

# SPATIAL ANALYSIS OF TRICYCLE STATIONS IN KADUNA NORTH LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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## Abstract

*This study analyzed the spatial distribution of tricycle stations in Kaduna North Local Government Area, Kaduna state. Specifically the study mapped tricycle stations, the spatial pattern of the tricycle stations and the major areas of influence or service of each tricycle stations. The study used the coordinates of tricycle stations in Kaduna North L.G.A, data generated from structured and validated questionnaires administered to the tricycle operators in each of the nineteen (19) stations distributed within Kaduna North L.G.A and the movement of tricyclist to and from the stations. Focus group discussion with the station operator's leaders was also adopted to generate data on factors influencing positioning/sitting of the stations. The methods of data analysis used were nearest neighbor analysis and creation of buffers to map the major areas of influence of each tricycle station. Findings from the study revealed that Ahmadu Bello Way had the highest number of tricycle stations with seven (7) stations and that the spatial distribution pattern between the tricycle stations is random pattern. Fourteen (14) of the tricycle stations were located along the major roads. The factors responsible for the location of the tricycle stations vary from one station to another and from one area to another, but most of them had one factor in common, which is, most of the tricycle stations were also stations for buses, taxis or bus stops. Findings also revealed that 46.05% of the operators were in the tricycle business because of the ban on Okada by the Kaduna State Government. As such, Okada operators were converted to tricycle operators; while unemployment, family sustenance and business failure were also part of the reasons why the operators ventured into the tricycle operation. The study recommended that state and local governments should provide a good road transport network and an organized mass transit system to help the tricycle system to provide a more efficient integrated public transport system in the study area.*

**Keywords:** Area of influence, Pattern, Spatial, Tricycle stations

## INTRODUCTION

Transportation is one of the most important spatially referenced socio-economic aspects of people's activities. Road transportation station is a major junction of transport activities and an important component of the road mode (Oyesiku, 1990). Without doubt, passengers' accessibility to intercity road stations could significantly affect intercity travel demand, consequently, studies on location of tricycle stations and passenger's access to them becomes crucial.

Recent studies conducted in different regions of the world and in different parts of the country tried to do justice to different problems and fill gaps left by other researchers. For example, according to Adetunji (2017) the 1993 draft national transport policy for Nigeria had no provision for deliberate location of tricycle stations. This seeming lack of planning has been responsible in part for the problem of incidental emergence of tricycle stations.

Kayode and Bolaji (2016), in their work "spatial distribution of intercity passengers stations in Lagos" investigated the relationship between distribution of intercity road passenger stations and transport needs of all socio-economic groups in the city of Lagos. They used data collected on station characteristics and factors influencing choice of location in their study area. In their analysis, they used the nearest neighbor analysis to determine the pattern of station location and analysis of variance technique was used to test the variation in station distribution across three activity zones. Findings from the study revealed that station distribution were clustered and their operational characteristics vary significantly across the three different activity zones.

However, Kayode and Bolaji (2016) did not collect the station operators' data to know the area of influence of each station. A gap in their research was observed which this study addresses. The distribution of the tricycle

stations has not been given proper consideration despite its importance in urban transportation because very little is known about tricycle transportation (Yakubu, 2016).

Yakubu (2016) determined the spatial service zones of influence of motorcycles in Okene. He collected data on fare and distance from the parks to the various locations in

Okene, the methodology he used was on the spot counting of the trips for one-hour period and extended for a week. In his analysis, he used regression analysis to obtain the flow equation to determine geographic service zones of influence for each motorcycle park

Adedeji, Olafiji, Omole, Olanbi and Yusuff (2014) examined rural transportation as it affects economic activities in the study area.

They used data for elements such as road quality, trip distribution (movement from origin to destination), waiting time at bus stops and road side, trip frequency to urban areas, traffic

survey and maintenance of roads, which they collected by administering a structured questionnaire. In their findings, they stated that most of the rural roads could not maintain their parks, consequently commuters had to wait for a considerable length of time by the road side

or bus stop/stations before they could get vehicle to convey their farm produce to the market. They also found that inequitable distribution of infrastructure in the study area has resulted in the disparities in development that are primarily influenced by transportation.

