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Urban Transport Policy and Land Use Planning Accessibility Nexus in Nairobi City

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Abstract

The evolution of urban transport policy in Nairobi City has followed the four primary land use planning regimes, from the colonial development containment (1948-1973) to the city expansion plan (1973-2000), the use of single issue plans to champion densification and intensification (1979-20022), Thorten (1948), Nairobi City Council (1972) the NUIPLAN (2014) and currently the National Land Use policy (2017). This study evaluates the integration of urban transport policy and land use planning in Nairobi City. The study analyses accessibility characteristics of journey time, travel time, travel speed, cost of travel, and journey length in Nairobi city. The research uses both primary and secondary data sources to analyse how accessibility is affected by the integration of urban transport policy and land use planning in Nairobi City. The variables measured included journey time, Levels of service on roads during peak times, transportation cost decay analysis, and changes in built-up areas along the Thika Road and Ngong Road Corridors. Further, the study analyses the institutions responsible for urban transport policy and land use planning in the study area. The data was analysed and interpreted to provide reliable information used to develop a model for integrating urban transport policy and land use planning. The study has found out that despite the urban transport policy and land use planning efforts, there is poor integration of urban transport policy and land use planning that has led to poor accessibility in the study area. The study has recommended and developed a model using a systems approach based on Transit Oriented Development (TOD) for the integration of urban transport policy and urban land use planning in order to achieve accessibility in Nairobi City and other similar cities in developing countries.

Keywords: Integration, land use planning, accessibility, transport policy, systems approach

INTRODUCTION

Urban Transport Policy (UTP) and the Land Use Planning (LUP) in Nairobi City have undergone evolutionary changes post colonialism. Studies have shown that transport is a vital component in the functioning of cities worldwide (O'Flaherty et al. (2018), Tolley et al. (1995) Litman (2003). Bryceson et al. (2003), and Meyer et al. (1984). The effective functioning of cities has a greater development potential if accessibility is increased by enhancing integrated planning of land use, transport infrastructure and operations, and freight services.

Research suggest that major changes in the transport system influence patterns of urban development and location choices of households and firms, and that major changes in land use patterns influence the number of trips, and their destinations and modes. The interplay between urban transport policy and land use planning affects accessibility in cities worldwide include travel time, travel speed, travel cost, journey length, journey distance, and cost of journey. In short, urban transport and land use systems are closely intertwined Urban transport and land use planning are therefore critical systems in their own rights as well as sub-systems of the urban system. Models used to support urban transportation policy need to be integrated with land use models to capture these effects (Waddell, 2011). A review of Urban transport policy and land use planning in Nairobi shows that shortcomings in the implementation of urban transport policy affect land use and vice versa as shown in **Table 1 a and b.**

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TABLE 1A
Performance of major Land Use and Urban Transport policies in Nairobi.

Land Use Policies		
Policy	**Main Recommendations**	**Progress/ Outcomes and Implications**
Nairobi Metropolitan Growth Strategy (1973)	Expansion of Nairobi along the axis of Thika Road and encouraged growth of Thika, Athi and Machakos town.	Incremental growth has been observed along Thika Road axis. However, only one main road (Thika Road) exist to link the axis to Nairobi CBD. Thika road experiences perennial traffic. Transport provision does not match land use change.
	A comprehensive network of roads and public transport routes was proposed. The roads proposed were in the form of a modified grid to provide maximum accessibility between residential, industrial and commercial areas.	Grid pattern of road network not established thus causing strain on the few main roads.
	Establishment of a conventional bus services. In addition, the report proposed a system comprising some form of high capacity route for exclusive use of buses.	No urban high capacity bus transport has been established. The city is dominated by the informal public transport in form of low capacity vehicles called matatus. This leads to increased dependence on the private car and congestion.
Nairobi County integrated Development plan (CIDP) 2013-2017	The sector developed a NMT policy, established a Nairobi Metropolitan Area Transport Authority (NaMATA) all in an effort to streamline public transport.	Public transport not streamlined presently (2022). Minimal segregated Non-Motorized facilities exist for use by pedestrians. Ngong Road has seen an improvement in development of pedestrian facilities with provision of sidewalks.
	Efforts to develop BRT on Mombasa road/Waiyaki way Corridor, Thika Road and Langata Road Corridor, Juja Road and Ngong Road corridor, Jogoo Road – Mbagathi Way corridor and Outer Ring Road were initiated	BRT facilities not set up and operationalized. The problem of congestion therefore persists.
Nairobi Integrated Urban Master Plan (NIPLAN) 2014-2030	The plan proposes development of sub-centres along the interchanges of urban transport system to synchronize urban development and urban transport development: interchanges of major road network, interchanges of road and railway (including Light Rail Transit (LRT)).	Sub-centers have developed along the periphery of Nairobi CBD including Ruiru, Ngong, Machakos. However, there is no diversification of modes of transport. No Mass Rapid Transit Systems e.g. Light rail. This presents an acute problem of accessibility.

