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The Nexus between city livability and transportation in Lagos Metropolis, Nigeria

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***Abstract* — The livability of cities has been a matter of global concern in recent times. Importantly, the ease of mobility and accessibility in cities remained paramount factors in enhancing residents' locational decisions and suitability. It is on this basis that this study examined the nexus between city livability and transportation in the Lagos Metropolis, Nigeria. Anchored on the concept of livability, the study descriptively and inferentially analyzed the results of 1264 questionnaires administered to residents based on key livability themes. The study revealed low satisfaction with the livability key performance indicators. Similarly, the study revealed that most of the assessed transportation infrastructure facilities are in poor condition and thus hinder the ease of commuting and livability in the city. The result of the regression analysis revealed that transportation infrastructure statistically influenced the livability of the Lagos metropolis. The study recommends the need for expedited proactive measures, particularly structural improvement in transportation infrastructure, towards improving the livability of the Lagos Metropolis.**

***Index Terms* — City livability, Transportation, Livability Indicators, Lagos Metropolis**

I. INTRODUCTION

Cities continue to be magnetic elements, attracting various categories of people, investments, and activities across nations and continents. With this, cities that provide enabling infrastructure for commerce and industrial development, health, housing, and recreation continue to witness an influx of investments and people from diverse directions who are seeking greener pastures and more comfortable living. Notably, the movement and spatial interaction of urban residents are no doubt, crucial to the effective functioning of the city (Fasina, Akanmu, Salisu & Okunubi, 2020). Also, a city as a very complex entity usually requires an efficient transportation infrastructure to make its various components of living, working, and industry function and interact seamlessly (Adesanya, 2011; Adeboyejo, 2021). It is in this regard that cities in both the developed and developing worlds are striving towards providing a series of critical services to support ease of living and livelihood.

Meanwhile, UN-Habitat (2012) noted that transportation infrastructure not only promotes the competitiveness of local businesses, improves civic participation, employment, and labor productivity, but also enhances the investment climate in the city by contributing meaningfully to its attractiveness and livability. Further to this is the fact that the ultimate motive of both the global Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) is to enhance the livability of human settlements through the adequate provision of urban infrastructure in numerous dimensions (UN, 2015; UN, 2017). This results in the clamor for livable cities globally, which Jiriko (2014) describes as those cities that are maximally conducive for living, mobility, accessibility, working, recreating, and being eco-friendly, in addition to the possession of all the attributes of felicity. In this context, a livable city is a safe, secure, and affordable community with appropriate transportation options and housing, aside from offering supportive community features and services.

Interestingly, cities in developed countries such as Melbourne, Vancouver, Vienna, London, and Amsterdam, among others, are making progress in city livability in terms of transportation infrastructure and mobility options, as evidenced by their outstanding performance in global mobility and livability rankings. Unfortunately, many African cities are lagging behind in the global livability ranking, with adverse implications for their residents, activities, investments, and visitors. Most importantly, it is disheartening to note that the Lagos Metropolis, which accounts for over 35% of Nigeria's Gross Domestic Products (GDP) with an estimated growth rate of 6%, is ranked among the least livable cities in the same category as Damascus, Port Moresby, Dhaka, and Algiers (Economist Intelligence Unit, 2021). The consistent inflow of people and unguided commercial activities in Lagos have occasioned several perceived challenges that affect the performance of the existing transportation infrastructure in meeting the daily mobility and accessibility needs of residents (Salisu et al., 2021). Specifically, the poor performance of transportation infrastructure has led to the experience of commuting difficulty and longer travel time on many major Lagos roads such as Ojota-Mile 12 road, Apapa-Oshodi expressway, Third Mainland Bridge, Ogba Road, Ikosi-Ketu road, Carter Bridge, Eko Bridge, Murtala Mohammed Way, Herbert Macaulay Way, Ojuelegba-Mushin, Agege Motor Road, Lagos-Abeokuta roads, and the dilapidated situations of other inner transportation facilities including pedestrian walkways and crossings, local streets,

bus sheds, etc. in the Lagos Metropolis have questioned the extent of its livability. Based on the foregoing, this study appraised the residents' perception of the nexus between city livability and transportation in the Lagos Metropolis towards evolving mechanisms to improve its subsequent rating in the comity of global cities. To achieve this study aim, the following research questions guided the study: What are the socio-economic and travel characteristics of the residents of the Lagos Metropolis? What are the perceived livability key indicators that enhance the livability of the Lagos Metropolis? Is there any relationship between city livability and transportation? And how much of a statistical influence does transportation infrastructure have on the livability of the Lagos Metropolis? In other words, this study is novel in that it not only establishes residents' concerns about the extent to which transportation infrastructure affects their livability in terms of needs achievement, but it also establishes the key livability indicators that require urgent attention from stakeholders, particularly the government, in order to improve Lagos Metropolis' ranking among global cities. Hence, the findings of this study contribute to the frontier of knowledge by adding to the literature on transportation and city livability.

II. CONCEPTUAL UNDERPINING AND LITERATURE REVIEW

A. Livability Concept

The concept of livability has become a general workable framework towards improving the livelihood and ease of working, especially in cities and large urban centers in recent times. This concept was viewed by Harrison et al. (2010) and Kaal (2011) to have different nomenclature that includes "sustainability", "functionality", "walkability", "standard of living," "quality of life," and "general well-being of a population." The concept, therefore, emerged in different languages for describing and planning better places to live. By implication, livability is an assessment of what a place is like to live in using criteria that include environmental quality, crime and safety, education and health provision, accessibility, and mobility, among others.

The concept of a livable city, according to Amare (2014), can be traced to the ancient Greeks, who promoted the ideology of fairness and justice, and was advanced in the early 19th century with the idea of "Garden Cities of Tomorrow" that was propounded and published in 1902 by Ebenezer Howard. In the view of Gossop (2006), the idea of garden cities was a reaction to the environmental and social legacy that accompanied the industrial revolution in Europe, most especially in London, which resulted in a century of industrialization, rapid growth, and unhealthy housing conditions.

The promotion of the concept extended to the United States of America in the early 1900s when New York City and other population centers dealt with industrial growth, pollution, and ill health in densely populated areas by successfully passing zoning laws to make the city more livable for their residents (Adejare, Akanmu & Ogunsesan, 2016). Livability was then defined as the ability of residents to live but not die from congestion, smog, tuberculosis, and other infections. However, Kaal (2011) states that the concept reappeared in the 1950s as a powerful linguistic tool in Vancouver, while Abad and Farahnaki (2017) observe that the concept was subsequently presented under the title of "livable streets" by Donald Appleyard in 1981 and, as such, brought livability to planners and urban designers concerning streetscapes and transportation. Livability is, therefore, a central concept for urban planning and is often used as a ranking tool that draws on diverse indicators such as public safety, social relations, maintenance of the streets, open spaces, and proximity to job opportunities to evaluate neighborhoods and cities. Considering the importance of the concept, many global organizations now make use of it for the assessment of the competitiveness of cities and other human settlements for various purposes. Hence, livability is now a concept that is widely applied by city administrators, development partners, international organizations, and investors to facilitate ease of livelihood and governance, while investors and residents equally use it to make decisions regarding the location of investments and residency.

B. Brief Review of Literature

Human settlements have been experiencing unprecedented urbanisation in all dimensions in recent times, leading to the rapid expansion of city boarders and functions with a correspondingly increasing number and volumes of people and freight that need to be moved across spatial nodes and links. As a result, the extensive and sporadic urbanisation, population explosion, and ageing transportation infrastructure are adversely affecting city mobility and performance. Yannis and Chaziris (2021) opined that transportation systems have faced ever-increasing challenges in recent times as a result of increasing urbanisation and the increasing demand for mobility and accessibility in the midst of inadequate and over-stressed infrastructure. However, the study of Zubala (2022) also established that transportation infrastructure development does not influence the components of the environment and city revitalization. Further to this, Akbari, Moayedfar and Khondabi (2018) observed that the increasing growth of urbanization has brought about numerous urban problems such as housing, urban transportation, environmental shortages and related pollution that

plague the cities and, ultimately, affect all aspects of urbanization, with the logical relations of urban life distorted and the overall livability reduced.

