An assessment of the impact of land use characteristics on residential choice making: Implication to urban transit planning in Port Harcourt, Nigeria.

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Abstract
In current practice, very few Metropolitan Planning Agencies attempt to capture the effects of transportation system changes on land use, and the consequent feedback effects on transportation system performance, despite substantial evidence that these effects may be significant. This has resulted in haphazard urban development characterized by lack of order in land use development and most importantly traffic bottlenecks. This informed the need for this research whose main objective is to assess the influence of individual land use types on household residential choice making and implication to urban transit planning. The study administered 3001 instruments to 15 study locations and land use survey was carried out using foot and automobile inspection and analysis of the 2005 updated auto photomap of Port Harcourt metropolis, using Arcview GIS. However, household residential choice making in the study area was statistically confirmed to be dependent on available transportation options, commercial, public/semi public and recreational land uses given a good income level. In terms of percentage land use allocations in the study area, residential land use (26.8%) and transportation (2.68%) accounts for the highest total area of the study area followed by open area undeveloped (20.80%) and mostly marshy environment. The occupation of 7.61% of Port Harcourt urban land area by transportation land use is mostly responsible for traffic congestion in the study area. Other land uses such as industrial (11.65%), rivers (12.25%), public and semi public (10.34%) and commercial (10.54%) where mapped in the study area. The study therefore recommended some counseling strategies for sustainable transportation and land use planning to include construction of fly-overs at major intersections such as Eleme, Artilery, Waterlines, Agip, Rumuokuta; maintenance of existing road networks; enlightenment of road users; and the application of geographic information system (GIS) for land development and land use planning.

1. Introduction

An urban area implies an area with diverse and spatially dispersed land uses. These land uses attract and generate movements to and away from them. Consequently, the more land uses an urban area has, the more diversified or greater: the destinations; modal trips; socio-economic activities; mobility conflicts vis-à-vis congestions. These movements will be constrained if the location of the land uses is not planned. Furthermore, the fact that available transportation facilities do not increase at the same rate as that of available traffic especially during the few hours of peak demand in the morning and afternoon hours of working days, further compounds the situation. This has been the situation in Nigeria's urban centres for years now and this has continued to assume crisis proportions because as cities grow in size and population, demand on the urban transport system increases. The resolution of this dilemma, the disequilibrium between demand and supply of urban transportation has always been a challenge to planners, policy makers and administrators (Okon, 2008).

Over the past decades, there has been growing interest in integrating transportation and land use planning, based on a recognition that land use not only influences transportation outcomes, but that transportation investments also influence land use decisions, potentially undermining the benefit of capacity expansion aimed at relieving urban congestion problems. This recognition of feedback between transportation and land use has led to calls for integrating land use and transportation models used in the metropolitan planning process. While there has been some progress in linking together aggregate transportation models with aggregate spatial-interaction or spatial –input-output models of land use, no disaggregate behavioural framework has yet been developed that explain land use and travel behaviour in an integrated way within the urban landscape especially in developing countries (Waddell, 2001).

To date, however, the framework for the understanding of the interdependence and interrelatedness of urban transportation and land use system especially in Nigeria and indeed Port Harcourt has not been complete enough to provide a robust behavioural foundation for model and policy development that incorporates housing and labour market behaviour with travel behaviour. Land use and transport according to Clark (1968) form a closed-loop system. The input of transportation improvements on urban development is perhaps one of the most important, and contested concern in metropolitan transportation planning today. On the one hand, it has long been known that transportation accessibility fundamentally influences firm location, household location, real estate development, land prices, and density (Von Thunen, 1826; Muth, 1969; Mills, 1967; Alonso, 1964). The practice of transportation planning, however, has until recently routinely ignored the effects of major transportation improvements on urban form, and the consequent indirect effects that such induced development can have on the efficacy of alternative transportation investment strategies. The theme of this paper therefore emerges in view of the half hazard nature of land use distribution and the attendant accessibility problems in Port Harcourt metropolis.

