



ABSTRACT

It is important that urban regions are identified and classified for the purpose of policy, planning and provision of infrastructure, as the size and hierarchy of an urban region determine what type and hierarchy of infrastructure is provided therein. This study identifies fourteen urban regions in Northern Nigeria based on population threshold of 500,000 and classifies them using both morphological and functional approaches. Population sizes, population density, landmass and passenger flows were the criteria used for the classification, with the first three being morphological and the last being

CLASSIFICATION OF URBAN REGIONS IN NORTHERN NIGERIA USING MULTI-MODAL INTERREGIONAL PASSENGER FLOWS

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Introduction

That urbanization and urban growth are both real and rapid in Nigeria is not a fallacy (Beall, Basuded, & Ravi, 2010; Robin, Monroy, Fox, & Ojo, 2015; Smart, 2018). It is a result of outlandish demographic changes in the country over the last two decades. The sizes of population of many hitherto small towns in the country have tremendously increased over the years (Robin, Monroy, Fox, & Ojo, 2015) hence, resulting in these towns acquiring the status of urban region.

Yet, the perception about them hasn't changed as they are seen and treated as small towns, and their contributions to regional economy not appreciated. Similarly, urban growth and attendant peri-urban land use changes has resulted in intersection of geographical areas of influence of some of these urban regions making delimitation of their spatial extent difficult. What may be an outskirts of a metropolitan or city region is now the center of an adjoining town region, giving rise to a polycentric urban region with high gravitational attractions. It is therefore, imperative that urban regions are delimited and classified so that their geographical boundaries and hierarchy are known, and their contributions to overall regional economic development appreciated. It is also important that urban regions are classified for the purpose of policy, planning and for the provision of infrastructure as the size and hierarchy of an urban region determine what type and hierarchy of infrastructure is provided therein.

The concept of urban region is not new in regional studies but often obscured within the epistemology of functional regions or



functional. Gravity model was applied in determining the expected passenger for each of the urban regions. As part of population criterion, application of rank size rule was tested with the results showing that Nigerian cities are averse to its application. Positions of the urban regions in the ranking keeps changing as different criteria were deployed and so, weighted index number method had to be applied based on a maximum score of 10 points to arrive at the final ranking. Kano urban region consistently tops the ranking, taking the whole of the points followed by Abuja, Kaduna, Jos, Zaria and Maiduguri in this order with Lafia urban region ranked last. It was recommended that planners, policy makers and government should adopt this ranking in planning and policy formulation for urban regions in Northern Nigeria.

KEYWORDS: Urban regions, classification of urban regions, Passenger flows, interregional passenger flow and Gravity model

polarized regions. While functional region is a large geographical area defined based on functional coherence and interdependence in terms of flows between settlements (Adedipe, 2002; Wahab, Ogunjobi, Guse, & Kadiri, 2014), urban regions are defined as large urban settlements that exhibit interdependence with their surrounding commuting small towns and countrysides. They are often large, specialised and differentiated with gamut of landuse distinctiveness where residential and employments areas are spatially detached but connected through network of flows of commuters, migrants, goods and services, telephone calls, internet services and different kinds of payments between the dominant and subsidiary centres. According to Hoover & Giarratani, (2020), each urban region should have a minimum of ten nucleus with each having a minimum population of 50,000 such that the core has more population than each of the nucleus or peripheries but functionally connected, interdependent and complementary.

In his spatial analysis of Southern Germany, where he experimented Central Place theory, Walter Christaller identified some cities and described them as Urban Regions or Regional Capitals based on functional interdependence and population being in excess of 500,000 (Hall & Kathy, 2006; Oluseyi & Joseph, 2018). His groundbreaking theory (the Central Place Theory) was the foundation of his analysis. In the same theory, he clarified the role of towns and cities as geographic/economic units and discussed the relationship between towns and cities in the same regions (Johnston, 2013; Knox & Heike, 2013). Urban region in this paper is therefore defined as an influential urban settlement whose population is in excess of 500,000 and whose network of influence traverses its corporate spatial limit and spread out to its surrounding commuting small towns and rural country side.