However, they laid emphasis on road quality at the expense of the passengers and station as an important infrastructure of transportation. This study however looked at the pattern of tricycle station distribution, the characteristics of the station locations and the factors responsible for such distribution in Kaduna North Local Government Area as well as the area of influence of the stations. It is equally worth noting that to the best of the researchers' knowledge, no research of this nature has been conducted in the study area (Kaduna North Local Government Area) hence the need for the study.

The Kaduna metropolitan area has a serious traffic congestion problem due to inadequate provision of appropriate terminal stations and well-defined off-street parking facilities. The coming of tricycles in the metropolitan area has added to the existing traffic congestion on the roads, which requires adequate provision of appropriate and planned

operations in Okene. Furthermore, Yakubu (2016) in his result found that some areas in Okene are close to the motorcycle stations while most areas are very far away from the stations due to the incidental emergence of the motorcycle stations.

Yakubu (2016) however did not investigate the distribution pattern of the motorcycle stations. This study fills the gap in the literature and investigates the spatial distribution of tricycle stations in Kaduna North Local Government Area (K.N.L.G.A) and it also looked at the factors responsible for the distribution pattern.

tricycle stations considering the spatial distribution of the users in Kaduna North Local Government Area. This makes the study of the appropriate location and distribution of tricycle stations in the study area important.

Consequently, this study is also envisaged as a base for information that can be employed for improving the location of tricycle stations, monitoring the distribution of the tricycle stations and facilities in each of the station point in Kaduna North L.G.A. Planners can use the geo-spatial data of the study to plan the places that are partially marginalized and to locate the exact station that serves a particular area. The study was also undertaken with the hope of bridging the gap between the users of the tricycle and the location of the serving stations. Other researches of similar features can be held to adapt the study in other locations. The study outcome could extend the frontiers of knowledge and be used for further research.

The study analyzed the movement of commuters from one area to another in relationship with areas covered by each station. An understanding of this relationship is vital to the tricycle station location policies and programmes that provide for equity, access and economic benefit. The primacy of the city, its economic status and the high level of regional interaction placed high demand on its transport system, particularly the tricycle stations. This has implication on tricycles' station distribution, patronage and economic activities.

## **MATERIALS AND METHODS**

### **Study Area**

The scope of this research covered all the existing tricycle stations within Kaduna North Local Government Area (LGA), which is one of four (4) LGAs that make up Kaduna metropolis, the others being Kaduna South,

Chikun and Igabi LGAs. The study area has an area extent of 72 square Kilometer and consists of settlements such as Hayin Banki, Ungwan Dosa, Badarawa, Malali, Ungwan Rimi, Ungwan Shanu, Shaba, Doka, parts of Kawo, and parts of Rafin Guza. This research covered only tricycle stations in Kaduna-North L.G.A as at July 2019.

Kaduna North is a Local Government in Kaduna State. It is located between latitudes 10°28' N and 10°37' N and longitudes 7°25' E to 7°37' E. It has its secretariat at Magajin Gari area of Doka District. It is bordered by Chikun Local Government Area in the South-eastern part, South west is Kaduna South Local Government Area and Igabi in the North. The three districts of Kaduna North are Doka, Kawo and Gabasawa Districts.

