

# Comparative analysis of spatial extent and population sizes of cities in Nigeria: implications for urban space administration

## Abstract

The paper examined the spatial pattern of Nigerian settlements of varying sizes and ranks. The study used the data extracted from SPOT V images of the entire country to classify the settlements in Nigeria into five categories based on total built-up area. A total of 5,088 settlements were extracted and classified into mega cities, major cities, Minor cities, Major Towns and Minor towns based on total land area built-up. Multi-distance Cluster and Spatial distance autocorrelation analyses on the categories of settlements shows that Mega cities and major cities are more concentrated towards the coastal areas while towns are more dispersed and tends towards randomization across the country. The study further examined the weighted regression between the total area and population of mega cities and major cities and observed that the  $r^2$  value of Megacity population and total land area is 0.95 while the regression analysis of Population and land area of major cities had  $r^2$  value of 0.27. This shows that the mega cities population has high prediction of the sizes of the cities, while the population of major cities has low prediction values for the land areas. In the final analysis the study identified the spatial relationship between mega cities and the surrounding settlements within the radius of 50 kilometers and observed that southern cities have more sublevel cities to serve them while northern cities are usually surrounded by fewer smaller settlements. The northern cities have capacity to expand without conflict with smaller peripheral cities while the southern cities have less capacity to expand their boundaries without running into another major city. The paper further identified the implication of the observed city distribution pattern in Nigeria on urban administrations. The paper suggests that rank size rule based on population figure is not valid in Nigerian urban system but spatial limit of cities is an alternative or can be combined.

**Keywords:** spatial clustering, cities, spatial autocorrelation, settlement ranks

## Spatial patterns of settlements' distribution and hierarchies

Settlement is a unit of space built up by man to live and where to find a living. Settlement serves man in a number of areas, it is a defense against external and natural intruders, it is also a place of social and cultural interactions among people who live together for business and development.<sup>1</sup> Settlements have evolved in their different shapes, pattern and population based on the level of development of man according to the prevailing culture and the heritage be-queitted by the previous generations. The shape, size, pattern and the nature of settlements are also measures of economic development of the inhabitants. You can estimate the level of economic development of a nation by nature of advancements exhibited by her cities and settlements. Poverty of a nation manifests in the physical canvas of cities and settlements in form of slums, run down housing and dilapidated infrastructure.<sup>2</sup> Settlements have been classified based on shape, spatial extent and structure which include nucleated settlements, dispersed settlements and linear settlement, satellite and emergence settlements. The popular classification of settlements is urban and rural classes. Settlement is basically the home of man, built by man and for man. The classification of settlements into rural and urban has been subject of research and academic discourse over the years especially on where the demarcation between the urban and rural settlement lies. Some authors have used population to define urban areas while others have used the availability of infrastructure

and secondary urban services. Population limit of 20,000 was applied as the mark line from which rural area becomes urban (Though the population size used is varied from one country to the other). Whichever approach used to classify settlements into urban and rural, cities have dominant physical features that qualify them irrespective of regions, races or generation. A city is a place of high concentration of people, homes and services. Every city has its history of migration and influx of people from smaller settlements to attain the current size and status. The size of cities has implications on urban administrations and the efficient management of urban infrastructure and economy. When cities grows their demand for more sophisticated management increases the interactions between cities and their adjoining surrounding settlements also depict the nature of economic interactions and activities taking place in the nation which may provide understanding the macro economy of the nation and Gross domestic product (GDP) (Table 1).

Core periphery model explained the nature of economy interaction between cities and hinterlands. Christaller 's central place theory provided understanding on the range of goods and services exchanges between the rural and central cities as well as threshold population to support services in the cities. Urban administration depends on the ability to effectively manage the interaction between the settlements in the hinterlands and the central city. The management should be in such a way as not to intensify the pull factors of the city which can depopulate the surrounding settlements.

**Table 1** Classification of settlements in Nigeria based on spatial limit

Class of Settlements	Description	Number of cities	Label
Class I	Cities with built-up area between 10,000 Sq. Km and Above 100,000 Sq Km	10	Mega cities
Class II	Cities with built-up area between 1,000 Sq km and 10,000 Sq Km	112	Major cities
Class III	Cities where built-up areas ranges Between 100sq km and 1,000 Sq Km	662	Minor cities
Class IV	Towns where built-up area is between 10sqkm and 100 sq km	2,392	Towns
Class V	Settlements where built-up area is between 2sqkm and 10 sq km	1,912	Minor settlements
<b>Total settlements</b>		<b>5,088</b>	