According to Ahmed, El-Halafawy and Amin (2019), livability has emerged as a holistic and systemic strategy to reverse some of the 20th century urban planning techniques and also provide a means to the fulfilment of human needs and wants, as well as differentiate between human needs and luxuries in relation to the Maslow hierarchy of human needs. Accordingly, livability describes the conditions and required characteristics of neighborhoods where residents live relatively free from intrusions with a sense of belonging, including the shift in development patterns from the decline of urban centers to rapidly growing suburban areas. As a behavior-related function of the interaction between environmental and personal characteristics, livability is a suitability for human living; thus, the degree of suitability is determined by community-specific values, ease of mobility and accessibility, and local connectivity and structure in relation to dominant economic, social, and cultural activities and backgrounds. Thus, the personal feelings or the desires of the residents of a particular place and the quality of available transportation facilities are what govern the degree of livability (Salisu et al., 2021; Gbadamosi, Omole, and Akanmu, 2021).

Kashef (2016) notes that livability is concerned with creative design processes that utilize elements of urban legibility (path, node, landmark, edge, and district) to enhance the aesthetics and physical characteristics of buildings, streets, and development blocks. Akanmu, Gbadamosi, and Omole (2021) opined that the transport infrastructural facilities captured under road, rail, water, air, and pipeline play pivotal roles in achieving city livability as cities throughout the world rely mainly on these transportation modal operations for efficient mobility and accessibility functions required in meeting daily human needs. Therefore, a high level of public services in housing, transportation, education, and health care is essential for livability in urban centres (Holzner & Römisch, 2021). In this context, livability becomes a multidimensional issue with professional connotation. Thus, Cramer-Greenbaum (2021) explained it as involving land use, environmental protection, enhanced mobility and accessibility, public health, and economic well-being; livability in transportation is about integrating the quality, location, and type of transportation facilities. Hence, livability is a set of flexible principles to guide transportation decision-making, including access, choice, and quality of life. Consequentially, fostering livability in transportation results in improved quality of life, creates a more efficient and accessible transportation network, promotes active lifestyles, and serves the mobility needs of all categories of users (Gbadamosi, et al., 2021; Akanmu, et al., 2021). Furthermore, livable cities emerged during the 1980s in connection with growing environmental concerns and the increasing competition among world cities to attract foreign investments and boost their economies (Kashef, 2016; Fasina et al., 2020). As a result, numerous indices and measurement tools have been developed over the last three decades to rank cities according to the amenities and opportunities afforded to their residents and visitors (Cramer-Greenbaum, 2021; Holzner & Römisch, 2021; Gbadamosi, et al., 2021). These include safety and security, crime, climate, transportation, infrastructure, healthcare, public policies and services, business environment, cost of living, recreational amenities, education, housing, gross domestic product (GDP) per capita, sanitation, culture, air quality, and natural capital have been incorporated into quantitative models to compare and rank these cities (Akanmu, n.d; Akanmu et al., 2021). In addition, qualitative aspects like lifestyle, well-being, happiness, tolerance, and environmental aesthetics have also been compiled to benchmark urban livability on a global scale (Akanmu, n.d).

In other words, the number of transportation options in a community is related to increased levels of livability regardless of the actual frequency of cycling and walking (Federman, 2018; Fasina et al., 2020). By incorporating livability principles into transportation plans and programs, the United Nations (2017) states that communities can maximize the efficiency of existing transportation investments while providing better access within and between activity centers. However, Harrison et al. (2010) argue that livability is a system that works as well for walking, wheeling, or taking transit in most communities. As such, it is a measure of the objective quality of life that can be referred to as suitable for human living, whether that be the quality of life, the standard of living, or the general well-being of a population in the city. Hence, the quality of life is seen in both objective terms using per capita gross domestic product and in a subjective term using self-reported life satisfaction perceptions. In this regard, the concept of livability addresses the objective conditions of infrastructure and is important for businesses and city governments because such livable cities attract good workers and businesses since business activity is the key to city development. This study, however, sees transportation infrastructure as a pivot for a livable city as all organs, activities, functions, and structures of the city have to be connected and sustained by it for cities to be functional, livable, and sustainable. In this regard, Adejare et al. (2016) opine that the concept of livability should transcend the provision and upgrade of infrastructure as well as economic and social nomenclatures, which are mostly used by scholars and researchers through socio-economic and infrastructural parameters.

In the opinion of Little (2018), livability refers to the subset of sustainability objectives that directly affect community members and, by this, addresses the combination of human needs and subjective well-being with the opportunities in the built environment, reflecting the importance of the interaction between the built environment and the subjective aspect. Therefore, livability is important for businesses and city governments because livable cities attract good workers and businesses, since business activity is the key to city development as there are numerous yardsticks that have been

used in measuring cities (Akanmu, n.d). Accordingly, Timmer and Seymaar (2004) note that livability includes an array of different issues that are underpinned by a common set of guiding principles such as accessibility, equity, empowerment, and participation that give substance to the concept of livability. Therefore, the quality of life experienced by residents and visitors in a city is tied to their ability to access transportation infrastructure and other routine and non-routine engagements. Undoubtedly, the transportation system has been a major influence on the changing lifestyle and its various dimensions across socio-economic, cultural, and psychological parameters that are now driving the change in livability at an increased pace.

Based on the foregoing, livability refers to an urban system that contributes to the physical, social, and mental well-being as well as the personal development of all its inhabitants and visitors, with easy mobility through transportation options. Therefore, a livable city is a city for all people that is not only attractive but worthwhile and safe for people of different ages and socio-economic characteristics. Therefore, livability is the sum of the factors such as built and natural environments, economic prosperity, social stability and equity, educational opportunity, and cultural, entertainment, and recreational opportunities that add up to a community's quality of life. Therefore, livability is anchored on the extent and nature of cordial man-environment interactions and relations.

III. Material and Methods

A. The study Area (Lagos Metropolis, Nigeria)

The study area is the Lagos metropolis, which is located in the southwestern part of Nigeria, comprising an area of 3,577 square kilometers. Lagos is bounded in the north and east by Ogun State, in the west by the Republic of Benin, and in the south by the Atlantic Ocean, and stretches for about 180 kilometers along the coast of the Atlantic Ocean. Lagos is loosely classified into two main geographical areas: the "island" and the "Mainland" due to its water bodies, in which the "island" is a loose geographical term used to define the area of Lagos that is separated from the sprawl of the mainland by the channel draining the lagoon into the Atlantic Ocean that forms Lagos harbor (Badejo, 2009; George, 2015), while the "Mainland" consists of many other Local Government Areas that sum up Lagos.

All modes of transportation and transportation facilities are available in the Lagos metropolitan area. However, the road, more than any other modern means of transportation, has the widest and largest network, linking up different areas of the city. Some of the prominent roads include the Ikorodu Road, Western Avenue, Marina, Third Mainland Bridge, and the Apapa-Oworonsoki express road, etc. The distinctive and functional characteristics of the transportation situation in Lagos are given by Adediran (2015), who opines that Lagos has about 1.2 million registered vehicles and an estimated 224 vehicles per kilometer of road space. According to Iyiola (2004), estimates of urban transportation demand in metropolitan Lagos in 1990 ranged from 7–10 million passenger trips per day, with road transport accounting for more than 95 percent of the total. The remaining 5% is split between rail and ferry transportation, both of which are on the decline.

B. Methodology

The study focuses on the residents of Lagos metropolis, who constitute the bulk of commuters and passengers. However, Lagos Metropolitan Local Government Areas had a population result of 7,937,932 people in 2006 (FGN, 2007), which is projected to be 12,849,132 in 2020 at a 3.5% growth rate. The sample size consists of 0.0001% of the total population of residents of Lagos Metropolis, which translates to 1,284 respondents who were selected from the study population, representing 0.0001% of the projected population. This is justified given the recommendation of Bruton (1985), who stated that when the population under study is below 5,000 and over 1 million, the sample size should be set at between 10% and 1% (or less).