2. Scale of the problem

In most of the urban areas in Nigeria and particularly Port Harcourt metropolis, there seem to be agglomeration of most of the land uses such that rather than help reduce traffic congestion as would have been the case if they were spatially dispersed, these land uses worsen traffic situation due to their clustering in space. The simultaneous timing of the opening and closing of different land use activities (7.30/8.00am – 3.30/4.00pm) further worsens the already bad traffic situation in the study area. Similarly, the allocation of space to most of the land use types usually does not take into consideration the parking needs of the vehicular traffic destined for the land uses. For instance the location of Mile 1 Market along Ikwere Road; the Abali park at Aba Road, the Oilmill Market at Aba Road etc, with their high traffic generating capacity becomes major mobility constraint to road users. This is because traffic lanes are converted to both spaces for displaying wares and parking spaces for stationary vehicles thus reducing the capacity of the already limited road space for the ever-growing volume of traffic. At peak periods (every Wednesday) the problem posed by this shortening in transport planning in the study area is better imagined.

Another land use-related urban transportation problem in Port Harcourt is the uncoordinated locations of functionally related land uses, example, the clustering of hotel facilities in the residential land use of both GRA 1 and 11 such as Baracuda Bar and Restaurant (GRA 1), Eltees Eatery (GRA 1), Jevinik Restaurant and Bar (GRA 1) Figaro Restaurant and Bar (GRA 1), Traces (GRA 1), Salui/Indian Restaurant (GRA 11), Toby Jug Restaurant and Bar (GRA 11) etc, generate not just traffic in an what used to be serene residential environment but also to a very great extent influences the habits of people around such areas especially teenagers. In other words residential quarters have been infiltrated by administrative, commercial and industrial establishments, health clinic in administrative, industrial and residential areas, etc (Okon, 2008).

Port Harcourt city like most Nigerian cities is growing at a very fast rate both in population and spatial dimensions with increasing demand for transport series. Unfortunately, her urban roads are grossly inadequate to meet up these mobility needs of the dwellers, the available ones are often poorly designed and maintained. Also, they are very narrow, and lack basic complimentary road facilities. This is added to the indiscipline of road users and poor traffic management. Many of the road inter-sections have no traffic lights and in most cases not manned by any traffic officer(s), just like there is haphazard land use in the city. The end result of these as expected is un-imagined movement difficulty especially during peak hours. Port Harcourt experiences serious traffic congestion such that trips are not only delayed but also some parts of the city are grossly inaccessible. The magnitude of the problem is such that it takes upward of three hours or more to move from Eleme junction to Abali Park, an ordinary 5km journey (Okon, 2004).

3. The study area.

Port Harcourt metropolis comprising of Port Harcourt City and Obia Akpor Local Government Areas, is located in the Niger Delta and bounded to the north by Ikwere, Etche and Omuma; east by Oyigbo, Tai, and Eleme, Part of which are in the metropolis; west by Emuoha; and south by Okrika and Degema Local Government Areas (figure 1.1). The city however lies approximately between longitude 6^0 55^I and $7^0 55^I$ E and latitude $4^0 35^I$ and $5^0 10^I$N of the equator and on an elevation of 1.00 – 3.00m above sea level. The city area is 664sqkm with metropolitan area of 934sqkm and is linked to the outside world by land, sea and air.

The rapid growth and urbanization of the city of Port Harcourt has been fueled by the massive influx of people from the surrounding hinterland to the city for job opportunities in various industries that sprang up as a result of the discovery of petroleum in the Niger Delta. Results of the 2006 population census put the metropolitan population at 1,255,387 and projected at 1,337,800 in 2009 (National Population Commission, 2006).

In Port Harcourt metropolis there are a variety of transport networks. These include highways of different categories, railways and waterways (Seaport and jetties) and airports. For example, interstate highways serving Port Harcourt include:

(a) **East-West Road:** West-wards, this road leads to Yenagoa and Kaiama in Bayelsa State and Patani, Ughelli, Warri, Effurum in Delta State. East-wards, it leads to Eleme, Bori and Onne in Rivers State and Ikot Abasi in Akwa Ibom State. The road is one of the Trans-West African routes that run West-East through the country from Badagry, on the western boundary of Nigeria, to Ikot Abasi on the eastern boundary.

(b) **Port Harcourt-Aba Expressway:** Popularly called Aba road, links Aba and Umuahia in Abia State, and Enugu in Enugu state. It also access Uyo, Akwa Ibom State and Calabar in Cross River State. This is part of one of the Trans-Saharan routes running south north.