The sizes, ranks and distributions of the cities have caught the attentions of researchers since the initial works of Central place theory Christaller<sup>3</sup> and Rank size rule.<sup>4,5</sup> Other recent works include Mutlu<sup>6</sup> that focused on urban primacy and economic development,<sup>7</sup> on city size and metro-politization, Das et al.<sup>8</sup> and Reed<sup>9</sup> worked on rank size distribution of settlements. Kumari<sup>10</sup> examined the city size distributions and the administrative hierarchies among the cities in India. In his studies Kumari<sup>10</sup> applied the rank size rule as postulated by Zipf.<sup>4</sup> The rank size rule is based on the postulations that the size and number of settlement in an urban system are determined by forces of unification and the forces of diversification. This postulation was however based on *postindustrial* city and may not apply to *post Fordism* cities. Beside every city has a unique history and at different time went through series of perturbations which may affect the sizes of the city. Cities also grow to subsume smaller surrounding settlements, while the culture and characteristics of the smaller settlements continue to play significant role in the emerging conurbation, the city tends to become an amalgam of several cultures and experiences. According to Zipf<sup>4</sup> the location of settlements primarily depends on the availability of Raw materials to aid production. Therefore with increased production and concentration of population in the production cities the population will split into larger number of smaller settlements as the raw materials are widely distributed. The location of the smaller settlements would be determined by nearness to the source of raw materials. The large settlements become the center of production and served as the market before the surrounding smaller settlements where raw materials are sourced consequently few large settlements emerged with larger numbers of smaller settlements. The large settlements tend specialize in in tertiary activities as a result of diversification of the economy. Mathematically the theory postulates that if cities are ranked from largest to smallest population, then the *r* ranked city is expected to have a population equal to the top ranked city divided by the rank of that city. For instance, if the first rank city in a country has a population of 1,000,000 the 3rd ranked city will have 1/3rd population of the highest ranking city. The relationship is expressed as:

$$K = P_r * r^q$$

K = Population of the largest city

*r* = Rank of a city

Pr = Population of a city of rank *r* and *q* is the absolute values of slope of the distribution.

Most applications of rank size rule have regressed the population of the settlements with the ranks of the settlements to obtain the *q*

absolute value using the beta value. Rosent and Resnick in their studies of over 44 countries believed that the Zipf's law operates in almost all the countries based on the use of Pareto distribution as discussed by Auerbach. The conventional rank size regression analysis has been extended to test the validity of Pareto distribution in representing city size distribution. Most of the applications of rank size rule are based on the population of settlements as the constructs of city sizes. The emphasis of the rank size rule is to use only population to define the sizes of cities. The use of population figure as a surrogate measure of city size is inadequate especially when the productivity and generative content of the city are considered. This is more important when cities in developing economy are considered. Cities in this context are characterized by large number on unproductive slum dwellers and huge population of footloose homeless vulnerable population. Such cities are big villages or at best a huge dormitory. Besides, population figures in many developing countries are often politicized for it determines the level of government attention that cities may get, therefore population figures for cities are largely unreliable. The paper posits that population figure as a measure of city size in urban classification is somewhat deficient.

However, population may be a primary factor to define or measure the size of cities in the developed economy but in Nigeria and other developing countries, the sizes of cities cannot be measured alone by the population. The spatial extent of cities is equally important especially for city administration and management of city economy. When large cities continue to grow, they often subsume wholly or partly smaller settlements in the hinterlands. The smaller cities maintain their identities and classifying their population with the larger settlements could result in violent engagements in Nigeria. Physical planning in such city also become precarious<sup>11</sup> as what is considered as outskirts by the larger city may actually be the city center of the smaller city. Though cities grow vertically and horizontally, population can be overestimated or underestimated but the physical dimension of a city cannot be mistaken. Population in the cities is not adequate to measure the sizes or rank of the city in terms of economic development or efficiency because the crude population figure does not influence the city economy but the productive population. A city may have large number of dependent population, increase in population may not result in higher productivity or developments in the city, but the growth in the city economy is primarily manifested in the physical developments through the expansion of the city boundaries and sprawl developments. Cities in Nigeria also have limited capacity to expand as there are locality boundaries with traditional administrators that are held sacred by the population. Few studies have applied the spatial delimitation of settlements as a construct of city size distributions. This paper seeks to use spatial delimitation of cities extracted from

satellite remote sensing data to identify the rank of cities and the pattern of distribution in Nigeria.

The paper provided answers to the following questions:

- I. What the natural size ranks of settlements in Nigeria based on spatial limit?
- II. What is the nature of spatial distribution of cities and communities in Nigeria?
- III. What are the implications of spatial distribution of settlements on urban administration in Nigeria?
- IV. What are the spatial interactions between mega cities and nearby settlements in Nigeria?
- V. What is the relationship between population and spatial extent in major Nigerian cities?

The paper is divided into four sections, the next section presented the adopted methodology, section three discussed result while section four presented the discussion and conclusion.

## Method

### Data sourcing

The study utilized SPOT 5 images at 5 meter resolution acquired in 2005 obtained from National Population Commission Nigeria to examine the pattern of settlements in Nigeria. The images of the gaps areas were procured from Digital Globe Canada. Visual interpretations were used to extract the settlements in order to avoid classifying settlements that joined together as one. The study further used some criteria to identify and extract urban settlements from hamlets and villages. Data were manually extracted through on-the screen data capture procedure.

### Population data

The population of cities is not available in the archives of the agencies in charge of population census, (National Population Commission) and National Bureau of Statistics (NBS) Therefore the estimate provided on the Mongabay website (<https://population.mongabay.com/population/nigeria> accessed Nov 2016) was used to provide population figures for the mega cities and major cities in Nigeria for the analysis.<sup>12</sup>

### Data extraction

Capturing settlements from the Medium resolution remote sensing data was not an easy task. The author initially used image segmentations approach of digital image processing techniques to extract cities from other land uses but there were series of classification errors as different land use types such as runways, large government institutions, and industrial premises were all classified as minor settlements. The tones of cities in the southern Nigeria are quite different from the cities in northern Nigeria. Supervised classification that was initially used failed to extract settlements of different classes as many rock outcrops, mining sites and abandoned factories and trailers parks were all misclassified as settlements. Cities in the southern Nigeria have different roof arrangement and tone compare with the settlements in the northern parts of Nigeria. While vegetation around residential buildings is a major discriminating symbol of settlements in the arid regions of Northern Nigeria, Settlements in the Southern parts of Nigeria have manmade and impervious structure as major

tones of discrimination. The south eastern region has series of linear (one structure deep) settlements usually along major and minor roads while most settlements in the southwest and north central Nigeria are mostly nucleated. There are also some trailer parks and Travelers rest joints along major inter-state trunk roads that will mimic the linear settlements in the northern parts of Nigeria from the image foot prints.