Source: Author, 2022

TABLE 1B

Performance of major Land Use and Urban Transport policies in Nairobi.

Urban Transport Policies		
Policy	**Main Recommendations**	**Progress/Outcomes and Implications**
Nairobi City Structure & Inventory of NMT Infrastructure Problems (SSATP) (1994)	• Better parking management with time dependent fees in the CBD. • Introduction of bus lanes as well as bus rapid transit (BRT). • Linkages of NMT facilities between mega generators and common attractions e.g. public transit terminals. • Relocation of bus terminals from the CBD.	The recommendations were not implemented and some are still in the development phase presently (2022). Bus terminals out of CBD, BRT on Thika road are still under development and testing.
Masterplan Study Report for Urban Transport in the Nairobi Metropolitan Area (NUTRANS) -2003	• Development of Policy for on-street parking, Bus / Matatu terminals and routes and NMT traffic. • Geometric improvement of intersections. • Restoration and installation of traffic signals and CCTV systems. • Construction of missing links.	Geometric improvement of intersections has been done on most intersections in Nairobi. Traffic signals have been installed in most roads leading to and in the CBD. Some Missing links have been constructed e.g. Red Hill road and Kibera (Ngong Road)-Langata link.
Non-Motorized Transport Policy-2015	The study found that: • There is lack of policy implementation of previous approved policies such as the Integrated National Transport Policy. • The Nairobi transport system is basically road-based, and more oriented to private car use. It does not offer practical and convenient alternatives to the private car. • Lack of or poor state of NMT infrastructure owing to motor vehicle orientated engineering and planning. • Encroachment into NMT spaces and lack of enforcement, especially when it comes to obstacles to NMT movement such as parked vehicles, hawkers, motor-cycles and matatus who often take over foot-ways (road shoulders).	The study identified planning and implementation gaps that have resulted in captive travellers (limited modes of transportation) and other safety issues.

Source: Author, 2022

The data clearly demonstrate that there is lack of integration of urban transport policy and urban land use planning in Nairobi City.

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THEORY

This study is based on Systems Theory. A system is a set of interacting units or elements that form an integrated whole intended to perform some function. Russell Ackoff (1981) defined a system as a set of two or more elements that are interdependent.

Hitchins (1992) reflected an equally realistic and methodical classification and defined a system as a collection of interconnected units such that both the collection and the interrelationships together reduce local entropy. Systems theory acknowledges that interaction of system-variables is so interlinked to each other that cause and effect is a kind of circular logic. One separate variable thus can be both cause and effect.

The main aim of formulating an urban transport policy is to reduce the costs of congestion, improve accessibility, ameliorate environmental impact and enhance conditions for those dependent on public transport. Urban transport policy demands are directly related to distribution and intensity of land uses and that these can be accurately predicted. Urban transport policy and land use are subsystems of the urban system. This implies that, any inputs such as policy changes in land use or in transportation affects the whole urban system. Accessibility is therefore achieved when urban transport policy and land use are integrated.

RESEARCH METHODS

Introduction

The research applied both primary and secondary data sources to analyse how accessibility is affected by the integration of urban transport policy and land use planning in Nairobi City. The variables measured included journey time, Levels of service on roads during peak times, transportation cost decay analysis, and changes in built-up areas along the Thika Road and Ngong Road Corridors. Further, the study analyses the institutions responsible for urban transport policy and land use planning in the study area. The data was analysed and interpreted to provide reliable information used to develop a model for integrating urban transport policy and land use planning.

Research Design

Vogt, Gardner, & Haeffele (2014) outlines survey, interview, experimental observational, archival and combined research designs as the potential research designs that can be used in any study. This research had questions that are both qualitative and quantitative. It therefore employed the fully mixed design method. The mixed methods research represents research that involves collecting, analysing, and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon. The research activities are divided into three components namely; (i) Diagnostic/Investigative Stage and (ii) Analytical stage and (iii) Prescriptive Stage.

In the Diagnostic/Investigative stage, the research team gathered information on the subject area as guided by the research objectives from secondary and primary sources of data. On secondary data the research team assembled and reviewed various existing literature, maps, plans and other documentary sources to facilitate a better understanding of variables being researched. Primary data sources involved field survey, administration of questionnaires to various respondent groups. In the research, the dependent variable is accessibility measured by travel time, travel speed, travel cost, journey length, journey distance, and cost of journey. The independent variable is land use planning measured by spatial plans, development control ordinances, land use planning policies, institutional cooperation/ coordination in transport, and land use planning.