The data collected was subjected to descriptive and inferential analysis. Descriptively, the analysis includes the use of frequency tables and weighted sums to support the interpretation of organized and summarized data. The mean weighted values involved the rating of responses on the predefined scale in which the significance of each factor as well as their corresponding weighted values were ranked on a scale with varying gradations using 5 points on Likert's scale of measurement for data in ordinal form. Also, the extent of the influence of transportation infrastructure on the residents' perception of the livability of Lagos Metropolis was tested through Analysis of Variance in the Regression Model.

IV. Results and Discussion

A. Socioeconomic Characteristics of Residents

This section discusses the results of analyzed data on the city's livability and transportation in Lagos metropolis, with emphasis on the main livability indicators. First, the overall results of the data analysis on the socio-economic attributes of sampled respondents in the study area (See Table I). First and foremost, Lagos metropolis is spatially delineated into six districts for this study, and respondents are made to associate with the closest spatial delineation to their area of residence. In this regard, it is observed that slightly more than one-tenth (10.3%) are within the residential zone/estate, while more than one-third (30.8%) are not living in the residential estate but within other residential neighborhoods.

However, slightly more than one-quarter (26.3%) reside in the zone of transition beyond the city perimeter, while only 5.0% reside in the Central Business District of Lagos Metropolis. In the same way, more than one-tenth (14.6%) of Lagos's population resides in the urban fringe or suburbs of the city, while the remaining 13.1% reside in settlements outside Lagos. This result shows that commuters in the Lagos metropolis reside in various residential areas and districts within and outside the spatial boundary of the metropolis, in particular, and Lagos State, in general, affirming the cosmopolitan nature of the metropolis with diverse areas of residents.

Residents administered with questionnaires are found to have been residing in the metropolis for varying periods. Accordingly, Table I reveals that slightly more than one-tenth (11.7%) have been residing in the metropolis for less than 5 years, while almost one-tenth (10.4%) have been living in the area between 5 and 10 years, and close to one-third (29.0%) are between 11 and 15 years. Also, more than one-quarter (27.8%) have been residing in the Lagos metropolis for between 16 and 20 years, while the remaining 21.1% have spent more than 20 years in Lagos. From this analysis, it can be deduced that a substantial part of the respondents are no strangers to Lagos metropolis, as the majority of them have spent more than 5 years living in the study area. Hence, they are familiar with happenings in the metropolis, including issues relating to the transportation system and the extent of their ease of access.

The gender classification shows that more than half (58.7%) are male, while the remaining 41.3% are female. This indicates that in a typical cosmopolitan city like Lagos, males are more frequently found in the act of mobility than female counterpart. Also, this finding is an attestation to the position of the 2006 National Population Census, which states that the male population is greater than their female counterparts in many Nigerian cities, including Lagos. Also, the analysis of data on marital status shows that the metropolis has fewer than one-third of respondents as single (28.3%), close to two-thirds (61.6%) are married, and the remaining one-tenth (10.0%) belong to other unclassified groups, including widows, widowers, and single parents. Based on this result, it can be deduced that a substantial number of respondents are married, with accompanying marital duties and responsibilities, demanding transportation infrastructure for the ease of their families' livelihoods.

In addition to the marital status of respondents in the study area, the analysis of their household size revealed that less than one-quarter have less than 2 people in the household (21.4%), while more than one-quarter (27.1%) have between 2 and 4 people in the household. Also, less than one-third (27.8%) have between 5 and 7 people in their household, while the remaining 23.7% have more than 7 people under the same dwelling roof. A cursory examination of these results shows a high rate of consistency in the results on marital status; hence, it can be deduced from this analysis that most of the respondents are not single but have one or more than one person living together under the same roof or room to cater for.

The age classification of respondents revealed that 2.0% is between 15 and 20 years, while more than one-tenth (14.1%) is between 21 and 30 years, and less than one-quarter (18.4%) is between 31 and 40 years. Also, slightly more than a quarter (27.9%) is between 41 and 50 years old, while less than one-quarter (19.6%) is between 51 and 60 years old, and the remaining 18.0% is more than 60 years old. Accordingly, the results of age classification revealed that a significant proportion of respondents are within the working age range in Lagos metropolis, as only 2.0% and 18.0% are at the school-going age and retirement age, respectively. Hence, they are bound to be mobile for varying socio-economic and cultural engagements that require mobility and transportation infrastructure to make a living in the metropolis.

The level of education of respondents varied and ranged from absence of formal education to a higher degree of education, showing that slightly more than one-tenth (11.5%) has no formal education, and almost one-tenth (10.7%) has an adult literacy education and 10.4% has a primary level of education. However, less than one-quarter (21.8%) have a secondary level of education, while almost one-third (31.2%) have a first degree or its equivalent level of education, and the remaining 14.3% have a higher degree level of education. From this analysis, it can be deduced that there is a high level of literacy and education among the respondents because only 11.5% have no formal education. This shows that respondents are not strangers to mobility and transportation infrastructure in the metropolis, and as such, their opinions could be treated as reliable. Moreover, the results of the analysis of the employment status of respondents revealed that only 5.7% are unemployed as at the time of the survey, while more than one-tenth (19.3%) are students or apprentices, and more than one-quarter (27.5%) are in personal or self-employment. Also, slightly less than one-quarter (20.0%) are in public service employment and 22.9% are in private service employment, while the remaining 4.4% are retirees. In this regard, the results established that the majority of respondents still engage in economic activities that require a change in spatial position over a particular distance; hence, they are involved in acts of mobility and accessibility towards earning livelihoods. This underscores the rationale for the usual transiting positions of residents in the Lagos metropolis.

The average monthly income of respondents' ranges from less than $30,000 to over $180,000, as shown in the results of data analysis presented in Table I. Only 5.8% earn less than the national minimum wage of $30,000 per month, while more than one-tenth (15.3%) earns between $30,000 and $90,000, and slightly less than one-tenth (9.7%) earns between $90,001 and $120,000 per month. Also, close to one-quarter (18.8%) earns between $120,000 and $150,000, while slightly more than one-third (32.7%) earns between $150,000 and $180,000 monthly, and the remaining 17.8% earns more than $180,000 on average every month. This is an attestation to the fact that a significant proportion of residents of Lagos make more than the national minimum wage of #30,000 on a monthly basis from

varying sources of economic engagement. The income range of respondents, in particular, and residents of Lagos metropolis is a reflection of the gross domestic product of the state, which is generally considered to be the highest among other states in the country.

It is interesting to note that the observed religious affiliation and practices of respondents in Lagos metropolis have no adverse influence on mobility and accessibility quest considering the results presented in Table I. In this regard, nearly half (46.4%) of respondents engage in and practice the Islamic religion, while slightly less than half equally practice Christianity. In addition, it is equally observed that those practicing traditional religion account for 9.1%, while the remaining 3.6% engage in other unclassified religions. With this, it can be deduced from the results of the analysis that there is an absence of religious dichotomy in access to transportation infrastructure and mobility options in the metropolis; hence, the existence of respondents practicing and engaging in varying religious practices and beliefs. This is typical of all cosmopolitan and global cities, in which Lagos is usually considered and assessed.

The respondents have different spatial locations where their workplaces are located in the metropolis, as shown in the results of the analyzed data, where 18.5% are within the residential zone and slightly less than one-quarter (24.1%) are in the adjoining neighborhood. Also, more than one-tenth (12.3%) have their workplaces located in the zone of transition, while slightly less than one-third (28.9%) have them in the Central Business District of Lagos. Also, slightly less than one-tenth have their workplace on the urban fringe, while the remaining 6.5% have unclassified locations as their workplace. Importantly, this analysis established the fact that Lagos remained the center of socio-economic excellence in the country because all areas and zones in Lagos are economically viable for various categories of socio-economic undertakings.

