement of sustainable living and working environment.



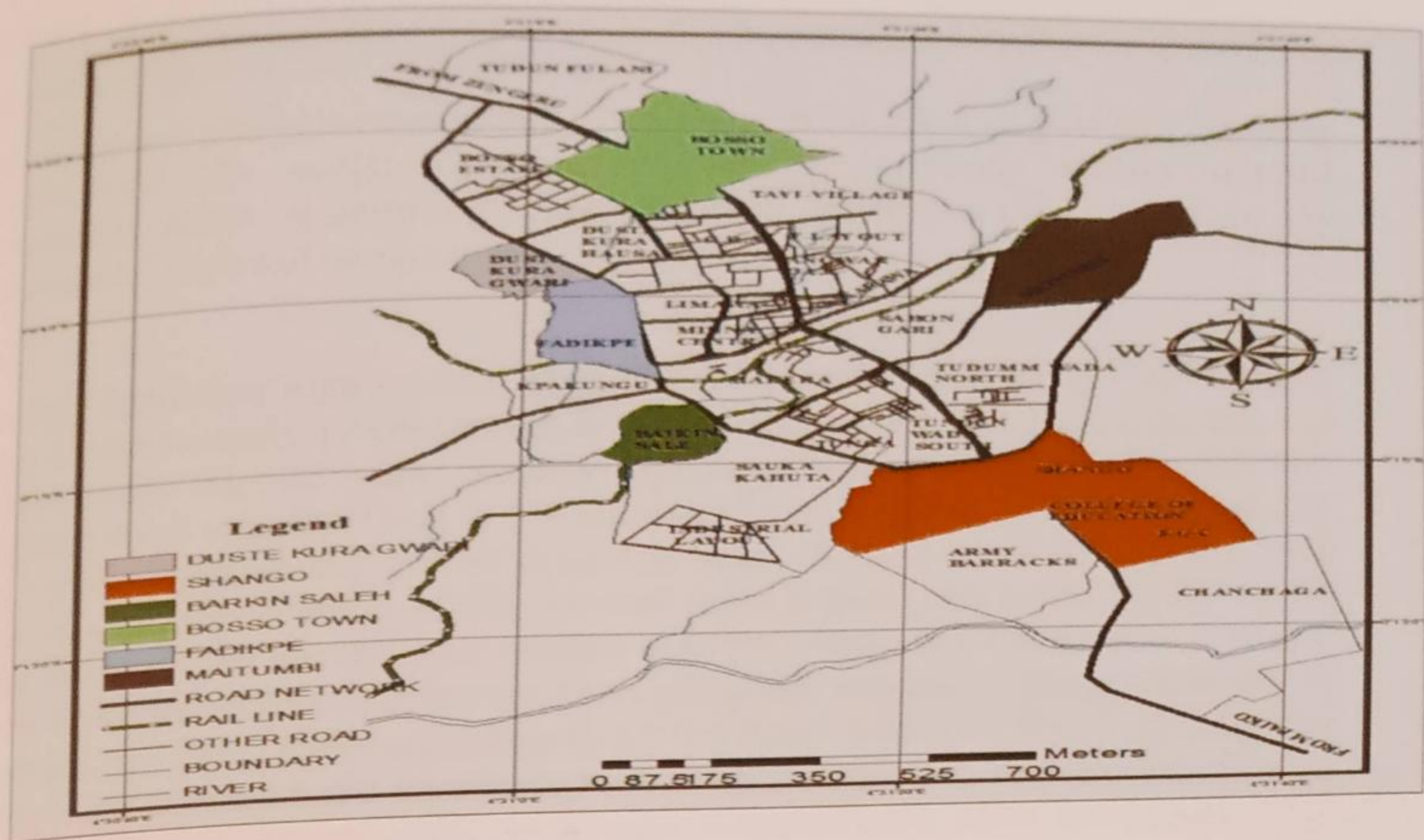


Figure 3. Delineated Boundaries of Sampled Neighbourhoods.  
Source: Adapted from Minna Street Map, 2014

### Methodology

Cluster sampling technique was adopted in the selection of sample areas for the study. The peripheral residential neighbourhoods were zoned into three namely; South-West peripheral, North-West peripheral and North-East peripheral zones with each zone representing a cluster. Two neighbourhoods were randomly selected within each cluster (zone) to ensure equal representation from each zone. The selected neighbourhoods formed the sample areas for this study and they include Barkin-Sale and Shango from the South-Western zone while Fadikpe and Dutsen-kura (Gwari) were selected in the North-Western zone and the North-Eastern zone has Bosso and Maitumbi. A sample size of 600 was drawn out of the total 18,387 households in the sampled neighbourhoods using Adams *et al.*(2007) simplified formula;

$$n_0 = \frac{Z^2 \alpha/2 \times P(1 - P)}{d^2}$$

Where:

