CARRYING CAPACITY AND INFRASTRUCTURAL DEVELOPMENT IN PERI-URBAN AREAS IN THE DEVELOPING NATIONS: A CASE OF NIGERIA

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Abstract:

Resource Carrying Capacity refers to the number of individuals who can be supported within the natural resource limits in an area sustainably in the interest of the present/future generations in order to avoid varous kinds of unacceptable negative impact. Infrastructure required in the peri-urban areas are no different from that of the urban centres and vary from roads to water, health care facilities to waste disposal facilities, electricity to educational infrastructure amongst others. The difference however is the fact that growth and development in the Nigerian peri-urban areas is usually unmonitored and the true picture of the activities is not often captured. In conclusion, the study underscores the best practice challenges and policy recommendations for sustainable peri-urban infrastructural development.

INTRODUCTION

Man's environment has always been instrumental to him in his everyday quest for a better life. This search for comfort and ease has involved the continuous extraction and deployment of environmental resources which over time have translated into the series of

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growth and development notable in our world today. Taiwo and Feyisara (2017) described this as the advent of globalisation and the quest for development which have triggered off impressive economic progress, creating materials and luxury of life. They stated further that, this progress and its associated benefits have imposed a tremendous cost to the global environment.

In spite of the serious challenges and threats introduced into our common global environment in return, it is certain that development around the world is taking place at a faster rate (Indian Institute of Technology, 2012). As Onibokun (2005) pointed out cities will continue to grow while challenges will continue to become more complex as development continues to take place in the different spheres of the world. This therefore implies that the need to take conscientious efforts in the deployment and management of resources is most important. This importance is most relevant because as noted by Taiwo and Feyisara (2017), the actions we take now will determine whether or not the current course of development will be sustainable for the future, or will merely produce deleterious repercussions that are capable of destroying us.

Resources as stated by Okude (2000) are those qualities inherent in any environment which can be used to better the state of well-being of the inhabitants of such an environment. It is any part of the environment that is useful to man, this can be interpreted to mean that resource is anything that mankind can find a relevance for in his environment and also derive satisfaction from. Resource availability is no doubt very important; so also, is having necessary information about the available resources, these indices are key to the resource management process. Mitchell (1978) considered resource management to be a process whereby resources are allocated over space and time according to the needs, aspirations, and desires of man within the framework of technological inventiveness, his political and social institutions, and his legal and administrative arrangement. A major factor that can aid the achievement of the goals and objectives set out by a resource manager in his management quest is to have access to vital information which may guide him during the resource allocation process, one of such items of information is the carrying capacity of a resource of interest.

The concept of carrying capacity is fundamental to many facets of resource management. Resource Carrying Capacity refers to the number of individuals who can be supported within the natural resource limits in an area sustainably (without degrading its natural, social, cultural & economic surrounding) in the interest of the present/future generations. Other notable descriptions of carrying capacity are:

i. the maximum population size of a biological species that the environment can sustain indefinitely, supplying food, water, habitat and other necessities in the environment;
ii. It is defined as the environment's Maximal Load in population biology; Load (or Bearing) Capacity in Engineering, measured in terms of food availability, water supply, environmental conditions and living space;
iii. The maximum population that can be supported or sustained by an ecosystem over time (Baldwin, 1985; Miller, 2004);
iv. Indian Institute of Technology (2012) defined it as the maximum number of people that can be supported by the environment of an area through optimum utilisation of the available resources;
v. The maximum pressure or load that a system can conveniently withstand before breaking down." A system breaks down when it can no longer cope with the pressure from the loads it is carrying (Taiwo and Feyisara, 2017).