Consequent upon these constraints the researcher adopted visual interpretation and on the screen data extraction for capturing the settlements from the SPOT V Images of the Country. The following criteria were used to delineate settlements and cities from other land uses on the images:

- A. Intensive urban land use:** The criterion utilized the concentration of buildings (high density of buildings over a large area of more than 2 square kilometers. The criterion rather excluded scattered buildings in the urban fringe as sprawl where building density is very low. (i.e. urban sprawl of scattered building and dotted isolated residences at the fringe of cities) This criterion also excluded villages and hamlets that are less than 2 square kilometers.
- B. Availability of link roads and other access roads:** This criterion was used to separate settlements from large commercial farms, major factories and large institutional premises. In this regards Settlements are regarded as places that have link roads from the major trunk roads that leads to them or pass through them and pass through them. This is used to differentiate settlements from industrial park, large educational institutions and other large land users that are usually community of people living in estate but could not be regarded as settlements nor cities.
- C. Roof tones:** Roof tones were used to differentiate settlements from rock outcrop or large manmade structure. The roof shapes and tones were markedly extracted from the image scenes as they are different from other land uses on the image
- D. Ground check:** After initial image extraction from the image, twelve (12) cities we visited across the country with the hand held Trimble GPS to validity check of the extracted boundary of the images. An average of error level of  $\pm 35$  meters was recorded in all the areas when maps boundaries were compared with ground boundaries.

### Data analysis

Spatial Statistical analysis techniques including multi-distance cluster analysis and spatial autocorrelation analysis were used to examine the nature of spatial distribution of different categories of settlements. The area covered by the settlements was used to classify the settlements into 5 classes based on modified natural breaks of sizes. Settlements with built up areas were less than 2 square kilometers were dropped from the analysis. The population and the built-up area were subjected to weighted regression analysis and to examine if spatially the population size could predict the size of settlements in Nigeria

**Limitation of study:** There are cloud covers in some area on the images used and image processing could not remove all error of classification in such areas. We however used Landsat images of these area obtained during clear seasons to extract the boundaries of these settlements. The images used for the settlements capture was about 9 years old before the research commenced but the changes in the boundaries of the settlements were not significant. The source of

population figures obtained from the website could not be verified nor the authenticity be established.

## Results

### Nature of nigerian settlements

Nigerian has several thousands of settlements in different sizes, shapes and structure, however for the purpose of the study only settlements that are above 2 square kilometers were used for this analysis. A total of 5,088 were used for the analysis the biggest settlement is 110,000 Sq. Kms while the smallest settlement extracted in the analysis is 2.45 Sq kms. Figure 1 shows the settlements extracted and their sizes. The figure shows that larger settlements are found in the southern parts of the country and especially in the coastal regions of Nigeria while smaller settlements are found in the northern parts of Nigeria. Most major cities are surrounded by a number of smaller settlements. In the northern parts of the country however there were many smaller settlements and fewer urban settlements, major urban settlements in the Northern parts of the country are often surrounded by villages and small communities. It is noteworthy to note that most of the major cities in the north were on the transit route of Trans-Saharan trade routes while some were colonial master's administrative towns. Most major cities are very old except few post-independence cities such as Abuja. Most major cities have the old core and the outer new areas. The core is characterized by older buildings and infrastructure while the outer rings have newer residences.

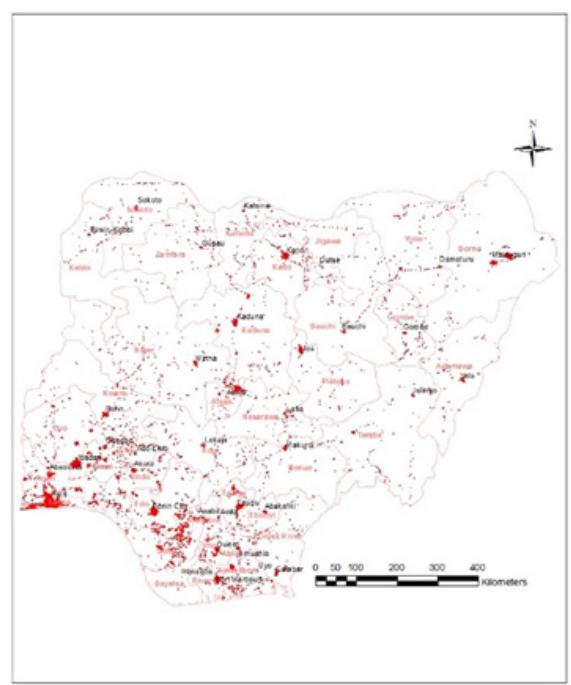


Figure 1 Settlements and their sizes in Nigeria.

