EVALUATING THE IMPACT OF URBAN ROAD TRANSPORTATION ON LAND USE PATTERNS IN GBAGADA LAGOS STATE

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ABSTRACT

This study investigates the relationship between urban road transportation and land use patterns in Gbagada Lagos state. Using a mixed-methods approach combining Geographic Information System (GIS) analysis, survey questionnaires, and regression modeling, this research examines how road network density, traffic volume, and transportation modes influence

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land use changes. The findings reveal significant correlations between road proximity, land value, and urban sprawl. Specifically, areas with high road density exhibit increased commercial and residential development, while areas with limited accessibility experience decreased land value and reduced development. Policy recommendations include optimizing transportation infrastructure, promoting mixed-use development, and implementing smart growth strategies to mitigate urban sprawl and enhance sustainable land use. In particular, certain transportation planning decisions tend to increase sprawl (dispersed, urban fringe, automobile-dependent development), while others support smart growth (more compact, infill, multimodal development). These development patterns have various economic, social, and environmental impacts. This report describes specific methods for evaluating these impacts in transport planning.

Keywords: Urban Road Transportation, Land Use Patterns, GIS Analysis, Urban Planning, Sustainable Development.

Introduction

Transportation is important to Towns and cities' physical and economic development worldwide. Property and land values tend to increase in areas with expanding transportation networks and gradually increase in areas without such improvements. Rapid and continuous rises in housing and land prices are expected in cities with transportation improvements and rapid economic and population growth. Man, nations, regions, and the world would be severely limited in development without transportation, which is key factors for physical and economic growth (Oyesiku, 2002).

Transportation systems and land use are interdependent. According to Bailey, and Little, (2008), the transportation route is part of a distinct development pattern or road network and is mostly described by regular street patterns as an indispensable factor of human existence, development, and civilization. The route network coupled with increased transport investment results in changed levels of accessibility reflected through cost-benefit analysis, savings in travel, time, and other benefits. Access to major roads provides relative advantages consequents upon which commercial users located to enjoy the advantages.

Modern businesses, industries, trades, and general activities depend on transport and transportation infrastructure, with the movement of goods and services from place to place becoming a vital and inseparable aspect of global and economic survival. Developments of various transportation modes have been pivotal to physical and economic development. Such modes include human partner age, railways, inland waterways, sea, air, and road.

The urban transportation problem remains one of the most nagging problems in urban transportation today. All over the world, attempts have been made to tackle these challenges, particularly in Gbagada, a city in Lagos state, yet the situation seems to worsen. Cities are centers of economic, social, cultural, and intellectual activities. these activities result in the drift of population from areas to urban centers and these congregations have caused cities to expand without control in many areas, causing congestion, and environmental and social challenges.

In Nigeria, a major cause of traffic problems is that City structure predicts the advent of the automobile. The structure pattern of the road, especially in the traditional area of the city, and the unplanned growth and haphazard land use distribution, impose a serious constraint on movements and facilities provided

(Oduoju, 1981). There is therefore the need for an understanding of an urban road Transportation Network classification and hierarchy are dominant considerations in the design of road networks. (Marshall 2005) accessibility and complementary theory played a key role in putting accessibility into operational form which sub-divided the concept into relative and integral. (Ingram 1971 and, Good all 1977). In a uni-modal city,

the central business district is not the point of maximum accessibility where business revenue is at maximum and cost (other land costs are minimized (Alonso 1964). This paper proposes a road network growth model considering population distribution and central business district (CBD) attraction. This study focuses on developing the understanding of terms theories, ideas analytical skills, surrounding land use, and transportation planning. Land use affects the environment, interacts with one another, and depends on transportation infrastructure investment.

The relationship between urban road transportation and land use patterns has been a subject of interest among urban planners, researchers, and policymakers (Banister, 2008; Handy, 2005). The rapid growth

of urban centers, particularly in developing countries like Nigeria, has increased pressure on transportation infrastructure, resulting in congestion, pollution, and inefficient land use (Adeleye, 2012; Salomon, 2010).