Taiwo and Feyisara (2017) also mirrored the importance of the concept of carrying capacity as one that is of fundamental importance to man especially if the system being referred to in the definition is the planet Earth. Hence, they stated that, when the carrying capacity of the earth as a system can no longer sustain the pressure of population explosion, the unacceptable impact occurs in the form of deteriorating or negative effects. In other words, carrying capacity of an area refers to an extreme limit. This limit defines the population carrying capacity of the area. If this limit is crossed then nature will react by imposing pressure to resist the abrupt growth and development of the people resulting into equilibrium. These pressures can be in form of floods, droughts, famines, landslides, etc.

Peri-Urban Infrastructure and Carrying Capacity

Indian Institute of Technology (2012) stated that a socio-economic survey could be carried out in an area to understand the population status, land requirement, economic status, etc. of the people residing there. The survey of the area will highlight the presence or absence of basic infrastructural amenities, so subsequent action may be taken based on the findings of the survey. The fundamental infrastructure required in peri-urban areas in Nigeria include but are not limited to roads; water; healthcare provision, and electricity.

Roads

Roads are the links that makes accessibility to locations possible and facilitate trade, exchange of goods and services as well as the carriage of information and ideas amongst other benefits. Road is therefore infrastructures that are of utmost importance in the peri-urban areas. Nevertheless, the situation of road infrastructure in Nigeria is one that can be described as chaotic as in the case of the peri-urban areas. Roads deterioration has factors that enhance it and this may vary from one peri-urban to another. This means that the socio-economic survey like the one suggested by Indian Institute of Technology (2012) may still be required to pinpoint factors that could make the roads to deteriorate fast; such information can aid planning using a concept like carrying capacity. Through the survey, vital information such as the population of interest; prominent activities; type of peri-urban area (residential, commercial, industrial, etc.) and other salient information etc. may be obtained and necessary plans may be embarked upon to construct a qualitative road infrastructure that will stand the test of time.

Water

WHO/UNEP (1997) described water as an environmental resource with a profound impact on public health, economic activity and environmental (and ecosystem) quality. Harman *et al.,* (2010) on their own part viewed water as arguably the most precious resource on earth. It is ecologically, economically and culturally valuable, and it has been recognised as an important element in maintaining and enhancing amenity. Furthermore, adequate water supply is central to life hence of the five basic human

needs (water, food, health, education and peace), water is a common factor to the other four (Akpor *et al.*, 2011). This therefore suggests that water as an environmental resource is indispensable to man and his kind; its indispensability is a function of its cultural, economic as well as ecological value. A further interpretation of this is that water resource is not just an anchor to man but it also provides an invaluable support system to the ecosystem which is also of fundamental importance to humans environmetal needs for survival.

Water requirement in peri-urban areas depends largely on the types and volume of activities going on within them. Based on the categorisation of peri-urban areas by Douglas (2006), it could be an area for the poor, for industry, for the middle class, for local government, for conservationists, for education and human well-being. This therefore suggests that water in the peri-urban areas could be required for domestic, commercial, industrial as well as ecological and cultural purposes; this information can also be obtained via a socio-economic survey as suggested by them Indian Institute of Technology (2012). Further information like the volume of each activity, the volume of water needed, etc. will be most useful to plan for water infrastructure using the concept of carrying capacity as a guiding principle.

Healthcare Provision

Healthcare provision in the peri-urban areas is mostly characterised by private care provision which in most cases is expensive and not always efficient (Bachmann, 1994). Where government-provided healthcare infrastructure exists, they are primary healthcare centres which are not often commensurate to the community population or the population of people requiring healthcare. Healthcare is required on a daily basis and may vary from maternity to paediatrics, to general medicine to emergencies, etc. with frequency based largely on the population of the host community. It is not out of place to state here that government healthcare provision in the peri-urban areas is insufficient hence the available ones are subject to immense pressure which in the end affects the quality of service they render to the patients who require it. Standard medical practice indices like: doctor-patient quota, doctor-nurse quota, available diagnostic equipment etc. are outright indicators of the failure in the Nigerian health sector and the situation is no different in the peri-urban centres. All these quota and

indices have standards which are necessary for efficient delivery of healthcare services. For instance, Olawale and Orogun (2017) stated that WHO standard is one doctor to 600 patients but what is obtainable in Nigeria is one doctor to 6,000 patients.