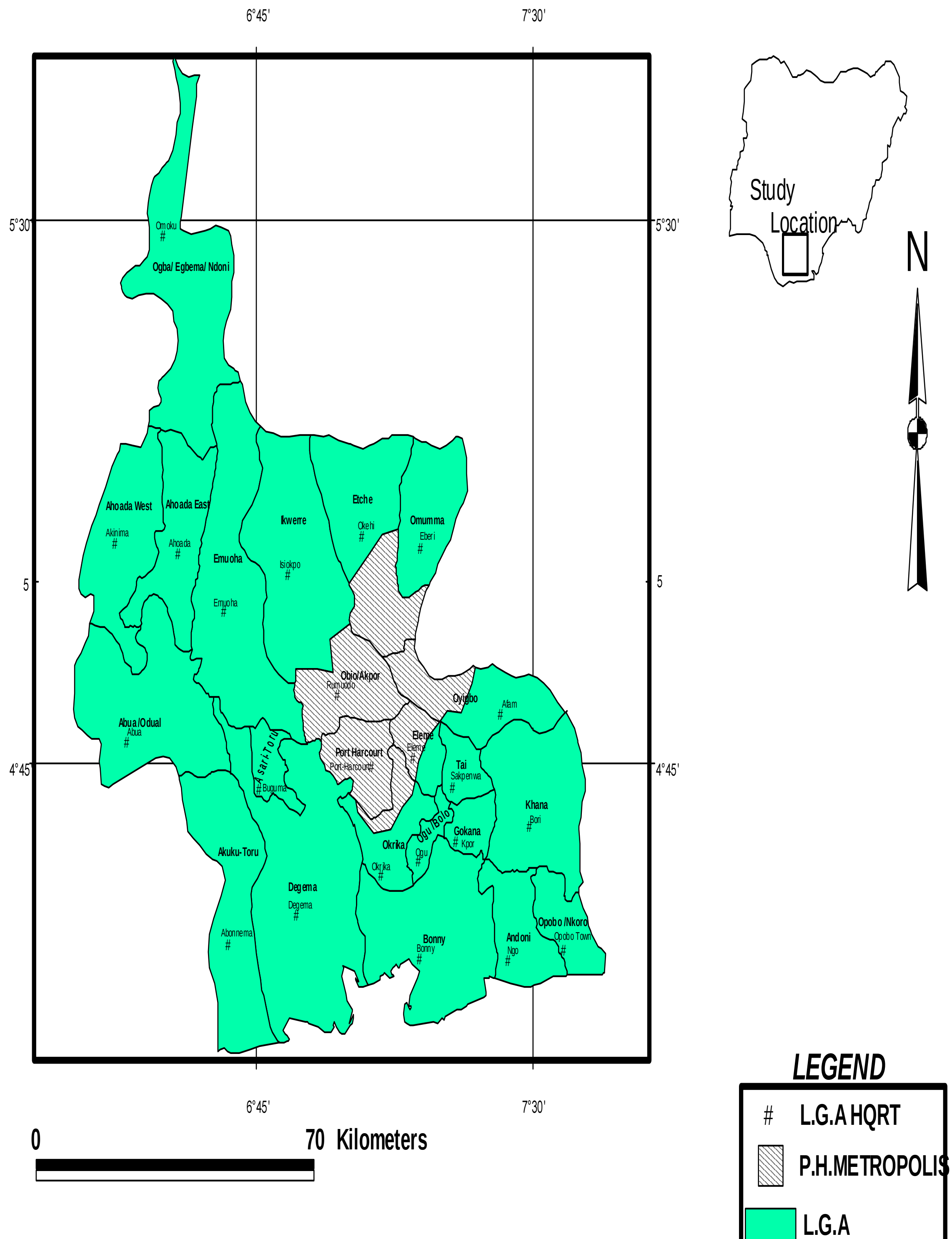

FIG.1.1:Rivers State Showing Port Harcourt Metropolis

(c) **Ikwere Road:** Otherwise referred to as Port Harcourt-Owerri Road, is one of the four roads in Nigeria that run south-north. North leads to Owerri in Imo State: Onitsha in Anambra State; and Enugu in Enugu State, from where the road accesses the northern part of the country. From Onitsha the road links Asaba and Agbor in Delta State and Benin in Edo State where it joins the Trans-west African routes running east west. However, many other intra-state routes exist in the study area that facilitates accessibility.