### Classification of settlements based on spatial limit

Since there is no national template to classify cities in Nigeria therefore, size classification rule was developed and used to classify the cities. The colonial government attempted to classify Nigerian cities into 1st class and 2nd class cities. Though Lagos the then seat of Government was the only 1st class city, the criteria used to classify the cities into classes was not explained in the available documents.<sup>11,13</sup>

During that period Lagos was the only First class town while many other major settlements were classified as second class Towns. In this study sizes of the built up area of cities were used to classify the cities as follows: There were few class I cities (10) in Nigeria while town's class is the largest number of settlements in Nigeria a total of 2,392. A total of 2,315 settlements were dropped from the extracted settlements because their spatial limits are less than the 2sqkms thresholds used for the analysis.

### Spatial pattern and clustering of settlements

A cluster analysis was carried out on the settlements to examine the nature of clustering of settlements based on their sizes. This is to identify if the sizes of settlement exhibit some form of clustering towards an area or they are dispersed. Multi-Distance spatial cluster Analysis (Ripley's K function) was used for the analysis. Multi-Distance spatial cluster analysis using Ripley's K Function interpretation is as follows; if the observed line (red) is on the left side of the expected line (blue diagonal line) there is spatial clustering of the settlements up to the value of K function. On the other hand if the observed line is on the right side of the expected line the settlement are dispersed. If the observed line lie on the same levels with the expected line the pattern is random (Figure 2). The k functions summaries the differences between the expected and the observed values at all the distance points used to measure the pattern.

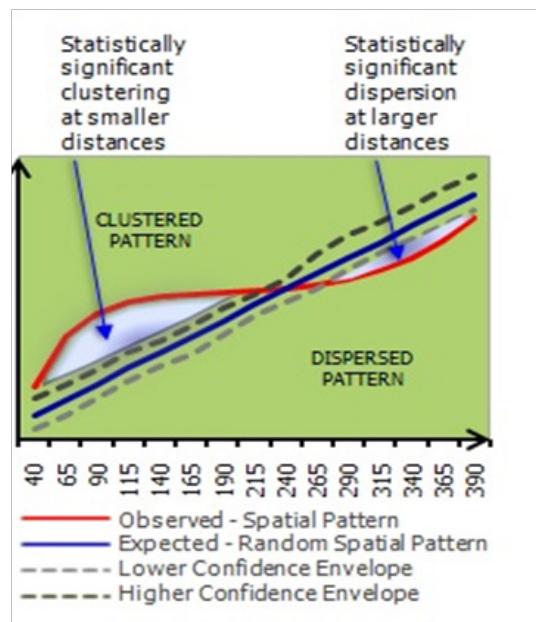


Figure 2 Interpretation of Multi-Distance spatial cluster analysis.

### Spatial pattern of mega cities

The first category of settlements is the Mega cities; these are cities that have land area between 10,000 SqKms and above 100,000 Sqkms. Only ten cities were classified in this category. There are ten cities classified in this size category and the run from south to the north. Cluster analysis on these settlements show dispersed pattern as shown in Figure 3. The cluster analysis shows there is spatial dispersion of the mega cities in Nigeria. They are scattered but evenly distributed across Nigeria. The peak distance of spatial autocorrelation is 260 kilometers. The North West and North east have no mega city. This implies that the mega cities are scattered at large distances.

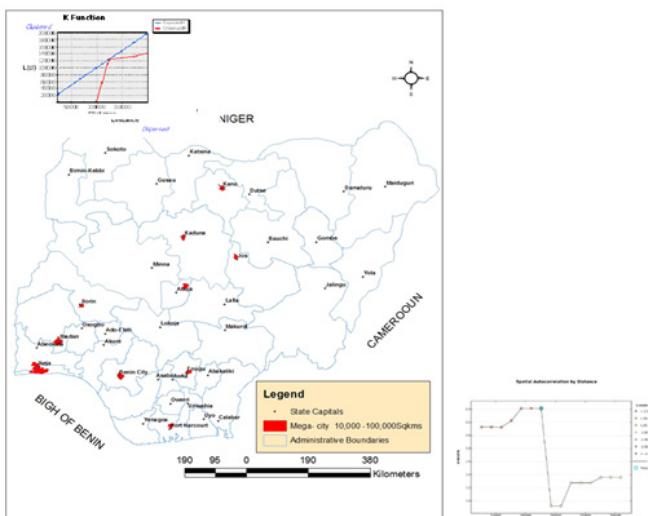


Figure 3 Mega cities between 10,000SqKm and Above 100,000Sq km.

### Spatial pattern of major cities

Major cities category are cities that have spatial extent ranging between 1,000 square kilometers to 10,000 Sqkms. They have sizes below the mega cities. The cities in class II are 112 and have spatial clustering toward the southwestern part of the country as shown in Figure 4. The major cities category have spatial limit ranging from 1,000 sqkm and 10,000 sqkm. There is spatial concentration of these class of cities in both small and large distances. The spatial clustering is towards the southern part of Nigeria especially coastal areas. The population generally gravitate towards the coast though the nation capital was relocated to Abuja in early 1990, ongoing mass migration towards the coastal cities is evident in Nigeria. The recent crisis in many parts of the northern cities including religious, ethnic and political crises further accentuate continuous outmigration from those cities to southern cities to settle. The k function graph shows that there is spatial concentration in small and large distances but there is no peak distance in the spatial autocorrelation by distance. Which shows that there are some imbalances in the spatial distribution of major cities in Nigeria. The southern cities are concentrated at very small distances while the northern cities are concentrated at large distances.