Description of case study

This study, sought to evaluate to what extent the Nairobi Urban Transport policy has been integrated with land use planning in Nairobi City. Specifically, the study, therefore; (i) examines the evolution of urban transport policy and land use planning in Nairobi City, (ii) analyses the existing models for integration of, urban transport policy and land use planning for optimal accessibility in Nairobi City, (iii) analyses the interplay between urban transport policy and land use planning on accessibility in the Thika Road and Ngong Road Corridors in Nairobi City and (iv) proposes a model for integration of urban transport policy

and land use planning for optimal accessibility in Nairobi and similar cities.

Sampling techniques

To provide a representative sample size of these areas, this study used a stratified random sampling approach. To administer the questionnaire. (Levy et al., 2008) define stratified sampling as sampling in which sampling frame can be partitioned into groups or strata, and the sampling can be performed.

Care was taken to ensure that the sample size was sufficient for both the study areas and was representative. (Gay , 1987) suggests that for co-relational research, 30 cases or more are required; for descriptive studies, ten percent of the accessible population is enough and for experimental studies, at least 30 cases are required per group.

Data collection and research tools

The research used questionnaires, guided interviews and geographical information systems to gather empirical data for analysis.

Research Questionnaires

The questionnaire collected data on travel time, travel speed, travel cost, journey length, journey distance, and cost of journey and modal choice alongside household characteristics of respondents. The questions were directly related to the indicators of accessibility.

Guided interviews (Institutional surveys)

In interview-based study, the design phase should be spent developing a systematic, well-developed, data collection protocol. (Ranney, et al., 2015). To this effect, this study developed a comprehensive list of questions (template) to be administered to the respondents that were identified in the institutions of interest. This ensured that the structure of the interviews was uniform thus producing consistent reproducible responses that seek to answer the study questions on the evolution of urban transport policy and land use planning, the interplay of their implementation and the results of their implementation on accessibility. The template included topic headings, open ended questions and probes to be used follow-up on critical questions.

The guided interviews collected data on the outcomes of institutions charged with formulation and implementation of Urban Transport Policies and Land Use Planning in Nairobi City. The outcomes and level of implementation of the policies was also evaluated. The institutions interviewed were: (i). Nairobi City County, (ii) Ministry of Devolution, (iii). Ministry of Lands and Physical Planning, (iv). Ministry of Transport, Infrastructure, Public Works, Housing and Urban Development, (v). Nairobi Metropolitan Area Transport Authority (NaMATA), (vi). National Transport and Safety Authority (NTSA) and Nairobi Metropolitan Services (NMS).

Geographical Information Systems (GIS) Studies to Determine Changes in Land Use

To collect the GIS data cloud-free images (below 5%) with fairly even intervals were sourced based on the availability and fairly even interval of years 1986,1993, 2002,2010, and 2020, the multi-spectral images were sourced from Landsat 4/5, Landsat 7 and Landsat 8 images.

Boundary shape-files were used to clip the area of interest before processing. Software used includes ArcGis 10.9, software to measure Land cover and Land Use classification.

Data analysis and presentation

In the analytical stage, data gathered using Questionnaire was analysed using SPSS statistical tool. GIS data was analysed using multispectral satellite images to: determine the shift in the land use development footprint over time between 1986 - 2020 through comparison and analysis of spatial data from land use maps created based on GIS and RS technology of the study corridors; to determine the implication of transportation corridor development through determining the shift in land use development footprint.

The prescriptive stage, involved the synthesis and recommendations of the research based on the findings of the various data gathered. It also formulates recommendations and proposes a model for integration of urban transport policy and land use planning in Nairobi City and other cities elsewhere to inform the way forward for research output users.

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RESULTS AND DISCUSSION

Distribution of Respondents

The study was carried out along Thika road and Ngong Road Corridors of the study area. The respondent's distribution was 41.2 per cent along Ngong' road and 58.8 per cent for Thika Road. The gender distribution of household respondents was (58.9 per cent) male and (401.1per cent) female with age distribution ranging from 18 to over 60 years. To date, gendered norms and responsibilities still affect women's and men's mobility and access differently especially in urban areas (Wedo et al., 2018). The distribution of age categories is shown in **Table 2.**

TABLE 2
Age distribution of the Households

Age Category	Frequency	Valid Percent	Cumulative Percent
18-24	52	14.7	14.7
25-30	77	21..8	36.5
30-40	99	28.0	64.6
40-60	97	27.5	92.1
Above 60	28	7.9	100.0
Total	353	100.0	

Source: Author, 2021

Household characterization

The average monthly income of households within the study area indicate a small marginal percentage on those earning between Kenyan shillings (Ksh.) 50,001-100,000 (20.3 per cent); Ksh. 10,001-30,000 (24.4 percent); and above Ksh. 100,000 (26.4 per cent). Majority of the households (46.7 per cent) earn more than 50,000. Kenyan shillings. Further, **Table 3** shows that there is a sample of households (13 per cent) that earn a monthly income of Ksh. 10,000 and below. This group forms a large part of non-motorised captive population that have little or no expenditure on public transportation. With the current dollar rate (1 dollar = ksh. 118 as at July, 2022), part of this group are living below poverty line placing them within the 17 percent of Kenya's population living below 1.90 U.S. dollars per day in 2022 (Kamer, 2022).