Gbagada, a densely populated suburb in Lagos State, Nigeria, exemplifies these challenges. Its strategic location along the Lagos-Ikorodu Expressway has spurred commercial and residential development, putting pressure on the road network (Lagos State Government, 2019). This study aims to evaluate the impact of urban road transportation on land use patterns in Gbagada, examining the effects of road network density, traffic volume, and transportation modes on land use changes.

Urban road transportation plays a critical role in shaping land use patterns and influencing the location of residential, commercial, and industrial activities (Levinson, 2008; Rodriguez, 2017). Research has shown that proximity to roads and transportation hubs can increase land value, promote economic growth, and enhance accessibility (Hansen, 1959; Vickerman, 2007). However, inadequate transportation planning can lead to urban sprawl, congestion, and environmental degradation (Newman, 1996; Ewing, 2016)

The preferences of individuals, institutions, and firms have an imprint on land use in terms of their locational choice. The representation of this imprint requires a typology of land use, which can be formal or functional: (Dr. Jean-Paul Rodrigue 2018)

Formal land use. Representations are concerned with qualitative attributes of space such as its form, pattern, and aspect, and are descriptive.

Functional land use. Representations concerned with the economic nature of activities such as production, consumption, residence, and transport, are mainly a socioeconomic description of space.

Transportation planning decisions influence land use directly by affecting the amount of land used for transport facilities and indirectly by affecting the location and design of development. For example, expanding urban highways increases pavement area and encourages more dispersed, automobileoriented development (sprawl), while walking, cycling, and public transit improvements encourage compact, infill development (smart growth).
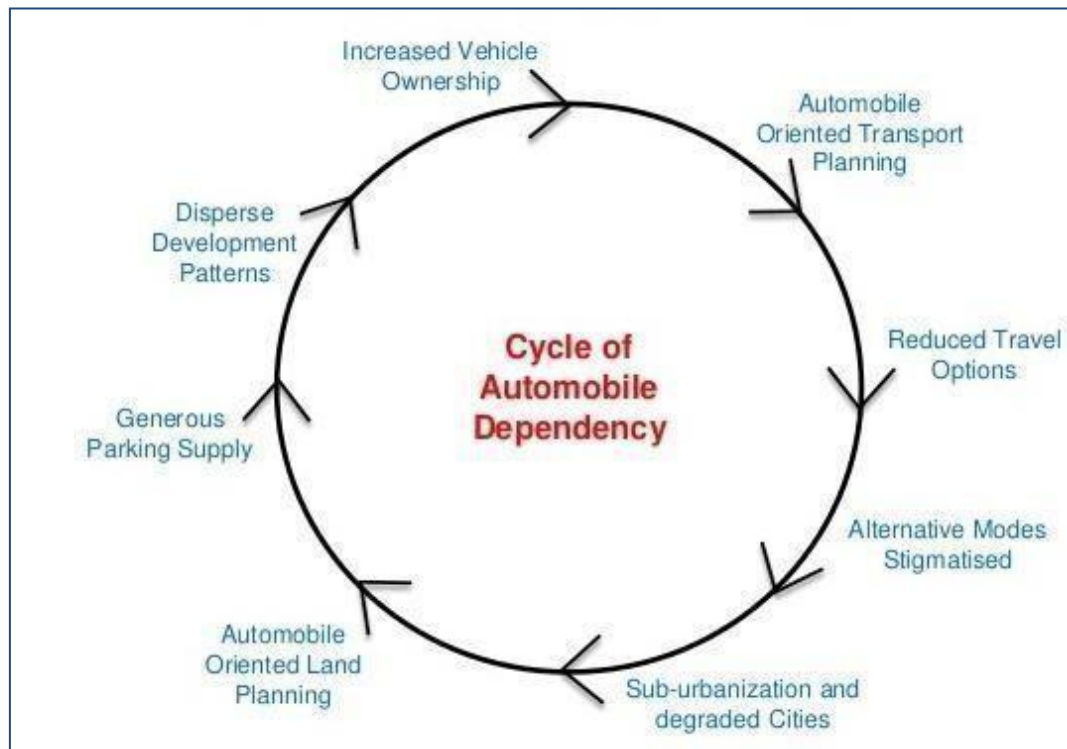
Figure 1
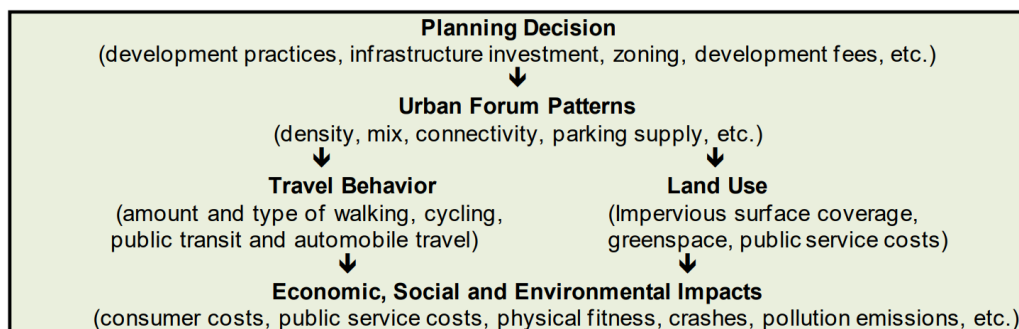
There may be several steps between a transport planning decision, its impacts on urban form and travel behavior, and its ultimate economic, social, and environmental impacts. Todd Litman (2021)