(d) **Olu Obasanjo Way:** This is the most recent and newly constructed dual carriage way linking Port Harcourt metropolis to other important land uses especially the Port Harcourt international airport in the Western axis of the metropolis.

4. The data and analysis

A household residential and transportation choice questionnaire was administered to residents of fifteen 15 study locations based on; distinctive land use pattern; historical background of the settlement; population size of the area; socio-economic relevance to the city; geographical location in terms of local government; and the emergence of settlement subject to peculiar land uses. Basically, three thousand and one copies of questionnaires were administered based on the population of individual settlement. In other words, $1/100^{th}$ questionnaires were administered in the study. The study employed the systematic sampling technique which involved selecting at regular intervals. This involves administering questionnaire to the first household head in every fifth (5^{th}) house in both sides of the chosen street. The questionnaire was carefully and technically designed to include information on household characteristics of respondents, socio-economy, household residential choice, household available transportation options, household ownership of transportation means, trip generation and distribution pattern/capacity, as well as influence of land use on individual household choice of residence. Multiple regression analysis technique was used in the analysis of data.

Because of the enormous size of the study area, the land use survey was accomplished both on foot and by automobile, i.e. “individual inspection”. In places where automobile was used, at least two persons were required: one to drive and the other to observe and record the observations for scattered development and residential areas, with good network of roads such as

Rumuopirikom, Diobu, Bori-Camp, Woji, Elellenwo, GRA, Trans-Amadi, etc windshield inspection proved very useful and quite satisfactory, whereas in areas of Mixed land use such as Mile 1, Garrison, D-line, Marine base, Waterlines, and particularly in the central business districts of Abali Park, Rumukoro, Rumuola, etc, the survey was successfully carried out on foot. The updated map of Port Harcourt metropolis was acquired from Ministry of works. This provided the framework upon which reconnaissance survey of the study area was based. The researcher further obtained the aerial photograph (auto photomap) of Port Harcourt from Akom Surveys Ltd updated in 2005.

5. Results and discussions

5.1 Statement of hypothesis

H_0 Household residential choice making in metropolitan Port Harcourt is not significantly dependent on available transportation options, commercial, public/semi public and recreational land uses.

H_1 Household residential choice making in metropolitan Port Harcourt is significantly dependent on available transportation options, commercial, public/semi public and recreational land uses.

Independent variables include: X_1 = Transportation; X_2 = Commercial; X_3 = Public/semi-public; and X_4 = Recreational, while the dependent variable is Y = Household residence

Table 1a (appendix) shows the simple correlation matrix for data obtained through carefully administered "land use, transportation and residential choice questionnaire" in the study area. This simple correlation matrix in Table 1b reveals a 0.755 or 75.5% contributory effect of all independent variables on residential choice making. Individual correlation for independent variables is shown below. Different regression equations are used to examine the relationship that exists in both the dependent variable and individual independent variables such as in Equations (i-iv). For the purpose of this section, the above equations are revised thus:

$$Y = a + bx_1 \quad (v)$$
$$y = a + bx_2 \quad (vi)$$
$$y = a + bx_3 \quad (vii)$$
$$y = a + bx_4 \quad (viii)$$
$$y = a + b_1 x_1 + b_2 x_2 \quad (ix)$$
$$y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 \quad (x)$$

$$y = a + b_1 x_1 + b_2 x_2 + b_3 x b_3 + b_4 x_4 + e \qquad \text{(xi)}$$

These seven regression equations above (Equations (v) – (xi) were fitted to the data on land use, transportation and residential choice questionnaire logically coded and analyzed through SPSS.

Inspection of Equation (v) indicates that the R^2 magnitude is close to 1.000, the sign and magnitude of the regression coefficient (+ 0.656) are satisfactory and the t value is significant at the 0.05 percent level of significance; there are 2889-2 = 2887 degrees of freedom associated with the estimated b and the t distribution magnitude at 0.05 percent is 13.0 The calculated significance of 0.00 is less than the test significance (0.05), therefore we accept that correlation is significant. Equation (vi) shows the use of commercial land use instead of transportation options. The sign and magnitude of regression coefficient (+ 0.443) is also satisfactory and the t value significant at the 0.05 percent level of significance. There is also 2889-2 = 2887 degrees of freedom associated with the estimated b and the t distribution magnitude at 0.05 percent is 35.4. The calculated significance of 0.00 is less than the test significance (0.05), therefore we accept that the correlation is significant.