TABLE 3
Average monthly household income

Average monthly (Ksh.)	Frequency	Valid Percent	Cumulative Percent
Ksh 0-10,000	43	13.0	13
Ksh 10,001-30,000	80	24.2	37.3
Ksh 30,001-50,000	53	16.1	53.3
Ksh 50,001-100,000	67	20.3	73.6
Above Ksh 100,000	87	26.4	100.0
Total	330	100.0	

Source: Author, 2022

The study area traverses different social groups in both high and low density residential zones. When sampled households were asked if they owned cars a large sample (44.2 per cent) indicated that they did not own a car. This reflects the spatial scope of the study area where close to half of the study area is located within the mixed development areas with its immediate surrounding (5 kilometre radius) predominantly a transit- or pedestrian-oriented neighbourhood, and this could partly contribute to higher percentage of households not owning a private car. While this is the case, it was noted that there is still a sizeable sample of households that own cars as indicated by 28 per cent that owned 1 car, 14.9 per cent that owned 2 to 3 cars and 12.5 per cent had more than 4 cars.

In establishing the rental expenses from those who do not own homes within the city, the study established that a large percentage (36.7 per cent) pay rent between ksh. 5,001 and ksh. 10,000. Majority of the household (49.8%) spend more than ksh. 10,000 with only a small sample (6.3 per cent) spending more than ksh. 40,000. A significant sample (13.5 per cent) spend ksh. 5,000 or less on rental expenditure as shown in **Figure 1.** In transportation, affordability is measured relative to income and rental cost.