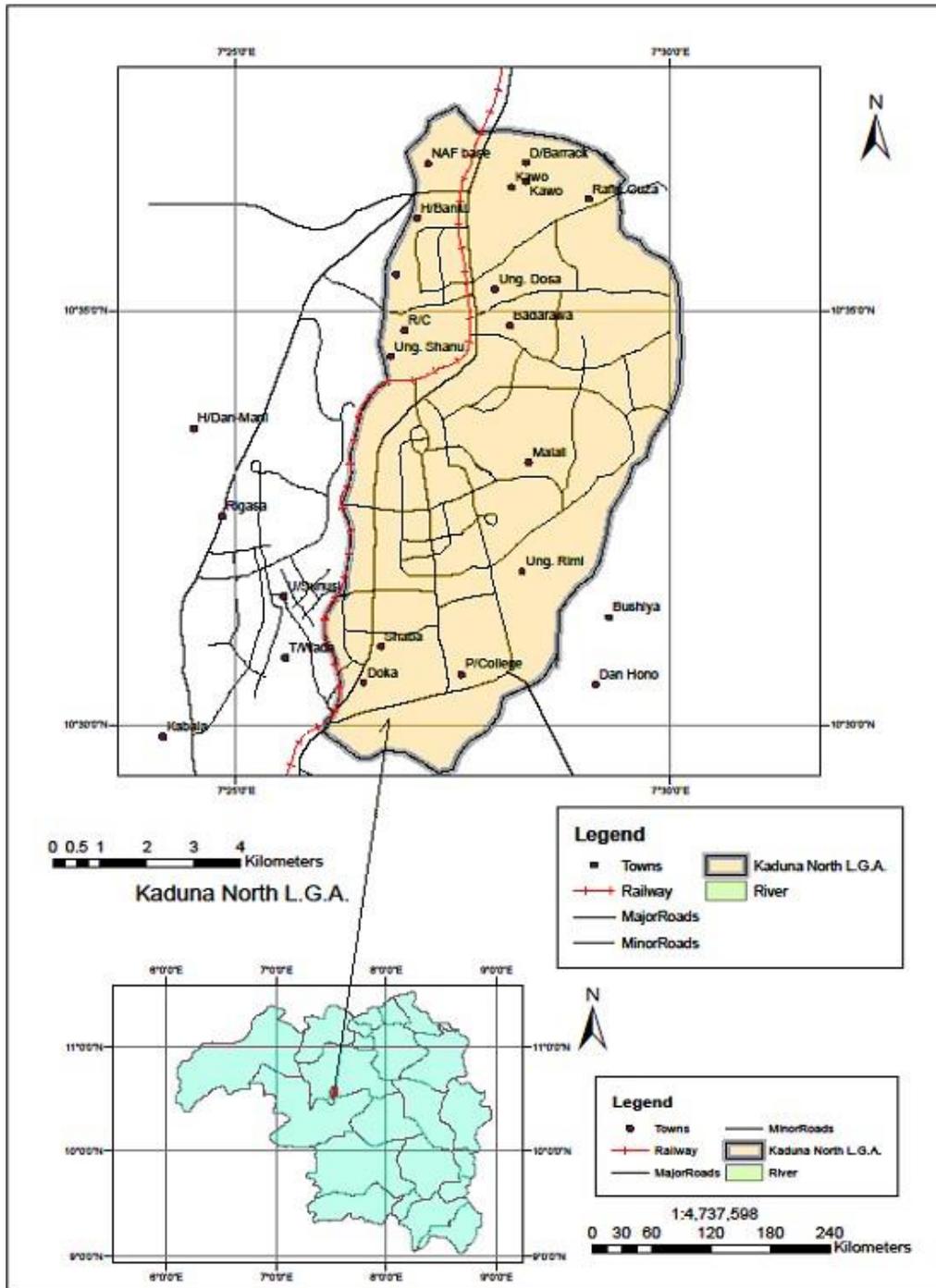
### Data Collection

The data used for the study are the base map of Kaduna North LGA (2018) sourced from Kaduna State Ministry of Lands and Survey; the coordinates of the tricycle stations within Kaduna North LGA was sourced using a GPS device directly in the field; factors influencing positioning/sitting of the tricycle stations in Kaduna North L.G.A are sourced through Focus Group Discussion with the tricycle station operators' leaders; the distance apart between the stations was calculated from the plotted coordinates in the base map; and the movement of tricyclists to and from the stations in Kaduna North LGA was sourced through the questionnaire administered to tricycle operators at the tricycle stations.

The research covered all the nineteen (19) stations in Kaduna north L.G.A. Structured and validated questionnaires were administered at the stations on the tricycle station operators (cyclist) to obtain information on their movement pattern (the origin and destination) in order to establish areas of influence of each tricycle station.

