

## Analysis of street utilization patterns in Makurdi, Benue state Nigeria.

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### Abstract:

*Streets are public spaces that are meaningful to all people because of lack of restriction. Studies show that conditions, activities and people contribute to the success of public spaces. Also, self-organization potential in activity patterns offers prospect for revitalization of an urban area. This potential is not used hence many African streets appear disorganised giving African urban areas an unplanned look Therefore; this study aims to analyse street utilization patterns and explore the relationship between the pattern of street use and condition of streets in Makurdi .These activity patterns form a data base for revitalization of public space. Three major and minor arterials streets in the nine wards that make up the built up part of Makurdi were purposively selected as units for measurement. A street activity audit was done on streets for activities that can be observed. For activities that cannot be easily observed 4 questionnaires were randomly administered on each of the three streets giving a total of 108 questionnaires. Multivariate statistical tools such as factor analysis and regression will be used to show emerging streets activity patterns and spatial variation among the nine wards.*

**Keywords:** *Streets, Utilization patterns, Revitalization, Urban design, urban areas, developing countries.*

### 1.0 Introduction and Problem Analysis

Streets are the principal fabric of the road network in settlements. Technically, a street is a public parcel of land adjoining buildings in both rural and urban contexts, on which people may freely assemble, interact, and move about Merriam Webster dictionary, 2015[1]. Hence, streets are used broadly for commerce, social interaction and community integration amongst a host of other uses. Multiplicity of uses has potential for chaos and disorderliness yet, in this diversity there exists patterns that have a self-organization potential. These potentials have been used by urbanists to revitalize public spaces Gehl, 1987,[2] Appleyard, 1981[3], Alexander, Ishikawa, Silverstein, Jacobson, Fiksdahl-king, and Angel, 1977 [4]and Jacobs, 1961[5].However these researches have been carried out in cities with optimal street conditions which is parallel to what obtains in many African cities. Street conditions in many African cities are usually substandard in terms of lack of infrastructure, poor street designs and lack of street furniture. Hence this study aims to analyze street utilization patterns in Makurdi, a typical African city. It also aims to explore a link between these patterns and street conditions broadly explained in terms of infrastructure, design and furniture.

By serving travelers and commerce, roads and streets unite people and foster economic growth. Street infrastructure such as sidewalks have become important to diverse planning concerns that range from walking for health and transportation to economic development, recreation and environment improvement Ehrenfeucht & Loukaitou-Sideris,2010[6], However, as they

develop, roads and streets also disrupt old patterns, upset balances of power, and isolate some as they serve others. Studies have shown, that consequent disagreements leave social struggles Norton, 2016[7] that lead to urban decay. Similarly, studies indicate a forerunner of urban decay, as street designs which emphasizes the transport function of streets rather than the social function resulting in street environments that are unattractive for people on foot, whether travelling along the street, or using the street as a destination for economic or social activities Jones, Marshal and Boujenko,2008[8]. Additionally street furniture such as lights, seats have been shown by studies to contribute to feelings of safety which are proportionately linked to street use. These studies stress the need to reconsider streets in wider urban context, as both a movement channel forming part of the road network and as place in its own right. They stress the health, safety and environmental arguments for reinventing the mixed-use urban streets Hebbert,2005 [9].

Revitalization of public areas is grounded basically on the relationship between activity and space. This relationship has been of interest to urbanist's, scientists and theorists for a long time, hence formulation of theories that explain how humans act in public space have developed out of a branch of psychology called environmental behaviorism. Theorists like Proshansky, Ittelson and Rivlin 1979[10] and Craik, 1973[11] amongst many others have empirical works which use scientific strategies in understanding space/activity relationships. These studies establish a reciprocal relationship between man and his environment with both influencing each other.