### Spatial pattern of minor cities

Minor cities classes are cities that have spatial extent ranging from 100 Square kilometers to 1,000 square kilometers. A total of 662 cities fall into this category as shown in Figure 5. The result of cluster analysis of the Minor cities also shows a spatial concentration at large and small distances. But the spatial concentration is more at small distances. The maps also show some concentration of these settlements are found in the southern parts of the country, especially in Delta state, Southern part of Ondo and Ogun states which still confirm earlier observation that cities in Nigeria tend to concentrate towards the coastal areas. The peak distance of the spatial autocorrelation analysis is 120 kilometers. The mega cities are clustered at an average of 120 kilometers.

### Spatial distribution of towns

Towns category are settlements that have built up area ranging from 10 Sq kilometers to 100 sqkms which are regarded as towns because they are not joined nor subsumed by major settlements. Many

settlements in Nigeria fall into this category as there are more than 2932 settlements classified into this category (Figure 6). The towns are randomly distributed across the entire country space as shown in Figure 6. There is almost equal distribution of these settlements in the northern, southern, eastern and western parts of the country. The categories of the settlements house more than half of the Nigerian population. This shows that majority of Nigerians dwell in small towns less than 100 square kilometers. The spatial autocorrelation peak distance is 70 Kilometers which shows that the major towns are well distributed within an average of 70 kilometers intervals. The short distance and large distances k function shows random distribution.

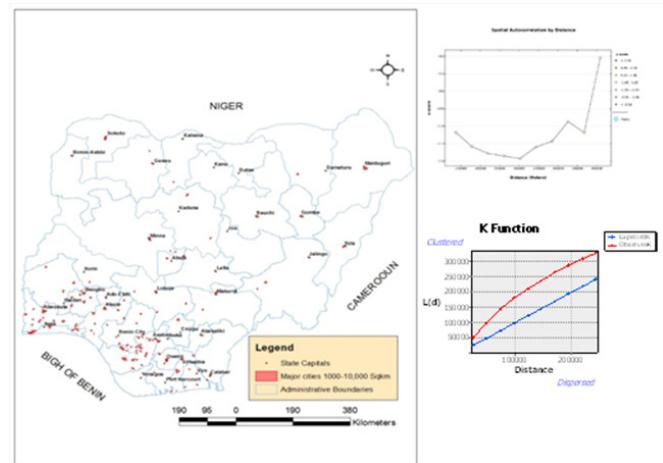


Figure 4 Spatial Distribution of Major Cities 1,000sqkms and 10,000Sqkms in size.

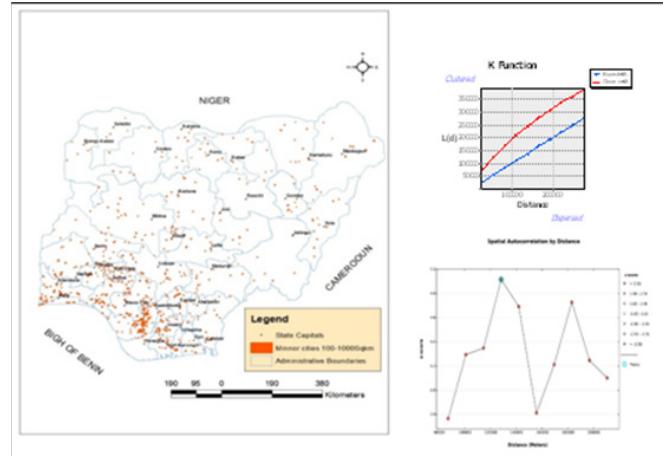


Figure 5 Minor cities 100sqkms and 1000SqKms in size.

### Spatial pattern of minor settlements

Minor settlements include communities and big villages that have spatial extent between 2sqkms and 10 sq kms. A total of 1912 of such settlements were extracted from the remote sensing images. The spatial distribution of these categories of settlements is shown in Figure 7. Figure 7 shows that there is even distribution of this type of settlement across the country just like major towns shown in Figure 6. These further confirm that large number of Nigerians dwell in villages and small communities. The cluster analysis shows that the observed line is almost parallel to the expected line which implies random distribution of minor towns in Nigeria. The spatial autocorrelation peak distance also shows that the clustering occur only at an average

of 120 kilometers. The minor settlements are largely randomly distributed.

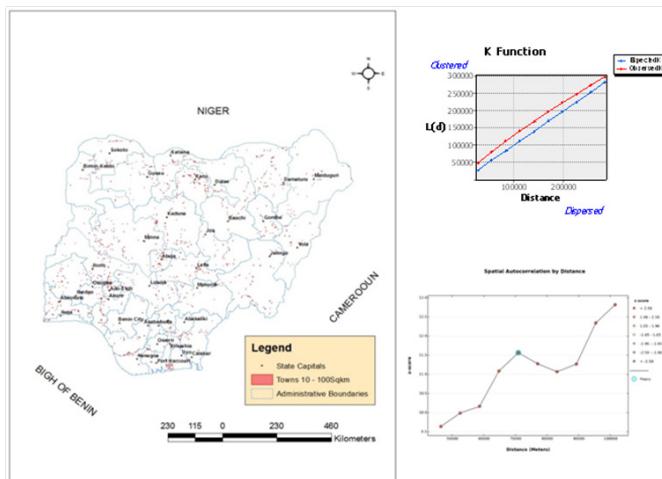


Figure 6 Towns Between 10-100 Sq Kms in size.