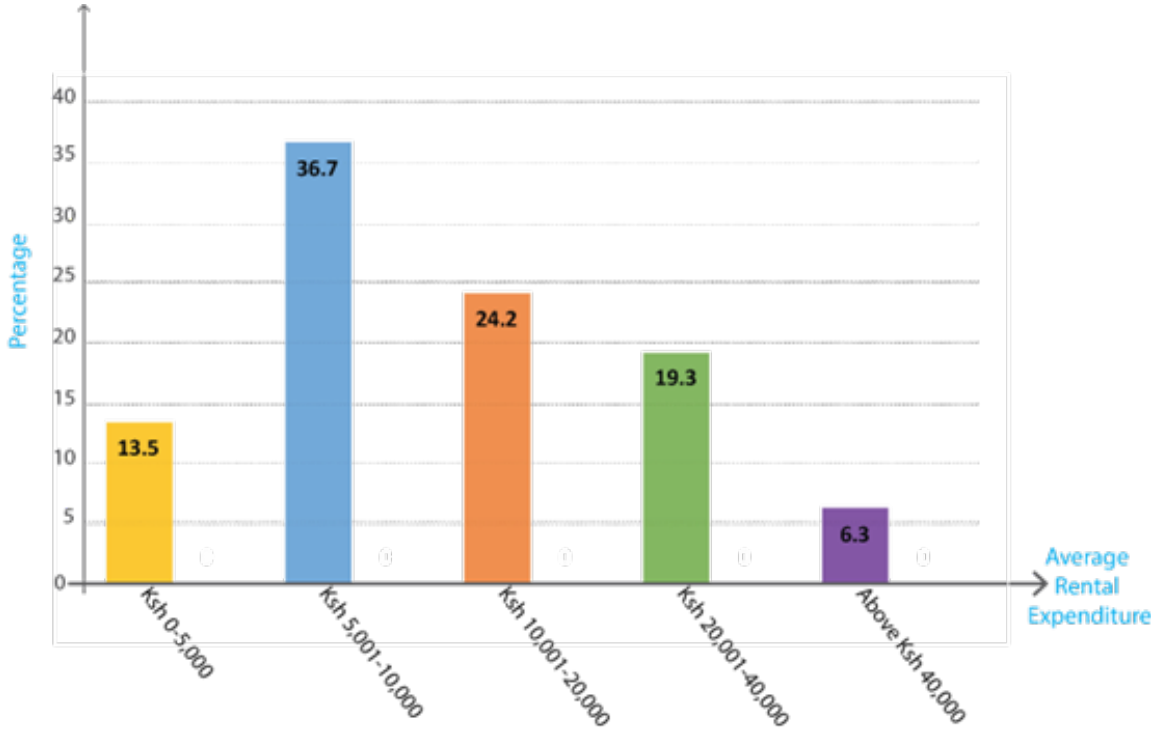

FIGURE 1
Average rental expenditure
Source: Author, 2022

Modes of Transport and Travel Patterns

Litman (2008) delineates accessibility as the definitive objective of transportation since it enables people to reach goods, services, and activities. Litman denotes that there are several factors that affect the measure of accessibility such as physical movement, quality and affordability of transport choices, connectivity, transport alternatives, and land use patterns. (Litman, 2008). A large sample of households (65.3 percent) uses a mix of walking and public transport to access their places of work. A significant sample of the households (30.3 percent) uses private cars to work. A marginal number of residents stated that they either use taxis (0.3 percent), combine public means and private cars (2.8 percent), or use motorbikes (1.4 percent) to access places of work as illustrated in **Figure 2.**

FIGURE 2
Modes of transport to place of work
Source: Author, 2022

The study established that there was a marginal percentage difference when comparing the choice of mode from work to home and vice versa. Households tend to use the same modes for the two scenarios. When asked what mode of transport they use from work to home, the majority of households (62.2 percent) noted that they use a mix of walking and public transport to access their places of work. This is 3.1 percent less than the percentage of similar choice of modes used when traveling from home to work as indicated earlier. A comparative analysis has been presented using **Table 4** to illustrate the marginal differences in modal choices in the two aforementioned scenarios.

TABLE 4
Comparative analysis on modal choice

Mode of transport	Percent: Home to work (Before)	Percent: Work to Home (After)	Percentage Difference
Road/ Public/ Walking	65.3	62.2	-3.1%
Private car	30.3	32.2	+1.9%
Both Public and Private car	2.8	2.2	-0.6%
Taxi	0.3	1.7	+1.4%
Motor Bike	1.4	1.7	+0.3
Total	100.0	100.0	

Source: Author, 2022

Travel time and expenses

The city of Nairobi experiences severe traffic congestion, particularly during the extended peak hours, leading to substantial economic losses in time and fuel (Murphy & Harris, 2014). This scenario is better reflected in the study area. It was established that during peak time, majority of travellers (41 percent) are more likely to spend between 1-2 hours when traveling to work. This is a considerably long time having in mind that most households work within the city centre while the longest stretch of the study area (Thika Road) is approximately 18 kilometres from the CBD. On the other dimension, the majority of the households (50 percent) spend less than 30 minutes when traveling to work during off-peak hours. The comparative difference in travel time to work during peak and off-peak hours have been illustrated using **Figure 3.**

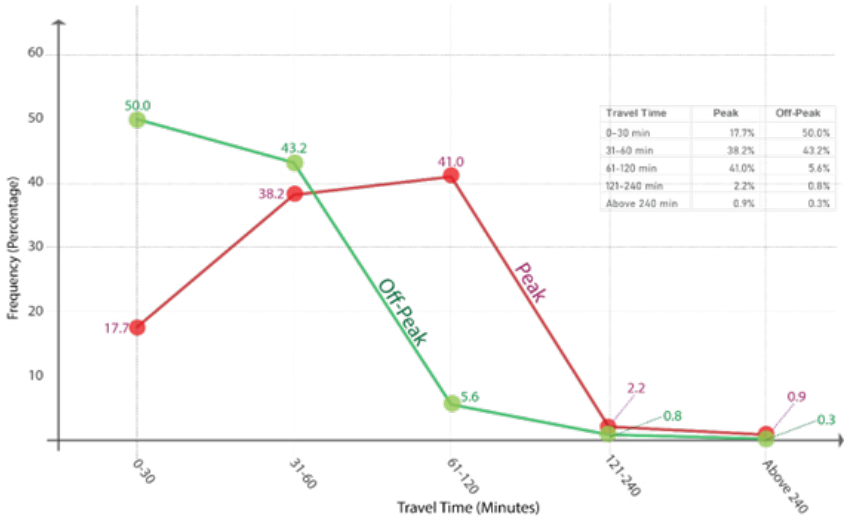

FIGURE 3
Travel time to work during peak and off-peak hours
Source: Author, 2022

It also evident that one is also likely to spend more time when traveling to home from work during peak time compared to off-peak time. The study established that a large percentage (43.5 percent) of respondents were spending between one to two hours when traveling to home from work during peak times primarily due to congestion. On the other front, a large sample of the respondents (48.9 percent) pointed out spending less time (below 30 minutes) when traveling to home from work during off-peak hours. **Table 5** presents a comparative summary of travel time to home from work during peak and off-peak periods.