The total population of the registered tri-cyclists in Kaduna North Local Government Area of Kaduna State was 1,033, while the average total population of the passengers per day was 69,484 (ACOTMORAN, 2019). Based on Krejcie and Morgan (1970), for a population of 1,033, a sample size of 278 is adequate. Therefore, a total of 278 tricyclists were sampled. The ratio (the number of registered tricycles divided by the total) of the number of registered tri-cyclist per station was multiplied by the total number of questionnaires which gave the sample size of questionnaire that was administered to each tricycle station as seen in Table 1.

The coordinates of the tricycle stations were taken from the field with the aid of a hand-held Garmin Map 62 Global Positioning System (GPS) receiver. The GPS receiver was connected to a computer which had ArcGIS 10.1 installed and the point coordinates of the stations were retrieved and saved in CSV format Using Microsoft Excel. The excel spreadsheet data was added to ArcMap and the coordinates were converted into point shapefile using ArcMap capabilities. These points, which are the locations of the tricycle stations, were overlaid the base map of the study area for analytical purposes.



**Figure 1** The Study Area, Kaduna north Local Government Area. Insert: Kaduna State  
Source: Adopted from Kaduna State Ministry of Lands and Survey (2018).

The factors responsible for the area distribution of the tricycle station in Kaduna North L.G.A were collected from Focus Group Discussion with the tricycle stations operators' leaders. The Nearest Neighbor Analysis technique was used to determine the pattern of

spread of the tricycle stations in Kaduna North L.G.A. The responses that were generated from questionnaires administered at the stations to operators were analyzed using buffers to map the major areas of influence of each tricycle station.

**Table 1** Number of registered tricycles, questionnaires administered and location of tricycle stations

S/no	Stations	Registered number of tricycles	Sample size	X coordinate	Y coordinate
1	Stadium round about	35	10	327616.67	1161217.65
2	Kabala Doki	18	8	329617.37	1161210.92
3	Kaduna State university	90	31	3330612.87	1162897.65
4	Polytechnic	16	8	329604.28	1163379.68
5	Jos Road by Ahmadu Bello way	20	8	328275.70	1162698.97
6	Kano Road by Mosque	30	10	330292.92	1170374.82
7	Kano road by Ahmadu Bello way	77	24	328256.39	1162868.70
8	Ibrahim Taiwo road by Ahmadu Bello way	34	10	328245.79	1163063.60
9	Co-operative bus stop	36	13	328245.21	1163247.65
10	Leventis bus stop	13	4	328256.98	1163576.26
11	U.T.C bus stop	60	20	328094.69	1164801.99
12	Abakpa Nepa	30	10	328490.91	1165816.01
13	Ungwan Sarki bus stop	65	20	329772.16	1166552.21
14	Rabah road bus stop	35	9	329893.86	1167089.32
15	N.D.A bus stop	49	14	329807.21	1167590.70
16	Ungwan Rimi total	36	12	331442.50	1164223.98
17	WAEC bus stop	18	8	329699.45	1169145.07
18	Kawo 1 <sup>st</sup> bus stop	148	45	330088.38	1170408.32
19	Lagos Garage park	44	14	329245.56	1170728.19
	<b>Total</b>	<b>1033</b>	<b>278</b>		

**Source:** Amalgamated Commercial Tricycle and Motorcycle Owners and Rider's Association of Nigeria (ACOTMORAN), Kaduna State Chapter and Fieldwork, 2019.

## RESULTS AND DISCUSSION

### Spatial Distribution of Tricycle Stations in Kaduna North LGA

The tricycle stations in Kaduna North Local Government Area were located along the major roads of the Local Government as shown in Figure 2 (Table 1) where the major roads are the Mando road, Zaria road, Ali Akilu road Ahmadu Bello Way, Junction road, Jos road by Ahmadu Bello Way and Tafawa Balewa Way. Ahmadu Bello Way had the highest number of tricycle stations (7), because it is located in the Central Business District (CBD) of Kaduna Metropolis where people from all parts of the township converge before they find their way to their places of work or business making it a

cluster of stations. Ali Akilu Way was the next after Ahmadu Bello Way, with a total number of four (4) tricycle stations followed by Zaria Road and Ungwan Rimi, each with two (2) tricycle stations. Mando Express Way, Junction Road, Kabala Costin and Marafa had one (1) tricycle station each.