Historical Context

During the last century, many transportation and land use planning practices reinforced a cycle of increased automobile dependency and sprawl, as illustrated in Figure 1. This was generally unintended, reflecting a lack of consideration of the full impacts of these decisions. For example, when deciding how much parking to require for a particular type of land use, traffic engineers were probably not thinking about the additional sprawl that would result from a more generous standard, they simply wanted to ensure motorist convenience. Similarly, planning decisions that

affect roadway supply, transit service quality or roadway user fees often overlook various land use impacts.

Figure 2 Cycle of Automobile Dependency and Sprawl

This figure illustrates the self-reinforcing cycle of increased automobile dependency and sprawl.

Smart growth can provide various economic, social, and environmental benefits. As a result, many professional organizations, jurisdictions, and government agencies have adopted smart growth planning objectives, as summarized in the box on the next page. Todd Alexander Litman (2023)

Evaluation Framework

An evaluation framework specifies the basic structure of an analysis, including which impacts are considered and how they are measured and compared (Litman, 2001). A framework usually identifies:

- Evaluation method, such as cost-effectiveness, benefit-cost, lifecycle cost analysis, etc.
- Evaluation criteria are the factors and impacts considered in a particular analysis. Table 2 lists various land use impact evaluation criteria.
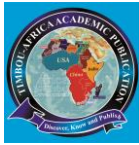
Table 1: Land Use Impact Evaluation Criteria

Economic	Social	Environmental
Value of land devoted to		
transportation facilities. Land use accessibility. Transportation costs. Property values. Crash damages. Costs to provide public services. Economic development and productivity. Stormwater management costs.	Relative accessibility for different groups of people – impacts on equity and opportunity. Community cohesion. Housing affordability. Cultural resources (e.g., heritage buildings). Traffic accidents. Public health (physical fitness). Aesthetic impacts.	Greenspace and wildlife habitat. Hydrologic impacts. Heat island effects. Energy consumption. Pollution emissions.

This table lists various types of land use impacts that may be affected by transport planning decisions. These impacts are described in more detail in this report.