Literature Review

Classification of urban settlements has been a subject of both interest and controversy since the central place novelty by Walter Christaller (Christaller, 1933) and Rank size rule by Goerge Zipf (Beckmann, 1988) and of course the recent work on urban primacy (Short & Pinet-Perelta, 2009). Classification based on Rank Size rule and central place theory have been popular recently as evidenced by the work of Chen & Zhou (2003) who used mathematical models in describing the hierarchies of cities based on rank size rule, the work of Rosing (1966), who



though applied the model, but brought out reasons to oppose its applicability in ranking cities, the work of Bajracharya & Sultana (2020) who used the model to rank cities of Bangladesh, the work of Valetka, (2010) whose application of the model resulted in evolution and analysis of the city size distribution in Belarus and Poland, and the varied application of central place such as in the work of Bromley, (1974); Casetti, (1993); Neal, (2011); AbouKorin, (2018) and Wang, (2021) and finally, the work of Hubert (1979), who establishes the nexus and compatibility between Central Place and Rank Size Model in analysis of spatial structure and ranking of urban settlements. Most of these scholars view urban settlements from morphological prism rather than functional as evidenced from several analysis of urban settlement based on rank size and the central place, both of which predicate on demographic or morphological characteristics.

The two prominent approaches for classification of urban regions are morphological and functional. While the former relies on population size, density and landmass, the later applies mobility pattern. Mobility is functional because it deals with exchange of people, goods and service over space and between urban regions which influence urban form, employment, population size, density and distribution of activities over space. The works of Giuliano & Small, (1991) and that of Silva, Manzato, & Pereira, (2014) emphasise population density in their classification while Casello & Smith, (2006) and Louf & Barthelemy, (2013) emphasise on employment density whereas, Shearmur and Coffey (2002) combine the two approaches. In the work of Akobia & Yankson (2020) however, eight separate criteria, none of which is functional were deployed in the classification of urban settlements in Ghana. These criteria were urban form, built-up extent, socio-economic functions, land-use dynamics, occupational structure, governance structure and population size. All of these criteria were morphological, and could be influenced by transport network. Difficulty in accessing travel flow data in the past had stultified classification based on travel flow. Gig data availability and the use of passengers manifest now makes access to flow data easier (Cats, Wang, & Zhao, 2014). This study attempts to combine both the morphological and functional approach in classification of urban regions in Northern Nigeria.

Methods

Population data for 2006 census was retrieved from national population commission repository and projected to 2021 using exponential model. A benchmark of 500,000 population threshold was adopted for urban region and used to identify the thirty four urban regions in Nigeria. The same benchmark was used in identifying the fourteen urban regions in Northern Nigeria. Northern Nigeria is made up of nineteen states drawn from the three geopolitical regions of North-western, North-central and North-eastern region. The urban regions were classified using multiple criteria drawn from morphological and functional approaches. First, they were classified and ranked based on population size and secondly rank size rule was applied in the classification. The rank size formula was used ($1/n^{\text{th}}$) where n represents the ranking of the size of the urban region. Ranking of urban region using the rank size rule was first done for all the urban regions of Nigeria before narrowing on Northern Nigeria. Landmass and population density of the urban regions were also used in further classification and analysis of the urban regions. Finally, classification of the urban regions was done based on interregional passenger flows. Average expected travel flow for each urban region was first determined using gravity model which is $S = \frac{P_1 * P_2}{D^2}$

Where P_1 = population of urban region 1 and P_2 = population of urban region 2 divided by the square of the distance between the two urban regions. Actual travel flow was obtained from



two methods: first, random passenger counts and secondly, passenger manifest at motor parks. The random count was done for one week starting from Sunday to Monday and the average was taken and compared with actual daily interregional passenger flow in the manifest. Four hundred and twenty six (426) passengers were purposively sampled out of the fifty six thousand eight hundred and forty two (56,842) daily interregional passengers across the fourteen urban regions proportionately to determine other interregional flow characteristics. The actual daily interregional passenger flow, the average annual expected volume of flow and the daily expected passenger flow for each urban region were determined using the gravity model formula and used as basis for classification. The average annual expected volume of flow for each urban region was determined by taking the sum of the calculated annual volume of flow between each urban region with thirteen (13) other urban regions divided by thirteen (13). Daily expected flow on the other hand was determined by dividing average annual expected volume of flow for each urban region by three hundred and sixty five (365). Ten percent (10%) of this was taken to represent daily expected interregional passenger flow. Passenger flow according to of the work of (Gilbert, 2016) is 25% of total flows, out of which 15% represents all kind of local passenger flows while 10% is long distance or interregional passenger flows. This is corroborated by the work of Hankin & Wright, (1958), Horner, (2004), Kingsley, (2015), and Zhang & Zhang, (2016). Weighted index number method was finally used based on a maximum score of 10 points to arrive at the final ranking and all results were displayed in tables.

Results and Discussion

Based on consideration of urban regions as settlements with population above 500,000, there were only fifteen urban regions in Nigeria in 2006. Three of these were in South-Western region (Lagos, Ibadan and Ile-Ife), three in South-Southern region (Benin-City, Port-Harcourt and Warri), two in South-Eastern Region (Enugu and Aba), three in North-Central region (Abuja, Jos and Ilorin), three in North-Western region (Kano, Kaduna and Zaria) and one in North-Eastern region (Maiduguri), see table 1.