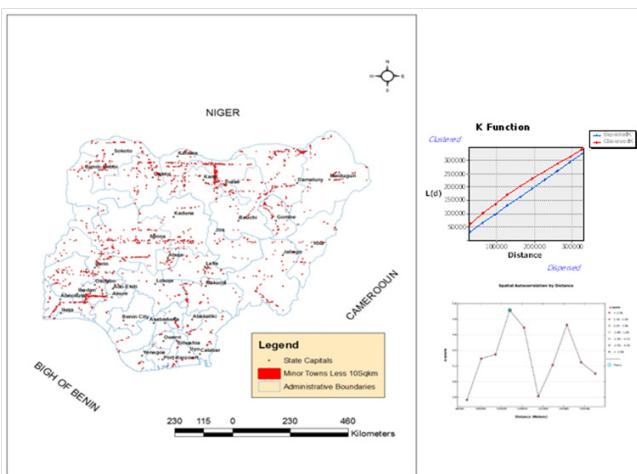


Figure 7 Minor towns less than 10 Sq kms in size.

Table 2 Settlements within 50 kilometers of mega cities

Number of settlements within 50 kilometers to mega cities						
Mega city rank by size	Mega city class I	Major cities class II	Cities class III	Major towns class IV	Minor settlements class V	Total
1	Lagos	10	43	47	63	163
2	Ibadan	5	14	27	99	145
3	Benin	7	24	14	5	50
4	Abuja	4	15	67	43	129
5	Enugu	2	21	41	18	82
6	Kano	0	5	111	65	81
7	Kaduna	0	4	34	6	44
8	Port Harcourt	4	27	65	16	112
9	Jos	0	3	13	6	22
10	Ilorin	2	9	53	55	119

## Relationships between cities of different hierarchies

Though the socio economic interactions between the settlements are outside the scope of this paper, the spatial interactions were evaluated in the study. The study examined the relationships of the mega cities on the lower order settlements. The result showed the size of the mega cities determines the number of the next lower rank of cities within the fifty kilometers. Fifty Kilometers is the assumed commuting limit in Nigeria judging from the nature of transportation system and the constraints that are associated with journey to work trip in Nigeria. Figure 8 shows that the northern cities have fewer settlements within a radius of fifty kilometers whereas the southern cities have many smaller settlements of different classes within a radius of 50 kilometers (Table 2).

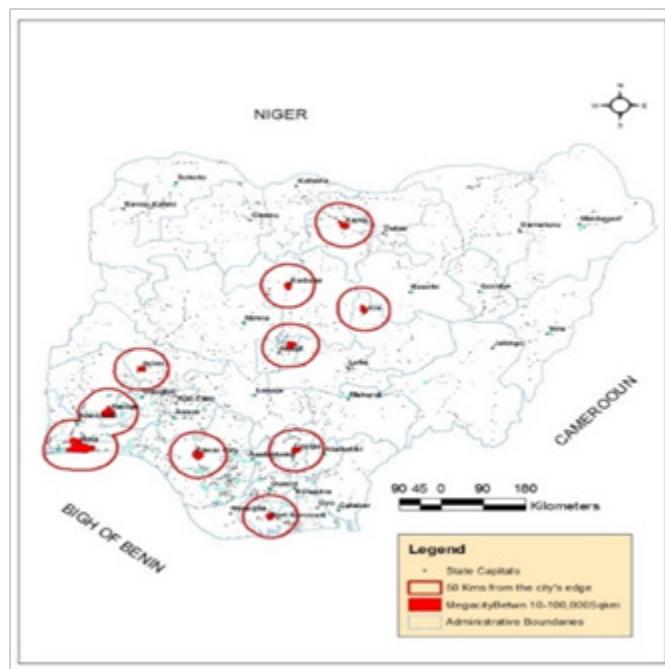


Figure 8 Settlements within 50 Kilometer radius from mega cities.

Table 2 shows that Lagos has the largest number of smaller settlements(163) within the radius of 50 kilometers, followed by Ibadan that has 145 smaller settlements withing the radius of 50 kilometers. Abuja, Ilorin and Porthcaorut respectively has 129,119 and 112 settlements within the radius of 50 kilometers. Jos has the least number of settlements (22) within 50 kilometers radius. The table further confirms that earlier deduction that cities tend to congregate towards the coastal region. Large cities in southern Nigeria results in literal expansion of dormitory settlements within commuting distances while northern cities tend to accommodate urban dwellers within the boundary of the cities. It is likely that acquisition of land in the Northern cities is less difficult compare to southern Nigeria.<sup>11</sup> The largest settlement in the northern Nigeria Kano has 81 settlements within the 50 km radius and these settlements are class III and below. This is indicateve that commuting is very unlikley in northern cities.