From figure 2, a cluster of tricycle stations can be seen most especially from NDA station to Ungwan Sarki station and from Leventis Roundabout station to Jos road by Ahmadu Bello way station. The southern part of the study area had 13 stations located there, this is as a result of the position of the Central Business District and other government institutions, which are located there.

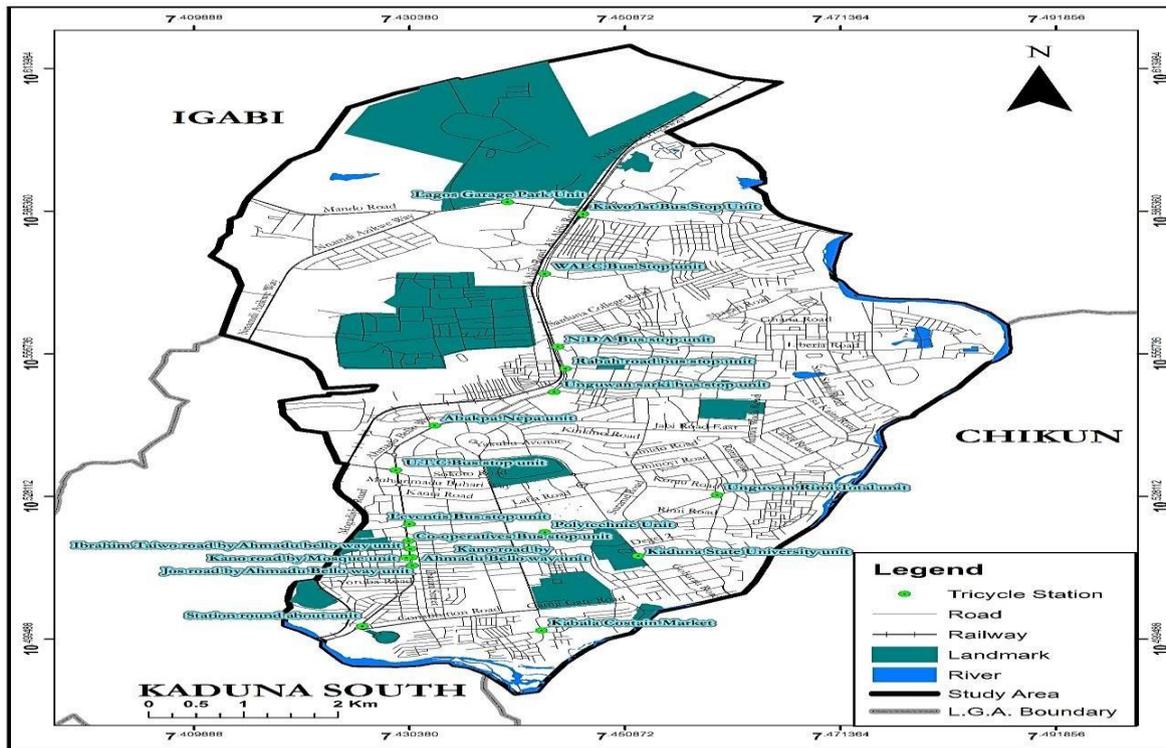


Figure 2 Location of tricycle stations in Kaduna North LGA

Source: Author's analysis, 2019

### Factors Influencing Location of Tricycle Stations

There are a variety of factors responsible for the location of the tricycle station in Kaduna North Local Government Area (Table 2). First, several of the tricycle stations are also stations for buses or taxis. These bus stops served either town service buses and taxis or buses and taxis that were coming from other towns and cities within Kaduna State or from other states of the federation. The existing stations also served two purposes, which are the town service for buses, taxis and major tricycle stations in Kaduna North Local Government Area. Such stations that served two purposes were the Lagos garage bus stop station, Kawo first bus stop station and Ungwar Sarki bus stop station; When the buses or taxis drop the commuters, the tricycles carry them to the next destination. These destinations were mostly routes where buses and taxis did not run regularly, as such the tricycle operators became an attractive alternative. The commuters sometimes pick a drop service to reach their final destination or for convenience. They also moved commuters from one tricycle station to

while the remaining served as only the town service bus stop. Some of the stations had one factor in common, that is, the tricycle stations were also stations for buses or taxis. These bus stops served either town service buses and taxis or buses and taxis that were coming from other towns and cities within Kaduna State or from other states of the federation. The existing stations also served two purposes, which are the town service for buses, taxis and major tricycle stations in Kaduna North Local Government Area. Such stations that served two purposes were the Lagos garage bus stop station, Kawo first bus stop station and Ungwar Sarki bus stop station; while the remaining served as only the town service bus stop.