Electricity

This is another recurrent problem in Nigeria and as always, the situation is worse in peri-urban areas. The state of electricity provision in Nigeria is nothing but extremely poor while attempts to corrected this provision has remained a constant failure recorded by different governments. The challenge with electricity is one that affects other areas of people's life which means that electricity affects people economically, socially, politically, educationally and also have implications for the healthcare sector amongst others (Simcock and Mullen, 2016). It is therefore not surprising that the state of electricity in peri-urban areas is nothing but shambolic as high-brow areas are no better off. Electricity in Nigeria suffers from the following and by extension, the problems are also manifest in peri-urban areas: Obsolete power infrastructure; Insufficient manpower; Technological deficiency; Corruption; Low power generation; Institutional gridlock (Generation, distribution and Transmission debacle.) etc.

Carrying capacity should not be underestimated in addressing the above stated issues. Similarly, other challenges such as technological deficiency, insufficient manpower, and obsolete infrastructures can be managed via the carrying capacity concept.

Factors Affecting Infrastructural Carrying Capacity in Peri-Urban Areas

These are factors that have implications which could either be positive or negative for the peri-urban areas and they include:

i. Environmental degradation: FAO described ecosystem degradation as an antagonistic interaction which occurs when the output of one activity degrades resources or modifies the environment in a way that harms another activity. Environmental degradation shrinks carrying capacity; overworking its elements of regulation as it has to cope with the spate of natural and manmade negativities which may break its resilience.

ii. Population: The peri-urban area is an area that holds a sizable population of people who relocate to the area because of their inability to cope with pressures of the urban centre notably the accommodation rents hence the population density in the peri-urban area is usually much. This in most cases is not healthy for the environment and the available resources such as the available infrastructure as the population of the people being serviced by the infrastructure usually overshadows its carrying capacity.

iii. Improved technology: This is more of a positive factor that may affect infrastructural carrying capacity. Technology is technical progress which may include the discovery of a better way (process) of doing something to yield a more productive result. It may be the discovery of newer products, ideas which may positively impact the construction of an infrastructure especially as it concerns its ability to accommodate more pressure or enhance its durability. In the construction industry for instance; newer materials that are more resilient, resistant and have more weight handling ability may be discovered and deployed in the construction process.

iv. Regulatory factors: This may be the introduction of policies intentionally by the government to checkmate an anomaly. Such an anomaly may be infrastructural decay in the peri-urban areas. Such factors may be used to keep the population size at equilibrium; a notable policy of this nature was that of the Chinese government to regulate their population by enforcing the one child per family policy until it was recently rescinded. Regulatory policies may therefore be used in peri-urban areas though it will need constant monitoring to ensure conformity.

v. Increasing stock of resources: This implies that provision should be made to make additional resources required available in areas where they are needed. This may work in peri-urban areas in the aspect of the infrastructure required for the day-to-day activities. For instance, household generation of electricity from efficient photovoltaic solar panels will reduce the burden of electricity provision by government.

Carrying Capacity and Infrastructural Provision in Nigerian Peri-Urban Areas

Urbanisation is the outcome of social, economic and political developments that lead to urban concentration and growth of large cities, changes in land use and transformation from a rural to metropolitan pattern of organisation and governance (Akunnaya and Adedapo, 2014). As at 2005, 40% of Africa's population lived in urban areas and by 2011, 12 of the 15 largest urban areas in the world were in low-and middle-income countries (Muggah and Frate, 2007; UN, 2011). In 2016, an estimated 54.5% of the world's population lived in urban areas and by 2030 the figure is projected to rise to 60% (UN, 2016). Generally, factors such as population dynamics, economic growth, legislative designation of new urban centres and increase in the density of rural trading centres are responsible for urbanisation (Akunnaya and Adedapo, 2014). In low- and middle-income countries, megacities are characterized by the following amongst others (UN, 2011):

i. Uncoordinated urban development and services
ii. Unplanned street patterns
iii. Poor governance and political resistance to decentralisation, accountability and transparency
iv. Informal systems of neighbourhood governance
v. Large pockets of poverty
vi. Substantial inequality in income
vii. High levels of pollution
viii. High levels of migration
ix. Large informal sectors