An investigation into the modal classification of vehicle ownership by respondents in Lagos metropolis revealed that more than half (58.0%) have no personal vehicle. Further to this is the fact that 1.4% have a bicycle, while those with a tricycle account for less than one-tenth (7.4%). In addition, almost one-tenth (11.6%) has a motorcycle, while more than one-tenth (15.3%) has a car, and the remaining 6.2% has a bus. Based on the results of this analysis, it can be deduced that large numbers of respondents are captive transit riders and, as such, mostly depend on the public transportation system for their various categories of intra-urban trips in the study area. Essentially, it is noticeable that ownership of bicycles as a crucial component of active transportation means least attests to the dwindling fortunes of this means of transportation in the city.

Table I: Socio-economic Characteristics of Respondents

Period of staying in the area			Period of staying in the area		
Spatial delineation	Frequency	Percentage	Range of Period	Frequency	Percentage
Within residential zone/estate	130	10.3	Less than 5 years	148	11.7
Within other residential neighborhoods	389	30.8	Between 5 and 10 years	132	10.4
Zone of transition	333	26.3	Between 11 and 15 years	367	29.0
City's CBD	63	5.0	Between 16 and 20 years	351	27.8
Urban fringe/Lagos suburbs	184	14.6	More than 20 years	266	21.0
Outside Lagos	165	13.1	Total	1264	100.0
Total	1264	100.0	Gender Classification		
Marital Status			Classification	Frequency	Percentage
Status	Frequency	Percentage	Male	742	58.7
Single	358	28.3	Female	522	41.3
Married	779	61.6	Total	1264	100.0
Others	127	10.0	Household Size		
Total	1264	100.0	Range	Frequency	Percentage
Age Classification			Less than 2 persons	270	21.4
Range of age	Frequency	Percentage	2-4 persons	343	27.1
Between 15 and 20 years	25	2.0	5-7 persons	352	27.8
Between 21 and 30 years	178	14.1	More than 7 persons	299	23.7
Between 31 and 40 years	232	18.4	Total	1264	100.0
Between 41 and 50 years	353	27.9	Level of Educational Attainment		
Between 51 and 60 years	248	19.6	Level	Frequency	Percentage
More than 60 years	228	18.0	No formal education	145	11.5
Total	1264	100.0	Adult literacy	135	10.7
Employment Status			Primary school	132	10.4

Nature of employment	Frequency	Percentage	Secondary school	276	21.8
Unemployed	74	5.9	First Degree/equivalent	395	31.2
Students	244	19.3	Higher degree	181	14.3
Personal/self-employment	247	27.5	Total	1264	100.0
Public service	253	20.0	Average Monthly Income		
Private employment	290	22.9	Range of income	Frequency	Percentage
Retiree	56	4,4	Less than #30,000	73	5.8
Total	1264	100.0	#30,000 - #90,000	193	15.3
Religion Affiliation			#90,001 - #120,000	122	9.7
Nature of religion	Frequency	Percentage	#120,001 - #150,000	238	18.8
Islamic	587	46.4	#150,001 - #180,000	413	32.7
Christianity	517	40.9	Above #180,000	227	17.8
Traditional	115	9.1	Total	1264	100.0
Others	45	3.6	Spatial Location of Work Places		
Total	1264	100.0	Spatial locations	Frequency	Percentage
Vehicle Ownership			Within residential zone	234	18.5
Classification	Frequency	Percentage	Adjoining neighborhood	305	24.1
None	733	58.0	Zone of transition	156	12.3
Bicycle	18	1.4	Lagos CBD	365	28.9
Tricycle	94	7.4	Urban fringe	122	9.7
Motorcycle	146	11.6	Others	0	0.0
Car	194	15.3	Total	1264	100.0
Bus	79	6.2			
Total	1264	100.0			

Source: Authors' Field survey, June 2021

B. Transportation and City Livability Indicators

The extent of performance of city livability indicators vis-à-vis mobility-related needs of respondents was assessed using ten (10) livability indicators that comprise Urban Utilities and Facilities, Urban Services, Land Use, housing, social security and safety, environment, ease of accessibility and mobility, resilience, gender equality and poverty, with eighty-one (81) sub-indicators were assessed on 5 points. Likert's scale, which has gradations, comprises Very Low (VL =1), Low (L =2), Fair (F =3), High (H =4), and Very High (VH =5). The index for each variable was arrived at by dividing the Summation of Weight Value (SWV) by the total number of responses accordingly. According to Fasina et al. (2020) and Salisu et al. (2022), the SWV for each of the variables was obtained through the addition of the product of the number of responses to each aspect and the respective weight value attached to each rating. This is expressed mathematically as thus:

$$\text{SWV} = \sum_{i=1}^{5} X_i Y_i$$

Where:

SWV = Summation of Weight Value,

X_i = number of respondents to rating i

$Y^i =$ the weight assigned a value (i= 1, 2, 3, 4, 5). Therefore, the higher the RMI, the higher the level of effectiveness for the variable under consideration is and this is expressed quantitatively as;

$$\text{RMI} = \frac{\text{SWV}}{\sum_{i=1}^{5} i = X_i} = \text{WM}$$

The details of the analysis are presented. However, it produces a weighted sum estimated to be 214.9996/81 = 2.5595 as a benchmark (Relative Index Mean) and a basis for comparisons of each Mean Index value (MIV) of the sub-indicators (see Table II). Concerning the sub-indicators of urban utilities and facilities, it is observed from the analysis that access to public elementary and secondary schools (4.2909) and access to public medical facilities (4.1171) are the most significant sub-indicators of city livability in the study area, with transportation infrastructure significantly influencing access to them. In addition, access to telecommunication facilities and services (3.2199), availability of visual interest (2.7816), connectivity, and connectedness of streets (2.5939) are also acknowledged by respondents among the sub-indicators of urban utilities and facilities having positive impacts on their livelihood in the city. In contrast, the results equally revealed the displeasure of respondents to sub-indicators that include access of pedestrians to sidewalk facilities (2.4494), sidewalk attraction to use (2.3343), emergency facilities and services (2.3456), access of pedestrians/commuters to first and last-mile travel (1.9369), walking permeability (1.6893), availability and adequate buffer zone facilities (1.6646).

The above results importantly acknowledged the necessity of transportation infrastructure for the efficient performance of city livability indicators as well as poor attention being accorded to other components of urban utilities and facilities, which are salient ingredients of city livability. For instance, pedestrians and pedestrianization-related attributes as well as their ancillary components, which are major ingredients for ensuring seamless commuting for pedestrians, are not adequately provided. Therefore, the results show the near absence of pedestrian aiding facilities, including handrails, protective guards, and elevated platforms, that are capable of guaranteeing the safe use of walkways in the highly motorized Lagos metropolis. Similarly, intermittent breaks or a lack of continuity in available sidewalk facilities appear to be an additional burden to pedestrians, while the results justify the need to make sidewalks and walkways appealing to use, and their design and construction should produce visual interest to attract users. However, there is a need to extend the focus on first and last-mile travel of respondents considering the poor rating of this component in intracity trip making. Also, the poor assessment of intermediate entry and exit, as well as the inadequacy (where exit) of a buffer zone for the sidewalk, required shifting attention to make them ensure ease of commuting and livelihood-city livability. Concerning urban services, it is observed from the results of the analysis that access to recreation and entertainment centers and services (3.8418), access to public parks (3.7152), access to shopping malls and supermarkets (3.6187), and access to public waste management facilities and services (3.2555) are the most significant sub-indicators being impacted by transportation infrastructure. However, the results of access to fire-fighting services and access to the public library (1.2634) showed poor attention and, possibly, their low attraction to respondents in their daily socio-economic engagements.