**Table 3** Rank Size rule applied to mega city

Rank sizes rule on mega cities					
Rank	Mega city	Expected area	Expected population	Area difference (rank size rule)	Pop difference (rank size rule)
2	Ibadan	542583095	4500000	174693075	934892
3	Benin	361722063	3000000	107733170	1874942
4	Abuja	271291547	2250000	73401054.5	1540103
5	Enugu	217033238	1800000	47171481.4	1111138
6	Kano	180861032	1500000	11155357.3	-2126068
7	Kaduna	155023741	1285714	9524448.43	-296388
8	Port Harcourt	135645774	1125000	1845797.39	-23665
9	Jos	120574021	1000000	3253583.87	183176

Table 3 shows the differences from the expected calculated areas and population and the observed area and population. Consequently the rank size rule need to be modified before it can be applied to Nigerian cities. This result is contrary to the submission of Rosent & Resnick (1980) that rank size rule can be applied to almost all the countries of

### Can Rank size rule apply in nigerian cities?

Using Lagos as the first rank , other mega cities were compared to Lagos to test applicability of Rank size rule in Nigerian settlements. According to the rank size rule, If lagos is ranked first in the population size order Ibadan being the second order to Lagos should have half the population and size of Lagos. Table 3 shows the Expected areas and expected popultion based on crude application of rank size rule. The expected area of Ibadan city acording to the rule is 542,583,094.9 Sqmts and population of 4,500,000. However compared with the real value it was observed that the area was over estimated by more than 174kilometers square while the population was over estimated by 934,892. Only three cities have underestimated population which are kano, Kaduna and Portharcourt. All the cities have their areas over estimated based on crude rank size rule.

**Table 4** Rank size rules using averages of cities in a category

Averages of major cities sizes	Area( Sq.mts)	Population
Expected Average for Major cities from crude rank size rule	137,508,684.75	1,153,839
Actual Average values for Major cities	27,316,877.87	216,511
Difference	110,191,806.87	937,328

### Population and spatial limit of settlements

Weighted Regression analysis on the area of cities in Sqkms and population of cities performed on Mega cities (10) and Major cities

the world. The researcher further obtained the average area values and Population of the Class I cities and Class II cities and compared the expected average values with the calculated average values. (Table 3) (Table 4) show that applying rank size rule to Nigerian cities may lead to spurious conclusions.

**Table 5** Weighted regression analysis on population and areas of cities

Weighted regression table for mega cities	R <sup>2</sup>	Adjusted R <sup>2</sup>	Residual
Dependent Variable: Areas in Sq.kms	0.959	0.939	3.172584e+0.16
Independent variable: Population			
Weighted Regression table for Major cities	R <sup>2</sup>	Adjusted R <sup>2</sup>	Residual
Dependent Variable: Areas in Sq.kms	0.275	0.269	3.016105 e+0.16
Independent Variable: Population			

## Discussion and conclusion

Most of the mega cities are located along the rail line which was constructed in early 1900. Majority of these settlements apart from Abuja that was a planted town during the relocation of the federal capital from Lagos to Abuja in early 1990s, most of these settlements predated the independent era and were major trade centers during the colonial regime. These settlements were also regional provincial capitals during the self-rule period that predated independence (1955-1960) One major characteristic of these settlements apart from the Federal capital City (FCC) is that they have grown to submerge many minor settlements. The physical boundaries of mega cities are combination of many cities that were originally separate entities with separate identities. Some of the mega cities have grown across administrative boundaries for instance Lagos has grown beyond Lagos state and spread to Ogun state. Traditionally in Nigeria prior to the enactment of Land use Act (1978) each city/town chiefdom or traditional authority controlled lands and land matters in their jurisdiction. Control on land has been subject of major contentions, agitations and even violent clashes before the advent of colonial government. The land use decree placed the ownership of all land into the hand of the Governors of state (provincial head) but primarily and practically land belong to the family and the chiefdom. Each chiefdom seeks promotions to higher status so that they can have better control of their lands. The chiefdom of mega cities are always in contention over the control of land by the smaller cities that were subsumed by the expanding mega city. Traditional authorities in large cities are often very complex and it is within the paramount rules water down its overbearing control on the smaller cities or face regular conflicts in the city. The local Government reform and subsequent fragmentations of Local government to the present 774 Local government areas in Nigeria also compound the problems as some mega cities have more than 10 local Government councils governing them. The cities are not multiple traditional authorities as well as conventional administrative authorities.<sup>11</sup>

The southern Nigerians are mainly urban dwellers while the residents in northern Nigeria dwell in smaller communities and only few stays in towns. This is also reflected in the nature of economic activities in the northern and Southern towns. Subsistence agriculture is very dominant in the Northern Nigeria but urban based agriculture is common in southern Nigeria. Youth migrate to the cities in the southern Nigeria leaving old people in the rural areas but involvement of youth in agriculture is very high in northern Nigerian towns and minor settlements. This is likely to be due to the presence of fewer large cities in the North and thus fewer economic opportunities in the cities for the unskilled rural youth. The close proximity to minor settlements to large cities in the southern part of the country result in expansion of the surrounding smaller settlements to higher class of settlements as urban residents choose surrounding smaller settlements to build residential accommodation as a result of cheap land values.