Table 1 Urban regions in Nigeria and their Projected Population

S/No	CITY	2006 POPN	2021 POPN	2030 POPN
1	Lagos	8,048,430	13, 483,928	16,361,143
2	Kano	2,828,861	4,739,329	6,459,219
3	Ibadan	2,559,853	4,288,647	5,763,212
4	Benin	1,147,188	1,921,940	2,619,407
5	Port Harcourt	1,005,904	1,685,240	2,296,809
6	Jos	821,618	1,376,497	1,876,024
7	Ilorin	777,667	1,302,863	1,775,669
8	Abuja	776,298	4,306,125	5,868,806
9	Kaduna	760,084	1,273,406	1,735,522
10	Enugu	722,664	1,210,714	1,650,079
11	Zaria	695,089	1,164,517	1,587,117
12	Warri	557,398	933,836	1,272,722
13	Maiduguri	543,016	909,741	1,239,883
14	Aba	534,016	894,663	1,219,333
15	Ile-Ife	509,035	852,811	1,162,294



16	Bauchi	493810	827,304	1,127,530
17	Akure	484,798	812,206	1,106,953
18	Abeokuta	451,607	756,599	1,031,167
19	Oyo town	428,798	718,386	979,086
20	Uyo	427,760	716,647	976,716
21	Sokoto Owerri	427760	716647	976,716
22	Yola	401,873	673,277	917,607
23	Calabar	392854	658,167	897,014
24	Umuahia	371,022	621,591	847,164
25	Ondo Town	359,230	601,836	820,241
26	Minna	358,430	600,495	818,413
27	Lafia	348,788	584,342	796,398
28	Okene	330,712	554,058	755,119
29	Katsina	320,260	536,547	731,258
30	Nsukka	318,459	533,530	727,147
31	Ado Ekiti	309,633	518,743	706,993
32	Awka	308,621	517,048	704,683
33	Ogbomosho	309,633	505,380	688,781
34		299,535	501,826	683,937

Source: National Population Census (NPC) in 2006 and projection to 2021 by the Researcher

By year 2021, the number of urban region in Nigeria had increased to thirty four (34). This was after the result of the 2006 census was projected. With this projection, the number of urban regions in South-Western Nigeria rose to nine (Lagos, Ibadan, Ile-Ife, Akure, Abeokuta, Oyo town, Ondo town, Ado-Ekiti and Ogbomosho). The number increased to five in South-Southern region (BeninCity, Port-Harcourt, Warri, Calabar and Uyo) and six in South-Eastern Nigeria (Enugu, Aba, Owerri, Umuahia, Nsukka and Awka). In northern region of Nigeria, the number of urban regions had equally increased from three to six in North-Central Nigeria (Abuja, Jos, Ilorin, Minna, Okene and Lafia), five in North-Western region Kano, Kaduna, Zaria, Sokoto and Katsina) and three in North-Eastern Nigeria (Maiduguri, Bauchi and Yola) as shown in table 2.

Table 2: Arrangement of the selected urban regions based on Geo-Political Regions

S/No	City	2006	2021	2030	Geo-political region
1	Lagos	8,048,430	13, 483,928	16,361,143	South-Western Region
2	Ibadan	2,559,853	4,288,647	5,763,212	
3	Ile-Ife	509,035	852,811	1,162,294	
4	Akure	484,798	812,206	1,106,953	
5	Abeokuta	451,607	756,599	1,031,167	
6	Oyo town	428,798	718,386	979,086	
7	Ondo town	358,430	600,495	818,413	
8	Ado Ekiti	308,621	517,048	704,683	
9	Ogbomosho	299,535	501,826	683,937	
10	Benin-City	1,147,188	1,921,940	2,619,407	
11	Portharcourt	1,005,904	1,685,240	2,296,809	
12	Warri	557,398	933,836	1,272,722	



13	Calabar	371,022	621,591	847,164	South-Southern Region
14	Uyo	427,760	716647	976,716	
15	Enugu	722,664	1,210,714	1,650,079	South-Eastern Region
16	Aba	534,016	894,663	1,219,333	
17	Owerri	401,873	673277	917,607	
17	Umuahia	359,230	601,836	820,241	
19	Nsukka	309,633	518,743	706,993	
20	Awka	309,633	505380	688781	
21	Kano	2,828,861	4739329	6,459,219	North-Western Region
22	Kaduna	760,084	1,273,406	1,735,522	
23	Zaria	695,089	1,164,517	1,587,117	
24	Sokoto	427760	716647	976,716	
25	Katsina	318,459	533,530	727,147	
26	Abuja	776,298	4,306,125	5,868,806	North-Central Region
27	Jos	821,618	1,376,497	1,876,024	
28	Ilorin	777,667	1,302,863	1,775,669	
29	Minna	348,788	584,342	796,398	
30	Lafia	330,712	554,058	755,119	
31	Okene	320,260	536,547	731,258	
32	Maiduguri	543,016	901,741	1,239,883	North-Eastern Region
33	Bauchi	493,810	827,304	1,127,530	
34	Yola	392,854	658,167	897,014	