- Modeling techniques, which predict how a policy change or program will affect travel behavior and land use patterns, and measure the incremental benefits and costs that result.
- A Base Case (also called do nothing), the conditions that would occur without the proposed policy or program.
- Reference units include costs per lane mile, vehicle mile, passenger mile, incremental peakperiod trip, etc.
- Base year and discount rate, indicating how costs are adjusted to reflect the time value of money.
- Perspective and scope, such as the geographic range of impacts to consider.
- Dealing with uncertainty, such as sensitivity analysis and statistical tests. • How results are presented so that the results of different evaluations are easy to compare.

Impacts are evaluated using a with-and-without test, which reflects the conditions that would occur with or without a particular policy or project. For example, the impacts of a roadway widening are the incremental changes that would occur if the project is implemented.

The study finds various parameters affecting the land use and transport relation during the literature. Some of the relevant indicators to the study area are taken for research in Gbagada to examine how land use factors such as density, regional accessibility, and mix and roadway connectivity affect travel behavior, including per capita vehicle travel, mode split, and non-motorized travel. This information helps evaluate the ability of Smart Growth, new urbanism, and access management land-use policies to achieve planning objectives such as consumer savings, energy conservation, and emission reductions.

After selecting the indicators, a content analysis was conducted by adopting the issue-based framework to investigate the standard land-use and transport integration literature approaches. Considering the two main themes of transport and the built environment. Prajakta Soner and Jashi (2022) These themes are separated into categories according to the general content of the studies reviewed as follows: (1) Transport (accessibility, mobility); (2) Built environment (density, diversity, design, Land use,) the contents of these indicators are analyzed and five indicator sub-categories formed according to their characteristics.

Table 2: The distribution of 13 indicators is provided in Table 1

Theme	Sub Categories	Indicators	Measure
Transport	Accessibility	Access to public transport (PT) stops	Average walking distance to the closest PT stop within 800 m
	Mobility	Number of car trips	The average number of car trips per household
		Commuting distance	Average distance traveled for work by all modes
		Street connectivity	Internal connectivity

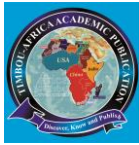|	Design and layout	Traffic calming	The ratio of road segments with traffic calming measures to overall network
		Pedestrian friendliness	The ratio of road segments with pathways to the overall network
		Open space availability	Average open space area per household
		traffic congestion	Average level of service (LOS)
		Land area occupied roadways	The land area dedicated to roads per capita
Built Environment	Density	Population density	The number of residents per hectare
	Diversity	Land-use mix	Entropy of land-use mixing
		Tourist Spots	

METHODS

In examining and assessing the urban transportation problem along the Gbagada Express Lagos, a reconnaissance survey was carried out. Both primary and secondary data were used in sourcing information for the study. A number of factors were assessed using a simple random sampling technique in selecting samples for the study.

Two sets of questionnaires were designed to gather data for the study. The first set of questionnaires was designed to obtain the personal data of respondents, particularly households within the premises of the study area. The second questionnaire was designed to obtain on socio-economic and physical characteristics of respondents from households, motorists, transport taskmasters, and the Ministry of Transport within the Gbagada Lagos State metropolis.

Table 3 Rate of Traffic Congestion in Gbagada

Roads/ Streets	Very High	Low	Indecisive	High Total	Very High	Total
GBAGADA EXPRESS	12	6	-	6	3	27
ADEBAYO	1	6	-	3	-	10
ADEOLA ADEKU	4	2	-	3	-	9
ADELABU	1	4	-	1	4	10
ANTHONY	-	2	1	6	1	10
AJAYI AINA	5	5	-	8	-	18
DIYA	1	4	-	3	-	8
OLATUJI INNER WAY	-	4	-	4	-	8