The use of public/semi-public land uses show a positive sign and high magnitude of regression coefficient (+ 0.468) in Equation (vii) as satisfactory and the t value significant at the 0.05 percent level of significance. There is 2889-2 = 2887 degrees of freedom associated with the estimated b and the t distribution magnitude at 0.05 percent is 37.3. The calculated significance of 0.00 is less than the test significance (0.05); therefore we accept that the correlation is significant.

In Equation (viii), the use of recreational land use reveal a positive sign (+ 0.207) of regression coefficient as equally satisfactory though not as highly consistent as other previous land uses in Equations (v-vii) and the t value significant at the 0.05 percent level of significance. There is also 1889-2 = 2887 degrees of freedom associated with the estimated b and the t distribution magnitude at 1 percent is 38.8. The calculated significance of 0.00 is less than the test significance (0.05); therefore we accept that the correlation is significant.

Equation (ix) which incorporates two independent variables, transportation and commercial land uses, is a slightly better equation statically than Equation (v). The standard error of the estimate is smaller for Equation (iii) and both of the partial-regression coefficients are statistically significant (t = 3.99 for 2886 degrees of freedom at the 0.05 percent level of significance). The constant term (1.439) is closer to zero comparatively to Equation (v) (4.461), indicating that there would be less overestimation of residential choice making from individual land uses.

Equation (x) which incorporates three independent variables; transportation, commercial and public/semi-public land uses, is therefore a better equation statistically than equations (v-ix). The standard error of the estimate (0.097) is smaller for Equation J and for the previous five Equations, and both of the partial-regression coefficients are statistically significant (t = - 3. 968 for 2885 degrees of freedom at the 0.05 percent level of significant). The constant term (- 1.411) less than zero and comparatively to other Equations (v,vi,vii,viii and ix): (4.461, 11.643, 11.585, 15.575, and 1.439 respectively) indicating that there would be less overestimation of residential choice making from other land uses (transportation, commercial, and public/semi-public).

It is important to review as well the characteristics of Equation (xi). The R^2 magnitude for this equation is the highest of the six equations tested and present attributes which make a more reliable predictive equation for residential choice making. The standard error of the estimate is 4.098, lower than Equations (v-x), and both of the partial-regression coefficients are statistically significant (t = - 4.367 for 2884 degrees of freedom at the 0.05 level of significance). The constant term (-1.730) less than zero and comparatively to all other previous equations) indicating that there would be less overestimation of residential choice making from other land uses (transportation, commercial, public/semi-public and recreational land uses). Also literarily speaking, this equation more adequately accommodates independent variables (land uses) than any other and has a combination effect on residential choice making. Therefore, given the extent of choice making, other individual land uses can be statistically estimated from this Equation (xi).

5.2 Land use trend in Port Harcourt metropolis

While the growing population (human and automotive) accounts for a major portion of the expected doubling in Port Harcourt urban land use, the tendency of increased use per unit, such as larger residential lot size or reduced coverage on industrial parcels, also contributes to the urban land explosion. Counterbalancing the trend toward decreased densities are the growing acceptance of planned unit development (clusters of housing types providing for more effective use of communal space) and the continuing organization of related activities into effective commercial, industrial, medical, cultural, and governmental complexes.

An analytical study of Port Harcourt land use trend has shown that land use densities are declining for population and manufacturing employment, and that commercial employment densities appear to be holding constant. And aerial view of Port Harcourt urban land space at various scales revealed over crowdedness resulting from an overwhelming concentration of vehicles and other commercial activities in the city’s CBD (Abali Park). This has however caused a growing discontentment among residents by such intrusive urban scene, a dominant feature of urban centers in most developing countries (Okon, 2008). Such overcrowding in vehicles and other commercial activities has great implication to intra-city mobility and environmental quality in terms of noise, pollution, security, aesthetics, etc., to urban livability. For instance, statistical summary of land use in the study area in Table 2 revealed a total land area of 41,740.338 (ha) or 103, 290, 885 (ac). Percentage distribution of urban land area of individual land uses further revealed a dominant 12, 185.330 (ha) for residential land use constituting 29.19% of the total urban land area. This corroborates earlier results of rapid