Building on this study of human/environment interaction urbanist's and scientists like Lynch, 1960 [12] and Alexander et al, 1977[4] amongst others have broadened the horizon with studies showing that behaviour in an environment can be predicted by observing activity patterns in a similar environment. This design approach is called placemaking. It stresses that public places have an inherent ability to be read, analyzed and made in order to utilize the inevitable self-organization potential of cities. Basically places have patterns that work and those that do not work. If emphasis is placed on patterns that work then space becomes a performing space. If this self-organization pattern of a place is identified, read, analyzed and evaluated in addition to making the people using the places in cities more visible in the planning process, then it can be synthesized into a plan that makes the place more functional. Activity patterns have been applied to revitalize public spaces in many cities especially in North America and Europe with varying results. However, the application of these principles in the face of rapidly urbanizing urban areas with poor physical settings particularly in Africa and Asian countries is still largely untested. This study **aims** to bridge this gap by **analyzing the activity patterns found on streets of Makurdi**.

## 2.0 Study area

Makurdi is the capital of Benue state, located between latitudes  $7^{\circ}37'$  and  $7^{\circ}47'$  North and longitude  $8^{\circ}27'$  and  $8^{\circ}40'$  East. Makurdi has a population of 297,398 persons according to National Population Census (2006) and covers an area of 804.2 square kilometres (16 km radius). The urban area is accessible through the air, road, water and rail modes of transportation. The River Benue which is the second largest river in Nigeria divides the town into two parts, north and south banks. The town has 24% Adzembra, 2012[13] of its land use defined by streets. Most of the city is laid out in a grid iron pattern. Parts of the neighbourhoods in the town and on the outskirts have been allowed to grow haphazardly with buildings taking over streets. Infrastructure deficits characterise most of the city with poor street networks; poor sanitary

conditions resulting in degraded environments. Informal settlements exist in many parts of Makurdi giving the town a blighted slum appearance.

### 3. Materials and methods

The study is an exploratory research. Maps were first generated from Google earth. The maps were then analysed on the basis of street uses, patterns, activity and street type. In the analysis of the study area, all streets in the built up area of Makurdi were counted. The total number of streets forms the total population under study (n=1356). This was followed up with the analysis of people's activities on the streets. Also, since activities are carried out by people, in order to be able to measure activities another population would be required; that is of people at activity areas. For this, the projected 2014 census figure for Makurdi will be used as the population.

The extent of a street is determined as the road segment between 2 intersections. The sample streets were determined by numbering all the streets. A table of random numbers was then applied to the streets and 27 selected and adjusted till one major arterial and two minor arterials were purposively selected for convenience in each of the nine wards that constitutes the built up area of Makurdi giving a total of 27 streets. The projected population figure for 2014 in Makurdi is 369,426 Tser, 2013[14]. The Taro Yamane formula applied to this figure gives a total of 399 or 400 as sample figure. Based on the National Demographic health survey report of 2013, that put the national household size at 5 people, a total of 80 households were sampled. Activities taking place on street were classified as;

1. Commercial activities like small convenience shops, kiosks, supermarkets, boutiques, meat shops, street hawking, outdoor bars and eateries both day and night, barber shops, salons, chemists, pharmacies, private businesses. These activities will be counted and total figures recorded
2. Public activities like public/government offices and spaces, churches, mosques, shrines, clinics, hospitals, traditional healing homes, schools, daycares, vocational centres. These activities will be counted and tallied up.
3. Advertisements like billboards, signage, digital boards, posters and automated billboards. Because of the quantum of posters they will be given a number 1 for present and 0 for absent. Street signage will be counted
4. Other uses like farming.
5. Social activities like rallies, protests, people watching, demonstrations, meetings, play areas, parties and carnivals. Information on this will be requested from questionnaires and tallied up.
6. Environmental degrading activities like carpentry workshops, vulcanizers, metal works which have end products that dirty the environment and refuse dumps will be counted
7. Socially deviant activities like assault, rape, robbery, and commercial sex workers, sale of illegal drugs and substances and presence of insane people will be sourced from questionnaires and totalled.
8. Residential activities, residences alone and residences with shops will be counted.
9. Street conditions like setbacks, presence of streetlights, street surfacing material, street landscaping will be measured using tapes and counting.