ILUPEJU BYPASS	6	3	-	1	-	4
OYINKAN ABAYOMI DRIVE	3	2	2	1	-	5
GBAGADA ESTATES	-	3	1	2	-	6
IFAKO	1	4	-	-	-	5
TOTAL	34	45	4	38	8	119

The table above illustrates that Gbagada Express Road had a very high traffic situation at a frequency rate of 12. This is followed by Ajayi Aina Road, Adeola Adeku Street. Diya Street had a traffic situation that was at a rate of 5.4%, which is followed by Soyinka Abayomi Drive. Gbagada Estate Road had a traffic situation at a rate of 5.4%, followed by Anthony, ifako, Ilupeju Bypass, and Adebayo Street, all had a low traffic situation respectively.

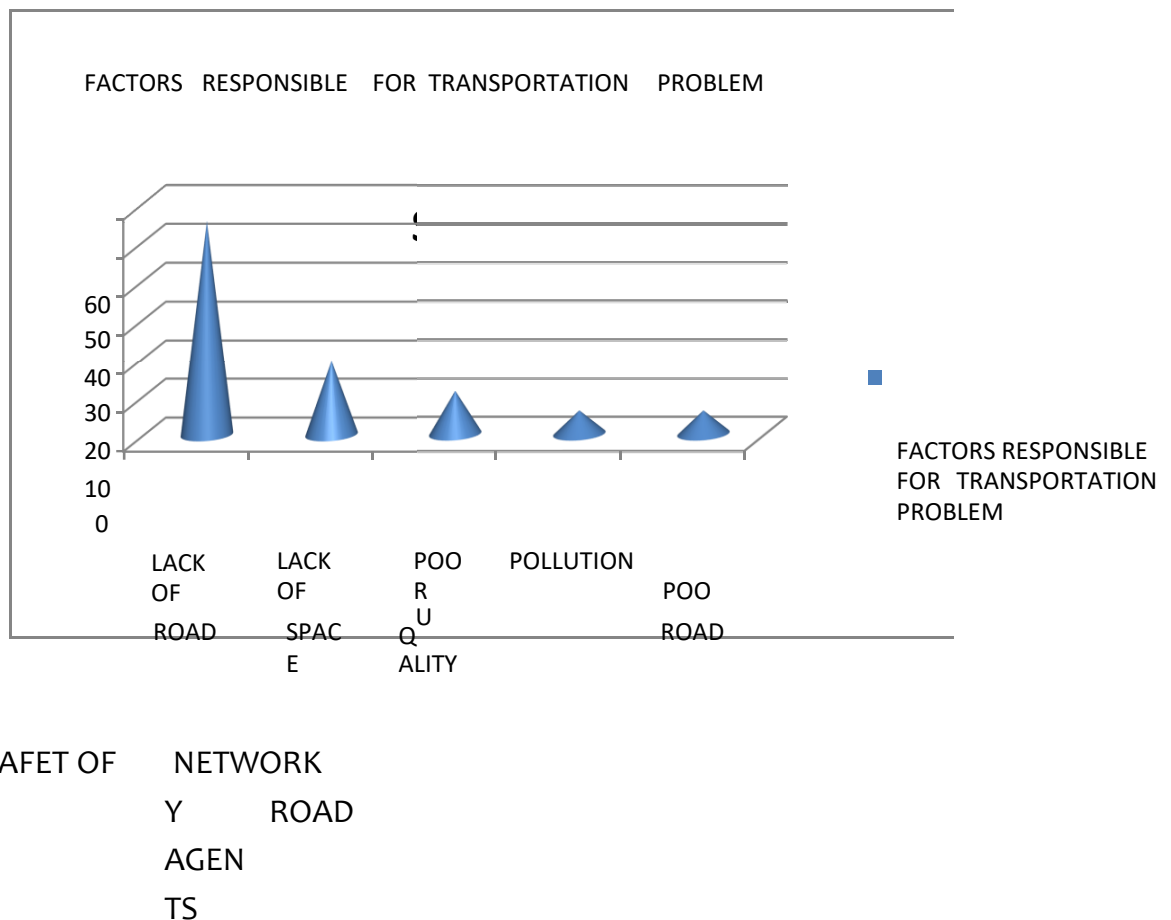Figure 3: factors responsible for transportation problem