Source: National Population Census (NPC) in 2006 and projection to 2021 by the Researcher

There are more of these regions in Southern Nigeria perhaps due to the preference for white collar jobs and urban based employment among the youth of the region who tend to locate where the jobs exist and perhaps due to nucleation of settlements and the impact of rural-urban migration.

Dispersal of settlements due to large landmass that characterizes Northern Nigeria and the flare for farming among the northern youths may have contributed to fewer urban regions in the region. All these classifications are based on population. While population may be used in city ranking, it should not be the only criterion as other factors like spatial extent of the city is equally crucial. While it is easy to calculate the spatial coverage of a city regardless of its size using space data, it is difficult to get precise population of a city as it may be overestimated or underestimated. However, some cities grow vertically due to several reasons such as limited space for expansion, love for traditional Neighbourhood and aversion to commuting. It is therefore difficult to be fair in classification based on spatial extent. The spatial growth of Lagos for instance, is encumbered by limited space and therefore, vertical growth is what prevails in most parts of the city. Kano is another example of an urban region where residents are either averse to commuting or have preference for living within the walled parts of the city (Okopi, 2021). This may be the explanation for storey building having as high as 51.1% and 52.9% of the buildings in Nasarawa GRA and Sharada Phase I of the city respectively (Oluseyi & Joseph, 2018). As large as Kano seems, its spatial coverage is just 449 km². For this reason, population could be used if it is from officially recognized agency like National population commission.



Having projected the 2006 official census results for urban regions listed in table 1 to 2021, the following settlement hierarchy and ranking of urban regions were arrived at.

Table 3 Hierarchy of the 34 urban regions in the country based on population

Class of urban region	Criterion used	No of urban region	Urban Region	Status
First Class	Urban region with population more than 10 million	1	Lagos	Mega-Urban Region
Second Class	Urban region with population between 5 million and 10 million	10	Kano, Ibadan, Benin City, Port-Harcourt, Abuja, Jos, Ilorin, Kaduna, Enugu and Zaria	Metropolitan-Urban Region
Third Class	Urban region with population between 500,000-1 million	23	Warri, Maiduguri, Aba, Ile-Ife, Bauchi, Akure, Abeokuta, Oyo town, Uyo, Sokoto, Owerri, Yola, Calabar, Umuahia, Ondo town, Minna, Lafia, Okene, Katsina, Nsukka, Ado Ekiti, Awka and Ogbomosho	City-Urban region

Source: National Population Census (NPC) in 2006 and projection to 2021 by the Researcher

Ranking of the 34 urban regions in the country based on population

S/No	Cities	Population	Population Range	Ranking
1	Lagos	13,483,928	Above 10,000,000	First Class Urban Region (Mega-Urban Region)
2	Kano	4,739,329	Between 4-5 Million	Second-Class Urban Region (Metropolitan Urban Region)
3	Abuja	4,306,125		
4	Ibadan	4,288,647		
5	Benin	1,921,940	Between 1-3 Million	Third-Class Urban Region (City-Urban Region)
6	Port-	1,685,240		
7	Harcourt	1,376,497		
8	Jos	1,302,863		
9	Ilorin	1,273,406		
10	Kaduna	1,210,714		
11	Enugu Zaria	1,164,517		



12	Warri	933,836	600,000-1 Million	Fourth-Class Urban Region (Big town Urban Region)
13	Maiduguri	901,741		
14	Aba	894,663		
15	Ile-Ife	852,811		
16	Bauchi	827,304		
17	Akure	812,206		
18	Abeokuta	756,599		
19	Oyo town	718,386		
20	Sokoto	716,647		
21	Uyo	716,644		
22	Owerri	673,277		
23	Yola	658,167		
24	Calabar	621,591		
25	Umuahia	601,836		
26	Ondo Town	600,495		
27	Minna	584,342	Less than 600,000	Fifth-Class Urban Region (Small town Urban region)
28	Lafia	554,058		
29	Okene	536,547		
30	Katsina	533,530		
31	Nsukka	518,743		
32	Ado Ekiti	517,048		
33	Awka	505,380		
34	Ogbomosho	501,826		