N= population size (18387)

n<sub>0</sub>= sample size

Z = standardized normal value (1.96)

$\alpha$  =level of significance (95%)



$p$  = estimate rate expressed as decimal (50% = 0.5)

$d$  = precision range expressed as decimal

Estimation rate and precision range of 50% and  $\pm 4$  respectively were adopted in determining the sample size. The sample size was distributed proportionally amongst selected neighbourhoods while systematic random sampling technique was adopted in the administration of copies of questionnaire.

infrastructure conditions were assessed using eleven (11) variables; namely, Water sources, frequency of water supply, power sources, drainage type, drainage conditions, condition of access road, waste disposal system, sewage disposal methods, general sanitary conditions and neighbourhood security (Table 1). Variables used were rated on 5 point likert scale and summed up to determine the 'perfect condition' score. A summation of all scores by a particular neighbourhood was divided by the total possible score, that is, the "perfect score" to get the infrastructure quality index number. AAPPA- Australian Association of Higher Education Facilities Officers, (2000) condition rating was adopted in rating conditions of infrastructure. The rating scale ranges from 0 -1 (Very Poor= 0.00-0.19; Poor 0.20-0.49; Fair 0.50-0.74; Good 0.75-0.94 and Excellent= 0.95-1.00). Data analysis was conducted using descriptive (mean; percentages) while results were presented using tables and figures.

**Table 1: Variables used in Infrastructure Condition rating and assessment**

S/N	Facilities/ Component	Type/ Weight (Rating)					Remark
		5	4	3	2	1	
1	Water source	Pipe borne	Borehole	Well	Stream	Canal	
2	Water frequency	Excellent	Good	Fair	Poor	V. Poor	EA
3	Power source	PHCN	Inverter	Generator	Lamp	Candle	
4	Power frequency	Excellent	Good	Fair	Poor	V. Poor	EA
5	Drainage type	Precast (covered)	Precast-uncovered	Plastered block	Unplaster block	Open gutter	
6	Drainage condition	Excellent	Good	Fair	Poor	V. Poor	EA
7	Access road condition	Excellent	Good	Fair	Poor	V. Poor	EA
8	Waste disposal method	Excellent	Good	Fair	Poor	V. Poor	EA
9	Sewage disposal	Excellent	Good	Fair	Poor	V. Poor	EA
10	Security	Excellent	Good	Fair	Poor	V. Poor	EA
11	General condition of sanitary neighbourhood	Excellent	Good	Fair	Poor	V. Poor	EA

\*NB: Expertise Assessment (EA)

Source: Author, 2014



## 4.0 Results of Findings and Analysis

### 4.1. Infrastructure Conditions Assessment in the Sampled Peri-urban Neighborhoods.

Physical observation during field work revealed availability of basic infrastructure, though some are in deplorable conditions. Conditions of infrastructure examined are summarized below:

**1. Water supply** :Major source of water is the public mains of which water supply not frequent and has failed completely in some neighbourhoods due to broken and obsolete pipes. However not all houses are connected to the water mains due to high cost of connection and irregularity in water supply. Majority of houses in Bosso and Maitumbi are not connected to public water mains (2.87 and 2.62 respectively), residents of the neighbourhoods relied more on secondary sources of water such as; borehole, well or employ the services of water vendors (Table 2).

**2. Power source:** major source of electricity is from the nation's power grid. Majority of the houses in the selected neighbourhoods are connected to the power grid but power supply has been very irregular. This condition is more evidence in Shango, Bosso and Maitumbi with condition mean scores of 2.78, 2.92 and 2.87 respectively. This made some houses resort to the use of alternative sources of power such as power generator set, rechargeable lamp, candle and lantern.

**3. Drainage:** not all neighbourhoods are provided with drainage. Mean scores for drainages ranges between 1.27 and 1.76 across sampled neighbourhoods. However, some major roads in Bosso neighbourhood have very good precast drainages; though some are blocked with waste deposition. Where drainages are not available, residents employ open gutter in disposing waste water (Plate I and II). These made the drainage conditions to rate very poorly on the assessment scale (Table 2).