There are nine (9) sub-indicators of land use that were assessed by respondents in Lagos metropolis, of which only five (5) show a greater positive influence on the ease of commuting and livelihood by having a MIV that is significantly greater than the RIV. Specifically, neighborhood pattern (3.6788), attractor destination (3.6566), development of essential services (3.5799), availability and accessibility of deterrent land uses (3.4589) and urban infrastructure maintenance (2.7856) revealed and established highly intensive land uses that characterized Lagos metropolis and the existing transportation infrastructure, providing an expected link to facilitate both mobility and accessibility in the metropolis. However, the results of the remaining sub-indicators that comprise the establishment of social services (2.1820), development of greenery (1.7816), availability of open space uses (1.4976), and ease of accessibility to recreation activities (2.710) showed their low level of impact on transportation infrastructure in the study area. Accordingly, the results showed that residential districts are characterized by established neighborhood patterns, attractor destinations for grocery, restaurants, and retail outlets; availability of deterrent land uses such as schools, offices, and shopping centers; and the development of essential services, which include stores, warehouses, and shopping centers, among others, which are undoubtedly predominant attributes of land use in the Lagos metropolis. Invariably, the nature of land use and its intensity in the city are associated with peculiar industrial and commercial activities domiciled in Lagos.

Concerning housing, five (5) indicators were assessed, of which only three (3) have a mean index value that is conspicuously higher than the benchmark value. As a result, housing options/types (4.0744), housing development (3.9805), and housing densities (3.9225) show a positive influence on the ease of urban commuting and livelihood vis-à-vis the existing transportation infrastructure in Lagos metropolis. As a result, the existence of varying housing options by occupancy, materials, and methods of construction, design, and several floors is no doubt noticed in the study area. Also, housing development by the government (Federal Government of Nigeria and Lagos State Government) and private developers, as well as individuals, is a recurrent activity in Lagos to bridge housing demand and the housing needs of over 20 million residents of the state, in which metropolitan Lagos remains spatially prime for housing construction and development. In addition, there are varying housing densities for various income groups in Lagos, especially in the metropolitan area. There is a series of mixed-income housing in all housing densities in the Lagos metropolis, with the exception of the government reservation areas in Ikeja, Magodo, and a host of others, which are predominantly for high-income members of society. However, another housing density mix is usually found adjoining such GRAs in the country. Meanwhile, there is a slight variation in the MIV sub-indicators that include neighborhood beautification and aesthetics (2.1748), while the results of the analysis show housing affordability in Lagos metropolis is in serious doubt considering the MIV of 1.2880 estimated. Arising from this result, it can be deduced that respondents are usually under immense pressure on housing prices and housing rents, considering the lowest mean index value of this sub-indicator. Hence, housing affordability in the Lagos metropolis is a major issue of concern considering transportation infrastructure and the ease of livelihood of respondents in the study area. This unequivocally denotes the existence of housing stress, which is a minus to the livability status and ranking of the city.

The importance of social security and safety to residents, respondents, communities, and commuters in intra-urban trips is enormous as they would want to reach their destinations safely and with their possessions secured. Based on the foregoing, respondents assessed eleven (11) sub-indicators of social security and safety concerning transportation infrastructure, ease of commuting, and livelihood. However, only six (6) of the sub-indicators assessed have a MIV exceeding the benchmark. As a result, the development of street security facilities, including the installations of Closed Circuit Television (CCTV) (3.6733), social protection (3.5385), the development of risky/crime hotspots (3.3244), enforcement of pedestrian safety regulations (3.0680), development of traffic safety measures (3.2603), and availability of street lighting (3.0680) have a mean index value that is slightly more than the benchmark. However, these values still showed the need for intensified efforts to boost and improve safety and security in the Lagos metropolis while at the

same time attesting to the positive attention that security and safety are receiving from appropriate authorities not only in the metropolis but across the state. In addition, the results of other sub-indicators, which comprise adequate traffic calming (2.4438), presence of street furniture for seating and bollards (1.4367), presence of shade and rain cover (1.2793), crime-free street (1.7073), and funding and resources devoted to pedestrian planning (1.5831) show their poor contribution to ease of commuting and livelihood in the study area. While the result shows the existence of first aid and emergency services (accident and rescue) as acknowledged by respondents, the performance of other sub-indications portrays the high degree of vulnerability of respondents to crime and insecurity during the use of transportation systems and infrastructure for intra-city trips.

Concerning the environment, the results of analyzed data on eight (8) sub-indicators revealed that only six (6) sub-indicators have a fair assessment from respondents. Increased water pollution and obstruction (3.8125), increased air pollution (3.8022), increased street noise pollution (3.5498), and environmental degradation such as floods (2.7848) are five sub-indicators with fair assessment that still indicate the need for government and other stakeholders to improve the environment for ease of commuting and livelihood. Water pollution and obstructions to spatial development and disposal of waste and refuse are common issues receiving the attention of the Lagos State Government in the last two decades, while air pollution is due to the concentration of industrial activities and production processes in the Lagos metropolis. Lagos is host to over 65% of industrial establishments and processes in the country and cannot be fully separated from air and noise pollution. Also, the high rate of motorization and automobile dependency in Lagos metropolis, like industrial production, calls for a renewed approach to minimize counterproductive externalities and make the city more comfortable and habitable for residents. Other sub-indicators such as the development of stationary images for beautification (1.8323) and increased green spaces (1.2184) have a MIV that is less than the estimated benchmark. However, specific statues identified as having been erected at designated locations throughout the metropolis include the three (3) wise men near Alausa, Gani Fawehinmi statue, MKO Abiola statue at Ojota, and Obafemi Awolowo statue at Ikeja, among others. The remaining sub-indicators, however, are ranked below the estimated benchmarks. In this category are the development of greenery (1.7816), the availability of open space uses (1.4976), the establishment of social services (2.1820), and the ease of accessibility to recreational activities or tourist attractions along the route (2.5110). As a result of this analysis, the ease of accessibility to recreational activities and the establishment of social services show slightly better performance than the remaining sub-indicators, with MIV slightly below the benchmark. In contrast, the result established the need for intensification of efforts and actions for the development of greenery and open space uses, among others, in the metropolis.

Significantly, ten (10) sub-indicators of ease of accessibility and mobility were assessed, and the results revealed the importance of transportation in ease of urban commuting, livability, and livelihood, as two (2) of the sub-indicators ranked first and second in the whole analysis and with the highest MIVs. Precisely, five (5) sub-indicators of modal choice/transportation options are among the leading sub-indicators that have MIV exceeding that of the benchmark. Notably, the shift to ridesharing/ride-hailing services has the highest MIV of 4.5879, denoting the importance placed on it by respondents, while access and use of another road modal split consisting of buses, taxis, and cabs, etc. is ranked second among all the sub-indicators with a value of 4.3932. Thus, having a MIV exceeding 4.0 is highly significant in this study as a result of the fact that such a value confirms the great extent to which the existing transportation infrastructure and transportation options have on city livability and ease of commuting. As such, existing transportation infrastructure is positively influencing the shift to ridesharing/raid hailing services and the use of road modal shift more than others. In addition, the subtitle for physical movement and access to city deliveries and urban logistics, which have MIV of 3.8426 and 3.5799, are ranked tenth and sixteenth, reflecting good and favorable complimentary by existing transportation infrastructure, while access to traffic information (3.0783), ranked thirty-first, shows the positive influence of available sources of traffic information in the metropolis and, as such, contributes to the ease of urban commuting and the livelihood of respondents.

In contrast, the remaining sub-indicators of ease of accessibility and mobility showed poor performance and the need to bridge the gap in their provision and management in the city. The results of the analysis in this regard revealed poor performance of dedicated bicycle lane/path (1.1835), ease of commuting (1.2017), affordability of modal fare (1.4525), and adequacy of carrying capacity of modal choice (1.2350). Resilience has now become the vanguard of sustainability and livability in recent times due to the adverse impacts of climate change and other anthropogenic occurrences. In this respect, respondents assessed eight (8) sub-indicators of resilience in which only the proneness of the city to floods, ocean surge and other coastal consequences (3.2832) and quick response to transportation-induced disasters (2.7555), while the results of the remaining sub-indicators revealed the need to urgently evolve a mechanism to improve the resilience of the Lagos metropolis. Specifically, there are dismal results for ease of passage during a downpour (1.1329), emergency services accessibility (1.4612), rescue and first aid during an emergency (1.3845), social integration program (1.6203), access to emergency relief packages during a disaster (1.2650), and availability of social support facilities (1.1250). Hence, the need to improve the mechanism for the resilience of Lagos metropolis, especially with the global and national recognized implications of climate change and variability on human settlements and livelihoods.