TABLE 5
Travel time to and fro home to work

Travel time	Peak Time	Off-peak Time
0-30 min	14.4%	48.9%
31-60 min	36.7%	41.2%
61-120 min	43.5%	8.8%
121-240 min	4.5%	0.8%
Above 240 min	0.9%	0.3%

Source: Author, 2022

Land Use Transformation

Geographical Information Systems (GIS) and Remote Sensing analysis of land use land cover change detection and built-up area footprints featuring 1986, 1993, 2002, 2010 and 2021 has indicated that there has been a high acceleration of increase in the built up area in Nairobi City which has changed from 7.5% in 1986 to 8.7% in 1993, 9.4% in 2002, 22.4% in 2010 and 38.4 in 2021. **Table 6 and Figure 4** illustrate the Land Use Land Cover Change detection in Nairobi.

The greatest changes have been recorded in the study corridors which recorded 41.4% and 57.1% in 2010 and 2021 respectively for Thika Road Corridor and 27.2% and 48.8% in 2010 and 2021 respectively for Ngong Road Corridor. These changes have caused high population growth which has not been matched with provision of appropriate public transport and non-motorised transport facilities thus impeding on accessibility.

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TABLE 6
Land use and Land Cover Change Detection in Nairobi County

Land Uses/ Classes	1986		1993		2002		2010		2021	
	Area (Ha)	Area (%)	Area (Ha)	Area (%)	Area (Ha)	Area (%)	Area (Ha)	Area (%)	Area (Ha)	Area (%)
Forest	27278	3.9	74369	10.5	27170	3.7	41377	5.9	28076	4.0
Water Body	1340	0.2	2481	0.3	3707	0.5	2290	0.3	3908	0.6
Built-up	52738	7.5	61348	8.7	64072	9.4	158813	22.4	272157	38.4
Rangelands/Shrubs	317110	48.8	230808	32.6	340498	48.1	306604	43.6	256600	36.2
Vegetation	308783	43.6	339285	47.9	272845	38.3	197208	27..8	147548	20.8
Total	708292	100	708292	100	708292	100	708292	100	708292	100

Source: Author, 2022

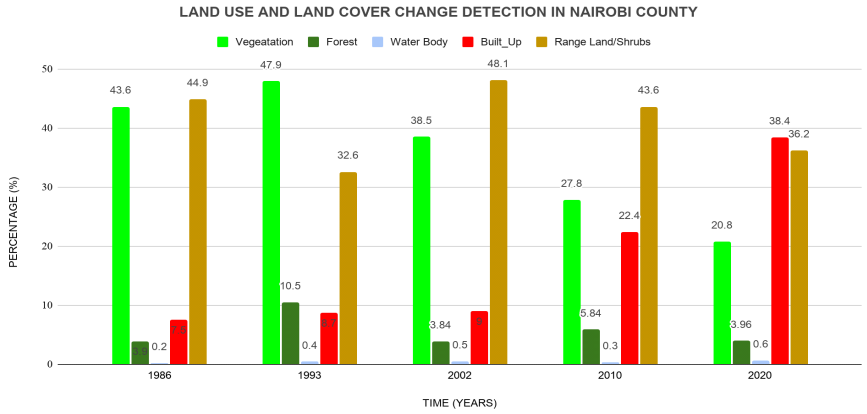

FIGURE 4
Land use Land cover (1986-2020)
Source: Author, 2022

Land Use, Land Cover Change on Thika Road and Ngong Road Transport Corridors

Within the study area, land use change detection shows that in 2010 the built up area covered 41.4% of Thika Road corridor, range lands, 16.86% and 8.4% while vegetation covered 34.04% and 50% for Thika Road and Ngong Road corridors respectively as shown in **Table7.** In addition, land use cover for range lands has changed from 16.8% to 15% and 8.4% to 7.8% while vegetation cover has changed from 34.8% to 15.1% and 50% to 34.8% for Thika Road and Ngong Road corridors respectively.

TABLE 7
2010 and 2020 Land use -Land cover along Transport corridor 1 Kilometre Buffer in percentage (%)

CLASS	THIKA ROAD			NGONG ROAD		
	2010	2020	Change	2010	2020	Change
Forest	4.43	2.3	-2.13	14	8.1	-5.9
Water body	0.04	0.2	0.16	0.05	0.4	0.35
Built up area	41.4	57.1	15.7	27.2	48.8	21.6
Range lands	16.86	15	-0.91	8.4	7.8	-0.6
Vegetation	34.8	15.1	-19.7	50.02	34.8	-15.22

Source: Author, 2022

Between 2010 and 2021 the built-up area increased by 15.7% and 21.6% for Thika Road corridor and Ngong road corridor respectively. The range lands cover was reduced by 1.8% and 0.6% while vegetation cover reduced by 19.7% and 15.4% for Thika Road and Ngong Road corridors respectively as shown in **Table 7.**

In comparison the built-up area for the general Nairobi county increased from 22.4% in 2010 to 38.4% in 2020 an average change of 16% **(Figure 4)**. The present research analysis therefore shows that land use cover changes in the study are much higher than the overall land use cover changes for the wider Nairobi City .