Table 2: Statistical summary of land use in Port Harcourt metropolis

S/N	**Land use**	**Frequency**	**Percentage**
1	Residential	12,185.330	29.19
2	Industrial	4,863.220	11.65
3	Transportation (roads)	3,177.464	7.61
4	Business (commercial)	4,398.401	10.54
5	Public/semi public	4,315.674	10.34
6	Open area (undeveloped)	8,685.028	20.81
7	Rivers	5,115.221	12.25
	Total	41,740.338	100

Source: Author’s field work analysis based on aerial photograph of Port Harcourt (2005)

urbanization in the study area occasioned by petroleum oil related activities with its population pull ability (Okon, 2004). Such desire for residential accommodation had led to the proliferation of housing especially in terms of its quality and distribution resulting to various levels of development violations. It is a common (however ugly sight) to see land use conversions of all kinds in the study area e.g. a family compound can have some or all of its rooms having access to the road converted to shops; residential houses converted to churches, etc. This have very serious implication to urban development in terms of land use, which can further be explained by the transitional nature of the once Slave Port to a contemporary urban centre with such great potentials like oil prospecting activities.

Moreover, industrial land use accounts for 4,863.220 (ha), i.e. about 11.65% of urban land area while business or commercial land use constitutes 10.54% representing 4, 398.401 (ha) of the entire Port Harcourt metropolis. Also, public/semi-public land use is observed to have accounted for 10.34% or 4,315.674 (ha) of urban land area in the study area. The indiscriminate distribution of these land uses has very serious implication to intra-city mobility. This is because there are high traffic generators, and are mostly responsible for the unimaginable traffic congestion in the metropolis. The location of these land uses have no consideration for parking spaces (knowing that vehicles are not constantly on the move), number of customers expected per day and at what time, the compatibility of the land use with others around and most importantly the accessibility to this land use in terms of the nature of road – circular roads, local and collector streets, arterials, freeways, etc.

These problems area even made worse by the limited network of roads existing in the study area as revealed in the table. For example 377.4640 (ha) or 7.61% of Port Harcourt entire urban space comprises of transportation land use including roads and rail. This and only 8,685.028 (ha) or 20.81% of Port Harcourt open area (undeveloped and mostly swamp) is grossly inadequate for sustainable land use and transportation planning and at variance with Metropolitan Dade County Planning Advisory Board, and the Metropolitan Dade County Planning Department (1961) findings in Miami, USA : residential (34.8%), commercial (3.5%), tourist (0.6%), industry (2.0%), institutional (3.1%), parks and recreational (3.8%), transportation (24.6%), agriculture (2.2%), undeveloped (23.5%) and water (1.9%) in a total urban land area of 127,381 acres ; Gubernick et al (1978) in Thomasville, North Carolina, USA where residential land use accounts for 24.36%, 2.75% for public/semi-public land use, 7.54% for highway, streets and railroad, 2.68 for commercial and 62.94% for vacant land; and many others where transport as the life-wire of any urban centre is seen to account for more percentage of urban land space than any other land use. Findings in these studies therefore revealed the inadequacy in urban transport infrastructure in the study area and/or available land space for its future development, which can be explained by lack of effective urban land use planning regulations/legislation. Therefore, it is expected that the problem of intra-city transportation in Port Harcourt may not have an end in sight yet, more so that population (resulting from birth and immigration) is increasing in geometric progression while the provision of new access routes may hardly at best be said to be increasing in arithmetic progression. However, such findings above require that conscious effort be made towards the provision of roads as well as the adoption of the zoning instrument to ensure order and best use for best land (Rattclif, 1949). Examination of changes in the proportion of major types of land in urban use indicates that vacant land in the reporting cities is rapidly disappearing. Consequently, the conclusion is drawn that "unless large amount of vacant land exists inside the city limits, the average large city appears to have nearly reached its upper limit of population and employment in manufacturing and commerce". The implications of these findings for enforcing coordinated land use planning are clear.

By and large, 8,685.028 (ha) representing 20.81% of open undeveloped area and 5,115.221 or 12.25% for rivers or water bodies which can be harnessed for effective intra-city transport in the study area provides hope, that much can still be achieved by adopting zoning to plan for future land use in the remaining undeveloped areas of the metropolis. The rail system can also provide sustainable remedy to this traffic problem.