The implications of these results are enormous and varied, considering the poor results of the assessment of city livability indicators in Lagos metropolis. The findings revealed that the lack of a dedicated bicycle lane/path in the Lagos metropolis, as well as the existence of transportation stress being experienced by respondents prior and during intra-

city trips, are denoted by unease commuting, affordability of modal fare (pricing), high demand volume/adequacy of carrying capacity considering the metropolis's over 7 million daily commuters, and erratic responsiveness of respondents' preferred modal choice. The assessment equally attested to restricted access and use of rail, water, and air modal choice by respondents. From the above summation, it can be deduced that only thirty-eight (38) sub-indicators across the main indicators exceed the benchmark of the whole analysis. Therefore, tactical and strategic planning and efforts have to be intensified to improve the performance and contributions of transportation options in the Lagos metropolis to ensure ease of commuting and improve the livability of the city.

Table II: Respondents' Assessment of City Livability Indicators in Lagos metropolis

Indicators	Sub-indicators	VL	L	F	H	VH	TWV	MIV	RIM	Rk
Urban Utilities and Facilities	Walking permeability	7	26	222	1112	4275	5753	1.6893	214.9996/84 =2.5595	54
	Pedestrian aiding facility	834	410	102	764	0	2110	1.6693		55
	Connectivity and connection of street	497	302	309	1628	530	3266	2.5839		38
	Sidewalk attraction to use	485	382	771	1324	0	2962	2.3434		45
	Access to public water facilities	353	1596	147	256	0	2352	1.8608		43
	Availability of visual interest	393	460	216	1592	855	3516	2.7816		48
	Access of pedestrians to the sidewalk	715	20	153	928	1280	3096	2.4494		36
	Response to emergency	124	1636	501	284	420	2965	2.3457		42
	Access of pedestrians to first and last-mile travel	714	362	312	1060	0	2448	1.9367		47
	Access to public medical facilities	3	0	600	2816	1875	5204	4.1171		4
	Access to public elementary and secondary schools	22	220	702	860	3415	5219	4.1290		35
	Availability and adequate buffer zone	827	350	363	564	0	2104	1.6646		56
	Access to telecommunication facilities/services	159	470	690	1796	955	4070	3.2199		30
Urban Services	Access to recreation and entertainment centers	48	14	747	3012	1035	4856	3.8418		12
	Access to public parks	73	210	528	2660	1225	4649	3.7152		14
	Access to shopping malls and supermarkets	255	222	309	748	3040	4574	3.6187		18
	Access to fire-fighting services	734	522	165	740	145	2306	1.8244		50
	Access to the public library	931	666	0	0	0	1597	1.2634		67
	Access to public waste management facilities	361	296	198	720	2545	4120	3.2595		29
	Access to public postal services	678	486	774	340	0	2278	1.8022		51
Land use	Attractor destinations(grocery, restaurant, retail,)	47	276	1056	1568	1675	4622	3.6566		17
	Neighborhood pattern	41	272	1038	1624	1340	4650	3.6788		15
	Availability and accessibility to deterrent land uses(schools, offices, shopping	230	78	216	3068	780	4372	3.4589		23
	Development of essential services (stores, shopping centers,)	145	216	408	2476	1280	4525	3.5799		19
	Development of	734	552	204	672	90	2252	1.7816		52

	greenery(parks, public spaces, front garden,)									
	Availability of open space uses (playground, sports pitch)	865	500	216	292	20	1893	1.4976		59
	Establishment of social services (education, health, shopping, service industries, etc.)	616	482	135	1140	385	2758	2.1820		44
	Urban infrastructure maintenance/management	443	224	543	1316	995	3221	2.7856		34
	Ease of accessibility to recreational activities/tourist attractions along the route(parks, theaters, cinema,)	213	766	1431	764	0	3174	2.511		46
Housing	Housing development	59	84	477	2436	1975	5031	3.9805		8
	Housing options (types)	102	38	282	2068	2660	5150	4.0744		5
	Housing density (low, medium, and high)	117	42	336	2428	2035	4958	3.9225		9
	Housing affordability	1013	370	57	188	0	1628	1.2880		64
	neighborhood beautification and aesthetics	641	288	288	1532	0	2749	2.1748		45
Social security and Safety	Presence of street furniture(seating, bollards)	1002	198	108	508	0	1816	1.4367		62
	Presence of shade and rain cover, trees, or canopy	1062	228	75	252	0	1617	1.2793		65
	Development of risky/crime hotspots	179	376	417	2240	990	4202	3.3244		26
	Availability of street lighting	164	284	1242	2176	0	3866	3.0585		33
	Crime free street	896	256	108	488	410	2158	1.7073		53
	Enforcement of pedestrians safety regulations	401	266	315	916	1980	3878	3.0680		32
	Development of street security facilities (e.g. CCTV)	87	338	333	2400	1485	4643	3.6733		16
	Funding and resources are devoted to pedestrian planning	863	406	180	552	0	2001	1.5831		58
	Adequate traffic calming elements per 60m interval	590	230	495	784	990	3089	2.4438		40
	Development of traffic safety measures (e.g. calming)	442	104	825	1980	0	4121	3.2603		28
	Social security	92	48	777	3556	0	4473	3.5388		22
Environment	Increase air pollution (emission) in the street	341	0	138	232	4095	4806	3.8022		14
	Increase noise pollution in the street	78	162	807	2690	480	4487	3.5498		21
	Increase water pollution and obstruction	261	134	225	424	3775	4819	3.8125		13
	Promotion of environmental degradation e.g. erosion, flood, etc.	508	222	525	340	1925	3520	2.7848		35
	Development of public spaces to gather	78	176	942	3136	0	4332	3.4272		24

	Increase green spaces	1024	444	54	0	0	1540	1.2184		70
	Accessible buildings (with elevators, staircase)	77	40	585	2712	1470	4880	3.8639		10
	Development of stationary image for beautification	679	538	525	524	50	2316	1.8323		49
Ease of accessibility and mobility	Dedicated bicycle lanes	1044	428	0	24	0	1496	1.1835		73
	Access to traffic information	346	40	483	6634	370	3891	3.0783		31
	Access to city deliveries/urban logistics	233	160	396	1436	2300	4525	3.5799		19
	Substitute to physical movements	31	20	669	3392	734	4857	3.8426		11
	Shift to ridesharing/ride-hailing services	29	0	312	792	4665	5798	4.5870		1
	Ease of commuting (day and night)	1060	348	27	84	0	1519	1.2017		72
	Affordability of Modal fare	1070	2	117	492	155	1836	1.4525		61
	Adequacy of carrying capacity of modal choice (e.g. bus, taxi, rail, ferry, etc.)	973	576	9	0	0	1561	1.2350		68
	Demand responsiveness of modal choice	105	260	27	84	0	1525	1.2065		71
	Access and use of road modal split (bus, taxi, cab, etc.)	105	0	42	1276	4130	5553	4.3932		2
	Access and use of rail modal split (trains and light rail)	875	498	0	240	490	2085	1.6495		55
	Access and use of water modal split (ferry)	874	268	57	540	774	2357	1.8647		48
	Access and use of air modal split (air shuttle)	1211	34	6	136	0	1387	1.0973		79
	Access and use of public transit (BRT)	133	212	264	2792	1195	4596	3.6361		18
Resilience	Quick response to transportation induced disaster	273	628	717	1300	565	3483	2.7555		37
	Prone to flood, ocean surge, etc.	125	536	498	2136	855	4150	3.2832		27
	Ease of passage during a downpour	1175	76	69	112	0	1432	1.1329		75
	Emergency services accessibility	1061	30	99	472	185	1847	1.4612		60
	Rescue and first aid during an emergency	1004	184	330	232	0	1750	1.3845		64
	Social integration programme	960	116	201	496	275	2048	1.6203		57
	Access to the emergency relief package	1121	82	96	200	100	1599	1.2650		66
	Availability of social support facilities	1043	130	153	340	100	1766	1.3972		63
Gender Equality	Preferential access to mobility options by women	1178	76	72	94	0	1422	1.1250		77
	Safe and comfortable facilities for women and physically challenged	1142	142	63	120	0	1467	1.1606		77