**Plate I:** waste deposit in drainage in Barkin Sale, Minna.  
Source: Author, 2016



**Plate II:** Open gutter in Maitumbi, Minna.  
Source: Author, 2014



**4. Access road:** Access road conditions were poor across neighbourhoods with mean scores of between 2.04 and 2.57. Most access roads within neighbourhoods are untarred and washed-off in some cases. Access roads within neighbourhoods are in deplorable conditions across the sampled neighbourhoods and worse in Maitumbi (Table 2).

**5. Waste disposal:** Waste within neighbourhoods was disposed by government or private operatives for a fee. However, some waste bins are seen filled and littering the environment due to delay in evacuating wastes by government and private operatives. Waste disposal methods was generally poor across neighbourhoods (2.00 -2.57). Some residents dispose their waste in uncompleted buildings or in water canals which has great implications on health and general conditions of the environment.



A



B

Plate III (a & b): Waste deposited in an uncompleted building & Drainage in Barkin-sale, Minna  
Source: Author, 2016.

**6. Sewage disposal:** mode of sewage disposal rated fair on the assessment scale in Dutsen-kura and Fadikpe neighbourhoods (3.11 and 3.47 respectively). These two neighbourhoods depended more on government evacuation vehicles while the other four neighbourhoods employed some other means such as disposing directly within neighbourhoods (Table 2).

**7. Neighborhood security:** all the sampled neighbourhoods have at least one (1) Police outpost, though not evenly distributed within the neighbourhood. In order to support the efforts of the government in providing security in the neighbourhoods, residents employed services of private/ local guards and dogs amongst others. However, security breaches were high in Bosso, Barkin-sale and Shango with mean scores of 2.69, 2.93 and 2.98 respectively (Table 2).

**8. General Sanitary Condition:** the overall environmental conditions of Dutsen-kura and Fadikpe rated fairly on the assessment scale (3.26 and 3.37 respectively). General condition



of the environment in the other neighbourhoods rated poor 2.43 – 2.83). The environmental condition as observed in the neighbourhoods has implications on health, housing quality and value.



Table 2: Mean Scores and Index for Infrastructure Condition Rating in Minna Peri-Urban Neighbourhoods

S/N	Neighbourhoods	N	WS	WF	PS	PF	DG	DG.C	AC.C	WD	SWG	STY	GNS	INDEX
1	Dutsen-kura	47	3.62	3.00	4.87	3.36	1.64	2.52	2.19	2.57	3.11	3.26	3.19	0.61
2	Fadikpe	30	4.07	3.43	4.90	3.17	1.73	2.83	2.57	2.57	3.47	3.37	3.47	0.65
3	Barkin-sale	42	3.57	3.33	5.00	3.29	1.76	2.60	2.19	2.48	2.86	2.93	2.86	0.60
4	Shango	45	3.96	3.11	4.98	2.78	1.27	2.27	2.04	2.00	2.47	2.98	2.82	0.56
5	Bosso	310	2.87	2.76	4.90	2.92	1.48	1.95	2.21	2.00	2.37	2.69	2.43	0.52
6	Maitumbi	126	2.62	2.94	4.99	2.87	1.45	2.30	2.33	2.42	2.69	3.03	2.53	0.55
	<b>TOTAL</b>	<b>600</b>											<b>Average Index</b>	<b>0.58</b>

NB: WS=water source, WF=water frequency, PS=power source, DG=drainage type, DG.C=drainage condition, AC.C=access road condition, WD=waste disposal, SWG=sewage, STY=security, GNS=general sanitary condition.

Source: Author, 2015.

**Condition Rating Indices**

Very poor 0.00 – 0.19  
 Poor 0.20 – 0.49  
 Fair 0.50 – 0.74  
 Good 0.75 – 0.94  
 Very good 0.95 – 1.00

**Mean Scores Rating**

Excellent 4.60 – 5.00  
 Good 4.00 – 4.59  
 Fair 3.00 – 3.99  
 Poor 2.00 – 2.99  
 Very poor 0.00 – 1.99



#### 4.2. Overall Infrastructure Conditions in the Sampled Residential Neighbourhoods

Infrastructural conditions also rated fairly on condition scale, with condition index scores ranging from 0.52 to 0.65. Conditions of infrastructure in Bosso, Maitumbi and Shango neighbourhoods are the worst amongst sampled neighbourhoods with condition index scores of 0.52, 0.55 and 0.56 respectively. Conditions of infrastructure in Fadikpe, Dutsen-kura and Barkin-sale rated better than the first three neighbourhoods mentioned with condition index scores of 0.65, 0.61 and 0.60 respectively (Table 3).