The study therefore shows continued growth in land use development hence increased developed land cover which in effect implies that transportation services is on the sharp rise with expansion of the built-up area and population growth. The expansion in developed city area is however causing increased car usage due to inappropriate provision of public transport service.

Performance of Major Nairobi Land Use and Urban Transport Policies

The present study found that the outcomes of Nairobi Urban Transport is poor as evidenced by the data collected on accessibility. Accessibility is measured in terms of mobility, proximity between destinations, affordability, and convenience. Up to 65% of commuters use the highly informal public transport known as Matatus. The study found out that lack of integration of urban transport policy and land use planning has resulted to poor accessibility due to:

1. Lack of implementation of land use plans and urban transport policies.
2. Poor land use planning and development control.
3. Fragmented institutional coordination and management of land use planning and urban transport policy.
4. Poor regulation of land use planning and urban transport.
5. Poor urban public transport operations and services.
6. Inadequate infrastructure for urban transport.

The study also found that there is poor accessibility arising from lack of integration of urban transport policy and land use planning as a result of:

1. Acute traffic congestion in the study area which has been manifested by very low levels of service at E and F of sections between Globe roundabout and GSU/Kasarani section of Thika Road corridor.
2. Long journey lengths and travel time occasioned by urban sprawl mostly in areas between Kasarani and Thika.
3. Low travel speeds at peak hours which fall as low as 5Km/h for excessively congested sections of Thika Road mostly between Survey of Kenya and Pangani interchange.
4. High cost of transport and urban modal captive challenge where the use of the car is dominant followed by matatu transport - thus it is estimated that over 2.2 Million Nairobians lack appropriate means of public transport.

The study attributes this poor accessibility to a lack of integration in land use planning and urban transport policy. As evidenced by the data collected on Land Use Changes along the two study corridors, there has been rapid changes in Land use in Nairobi which are characterized by increased demand for transport. Between 2010 and 2020, the Thika Road corridor experienced 15.7% increment in the built-up area while Ngong Road experienced 21% increment in the built-up area. In the same period, there has been minimal evolution of the transport situation in Nairobi City. The Bus Rapid Transit systems that were proposed in 1994 are yet to be implemented, the planning is still motor vehicle oriented with efforts centred around road expansion. This means there is minimal provision for Rapid Mass Transit in Nairobi. NIPLAN (2013) proposed the development of Light Rail to reduce pressure on road transport and till now (2022) there has been no progress. It is evident that transport policy is not integrated with Land use planning.

CONCLUSION AND RECOMMENDATIONS

Poor integration and low accessibility have caused urban transport problems that affect travellers on a daily basis. Further, transport management, institutional and policy implementation and urban development issues have further accentuated the problems of urban transport services and land use planning.

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The present study has developed a model using a systems approach for the integration of urban transport policy and urban land use planning and development in order to achieve accessibility in Nairobi City and other similar cities in developing countries as demonstrated in **Figure 5.** The model views urban transport policy and land use planning and development are systems in their own right and are also part and parcel of the urban system. The urban transport system and the urban land use system have their own sub-systems which are interdependent being instrumental in the functioning of the urban system. In order to achieve integration, the urban transport sub-system and the urban land use sub-system must be organized as concomitant sub-systems to each other. The Urban transport policy and urban land use integration model views the urban transport policy inputs and urban land use planning and development inputs as being interdependent and inputs into each other's sub-system scientifically during policy formulation and land use planning processes.

Urban transport policy sub-system inputs include; transport inventories, main road, and pedestrian and other non-motorized based inventories, traffic volume census, public transport passengers, pedestrian, and non-motorized volumes, travel time studies, parking inventory, bus inventory, rail inventory, planning, and development of the main road, pedestrian and non-motorized transport networks and public transport networks. These urban transport policy sub-system inputs when scientifically analysed give an output; of network planning, tentative main road, pedestrian and non-motorised networks and public transport networks, and inter-modal transport terminal facilities. The urban transport policy sub-system out-put, therefore, becomes an input into the integration analysis.

The urban land use planning sub-system have inputs of; land uses, determination of the distribution of population, households, employment, housing, and other land uses. These inputs are scientifically analysed to give outputs of planning forecasts, projections of population and households, projections of employment, and future distribution of land use including housing, employment, and work areas. These urban land use sub-systems outputs become inputs into the integration model. The Urban transport policy sub-system outputs and the urban land use sub-system outputs are then fed as inputs into the urban transport policy and urban land use planning integration model to scientifically produce system networks, trip assignments analysis, volume capacity analysis, land use development scenarios and cost as shown in **Figure 5.** Other factors considered in the urban transport and land use planning and development system model are; external environment factors, internal environment factors, environmental, Health and Climate Change factors, institutional coordination and functioning factors and socioeconomic and Legal, Regulatory and Political factors.