6. Conclusion

This study was concerned with the core rationale for the development of physical forms-including new urbanist neighbourhoods, transit villages, job-housing balance, and smart growth that seek to provide an alternative to low-density, automobile-oriented neighbourhoods and communities. Much of the research and policy debate currently surrounding these physical and policy directions centre on the potential impact their provision may or may not have on travel behavior. Under this formulation, scientific evidence establishing the connection between alternative forms of urbanization and reduced automobile use is the rationale for policies that would be supportive of such alternatives. Underlying such a framework is an implicit worldview that current auto-dependent development patterns are the product of individual preferences revealing themselves through markets, and that development of alternatives rest on planning's regulatory intervention into market processes. But the process of neighbourhood development is hardly an unfettered market, as is evidenced by the rich literature on exclusionary zoning of most countries e.g. the USA. Individual communities frequently employ their regulatory powers in order to limit certain types of land uses, notably housing that are likely to be occupied by people of lower socioeconomic status than current community residents.

Parking spaces should be accorded priority in any city's master plans. Land use planning has remained a veritable force in managing contemporary land use problems. The overriding aim of land use decree includes monopoly on lands, discourage speculation, and discourage national integration through equitable distribution and the likes. Application of GIS and surveying in urban transportation modelling efforts should be encouraged for sustainable land use and transport integration.

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APPENDIX

TABLE 1a
Correlations

		Resident	Transport
Pearson Correlation	Resident	1.000	.656
	Transport		1.000
Sig. (1-tailed)	Resident	.	.000
	Transport	.000	.
N	Resident	2889	2889
	Transport	2889	2889

TABLE 1b
Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.656[a]	.430	.430	4.71094	.430	2181.267	1	2887	.000

a. Predictors: (Constant), Transport

TABLE 1c
ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	48408.762	1	48408.762	2181.267	.000[a]
	Residual	64071.076	2887	22.193		
	Total	112479.84	2888			

a. Predictors: (Constant), Transport
b. Dependent Variable: Resident

TABLE 1d
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.461	.343		13.018	.000		
	Transport	.483	.010	.656	46.704	.000	1.000	1.000

a. Dependent Variable: Resident

TABLE 2a
Correlations

		RESIDENT	TRANSPORT
Pearson Correlation	Resident	1.000	.443
	Commerce		1.000
Sig. (1-tailed)	Resident	.	.000
	Commerce	.000	.
N	Resident	2889	2889
	Commerce	2889	2889

TABLE 2b
Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df2	df1	Sig. F Change
1	.443[a]	.196	.196	5.59648	.196	704.238	1	2887	.000

b. Predictors: (Constant), Commerce

TABLE 2c
ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	48408.762	1	22057.178	704.238	.000[a]
	Residual	64071.076	2887	31.321		
	Total	112479.84	2888			

a. Predictors: (Constant), Commerce
b. Dependent Variable: Resident

TABLE 2d
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	11.643	.329		35.359	.000		
	COMMER	.619	.023	.443	26.537	.000	1.000	1.000

a. Dependent Variable: Resident

TABLE 3a
Correlations

		Resident	Transport
Pearson Correlation	Resident	1.000	.468
	Public/semi public		1.000
Sig. (1-tailed)	Resident	.	.000
	Public/semi public	.000	.
N	Resident	2889	2889
	Public/semi public	2889	2889

TABLE 3b
Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df2	df1	Sig. F Change
1	.468[a]	.219	.219	5.51494	.219	811.227	1	2887	.000

c. Predictors: (Constant), Commerce

TABLE 3c
ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	24673.082	1	24673.082	811.227	.000[a]
	Residual	87806.756	2887	30.415		
	Total	112479.84	2888			

a. Predictors: (Constant), Public/semi public
b. Dependent Variable: Resident

TABLE 3d
Coefficients[a]

Model	Unstandardized	Standardized			Collinearity Statistics

	Coefficients		Coefficients	t	Sig.		
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant) Public/semi public	11.585 .533	.311 .019	 .468	37.308 28.482	.000 .000	 1.000	 1.000

b. Dependent Variable: Resident

TABLE 4a
Correlations

		Resident	Recreation
Pearson Correlation	Resident Recreation	1.000	.207 1.000
Sig. (1-tailed)	Resident Recreation	. .000	.000 .
N	Resident Recreation	2884 2884	2884 2884