Governments in the developing countries are seemingly overwhelmed by this rapid rate of urbanisation with less provision of infrastructure for the increasing population (Ibem, 2009). As a result, rural areas, farmlands, country sides, vegetations amongst others are converted into urban sprawls, with an upsurge in economic growth (Indian Institute of Technology, 2012). The process of urbanisation seems inevitable as cities and towns are growing exponentially with increasing demand for urban area. The urban areas are the entities which have great potential of exceeding the local carrying capacity because they require enormous concentrations of food, water, and materials in a small area. The concentration requirements may go far

beyond the level provided by the local carrying capacity. As urban areas continue to expand, they transit into surrounding rural areas. This is what brought about the concept of peri-urban areas. Even though it defies a universal definition, it can safely be regarded as areas that are transition zones between the clustered urban spaces and the rural areas. According to Ravetz *et al.*, (2013), urbanisation is one of the critical instigators of peri-urban formation and these are driven by - demographic and social dynamics; economic and employment growth; environmental dynamics and constraints, and urban built structures and infrastructure.

In addition, a high degree of consumption in urban areas is associated with huge quantity of waste production and sewage which cannot be properly assimilated within the local carrying capacity (Aspeslagh, 1994). This likelihood of overshooting the local carrying capacity is not peculiar to the urban centres only; the situation is also becoming common in the peri-urban areas which is seen as the transition or interaction zones where urban and rural activities are juxtaposed and landscape features are subject to rapid modifications induced by human activities (Douglas, 2006). The Decision Intelligence Document (2013) considers the peri-urban areas to be the urban fringe; which are mostly transitional areas where people, resources, and goods connect and move between rural and urban areas. Owing to peri-urban areas because of their proximity to the urban areas have first-hand experience of the multiple activities taking place within the urban centres which in most cases places them at a disadvantage. Peri-urban formation goes through a series of dynamics as identified by Ravetz *et al.*, (2013) including:

i. Urban expansion as a result of growth in population, economics and space demands
ii. Regional agglomerations formed with changes in economies of scale
iii. Political and cultural forces underlying developing agglomerations
iv. Rapid transition, radical change and restructuring, and
v. Policy responses to transitions

An early recognition of peri-uban formation is critical if the sustainable use of available resources in such areas are to be achieved. This means that carrying capacity will be examined within the context of peri-urban infrastructural needs.

Akrofi & Whittal (2011) described infrastructure as a broad concept that includes public investment in physical assets and social services. Infrastructural development tends to be high-cost investments inclined; however, it is vital to a country's economic development and prosperity. Provision of infrastructure for basic services is vital for the growth and development of peri-urban areas where the spill over effects of activities in the urban centres are usually obvious and mostly negative. Some of the sprawling effects induced by the proximity of peri-urban areas to urban areas were captured by Cofie and Amerasinghe (2012) and they include: Pressure on available land and water resources; constantly changing environment; large concentration of low to middle income earners; often used as dump sites for urban wastes; receives storm and waste water from the city.