Source: National Population Census (NPC) in 2006 and projection to 2021 by the Researcher

It is obvious from table 4 that overtaking Lagos as the only first class city will be difficult because, since its classification as the only first class urban region and the largest city in Nigeria in 1917 (Oluseyi, 2018), one hundred and five (105) years later, it has been able to retain this status. Although Ibadan had emerged as the largest city in Nigeria based on 1953 census, this status was not retained in 1991 as Lagos again overtook Ibadan. The 2021 projected population of Lagos (13, 483,928) is more than twice the projected population of Kano (4,739,329), this implies that the country is now moving towards primate city system. However, there have been a lot of controversies regarding the real population of Lagos. For instance, the 2006 census estimate put the population of the city at 9.8 million. In the same year, Lagos state government undertook another census and came up with 17.5 million as the population of the city (Bloch, Monwy, Fox, & Ojo, 2015). This discrepancy of 7,700,000 is outlandish and could be as a result of lack of clear boundary between Lagos and Ogun state as some parts of Ogun



state may have been counted by the state government in its own estimate or a part of Lagos may have been counted for Ogun state by the NPC. It is not clear what Lagos population is at the moment but projection in this study was based on the 2006 census result. Table 1.4 therefore, represents the demographic classification of urban settlements in Nigeria.

After attempting to classify urban regions in Nigeria based on Rank Size rule, no urban region was able to stand the test of the rule. The rank size rule states that a ranked city or urban region is expected to have a population equal to the top ranked city divided by its rank in the scale. $K=pr*r^q$ where K =population of the largest city, r =rank of a city, pr = population of a city of rank r and q in the hierarchy. For example, if the first ranked city or urban region has a population of 10,000,000, the second ranked city should have a population $\frac{1}{2}$ of that population (5,000,000) and the third ranked city, $\frac{1}{3}$ (3,333,333) of the first city and it goes in that order. Testing the rule based on 2021 projected population, the following ranking or classification of urban region is possible as shown in table 5.

We can clearly see from table 5 that Kano is expected based on the rule to have a population of 6,741,964 but the population of Kano urban region is 4,739,329. This implies that Kano urban region is short of its rank size rule expected population by 2,002,635. The inference is that, either the population of Kano was underestimated or that of Lagos was overestimated, if the rank size rule is anything to go by. Similarly, even the 2006 census population result observed the same pattern. The population of Lagos was estimated to be 8,048,430 and that of Kano 2,828,861. Based on rank size rule, the population of Kano should have been 4,024, 215 rather than 2,828,861. Even then, there was a shortfall of 1,195,354. It is easy to conclude that either the population of Lagos was overestimated or that of Kano was underestimated or Kano is not supposed to be the second largest city. In the same vein, Abuja which is third in the list is expected by the rule to have 4,494,642 population. Abuja however, has 4,306,125 population which is 188,517 less than its ranked size rule expected population. Ibadan on the contrary, has its population above its expected rank size population. Its population is 4,288,647 and its rank size population should be 3,370,982.

Its population is above its rank size population by 917,665.

Application of rank sized rule in classifying urban regions in Nigeria

S/No	Cities	Population	Expected Population	Differences
1	Lagos	13,483,928	13,483,928	-
2	Kano	4,739,329	6,741,964	-2,002,635
3	Abuja	4,306,125	4,494,642	-188,517
4	Ibadan	4,288,647	3,370,982	+917,665
5	Benin	1,921,940	2,696,786	-774.846
6	Port-Harcourt	1,685,240	2,247,321	-562,081
7	Jos	1,376,497	1,926,275	-549,778
8	Ilorin	1,302,863	1,685,491	-382,628
9	Kaduna	1,273,406	1,498,214	-224,808
10	Enugu	1,210,714	1,348,393	-137,679
11	Zaria	1,164,517	1,225,812	-61,295



12	Warri	933,836	1,123,661	1,037,225	-189,825
13	Maiduguri	901,741	963,138		-135,484
14	Aba	894,663	898,929		-68,475
15	Ile-Ife	852,811	842,746		-46,118
16	Bauchi	827,304	793,172		-15,442
17	Akure	812,206	749,107		+19,427
18	Abeokuta	756,599	709,680		+7,492
19	Oyo town	718,386	674,196		+8.706
20	Sokoto	716,647	642,091		+42,468
21	Uyo	716,644	612,906		+74,553
22	Owerri	673,277	586,258		+60,371
23	Yola	658,167	561,830		+71,909
24	Calabar	621,591	539,357		+59.761
25	Umuahia	601,836	518,613		+62,479
26	Ondo Town	600,495			+81,882
27	Minna	584,342	499,405		+84,937
28	Lafia	554,058	481,569		+72,489
29	Okene	536.547	464,963		+71,584
30	Katsina	533,530	449,464		+84,066
31	Nsukka	518,743	434,965		+83,778
32	Ado Ekiti	517,048	421,373		+95,675
33	Awka	505,380	408,604		+96,776
34	Ogbomosho	501,826	396,586		+105,240