**Table 3: Infrastructure Quality Indices in Minna Residential Neighbourhoods**

S/N	Neighbourhoods	N	INDEX
1	Dutsen-kura	47	0.61
2	Fadikpe	30	0.65
3	Barkin-sale	42	0.60
4	Shango	45	0.56
5	Bosso	310	0.52
6	Maitumbi	126	0.55
	<b>TOTAL</b>	600	0.58

Source: Author, 2015.

Although the infrastructure assessed rated fairly on the assessment scale, some are in a very bad condition and incapable of meeting the needs of the increasing housing and population in the neighbourhoods. According to Agbola and Agunbiade (2009), continuous housing development not well supported by good infrastructure can lead to slum formation.

#### Conclusion and Recommendations

The research has assessed the conditions of infrastructure in some selected residential neighbourhood in Minna, Nigeria and observed that the neighbourhoods were characterized by; inadequate infrastructure to cater for household's need, obsolete infrastructure resulting to service failure due to poor maintenance culture on the part of the government and the community.

The study therefore recommends refurbishment of existing infrastructure and provision of new ones in order to enhance the neighbourhood's environmental quality. The study also recommends community participation in infrastructure provision and maintenance in order to compliment the efforts of government.



## References

- Agbola, T. & Agunbiade, E. M. (2009). Urbanization, Slum Development and Security Of Tenure: The Challenges Of Meeting Millennium Development Goal 7 In Metropolitan Lagos, Nigeria. In: Sherbiniin, A., A. Rahman, A. Barbieri, J.C. Fotso, & Y. Zhu (eds). *Urban Population-Environment Dynamics in the Developing World: Case Studies and Lessons Learned*. Paris: Committee for International Cooperation in National Research in Demography (CICRED).
- Arunma, O. (2010). Capital Market as a Long term Option for Financing Infrastructure Development. A paper presented at the Central Bank of Nigeria Infrastructure Finance Conference held at the Sheraton Hotel and Towers, Abuja. December 6<sup>th</sup> and 7<sup>th</sup>.
- Australian Association of Higher Education Facilities Officers (AAPPA) (2000). *Guideline for Strategic Asset Management, SAM – How to Undertake A Facility Audit*, 1st Edition. Australia: AAPPA
- Chan, C., Forwood, D., H. Roper, and C. Sayers (2009) 'Public Infrastructure Financing: An International Perspective', Productivity Commission Staff Working Paper.
- Deepika, G. (2002): Impact of Infrastructure on Productivity: Case of Indian Registered Manufacturing Centre for Development Economics. Working Paper No. 106.
- Gianpiero, T. (2009): Public infrastructure: definition, classification and measurement issues. Online at <http://mpira.ub.uni-muenchen.de/12990/> MPRA Paper No. 12990, posted 25. January 2009 06:11 UTC.
- Holly K. W. (2014). Financing Sustainable Infrastructure. *International Development Finance Club (IDFC) Volumes I & II*.
- Iseh, F. (2003,) The state of urban infrastructure in Nigeria. Atlantis Books, Ibadan. Nigeria.
- Jacoby, H.. (2000). Access to Rural Markets and the Benefits of Rural Roads. *The Economic Journal*, 110.
- Otegbulu, A.C. (2014), 'Urban Infrastructure Condition and Neighbourhood Sustainability: A Contingent Valuation Approach'. *Ethiopian Journal of Environmental Studies & Management*, Vol.7 (2) 160.
- Sahoo, P. and Dash, R. K. (2009), Infrastructure Development and Economic Growth in India. *Journal of the Asia Pacific Economy*. Rutledge, 14(4) 351-365.
- Sahoo, P., Dash, R. K. and Nataraj, G. (2010), Infrastructure Development and Economic Growth in China. Institute of Developing Economies (IDE), JETRO, JAPAN. Discussion Paper No. 261.
- Stewart, J. (2010, ) Public and Private Financing of Infrastructure- 'The UK National Infrastructure Plan 2010', European Investment Bank Papers.
- Udoka, I. S. (2013), The Imperatives of the Provision of Infrastructure and Improved Property Values in Nigeria. *Mediterranean Journal of Social Sciences*. 4 (15). 21-33.
- World Bank, (1994), World Development Report - Infrastructure for Development. Oxford University Press, New York.