TABLE 4b
Model summary

Model	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change
1	.043	128.726	1	2882	.000

a. Predictors: (Constant), Recreation

TABLE 4c
ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression Residual Total	4807.335 107629.43 112436.77	1 2882 2883	4807.335 37.345	128.727	.000[a]

c. Predictors: (Constant), Recreation
d. Dependent Variable: Resident

TABLE 4d

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.575	.401		38.843	.000
	Recreation	.588	.052	.207	11.346	.000

a. Dependent Variable: Resident

TABLE 5a
Correlations

		Resident	Transport	Commerce
Pearson Correlation	Resident	1.000	.656	.443
	Transport		1.000	.310
	Commerce			1.000
Sig. (1-tailed)	Resident	.	.000	.000
	Transport	.000	.	.000
	Commerce	.000	.000	.
N	Resident	2889	2889	2889
	Transport	2889	2889	2889
	Commerce	2889	2889	2889

TABLE 5b
Model summary

Model	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change
1	.494	1407.595	2	2886	.000

b. Predictors: (Constant), Commerce, Transport

TABLE 5c

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	55541.398	2	27770.699	1407.595	.000[a]
	Residual	56938.440	2886	19.729		
	Total	112479.84	2888			

a. Predictors: (Constant), Commerce, Transport
b. Dependent Variable: Resident

TABLE 5d
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.439	.360		3.998	.000
	Transport	.422	.010	.574	41.197	.000
	Commerce	.370	.019	.265	19.014	.000

TABLE 6a
Correlations

		Resident	Transport	Commerce	Public/semi public
		1.000	.656	.443	.468
			1.000	.310	.247
				1.000	.224
					1.000
Sig. (1-tailed)	Resident	.	.000	.000	.000
	Transport	.000	.	.000	.000
	Commerce	.000	.000	.	.000
	Public/semi public				.
N	Resident	2889	2889	2889	2889
	Transport	2889	2889	2889	2889
	Commerce	2889	2889	2889	2889
	Public/semi public	2889	2889	2889	2889

TABLE 6b

Model summary

Model	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change
1	.569	1271.222	3	2885	.000

a. Predictors: (Constant), Transport, Commerce, Public/semi public.

TABLE 6c
ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	64036.704	3	21345.568	1271.222	.000[a]
	Residual	48443.134	2885	16.791		
	Total	112479.84	2888			

c. Predictors: (Constant), Transport, Commerce, Public/semi public
d. Dependent Variable: Resident

TABLE 6d
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.411	.356		-3.968	.000
	Transport	.382	.010	.519	39.689	.000
	Commerce	.296	.018	.212	16.184	.000
	Pub/semi pub	.328	.015	.288	22.493	.000

		Resident	Transport	Commerce	Public/semi public	Recreation
Pearson Correlation	Resident	1.000	656	.444	.469	.207
	Transport		1.000	.311	.248	.139
	Commerce			1.000	.247	.227
	Public/semi public				1.000	.230
	Recreation					1.000
Sig. (1-tailed)	Resident	.	.000	.000	.000	.000
	Transport	.000	.	.000	.000	.000
	Commerce	.000	.000	.	.000	.000
	Public/semi public	.000	.000	.000	.	.000
	Recreation	.000	.000	.000	.000	.
N	Resident	2889	2889	2889	2889	2889
	Transport	2889	2889	2889	2889	2889

	Commerce	2889	2889	2889	2889	2889
	Public/semi	2889	2889	2889	2889	2889
public		2889	2889	2889	2889	2889
	Recreation					

TABLE 7a
Correlations

TABLE 7b
Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.755[a]	.570	.570	4.09787	.570	956.695	4	2884	.000

a. Predictors: (Constant), , Transport, , Commerce, Public/semi public, Recreation

TABLE 7c
ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	64261.279	4	16065.320	956.695	.000[a]
	Residual	48429.617	2884	16.793		
	Total	112690.90	2888			

a. Predictors: (Constant), Transport, , Commerce, Public/semi public, Recreation
b. Dependent Variable: Resident

TABLE 7d
Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
						Tolerance	VIF
	B	Std. Error	Beta				
1. (Constant)	-1.730	.396		-4.367	.000		
Transport	.381	.010	.518	39.589	.000	.871	1.149
Commerce	.290	.018	.208	15.672	.000	.849	1.178
Public/semi public	.324	.015	.284	21.842	.000	.879	1.138
Recreation	6.428E-02	.36	.23	1771	.077	.915	1.093