Infrastructure requirements in the peri-urban areas are no different from that of the urban centres and vary from roads to water, healthcare facilities to waste disposal facilities, to electricity to educational infrastructure amongst others. The difference however is the fact that growth and development in the Nigerian peri-urban areas is usually unmonitored and the true picture of the activities is not often captured. The reality is that the magnitude of activities within the peri-urban centres far outweighs the infrastructural provision. This implies that activities (economic, social, educational, commercial. etc.) are more than the expected volume hence the available infrastructure catering for the teeming population of people are usually and always overworked and damaged sooner than due if such infrastructural facilities are not over-streched. This is where the concept of carrying capacity comes in handy. Infrastructure capacity level according to Aspeslagh (1994) involves the evaluation of the growth and development of a locality on the basis of its infrastructural development. Here the intensity and pattern of resource usage is estimated for the development of infrastructure like, water supply system, sewage system, transportation system, waste disposal system, etc. This means that infrastructural growth and development will be on the basis of analytical evaluation carried out to determine how much of an infrastructure is required to service a specific area.

As a case study on the realities of peri-urban areas in Nigeria, the work of Lawanson *et al.* (2012) was reviewed. They evaluated the

challenges of peri-urban settlements around Lagos Mega-city and noted that peri-urban areas such as Mowe, Ibafo, and Ofada are already under heavy and intense pressure of physical growth with very few indicators of real development. They observed the phenomenal increase in the population of these settlements over time due to massive relocation of residents from - Lagos Megacity where about 76.6% of the people moved in from Lagos and about 89.8% of this group moved in less than 10 years ago. Factors such as cheaper land, cheaper rent, social engagements and cultural interactions, political affiliations nearness to Lagos and nearness to work place were identified as reasons for moving to these settlements. With regards to transportation networks, they found that a large number of people living in the peri-urban settlements were found to be working in Lagos Mega-City and commuting to Lagos Mega-City on a daily basis (about 96.3% with about 64% of this group doing so for an employment purpose only. This was considered to be a major factor accounting for the increase in traffic volume and hence traffic congestion along the highway. The value of land and house rent in the peri urban settlements was also found to have risen sharply especially between the last 10 and 15 years.

5. Conclusion and Recommendations for Policy

The growth patterns in Lagos peri-urban areas are identical in many respects to those observed in large cities across the world with regard to the types of economic and commercial activities that are most dynamic (Kennedy, 2007). Arrow *et al.* (1995) commented that carrying capacity is not static but is based on the complex relation of preferences, application of technology and patterns of production and consumption. Also, carrying capacity is contingent on the state of interactions of the biotic and abiotic environment. However, the importance of carrying capacity as a concept that could be adopted to ensure infrastructural sustainability is also subjected to policies and the implementation of basic components of any country's system (Ayeni and Olorunfemi, 2014; Ayeni, 2019). Policy refers to the commitment of people or organisation to the laws, regulations, and other issues governing a nation or group of people (Fashagba and Ayeni, 2018; Ayeni, 2019).

The implementation of policies, laws, regulations and programmes through organisations or groups of individuals enhances the benefits of

polices and programmes and adds value to policy as well as making the policy's results and responses more effective and stronger. In Nigeria for example, environmental policy provides a cohesive and comprehensive framework (plans and programmes) for government at all levels to identify significant aspects and manage its environment (UNEP-IETC, 2004; Ayeni, 2019). Policy is a widely used concept, not only in the academic literature but in policy-making documents, international discussions, as well as in local debates when considering issues dealing with decision making to achieve sustainable infrastructural development (Fashagba and Ayeni, 2018; Ayeni, 2019). Infrastructural development, economic growth, and climate protection are intimately related. Infrastructure is a key driver of economic growth and development. In the current context of increasing concerns about prospects for global growth, infrastructural investment can play an especially important role, by boosting global aggregate demand today and laying stronger foundations for future growth. Infrastructure is also a key element of the climate change agenda. Done badly, it is a major part of the problem; infrastructure accounts for more than half of global carbon emissions. Done right, it is a major part of the solution, vital to both climate change mitigation and adaptation.