	Equal mobility accessibility for all users	181	392	297	2288	1080	4238	3.3528		25
Poverty	Stable source of income	373	842	375	1084	360	3036	2.4019		41
	Access to public health services/facilities	4	50	453	3132	1505	5144	4.0696		6
	Access to public water supply	1152	68	12	240	70	1542	1.2199		69
	The proportion of income spent on transportation	20	98	375	3096	1480	5069	4.0103		7
	Access to conventional public transportation	950	134	276	464	195	2019	1.5973		58
	Access to subsidy and price incentives	373	842	375	1084	360	3036	2.4019		41

Source: Authors' Field Work, June 2021

C. Hypothesis Testing (Influence of Transport Infrastructure on City Livability)

In a bid to understand whether or not transportation infrastructure statistically influences the livability of Lagos metropolis, further investigations were conducted using Multiple Regression Analysis to explain the significance outcome of the relationship between transportation and city livability. The city livability of Lagos metropolis (which is the dependent variable) was measured using the aggregated mean value of urban utilities and facilities (UUF), urban services attributes (USA), land use attributes (LUA), housing quality attributes (HQA), social security and safety attributes (SSS), environment and climate resilience (ECS), ease of mobility and accessibility (EMS), resilience and disaster preparedness (RDP), gender equality and social cohesion (GEC), and poverty attributes (POA), which were initially measured as categorical nominal variables ranging from very low, low, and very high, which were considered moderate and fit for multiple regression analysis. Meanwhile, the independent variables are also known as the predictor variables (transportation infrastructure), which include 38 variables that were grouped under road/highway infrastructure attributes (HIA), rail infrastructure attributes (RIA), air infrastructure attributes (AIA), water infrastructure attributes (WIA) and pipeline infrastructure attributes (PIA). It is important to note that the independent variables were also dichotomized into binary digits, similar to the dependent variables. For data analysis, with this data transformation, the dichotomized analysis, which is an extension of multiple regression, was used for data analysis.

The result presented (see Table III) shows the "R" value representing the multiple regression correlation coefficients, which measured the quality of the prediction of the independent variable "city livability index" as 0.695, indicating a good level of prediction. The R square (R^2) value represents the coefficient of determination, which measures the proportion of the variance in the dependent variable that can be explained by the independent variables, and shows 0.483. This means that the independent variables were able to explain 48.5% of the variability of the dependent variable (city livability). Meanwhile, the adjusted R square (Adj. R2), which revealed 47%, shows the model accuracy of prediction.

Table III: Model summary of the multiple regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.695[a]	.483	.467	.11550

The F-ratio in the ANOVA (see Table IV), which tests for the overall significance of the regression model as a good fit for the regressed data, reveals F38,1225 = 30.091 and reaches significance with a p-value of 0.000. While comparing the ANOVA results, the findings show that the observed and calculated p-value is less than the table p-value of 0.05 (p 0.005). Hence, the decision to accept the H_1 (alternative hypothesis) and reject the h_0 (null hypothesis). This implies that the transportation infrastructure statistically influenced the city's livability in the Lagos Metropolis.

Table IV: Results of the Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.255	38	.401	30.091	.000[b]

	Residual	16.343	1225	.013		
	Total	31.599	1263			

The results of the unstandardized coefficient (β), which indicates how much the dependent variables vary with an independent variable when all other independent variables are held constant (see Table V), the coefficient table shows that for each increase in the independent variables, there is a decrease in the dependent variable (city livability) (unstandardized coefficient value). Hence, the general form of the equation to predict city livability (dependent variable) from independent variables (transportation infrastructure) is predicted as;

CLI: $2.386 + (0.011*X_1) + (0.007*X_2) - (0.019*X_3) + (0.000*X_4) + (0.005*X_5) - (0.031*X_6) + (0.006*X_7) + (0.011*X_8) + (0.015*X_9) + (0.017*X_{10}) + (0.013*X_{11}) - (0.011*X_{12}) - (0.012*X_{13}) + (0.005*X_{14}) + (0.015*X_{15}) + (0.007*X_{16}) - (0.010*X_{17}) + (0.007*X_{18}) - (0.001*X_{19}) - (0.008*X_{20}) + (0.006*X_{21}) + (0.021*X_{22}) + (0.009*X_{23}) - (0.008*X_{24}) + (0.016*X_{25}) + (0.010*X_{26}) - (0.021*X_{27}) - (0.023*X_{28}) + (0.003*X_{29}) + (0.006*X_{30}) - (0.004*X_{31}) + (0.019*X_{32}) - (0.010*X_{33}) - (0.018*X_{34}) + (0.011*X_{35}) + (0.011*X_{36}) - (0.035*X_{37}) + (0.034*X_{38})$.

The results of the statistical significance of each unstandardized (or standardized) coefficient were equal contributions to the model were also established. With this, the results are presented in Table V. Through the t-value and corresponding p-value, we shows that 22 variables out of the 38 predictor variables are statistically significantly different from 0 (zero). Thus, the 22 variables best contributed significantly to the model prediction. As such, the twenty-two (22) predictor variables that contribute significantly to the model include availability and condition of local street with drainage (t-=2.111,p=0.035), access road to rail terminal (t=-5.583), p=0.000), condition of distributor and collector road (t=-7.061, p=0.000), condition of rail station (t=3.039, p=0.002), condition of bus stop with passenger shed (t=4.401, p=002), condition of bus stop without passenger shed (t=3.702, p=0.000), condition of underlying public pipes (t=-2.569, p=0.10), condition of layby (t=-2.447, p=0.15), condition of pedestrian crossing (t=3.675, p=0.000), condition of parking facility at rail station (t=3.568, p=0.000), condition of public transportation information (t=-12.556, p=0.011), condition of rail signal (t= 2.053, p=0.040), condition of pedestrian bridge (t=3.905, p=0.000), condition of walkway (t=2.337, p=0.20), condition of road/ferry terminal linkage (t=2.028, p=0.043), condition of ferry route (t=-5.556, p=0.000), condition of ferry terminal/jetty (t=-5.983, t=0.000), condition of boarding and alighting aid facilities (t=2.058, p=0.40), condition of airport terminal (t=-4.454, t=0.000),condition of domestic water pipes (t=2.722, p=0.007), condition of gas supply mains (t=-6.036, t=0.000) and condition of sewerage pipe connection (t=8.641, p=0.000).