The streets in Makurdi constitute the sampling frame. Preliminary map analysis determined a sample size of 2% giving 27 streets from a total of 1359 streets. Data will be sourced from 4

households per street giving a total of 108 households serving as data sources to which questionnaire will be administered to obtain information that will be used to achieve objectives of this study. On each street numbers will be allocated to the houses as seen on the updated map, numbers allocated to houses will then be placed in a container and 4 numbers randomly picked. To these randomly selected households' questionnaires will be administered. The bulk of data needs for this study is sourced by observation hence questionnaire will be used mainly to source for demographic/socioeconomic information and information that cannot be obtained from observation. The study made use of the following instruments: Questionnaires; Field observations; and Map analysis. This study employed a combination of factor analysis, multiple correlation/regression analysis as statistical tools.

#### 4.0 Findings

The findings of this study are in three dimensions. The first part focuses on the identified factors on activity pattern. Influence of the identified factors using factor analysis on the nature and pattern of streets in the area is determined using regression model. The formula is stated thus:

$$Y_{1,2,3} = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8.$$

Where  $Y_1$  = Street infrastructure

$Y_2$  = Street furniture

$Y_3$  = Street design

a = constant

$b_1, b_2, \dots, b_9$  = plane of the variables

$X_1$  = Public commercial

$X_2$  = Public information

$X_3$  = Commercial antisocial

$X_4$  = Environmental/ Antisocial

$X_5$  = Residential antisocial

$X_6$  = Social public

$X_7$  = Antisocial

$X_8$  = Commercial

**Table 1: Model Summary**

Model	R		
	R	Square	Std. Error of the Estimate
1	0.99	0.982	0.12144
2	0.999	0.989	0.09395
3	0.748	0.560	0.97131

Predictors: (Constant), X8, X1, X3, X2, X7, X4, X6, X5

Table 1 shows the regression coefficient for factors that determine the pattern and nature of streets in Makurdi town. A regression model that accommodates eight (8) major activities along the streets: public commercial, public information, commercial antisocial, Environmental antisocial, social public, residential antisocial, antisocial and commercial activities. It showed that the eight independent variables regressed against street infrastructure, street furniture, and street design (the dependent variables) in the area gave coefficient of determination ( $R^2$ ) of 0.98, 0.99 and 0.56 for street infrastructure, street furniture and street design respectively. Thus the variation in street infrastructure, furniture and design can be adequately explained by 98%, 99% and 56% of the identified factors respectively. That is to say, 98% variation that can be observed in the street infrastructural development, 99% variation in street furniture, and 56% variation in existing street design are determined by the identified human activities along the streets of the area. Table 2 demonstrates determinants of street infrastructure.

**Table 2: Determinants of Street Infrastructure in the area**

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.811	.325		2.496	.243
	X1	.090	.078	.275	1.152	.455
	X2	.208	.153	.332	1.363	.403
	X3	.170	.104	.526	1.628	.351
	X4	-.510	.210	-.587	-2.423	.249
	X5	-.100	.088	-.460	-1.137	.459
	X6	.086	.025	.930	3.441	.180
	X7	.062	.086	.177	.726	.600
	X8	.156	.151	.389	1.031	.490

Table 2 shows the factors that determine the level of street infrastructural development in the area indicating that social public activities is the highest determinate of street infrastructure observed in the area. Commercial activities that are antisocial also contributed to street infrastructural development. Public activities that are information dissemination oriented affected street infrastructure development positively in the area. Also, public commercial and night commercial activities along the existing streets contributed to the development of the street infrastructure. On the other hand, industrial and activities that are antisocial were an impediment to the development of street infrastructure.