Source: National Population Census (NPC) in 2006 and projection to 2021 by the Researcher

Testing the rank size rule in Benin City for instance, Benin had a population of 1,147,188 based on NPC estimate of 2006 and 1,921,940 projected. Benin City, being the fifth largest city in the country, should have a population of 2,696,786 by the rule, rather than its 1,921,940 population. None of the urban regions among the 34 listed has its population exactly matching its rank size rule population. The result questions the workability of rank size rule in Nigeria or the accuracy of population census results. Classifying urban regions in northern Nigeria based on population and rank size rule, the following results were obtained.

Classification of urban regions in Northern Nigeria based on Population

S/No	Urban Region	Population	Population Range	Classification
1	Kano Abuja	4,739,329	Between 4-5 Million	First-Class Urban Region (Metropolitan Urban Region)
2		4,306,125		



3	Jos	1,376,497	Between 1-3 Million	Second-Class Urban Region (City-Urban Region)
4	Ilorin	1,302,863		
5	Kaduna	1,273,406		
6	Zaria	1,164,517		
7	Maiduguri	901,741	600,000-1 Million	Third-Class Urban Region (Big town Urban Region)
8	Bauchi	827,304		
9	Sokoto	716,647		
10	Yola	658,167		
11	Minna	584,342	Less than 600,000	Fourth-Class Urban Region (Small town Urban region)
12	Lafia	554,058		
13	Okene	536,547		
14	Katsina	533,530		

Source: Researcher 2022

As can be seen from table 6, Kano and Abuja are the only first class urban regions in northern Nigeria based on population benchmark of 4-5 million. Second class urban regions are four and each of them is influential in its area. Except Zaria, the other three are state capitals and all the four are university towns-University of Jos, University of Ilorin, Nigerian Defense Academy and Ahmadu Bello University are in Jos, Ilorin, Kaduna and Zaria respectively. Each class with the exception of the first class has four urban regions. Maiduguri, Bauchi, Sokoto and Yola have made the third class. No single settlement from the North-Eastern region has made it to both the first and the second class as all the urban regions from the region are classified in the third class. This is obvious because the region has preponderance of rural settlements and their youth are reluctant to leave the villages for non-farming occupations in the towns. Similarly, with the exception of Katsina, all the settlements in the fourth class are from North-central region. The second class is equally shared between the north-central and North-western regions.

Going by rank size rule, all the urban regions in Northern Nigeria have their population overestimated. Jos is the only exception with its population below its expected rank size population as shown in table 7. This implies that the population of Jos, according to the rule, has been underestimated.

Application of rank sized rule in classifying urban regions in Northern Nigeria

S/No	Urban Region	Population	Expected Population	Differences
1	Kano Abuja	4,739,329	4,739,329	-
2		4,306,125	2,369,665	+1,936,460
3	Jos	1,376,497	1,579,776	-203,279
4	Ilorin	1,302,863	1,184,832	+118,031
5	Kaduna	1,273,406	947,866	+325,540
6	Zaria	1,164,517	789,888	+374,629



7	Maiduguri	901,741	677,047	+224,694
8	Bauchi	827,304	592,416	+234,888
9	Sokoto	716,647	526,592	+189,755
10	Yola	658,167	473,933	+184,234
11	Minna	584,342	430,848	+153,494
12	Lafia	554,058	394,944	+159,114
13	Okene	536,547	364,564	+171,983
14	Katsina	533,530	338,524	+195,006

Source: National Population Census (NPC) in 2006 and projection to 2021 by the Researcher

Kano is the ranked urban region and by the rank size rule, Abuja should have population twice less than that of Kano and Jos thrice less as shown in table 7. Abuja is expected to have 2,369,665 population instead of its 4,306,125. By the rule, Abuja has 1,936,460 population above its expected rank size population. The implication of this rule is that the population of Abuja has been overestimated. Similarly, Ilorin has 118,031 population above its expected rank size population while Kaduna has 325,540 above its expected rank size population. The widest disparity is in Abuja where the gap between the actual population and the expected rank size population is as much as 1,936,460. All the urban regions seem to have defied the rank size rule as there is no single match between the actual and the expected rank size population for any of the urban regions as shown in table 7.