Table V: Unstandardized and standardized coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.386	.044		53.750	.000
availability and condition of the local street with drainage	.011	.005	.056	2.111	.035
availability and condition of the local street without drainage	.007	.005	.040	1.372	.170
availability and condition of the access road to the rail terminal	-.019	.003	-.138	-5.583	.000
availability and condition of the parking facility at the domestic airport	.000	.004	.004	.112	.911
availability and condition of street light	.005	.004	.042	1.310	.190
availability and condition of the local street(distributor and collector)	-.031	.004	-.260	-7.061	.000
availability and condition of road marking	.006	.004	.047	1.415	.157
availability and condition of cyclist path	.011	.008	.030	1.335	.182
availability and condition of rail station	.015	.005	.087	3.039	.002
availability and condition of a bus stop with passenger shed	.017	.004	.162	4.401	.000
availability and condition of a bus stop without passenger shed	.013	.004	.111	3.702	.000

availability and condition of underlying public pipes	-.011	.004	-.076	-2.569	.010
availability and condition of the layby	-.012	.005	-.081	-2.447	.015
availability and condition of route information	.005	.003	.042	1.600	.110
availability and condition of pedestrian crossing	.015	.004	.100	3.675	.000
availability and condition of the parking facility at the rail station	.007	.002	.087	3.568	.000
availability and condition of public transportation information	-.010	.004	-.079	-2.556	.011
availability and condition of rail signal	.009	.004	.087	2.053	.040
availability and condition of the arterial and sub-arterial road	-.001	.004	-.010	-.337	.736
availability and condition of rail track	-.008	.005	-.056	-1.718	.086
availability and condition of a dedicated lane	.006	.004	.048	1.354	.176
availability and condition of the pedestrian bridge	.021	.005	.178	3.905	.000
availability and condition of the walkway	.009	.004	.087	2.337	.020
availability and condition of the rail terminal	-.008	.008	-.086	-1.060	.289
availability and condition of the parking facility at the ferry terminal	.016	.014	.120	1.172	.241
availability and condition of road/ferry terminal linkage	.010	.005	.102	2.028	.043
availability and condition of the ferry route	-.021	.004	-.197	-5.556	.000
Waiting facilities at ferry/jetty	-.023	.004	-.227	-5.983	.000
Rest room facilities at jetty/ferry terminal	.003	.004	.025	.822	.411
facilities for specialized person at jetty/ferry terminal	.006	.003	.049	1.710	.087
availability and condition of ground access to airport	-.004	.006	-.038	-.615	.538
boarding and alighting aid facilities	.019	.009	.198	2.058	.040
walking aid for specialized persons	-.010	.014	-.075	-.704	.481
restroom facilities at the airport terminal	-.018	.004	-.192	-4.454	.000
availability and condition of traffic signal	.011	.006	.090	1.830	.068
domestic public water pipes	.011	.004	.068	2.722	.007
public gas supply mains	-.035	.006	-.194	-6.036	.000
sewerage pipe connection	.034	.004	.299	8.641	.000

V. CONCLUSION AND RECOMMENDATIONS

The increasing urbanization, spatial development, and expansion of cities no doubt contribute to global concern for the sustainability and livability of human settlements. Also, it is not a fallacy that cities are in a constant state of unprecedented change due to transportation infrastructure and other pull factors, which lead to an immense attraction of people and investments. Expectedly, the demand for transportation and urban infrastructure provision has equally been increasing alongside an increase in wealth and a change in lifestyle, with influence and implications on the extent of ease of living and livelihood in cities. It is on this basis that the livability of Lagos has been a matter of concern to all stakeholders, despite several past and present efforts to make the city competitive in all ramifications among global cities. However, the consistent inflow of people and investments into Lagos and the several perceived challenges underscore the need for appraisal of her livability vis-à-vis established indicators.

Functionally, better transportation and accessibility options imply access to higher levels of livability in all their ramifications and ease of living for residents, while the presence of alternative transportation infrastructure and mobility options that allow individuals to choose a mode of transportation was found to be a positive stimulus for increasing the livability of a community and cities. It is based on the foregoing that the study appraised the livability of Lagos metropolis from the perception of residents/respondents with emphasis on livability indicators and ancillary transportation infrastructure. As a result, the study established the existence of a sharp gap in the livability parameters in the Lagos metropolis and a high rate of respondents' dissatisfaction with available transportation infrastructure despite the huge potential to make the city more livable for residents.

As such, the study concluded that many proactive steps and efforts are still required to improve residents' satisfaction with the city's livability and improve mobility, especially the ancillary transportation infrastructure that guarantees accessibility and travel options in Lagos metropolis. There is a need for operational and structural improvement of existing sidewalks to attract pedestrians' use and improve access to them, while also discouraging existing and further encroachment by intruders. Also, the improvement, provision, and rehabilitation of sidewalks in neighborhoods and streets should be of the utmost priority to statutory organs of the government. In addition, pedestrian aiding facilities, sidewalk continuity, sidewalk attraction to use, walking permeability, visual interest, footway accessibility, first and last mile, and travel facilities, among others, required the intervention of the government to make them more attractive to use and accessible to pedestrians.

The ongoing intersection and junction improvement programme in Lagos has to be intensified and expanded in coverage to enhance traffic flow and improve the livability of the city for residents by ensuring ease of flow and urban commuting. With the notion that traffic generation is a function of land use, there is a need for sustenance and improvement in the land use structure of the city to support shared-riding with the expected transportation infrastructure to provide the required link capable of facilitating accessibility and also integrating pedestrian flow into junction improvement in the city. Moreover, sustainable measures to activate affordable housing and minimize housing stress have to be evolved to mitigate the already tense situation which is adversely affecting the livability of the city and, at the same time, possibly contributing to the dismal rating and ranking of Lagos in the global index.

Likewise, boosting social security and safety is indispensable to enhance the confidence and sense of safety of residents. To achieve this, existing social security and safety measures have to be intensified, while lapses or shortcomings observed in the aids and emergency services, street furniture for seating and bollards, shade, and rain cover, among others, to have a crime-free society should be adequately rectified. Moreover, the recurrent environmental issues such as water pollution, obstruction to spatial development, disposal of waste and refuse, and air pollution in various forms deserve urgent attention and intervention to improve environmental quality and serenity. Towards this, the erection of statutory images and increasing green space become indispensable in improving residents' perception of the livability of Lagos. Therefore, redesigning the spatial form and accessibility of Lagos is necessary to accommodate means of movement such as cycling and pedestrianization. Hence, having a dedicated bicycle path, guaranteeing ease of commuting, affordable modal choice, improved carrying capacity, demand responsiveness, access and use of rail and water modal transit, as well as air modal split, is not essential to widen ridership and modal options.

With the resilience of Lagos being questioned due to poor passage and inaccessibility during a downpour, emergency services' inaccessibility, weak rescue and first aid during emergencies, absence of social integration programmes, poor access to emergency relief packages during a disaster, and weak social support, reversal of the aforementioned attributes and sub-indicators of city livability is essential not only to improve the resilience of Lagos but to also improve its sustainability and livability for the residents in all ramifications. Essentially, the ongoing bus reform initiative of the Lagos State Government has to be intensified and expanded to capture other ingredients of travel models that include up-to-date facilities and information as well as sufficient and comfortable seating for users. In addition, the reliability and responsiveness of travel modes has to include enhancing affordable travel fares and overall affordability of modal options and choice in the city. Also, poor service delivery, ticketing, terminal facilities, etc., and complaint handling processes have to be properly addressed and captured by the reform to improve the operational performance and reliability of travel choice. Therefore, tactical and strategic planning and efforts have to be intensified to improve the performance and contributions of transportation options in the Lagos metropolis to ensure ease of commuting and improve the livability of the city.

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Povezanost med življenjskim okoljem in prometom v mestu Lagos v Nigeriji

Izvleček – Življenska primernost mest je v zadnjem času predmet svetovne zaskrbljenosti. Pomembno je, da sta enostavnost mobilnosti in dostopnost v mestih še vedno najpomembnejša dejavnika pri odločanju prebivalcev o izbiri lokacije in njeni ustreznosti. Na podlagi tega je ta študija preučila povezavo med življenjsko primernostjo mesta in prometom v metropoli Lagos v Nigeriji. Študija je temeljila na konceptu življenjske primernosti, zato je opisno in sklepno analizirala rezultate 1264 vprašalnikov, ki so bili razdeljeni prebivalcem na podlagi ključnih tem o življenjski primernosti. Študija je pokazala nizko zadovoljstvo s ključnimi kazalniki uspešnosti na področju življenjske primernosti. Podobno je študija pokazala, da je večina ocenjenih objektov prometne infrastrukture v slabem stanju in tako ovira lažje potovanje na delo in prijetno življenje v mestu. Rezultat regresijske analize je pokazal, da prometna infrastruktura statistično vpliva na življenjsko primernost metropole Lagos. Študija priporoča potrebo po hitrih proaktivnih ukrepih, zlasti strukturnih izboljšavah prometne infrastrukture, za izboljšanje življenjske primernosti metropole Lagos.

Ključne besede - živahnost mesta, promet, kazalniki živahnosti, metropola Lagos