Policy has a central role to play in the agenda to promote sustainable peri-urban development through the provision of better infrastructure (Sutherland *et al.*, 2011; Mulugeta, 2013). More importantly, policy provides gestures and sets the regulatory and institutional frameworks that influence the actions public and private investors to play a much better role in the infrastructure challenge, private investment and finance (Crihfield and McGuir, 1997;). Governments at all levels need to express clear and comprehensive strategies for sustainable infrastructure and incorporate them in policy and programme development for sustainable peri-urban growth and development (Crihfield and McGuir, 1997; Sutherland *et al.* 2011; Mulugeta, 2013). There is a need to address policy and programme failures and other constraints to sustainable peri-urban infrastructure development. Sustainable peri-urban infrastructure is also important for governments to reflect and integrate their overall national development strategies (Crihfield and McGuir, 1997; Mulugeta, 2013).

Enhancing sustainable peri-urban infrastructure with the quality needed will require improvements in the policy and institutional framework needed

to strengthen planning and management capacities to build and implement a stronger infrastructural project (Crihfield and McGuir, 1997; Sutherland *et al.,* 2011; Mulugeta, 2013). This are particularly imperative to developing countries, but with limited need. More so, countries need to improve the policy regulation and institutional framework for public and private participation in infrastructure provision and development for the peri-urban population. Sustainable peri-urban infrastructure may likely face financing challenges that will require the strong and combined efforts of all stakeholders to finance through improved and innovative technologies. Finance specifically aimed at promoting sustainability and more importantly used to increase ways of leveraging access to infrastructural resources is imperative. Finally, government at all levels will take a leading role as an investor in financing sustainable peri-urban infrastructure especially such infrastructure in developing countries (Crihfield and McGuir, 1997; Sutherland *et al.,* 2011; Mulugeta, 2013).

The emergence of peri-urban has been on the increase in both the developing and developed world as a result of rapid urbanisation and other factors which include but are not limited to crippled domestic food distribution systems, increasing demands for fresh food in urban areas, limited urban land-use regulations rising unemployment, declining purchasing power. This shows that there is at present little opportunity for capacity-building or sustained behaviour changes, which is considered to be critical for peri-urban infrastructure development, planning processes and sustainability (Budds and Minaya, 1999; Albert and Haaren, 2017).

In conclusion, the concept of carrying capacity is of immense importance to professionals and decision makers in the private and public domain. A sound knowledge of the concept and proper application will definitely help in achieving availability, accessibility and sustainability of resources. Estimating carrying capacity is no doubt still a daunting task, however there are lots of methods which will fit a particular resource of interest than others and the advent of computer-based applications in its use for estimation means that the use of the concept is now ripe and should be used for sound planning to achieve the better management and sustainability of man's environmental resources.

REFERENCES

Akpor, O. A. (2011). Challenges in Meeting the MDGs: The Nigerian Drinking Water Supply and Distribution Sector. *Journal of Environmental Science and Technology* 4 (5): 480-489.

Akrofi, &. W. (2011). *Land for Peri-urban Infrastructure in Customary Areas: A case study of Kumasi, Ghana.* Marrakech, Morocco: FIG Working Week.

Akunnaya, P.O., & Adedapo, O. (2014): Trends in Urbanization: Implication for Planning and Low-Income Housing Delivery in Lagos, Nigeria. *Agricultural Research,* 4(1A), 15-26. DOI: 10.5923/s.arch.201401.03

Albert, C. and C. V. Haaren (2017). Implications of Applying the Green Infrastructure Concept in Landscape Planning for Ecosystem Services in Peri-Urban Areas: An Expert Survey and Case Study, Planning Practice & Research, 32:3, 227-242, DOI: 10.1080/02697459.2014.973683.

Arrow, *et. al.,* (1995). Economic Growth, Carrying capacity and the environment. Science, 268, 1-2.

Aspeslagh, W. (1994). *"Carrying Capacity and its application to Portland metropolitan area".* Discussion paper, 1-90.