Classification based on landmass

S/No	Urban Region	Population	Landmass (km ²)	Population Density (km ²)
1	Jos	1,376,497	1,821	756
2	Abuja	4,306,125	1,769	2,434
3	Minna	584,342	1664	351
4	Yola	658,167	831	792
5	Ilorin	1,302,863	765	1,703
6	Zaria	1,164,517	563	2,068
7	Kano	4,739,329	500	9,479
8	Kaduna	1,273,406	431	2,955
9	Okene	536,547	328	1,636
10	Bauchi	827,304	260	3,182
11	Sokoto	716,647	220	3,257
12	Lafia	554,058	180	3,078
13	Maiduguri	901,741	169	5,336
14	Katsina	533,530	142	3,757

Source: Researcher 2022

After classifying the urban regions based on landmass as shown in table 8, Jos urban region is ranked 1st with 1,821 Km², followed by Abuja urban region with 1,769 Km². Kano urban region which has been consistently topping the ranking is now ranked 7th and Minna which was ranked 11th based on demographic classification is now 3rd. Landmass may not be a good



criterion for classification of urban region as the landmass responsible for this ranking may be idle. This is especially so, considering the topography in Jos, which is predominantly rocky and valley (DungGwom & Jugu, 2017), and the same landmass qualifies Jos as the 1st urban region in the ranking. The bulk of these landmass that qualify the urban regions for this ranking may not have any reasonable contribution to employment of labour and capital as factors of production. Except perhaps in the case of Abuja, where the bulk of the land is planned for and committed to various land use activities including functional open space, most of the urban regions ranked highest have the greatest percentage of the landmass lying idle.

Additionally, the same urban regions that top the table based on this ranking have about the least population density. Minna urban region for instance, is ranked 3rd and it has the least population density among all the urban regions. Jos urban region which is listed 1st in the ranking has the second least population density and Yola urban region which is ranked 4th has the 3rd least population density and paradoxically, Kano urban region which is ranked 7th has the highest population density (9,479) among the urban regions. These confirm that the bulk of the landmass that qualify these urban regions for this classification are idle.

Classification based on population density

S/No	Urban Region	Population	Landmass (km ²)	Population Density (km ²)
1	Kano	4,739,329	500	9,479
2	Maiduguri	901,741	169	5,336
3	Katsina	533,530	109	3,757
4	Sokoto	716,647	220	3,257
5	Bauchi	827,304	260	3,182
6	Lafia	554,058	180	3,078
7	Kaduna	1,273,406	431	2,955
8	Abuja	4,306,125	1,769	2,434
9	Zaria	1,164,517	563	2,063
10	Ilorin	1,302,863	765	1,703
11	Okene	536,547	328	1,636
12	Yola	658,167	831	792
13	Jos	1,376,497	1,821	756
14	Minna	584,342	1,664	351

Source: Researcher 2022

Urban regions were also classified based on their population density and the result as shown in table 9 ranks Kano urban region first followed by Maiduguri. If rank size rule were to be applied here, it would have been effective because the population density for Kano urban region is almost twice that of the second ranked urban region (Maiduguri). This classification seems more effective than the classification based on landmass because Kano region which is ranked first is also having the highest population. Katsina which was ranked last in the classification based on landmass is now ranked 3rd.

High population density influences human capital, production and propensity for economic growth, this may explain why Kano is the most influential urban region in Northern Nigeria and Maiduguri, in spite of its low population, commands a lot of influence in North eastern region of Nigeria.



Classification based on daily interregional passenger flow

S/No	Urban Region	Average Annual expected volume of flow	Daily expected passenger flow	Actual interregional passenger flow	daily	Differentials
1	Kano	1,248,174,445	341,966	11,727		330,239
2	Abuja	1,075,554,127	294,672	10,636		284,036
3	Kaduna	733,425,966	201,487	7,108		194,379
4	Zaria	598,442,097	163,957	5,984		157,973
5	Jos	357,745,953	98,013	4,796		93,217
6	Maiduguri	41,974,916	11,500	3,007		8,493
7	Bauchi	187,378,502	51,621	2,712		48,909
8	Katsina	85,425,580	23,404	2,369		21,035
9	Minna	173,430,697	47,515	2,309		45,206
10	Ilorin	79,047,760	21,657	2,161		19,496
11	Okene	67,031,946	18,365	1,063		17,302
12	Sokoto	43,294,571	11,862	1,024		10,838
13	Lafia	113,761,316	31,167	982		30,185
14	Yola	32,053,796	8,782	964		7,818
	Total	2,745,385,956	1,325,968	56,842		1,269,126

Source: Researcher 2022

In this classification, Kano urban region is also ranked first because it has the highest expected volume of flow (1,248,174,445), the highest daily expected interregional passenger flow (341,966) and the highest daily actual interregional passenger flow (11,727). These flows are results of large volume of economic activities and being the urban region with both the highest population size and density, it has the highest gravitational attraction. Kano has the highest daily interregional passenger flow involving at least five out of the fourteen urban regions in Northern Nigeria- Zaria (1761), Katsina (1,418), Maiduguri (1411), Sokoto (301) and Yola (223) and second highest involving six urban regions- Abuja (2620), Kaduna (1912), Bauchi (461), Minna (441), Ilorin (316) and Okene (196) urban regions. With all these flows, Kano still needs 330,239 daily interregional passenger flow to reach its full potentials as urban region.