City administration is simple in the northern Nigeria because the settlements are small and they basically submit to traditional rulers or religious leaders.<sup>11</sup> The concept of anomie as postulated by the Chicago school of sociology does not seem to apply in the northern settlements except in few mega cities like Kaduna, Kano and Jos but most of the settlements have community spirit and they relate with each other as community. In the southern Nigeria the traditional rulers and religious leaders do not have overall control on the people of their cities, they result to violence or conventional police power to ensure compliance over rules churned out from the king palaces. There is no cultural, political nor economic allegiance to the King, Obas

or Obis in the southern Nigeria as there is the case in the northern parts of Nigeria. However there is social cohesion and community affiliation among the supra-local subgroups within the groups.<sup>14,15</sup> This experience also has historical antecedence; the colonial government allowed indirect rule through the emirs in the northern part of Nigeria but the reverse was the case in the southern part of the country.<sup>11,16</sup> The kind of power and authority that the native authority had in the northern part of Nigeria over the people and the communities was so strong that the people both elite and the commoners deferred to the Kingship. The semblance of these authorities still reside in many of the northern traditional rulers till today even though there is no provision for such authority in the Nigerian constitution. The southern parts of the country city dwellers bear allegiance to the conventional authority and only respect traditional authority for communal identity and vestige of patriotism.

## Implication for urban space administration

If an urban system perfectly conforms to the rank size of city distribution, it shows even economic development and a positively integrated urban system. However, when there is an overriding primate city, it indicates underdevelopment and imbalances in the economy of the cities of lower order. The study posited that in applying rank size rule for Nigerian cities, Population size is not adequate to rank cities rather a combined analysis of the spatial extent and population size could provide a better estimate of other categories of settlements. We argued that a city may be a dormitory town where residents retire after the work day, such city will be less generative in terms of economic efficiency than a city that mostly comprises of industries, businesses, offices, factories and fewer residences. Such city may be more generative and yet have less population. Where a large city is surrounded by smaller settlements the working population would stay in the smaller surrounding settlements where land value is low and is within commuting distance. They may build private residences or rent accommodation in the smaller settlement due to low rent or cheap land. These people contribute to the economy of the cities but derive most of their benefits from the smaller settlements where they reside. The situation becomes more complex if the dormitory settlement is under another administrative jurisdiction. Examples are Lagos and some surrounding dormitory settlements that are in Ogun state. Asaba and Onitsha are divided by River Niger, connected by a bridge but while Asaba is in Delta State, Onitsha is in Anambra state. There are many people who work in Onitsha but live in Asaba and vice versa. Counting population of either of the cities to estimate the rank may be misleading and produce spurious result because there is possibility of double counting or under estimation.

In the studies of Ibadan city, Fabiyi<sup>11</sup> noted that most Nigerian Cities grow through the activities of Informal private developers as opposed to government or corporate property developers they may be the case in other countries. In Nigeria wealth of middle income earners is measured by home and car ownership. Most middle income earners prefer to build their own residences in piecemeal rather than outright purchase of already built apartments. The only available option for them is to move to hinterlands where there is cheaper land but may be under the control of another chiefdom or conventional administration.

It was noted in previous studies that many major urban residents have country homes but continue to live in cities.<sup>11</sup> There are many residences in smaller towns that are basically occupied twice a year when the owners are on vacation or during festivals. A number of such residences that are not occupied could be found in estates and Reservation areas and housing estate built by government or property developers. Many people buy properties in their hometown while

they live in major cities. The properties at home serve dual purposes; showing patriotism and display wealth acquired from the cities. Most minor towns in Nigeria are basically dormitory settlements where residential accommodation form more than 80% of the properties in the settlements. In some cases the smaller settlements were historically superior to the bigger city and might exercise control over the bigger city in the past. The traditional ruler of the smaller city that was historically more powerful would prefer to invoke the old tradition and want to exercise control over the bigger city's traditional authority. The bigger city on the other hand though is not oblivious of the historical traditions will prefer to utilize sheer size and the level of government patronage to enforce dominion over the smaller settlements in some cases change the course of tradition. The government often supports the bigger settlements against the smaller ones in the case of conflict due to the voting potential of cities compare to small communities. This is the primary reason for many communal strife or sometimes violent conflicts.

The study showed that large number of Nigerians dwells in small settlements and communities. The implication of this on city administration is that such settlements would not have the required threshold population to sustain facilities and amenities. Business in these communities will also be constrained except if the communities are close to bigger towns where they derive some form of economic benefits and access secondary functions due to trickle down effects of development and economic facilities. One striking characteristics of some of these settlements is that they are older than some major towns today. Some recent towns developed along major route and nodes. Such cities grew rapidly as people move toward the nodes to benefit from economic activities associated with nodal towns which further deplete the surrounding smaller settlements but some people still remain in the smaller settlements to farm or engage in minor trading and art and craft. The minor settlements also serve as location for people who retire from the city or people who had economic misfortunes in the cities and resorted to low life s in smaller towns. The economy of the minor towns is simple as such that people survive on very little income and there is high sense of social capita and community cohesion.

Urban administrations in Nigeria should recognize the identities of smaller communities as separate entities and should not be classed as part of the mega or major cities that is expanding to absorb them. There may be a single large city on the map but urban administration apparatus should recognize the nature of cities within city in Nigerian context. Urban land use projection should not be treated as if the city has unlimited capacities to expand. Even if there are no physical or natural barriers, there may be traditional or cultural barriers preventing a city from expanding into another city without negative consequences. Urban areas in Nigeria should have separate master plans which will recognize the extent of available land resources to the city. Every development programme should be contained within the boundary.<sup>17-24</sup>

## Acknowledgements

None.

## Conflict of interest

Author declares that there is no conflict of interest.

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