The coefficients were further presented in the linear regression model thus:

$$Y_1 = 0.811X_1^{0.275} + X_2^{0.332} + X_3^{0.526} + X_4^{-0.587} + X_5^{-0.46} + X_6^{0.93} + X_7^{0.177} + X_8^{0.389}$$

By linearizing the above equation we have

$$\text{Log } Y_1 = 0.811 + 0.275\log X_1 + 0.332\log X_2 + 0.526\log X_3 - 0.587\log X_4 - 0.46\log X_5 + 0.93\log X_6 + 0.177\log X_7 + 0.389\log X_8$$

Thus, it therefore implies that, a unit increase in social public activities in the area will lead to 93% increase in street infrastructure, a unit increase in commercial activities that are antisocial will lead to 52% increase in street infrastructure, a unit increase in public information activities will lead to 33% increase in street infrastructure. Also, a unit increase in public commercial activities will lead to 27% increase in street infrastructure, while a unit increase in night commercial activities will lead to 39% increase in street infrastructure. On the other hand, a unit increase in industrial activities that are antisocial will lead to 58% decrease in street infrastructure; a unit increase in activities that are antisocial will lead to 46% decrease in street infrastructure. Table 3 discusses factors that are impacted on by street furniture.

**Table 3: Determinants of Street Furniture in the area**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.829	2.602		-.319	.804
	X1	.078	.625	.090	.125	.921
	X2	-.101	1.222	-.060	-.082	.948
	X3	.580	.834	.676	.695	.613
	X4	-.440	1.684	-.190	-.261	.837
	X5	.343	.706	.593	.487	.712
	X6	-.050	.201	-.202	-.248	.845
	X7	.242	.689	.257	.352	.785
	X8	-.077	1.211	-.072	-.063	.960

Table 3 shows that commercial activities that are antisocial activities are the major determinants of the level of street furniture. Though, public commercial activities affect street infrastructure positively but not significant. On the other hand, the other identified factors affect street infrastructure negatively. Thus, it therefore implies that, a unit increase in commercial activities that are antisocial will lead to 67.6% increase in street furniture; a unit increase in activities that are antisocial can lead to 48.7% increase to street furniture, while a unit increase in other antisocial activities can lead to 35.2% increase in street furniture. On the other hand, a unit increase in Environmental degrading industrial activities can lead to 26.1% decrease in street furniture, while a unit increase in social public activities can lead to 24.8% decrease in street furniture. Table 4 describes factors affected by street design

**Table 4: determinants of Street Design**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.392	2.599		.151	.905
	X1	.061	.624	.114	.097	.938
	X2	-.249	1.220	-.243	-.204	.872
	X3	.331	.833	.628	.397	.760
	X4	.125	1.682	.088	.074	.953
	X5	-.024	.705	-.068	-.034	.978
	X6	.127	.201	.835	.632	.641
	X7	.411	.688	.711	.597	.657
	X8	-.391	1.210	-.598	-.323	.801

a Dependent Variable: Y3

Table 4 shows that, social public activities, commercial activities and antisocial activities are the major factors affecting the state of street design in the area. From output of the regression analysis, the street design of the town is determined by 63.2% of the social public activities of the area, 39.75 of the commercial activities and 59.7% of other activities that are antisocial.

## 5.0 Conclusion and Recommendations

Street utilization patterns tend towards commercial and public activities in Makurdi. This finding has implications on approaches to street design which have the potential to encourage the street life and activity, this potential for revitalization should be used as such. Street infrastructure such as sidewalk, pedestrian walkways and drainages have been shown to encourage activity, thus the development of street infrastructure and furniture this has dormant potential for enhancing street use. These findings agree with studies by Biddulp, 2012[15]; Boarnet, Forsyth, Day and Oakes, 2011[16] and Anticipated setbacks include hindrances from established top down planning systems which are not sensitive to the plight of end-users. This area forms fodder for further research.

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