FACTORS RESPONSIBLE FOR TRANSPORTATION PROBLEM

Table 4 Impact of Economic Activities in the Area

Response	Positive	Negative	No impact	Frequency	Percentage
Competition	9	3	2	14	12.5
Transport cost	8	4	4	16	14.3
Traffic congestion	6	9	2	17	15.2
Location	11	3	-	14	12.5
Demand	2	3	6	11	9.8
Accessibility	13	3	1	17	15.2
Intensity of land use	14	6	3	23	20.5
TOTAL	**63**	**31**	**18**	**112**	**100**

Table 2 shows that the impact of the intensity of land use had a greater positive economic effect with a 20.5% response against demand with a 9.8% impact Traffic congestion had a 15. 2%mpact cost of transportation had a 14.3% positive impact, while 12.5% of the respondents agreed that completion positively impacted economic activities in the area.

The figure below shows that 72% of the respondents agreed that their business would have performed better if they had been located outside the present premises, while 28% disagreed.

Result

The study revealed that urbanization has been one of the dominant contemporary processes as a growing share of the global population lives in cities, thereby resulting in urban transportation issues which affect economic growth as revealed in the literature review.

Also, it was discovered that the problems of road transportation in Gbagada road range from lack of road safety agents with 55% response, to lack of space and intensity of land use among others. The research revealed that

road quality is an attribute of the transportation system. The condition of the road within the study area varies from one location to another. However, the effect of a good road transportation network on the immediate neighborhood

Strongly exerts economic development as 22 representing 19.6% strongly agreed. Although, the result showed a non-significant direct effect of the quality of road as a factor that influences choice of location, 72% of respondent strongly agreed that their business would have performed better if they had located off the present premises. It was discovered that the intensity of the use of land had a greater positive economic effect in the area (20.5% as against the demand for space. The study revealed that the rate of traffic congestion on Gbagada Road largely depends on the length, and type of activity on the premises and areas, as UST Road recorded very high traffic conditions followed by Azikiwe Road. It was discovered that locations along arterial roads and nodal points, positively affect commercial activities in the areas as 61% of the respondents strongly affirmed.

CONCLUSION

This paper examines the nature, type, and cause of urban transportation problems in Nigerian cities and has made suggestions to reduce the problem that remains recurrent in many of our urban centers, efforts should be adopting best practices acknowledged to be effective elsewhere to tackle the transportation process in Nigerian cities.

The study revealed that there has not been a comprehensive transportation study for many urban centers in Nigeria. Thus, the volume of traffic along many of the urban routes of our cities is not known.

Associated with the traffic congestion are problems with parking. Accidentfrequently occurs on roads in Nigeria's urban centers.

The environment is the most prone to motor traffic accidents because 75%oftraffic accidents take place in built-up areas of cities due to the underlying factors of undue concentration of vehicles in Urban centers

Access to a good road network and transportation infrastructure not only enhance the economic development of the country but will facilitate the efficient delivery of goods and agricultural produce to market, it will reduce

traveling time and transportation costs and minimize accidents and human deaths in Nigeria roads.

The implementation of social change in this study can include providing scholars with a better understanding of the influence of good road infrastructure investment on economic development, especially in a struggling economy such as Nigeria. This study can potentially contribute to providing social change by suggesting improvement in the road network, which can subsequently lead to an improved standard of living and, a decrease in travel time and cost of transportation.

Transportation influences the amount of land available for development and the spatial distribution of economic activities which in turn has an impact on land prices, housing affordability, health and well- being of people, production, and economic performance. By reducing the amount of space required to transport people, quicker journey time and production activities are hampered.

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