another tricycle station which also served as a bus or taxi stop to link them up to bus or taxi services to their next destination. Sometimes, these are the final destination stations for passengers as well either for business transaction or even as residence. Some of the stations that linked up passengers to bus services include: Rabah road, Ungwan Rimi total and NDA bus stop stations.

**Table 2** Factors responsible for tricycle station locations in Kaduna North LGA

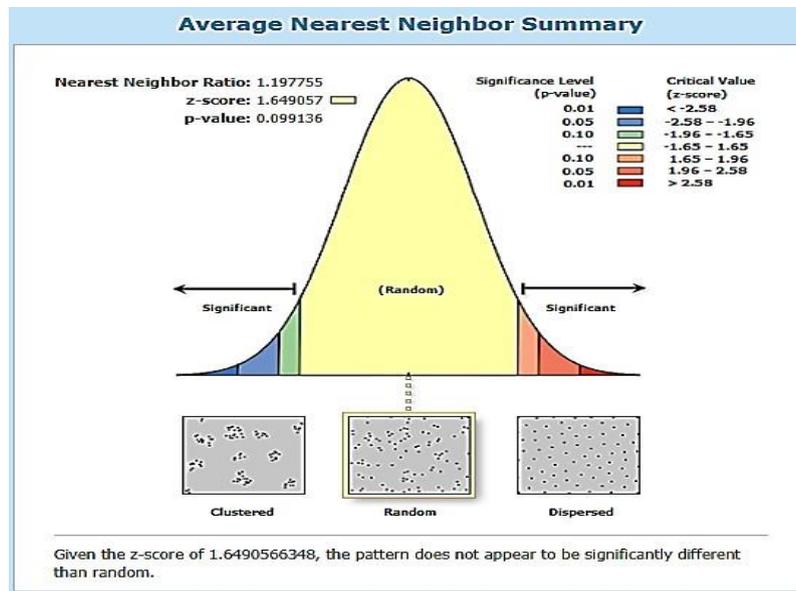
S/N	Factors	Tricycle Stations
1	Stations for either buses, taxis or bus stop	Lagos garage bus stop station, Kawo 1 <sup>st</sup> bus stop station and Ungwar Sarki bus stop station
2	Link up to bus or taxi services to their next destination or as their destination	Rabah road bus stop station, U.T.C bus stop station, Ungwan Rimi Total station, Abakpa Nepa unit and NDA bus stop station.
3	Availability of passengers	Stadium round about station, Kano road by Ahmadu Bello Way station, Ibrahim Taiwo 4road by Ahmadu Bello Way station, Co-operative bus stop station, Jos road by Ahmadu Bello Way station and Leventis bus stop station
4	Presence of Government institutions	Kaduna State University station, WAEC bus stop station (Kaduna State Secretariat), Stadium round about station and Polytechnic station.

Source: Fieldwork, 2019

**Spatial Pattern of Tricycle Stations**

The spatial distribution pattern of the stations in Kaduna North Local Government Area is presented in Figure 3. The degree of clustering,

randomness or dispersion of a tricycle station’s distribution in Kaduna North Local Government Area was determined using the nearest neighbor analysis (NNA) technique.



**Figure 3** Nearest Neighbor Analysis of Tricycle Stations  
 Source: Author’s Analysis, 2019.

Figure 3 shows the result of the Nearest Neighbor Analysis with the Nearest Neighbor ratio in Kaduna North Local Government Area to be equal to 1.197755, with a z-score of

1.649057 and a p-value of 0.099136. The figure shows a random pattern of distribution of tricycle stations in Kaduna North Local Government Area.