The present research, therefore, proposes the Urban Transport Policy and Land Use Planning Integration Model to integrate Urban Transport Policy and Urban Land Use Planning and development. The model, therefore, contributes to the body of knowledge of the integration of urban transport policy and urban land use planning to optimize accessibility in Nairobi City and similar cities in developing countries.

This proposed Urban Transport Policy and Land Use Planning Integration Model put emphasis on accessibility at citywide and at neighbourhood levels as follows:

1. Integrate land use planning with urban transport policy to optimize accessibility.
2. Structure appropriate institutional framework for coordination and strengthening regulations that govern urban transport policy and land use planning.
3. Plan and Develop Public Transport Infrastructure that is integrated with Land Use.
4. Plan and Develop Bust Rapid Transport (BRT) and Mass Rapid Transit (MRT) for Mass Public Transport services in Nairobi City.
5. Deepen adaptation of telecommunication substitutes for physical travel such as.

These policies evidently seek to reduce the need to travel, especially by car, by influencing the location of different types of development relative to transport provision (and vice versa), and by fostering forms of development that encourage walking, cycling, and public transport use. These non-private cars based integrate land use and transportation aspects.

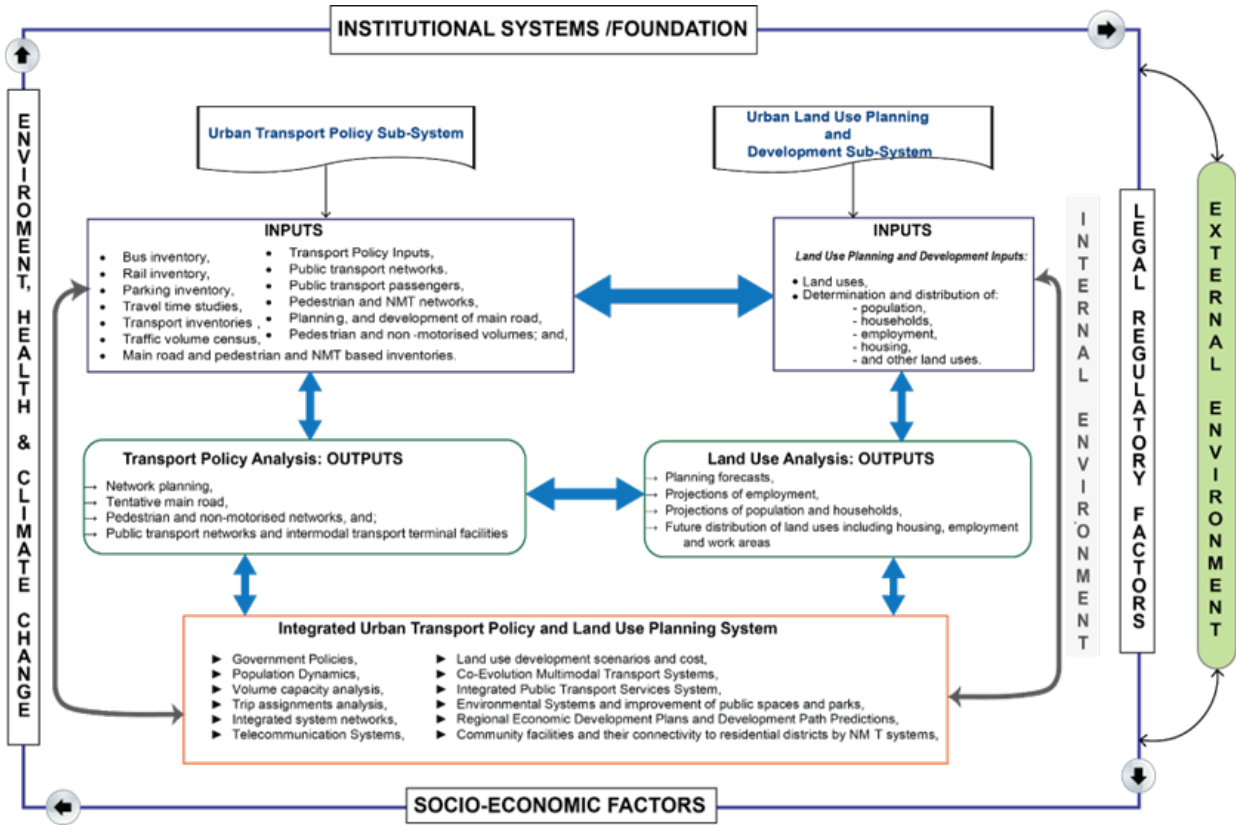

FIGURE 5
The Urban Transport and Land Use Planning Integration Model.
Source: Author, 2022

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