Ayeni, A. O. (2019). Environmental policies for emergency management and public safety: Implementing green policy and community participation. In Emergency and Disaster Management: Concepts, Methodologies, Tools, and Applications; IGI Global: Hershey, PA, USA, pp. 903–922.

Ayeni, A. O. and F. B. Olorunfemi (2014): Reflections on Environmental Security, Indigenous Knowledge and the Implications for Sustainable Development in Nigeria, *J. Res. Natl. Dev.* 12 (1), pp 46 – 57.

Bachmann M. O. (1994). Would national health insurance itnprove equity and efficiency ofhealth care in South Africa? *SAMJ,* 84: pp 153-157

Baldwin, J. (1985). *Environmental planning and management.* Boulder, Co, USA.: Westview Press Inc.

Budds, J. and A. Minaya (1999). Overview of Initiatives Regarding the Management of the Peri-Urban Interface, Strategic Environmental Planning and Management for the Peri-urban Interface Research Project, http://www.fao.org/uploads/media Overview_of_initiatives_regarding_the_management_of_the_periurban_interface.pdf. Accessed on 20/02/2019.

Crihfield J. B. and T. J. McGuir (1997): Infrastructure, economic development, and public policy, *Regional Science and Urban Economics,* 27 (2), 113-116.

Douglas, I. (2006). Peri-urban ecosystems and societies transitional zones and contrasting values. In Peri-Urban Interface: Approaches to Sustainable Natural and Human Resource Use, edited by D. McGregor, D. Simon, and D. Thompson, pp. 18-29. London, UK: Earthscan Publications Ltd.

Fashagba J. Y. and A. O. Ayeni (2018). Natural Resources: Distribution, Governance and Politics. In Human Geography: Concepts, Approaches and Trends, Stamford Lake publication, pp 371-392.

Grigsby, L. L. (2012): Electric Power Generation, Transmission, and Distribution, CRC Press, Taylor & Francis Group, London, 768

Harman, E. A. (2010). *Institutional Arrangements for Water Management in South East Queensland.* Urban Water Security Research Alliance Technical Report No.21.

Ibem, E.O. (2009). Community-led infrastructural provision in low-income urban communities in developing countries: a study on Ohafia, Nigeria. *Cities*, 26, 125-132. doi: 10.1016/j.cities. 2009.02.001.

Indian Institute of Technology (2012). *Urban carrying capacity. "Concepts and calculations"*. Guwanatti.: Centre for Integrated Land use Planning and Water Resources Management. Department of Civil Engineering, Indian Institute of Technology (IIT).

Kennedy, L. (2007). Regional industrial policies driving peri-urban dynamics in Hyderabad, India, Cities, 24 (2): 95–109.

Lawason, T. O., O. Yadua and I. O. Salako (2012). Environmental challenges of peri-urban settlements in the Lagos Mega-city. *Proceedings of the 17th International Conference on Urban Planning, Regional Development and Information Society*, 14-16 May, 2012 Schwechat, Austria. 275 - 285

Miller, G. (2004). *Sustaining the earth: An integrated approach, (7thedn). Advantage Series.* Brooks/Cole: Thomson Advantage Books.

Mitchell, B. (1978). *Geography and Resource Analysis.* U.K.: Longman Group, Limited, 386 Pages.

Muggah, R. and Frate, A. (2007). *More Slums Equal More Violence: Reviewing Armed Violence and Urbanization in Africa.* Geneva. UNDP.

Mulugeta, M. (2013). The Need for Policy Framework for Urban/Peri-Urban Agriculture in Ethiopia: A Reflection, Ethiopian Journal of the Social Sciences and Humanities. IX (1): pp 79 – 109.

Olawale, G and G. Orogun (2017). One doctor still attends to 6,000 patients in Nigeria, https://www.vanguardngr.com/2017/01/one-doctor-still-attends-6000-patients-nigeria-don/ Accessed on 14/02/2019.