Abuja urban region is ranked second in this classification because it has the second highest daily interregional passenger flow which stands at ten thousand six hundred and thirty six (10,636) and the second highest daily expected passenger flow of two hundred and ninety four thousand six hundred and seventy two (294,672). The urban region also has the second highest annual expected volume of flow, which is one billion seventy five million five hundred and fifty four thousand one hundred and twenty seven (1,075,554,127) flows. This is also not surprising because in Abuja region lies the capital of Nigeria. It is not a commercially- oriented region per se, but the volume of flow may be due to its administrative function, and perhaps because it is the gateway connecting the northern and southern region. Abuja has the highest daily interregional passenger flow involving at least five out of the fourteen urban regions in Northern Nigeria-Kaduna (2998), Ilorin (976), Minna (767), Lafia (398) and Okene (311) urban regions and second highest involving Maiduguri (616) and Yola (211). Abuja needs a daily



interregional passenger flow of two hundred and eighty four thousand thirty six passengers to meet its daily interregional expected passenger flow.

Kaduna urban region is ranked 3rd because it has the 3rd highest annual expected volume of flow (733,425,966). The urban region also has the third highest total daily interregional passenger flow (7,108) and the 3rd total daily expected interregional passenger flow 201,487). Kaduna was the headquarters of the defunct Northern region and its centrality reduces its friction of distance with other urban region of Northern Nigeria. That may explain why the urban region is the third highest in terms of actual daily and expected daily interregional passenger flow in Northern Nigeria. Kaduna has the highest daily interregional passenger flow involving (2,998) and second highest daily passenger flow with Zaria (1556), Jos (718) and Lafia (126). It has the third highest daily passenger flow with Minna (316) and Okene urban region (103). Total number of daily interregional passenger flow required for actual passenger flow involving Kaduna to equal its expected daily passenger flow is one hundred and ninety four thousand three hundred and seventy nine (194,379) daily passenger flow.

Yola urban region is at the bottom of this classification because its annual expected volume of flow (32,053,796) is the least in the region. It also has the least total daily passenger flow (964) and the least daily expected passenger flow (8,782). Yola urban region has the least daily interregional passenger flow involving the following urban regions-Ilorin (0). Lafia (9), Minna (10), Kaduna (45) and Abuja (203). This low daily interregional passenger flow may be a result of large friction of distance between Yola and the remaining thirteen urban regions in Northern Nigeria. Yola is the farthest urban region from Ilorin (1,244 Km), Sokoto (1,096 Km), Katsina (804 Km), Kaduna (796 Km) and Zaria (764 Km). Yola is also the second farthest urban region from Minna (914 Km) and Abuja (786 Km). This may explain why interregional passenger flow involving Yola urban region is the least in Northern Nigeria.

Table 11: Application of weighted index number method in ranking of urban regions

S/No	Urban Region	Population size criterion (2)	Population Density Criterion (2)	Landmass Criterion (1)	Passengers flow Criterion (5)	Total score (10)
1	Kano	2	2	1	5	10
2	Abuja	2	1	1	5	9
3	Kaduna	2	1	1	5	9
4	Jos	2	1	1	5	9
5	Zaria	2	1	1	5	9
6	Maiduguri	1.5	1	1	5	8.5
7	Bauchi	1.5	2	1	3.5	8
8	Ilorin	2	1	1	3	7
9	Katsina	1	2	0.5	3	6.5
10	Sokoto	1	2	1	2	6
11	Minna	1	1	1	3	6
12	Okene	1	1	1	3	6
13	Yola	1.5	1	1	2	5.5
14	Lafia	1	1.5	0.5	2	5

Source: Researcher, 2022

After collating the results of all the criteria used for the classification, weighted index number method was used to arrive at the final ranking as shown in table 11 with Kano urban region having the highest ranking followed by Abuja, Kaduna and Jos urban region among others while Lafia urban region was ranked last.



Summary and Recommendation

Ranking of urban regions is imperative for policy, planning and resource allocation. It is expected that policy makers, planners and government will make reference to the result of this study when deciding the locations for activities and industries so that every decision taken can be rational and meaningful.

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