**Areas of influence of tricycle stations**

The major areas of influence of each tricycle station in Kaduna North Local Government Area of Kaduna State vary. From figure 4, each tricycle station and the area of influence are represented with the same type of color. Out of the nineteen (19) tricycle stations, the major area of influence of fifteen (15) of them were within Kaduna North Local Government Area, while the major areas of influence of the remaining four (4) stations extended from within the study area to neighboring Local Government areas that make up Kaduna metropolis.

The stations with major area of influence outside the study area were Kaduna State University station which had influence extending to NNPC Junction in Chikun Local Government area; U.T.C bus stop station which had area of influence extending to Kurmin Mashi, Badiko and U/Sunusi in Kaduna South

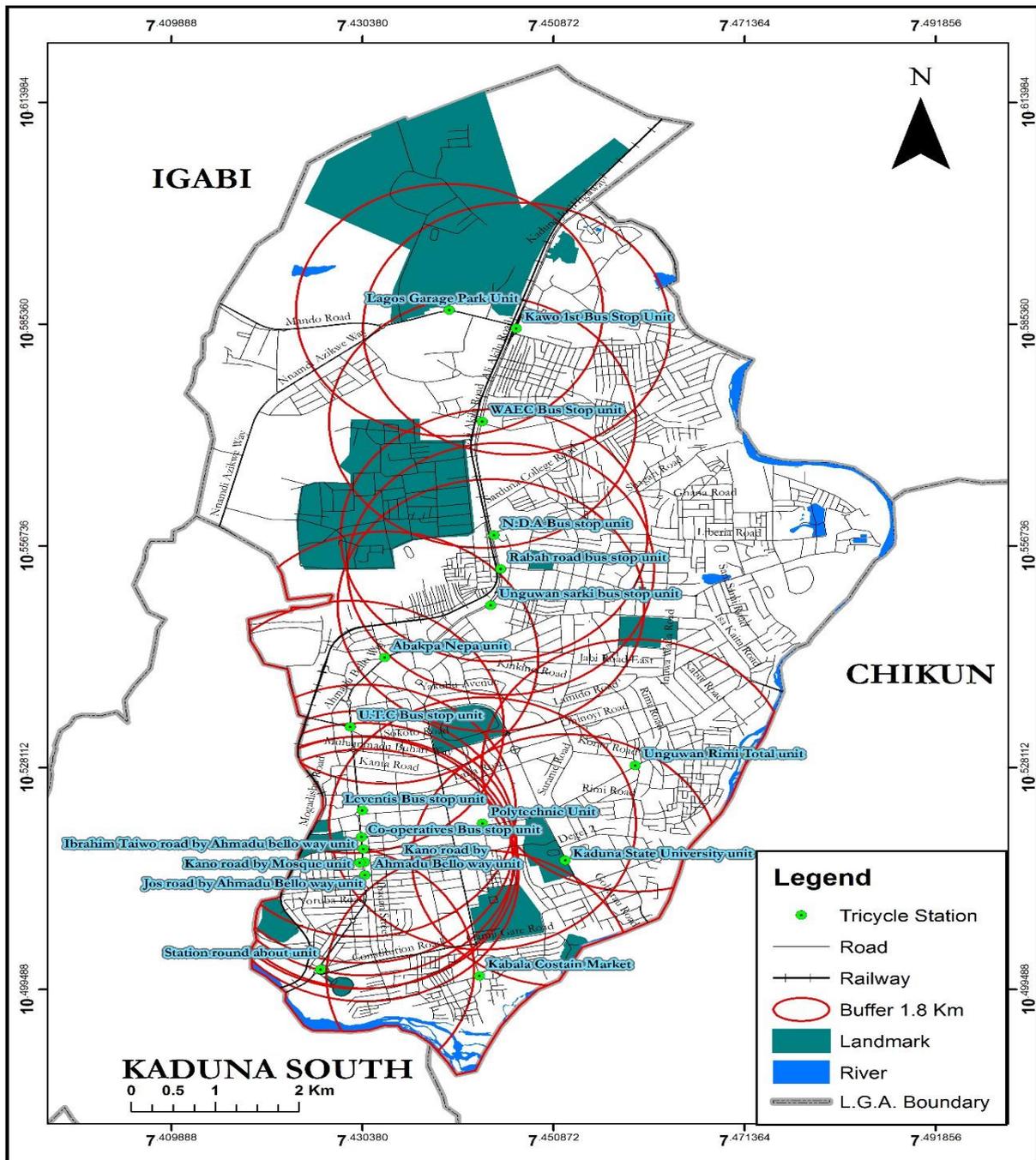
Local Government Area. Other tricycle stations that had areas of influence outside the study area were Kano road by mosque station with the major area of influence extending to Tudun Wada, Kasuwar Barci and Tudun Wada Polytechnic all in Kaduna South Local Government Area. The Kawo tricycle station which had one of its major areas of influence outside the study area included Rafin Guza located in Igabi Local Government Area.

Table 4 shows that some of the tricycle operators had the same area of influence though they were different stations. Among them were Stadium round about station, Kano road by Ahmadu Bello Way station, Ibrahim Taiwo road by Ahmadu Bello Way station, Co-operative bus stop station and Leventis bus stop station. While some tricycle stations had two or more areas of influence because they registered with both the Kaduna State University station and WAEC bus stop station.

**Table 4** Major Area of Influence of each Tricycle Station in Kaduna North L.G.A

<b>Stations</b>	<b>Major areas they serviced (influence)</b>
Stadium round about station	Kaduna State University, State Secretariat and Kabala Doki.
Kabala Doki station	Stadium round about unit and Kaduna State University.
Kaduna State University station	Stadium round about unit, U/Rimi, Badarwa, Leventis roundabout and NNPC Junction.
Polytechnic station	U/Rimi, Leventis roundabout.
Jos road by Ahmadu Bello way station	Independence Way, Yakubu Gowon Way
Kano road by mosque station	Tudun Wada, Kasuwar Barci, T/Wada Poly.
Kano road by Ahmadu Bello way station	Kaduna State University, State Secretariat and Independence Way.
Ibrahim Taiwo road by Ahmadu Bello way station	Kaduna State University, State Secretariat, Independence Way and Bida Road.
Co-operative bus stop station	Kaduna State University, State Secretariat U/Rimi
Leventis bus stop station	Kaduna State University, Barau Dikko Hospital, State Secretariat and U/Rimi.
U.T.C bus stop station	Kurmin Mashi, Badiko, U/Sunusi.
Abakpa NEPA station	Abakpa GRA, Abakpa and U/Shanu.
Ungwan Sarki bus stop station	Malali, Isah Kaita Road and Sultan Road.
Rabah road bus stop station	Malali, Katuru Road, Capital School and Federal Government College.
N.D.A bus stop station	Malali, Badarawa bus stop and Kwaru.
Ungwan Rimi Total station	Kaduna State University, Poly U/Rimi, Co-operative and Leventis bus stop.
WAEC bus stop station	KTC, GGSS Kawo and U/Dosa.
Kawo First bus stop station	Kawo New Extension and RafinGwuza.
Lagos Garage park station	Kawo, Hayin Banki, Mando and By-pass Express Way.

Source: Field Survey, 2019



**Figure 4** Major Area of Influence (service) of Tricycle Stations in Kaduna North LGA  
 Source: Author’s analysis, 2019

**CONCLUSION**

The spatial pattern of tricycle stations in Kaduna North local Government Area was a random pattern from the Nearest Neighbor Analysis. Fourteen (14) out of the 19 tricycle stations were located along the major roads of the study area that started from Kawo Kaduna, to Stadium Roundabout. The operation of tricycles in Kaduna North Local Government Area is one of the major means of transportation of people and goods to various parts of the

Local Government Area and even to parts of the neighboring Local Government Areas of Kaduna South, Chikun and Igabi, that made up Kaduna metropolis. It also served as a means of public transport in the area due to the poor public transport system and poor road network in the state. As a result, the State and Local governments should make provision for a good road transport network and an organized mass transit system to help the tricycle system, among others, to provide a more efficient public

integrated transportation system in the study area. There should be further research on the complementary roles the tricycle means of transport plays in providing a good transport mix in the study area.

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