

Infrastructure Dynamics Of Urban Human Agglomeration In Nairobi, Kenya

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Abstract

Nairobi City has endured various challenges since its establishment in 1899 as an outpost for colonial railway workers. With a current metropolitan area population of close to ten million people and being home to hundreds of world-class institutions, the city is continuously becoming more complex. Activities within the old city space have become too compact, forcing the city to expand over wider geographical boundaries. Guided by general systems and concentric ring theories, this paper undertakes a descriptive examination of the city's expansion in the backdrop of its public infrastructure systems. Its central observation is that the city's laissez-faire development poses a danger to its organised growth as envisioned in the Sustainable Development Goals (SDGs). Furthermore, inadequate government investment in road, water, drainage, sewerage and general hygiene, education and public health infrastructure to correspond with the mega growth of the city's population and economic activities is contributing to a general sense of untidiness and reduced liveability of the city with the subsequent rise in living costs and lag in the city's global ratings being evident. It hence recommends the adoption of a mix of public and public-private investments accompanied by defined and time-bound tolling of users of these services in the interim to speed up their installation and access to alleviate the suffering being endured by the city's residents.

Key Words: *Nairobi, Suburbia, Governance, Public Infrastructure, Public Private Partnership*

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I. Introduction: Background Information

According to Duranton and Puga (2014), cities generally tend to grow despite seeming stagnation in their population. Still, population growth is the primary driver of urban sprawl (De Espindola et al., 2017). This sprawl results from increased consumerism as people seek to occupy more space (increasing home sizes), coupled with changing tastes, which result in people changing their abodes from time to time. Such dynamics also characterise dwellers' use of basic amenities. As the population and wealth of the city grow, its residents will consume more water, generate more garbage, drive more, seek more medical services, get more education, eat more, and pooh more. Furthermore, technologies used in buildings also change with time. Some people, therefore, relocate or redesign buildings and other urban infrastructure in response to this change. The reorganisations resulted in the evolution of cities and their infrastructure, making them cover more space both on the earth's surface and in their penetration of the skylines (Burgess, 1925).

The rapid expansion of cities by population and geographical spread is often a response to the changing socio-economic fortunes of cities and their dwellers. The availability of finances (capital) and opportunities in cities encourages rural-to-urban migration and the expansion of cities beyond their traditional boundaries (Vidal, 2018). As the financial inflows into cities increase, their populace's demand for better services increases, too. People find themselves more able to afford high-end urbane conveniences. Similarly, the supply end will respond by gratifying this need for amenities and lifestyles. Such results in cities' social, economic, and physical evolution into new shapes (Mwau et al., 2020; Ehrlich et al., 2019; Macagba, 2016;).

As a result of their exponential growth trajectory, cities the world over are experiencing various sustainability challenges. These range from air pollution, uncontrolled and unplanned urban growth, poor urban transport, unsustainable urban fuel use and energy consumption, pollution, crowding, high cost of living, including the high cost of housing, and degradation of the urban environment associated with the turning of cities into concrete jungles which lead to low carbon absorption capacities (De Espindola et al., 2017). Besides, cities face a distribution challenge affecting the spread of urban utilities across space. The state often tends to overconcentrate resources in developing certain areas at the expense of others without considering urban expansion and urban stagnation or shrinkage dynamics here (Ehrlich et al., 2019).

Zheng *et al.* (2015) opine that cities' tendency to have much higher population concentration than rural areas tends to overwhelm the ordinary environmental population carrying capacity and ecological elasticity. In response, technologies such as tarmacked walk and driveways, concrete or tiled floors, parking spaces and games arenas make life easy and more friendly for humans but limit vegetation growth and the water absorption capacity of town surfaces. Consequently, urban areas, which often have more cars than trees, generally tend to experience flooding than rural or naturally conserved locations with their equivalent topographical characteristics, hence forcing a reverse migration into suburbia (McDonald *et al.*, 2018; Humphries, 2012). Similarly, poorly planned cities tend to have slums and chaotic streets characterised by untidiness and accumulation of waste (Vidal, 2018). These are issues that may quickly degrade such cities if left unchecked (Mwau, 2019). Nairobi is not spared from this trend.

Whereas traditional data collection methods have concentrated on collecting and collating data for local and subnational consumption, emerging trends demand the availability of such data for making global comparisons and peer learning. This data transcends demography, human settlements and socio-economic conditions of human dwellings. Its collection, compilation, and distribution are the interests of both physical and social scientists, hence the need to establish the size and type of activities that take place within human settlements. This entails collecting data, especially from data-poor and often less-developed regions, to establish a global database on human settlement patterns. It is expected that this study, which focuses on the urban growth dynamics of Nairobi, Kenya, is a step towards contributing to that global effort.

II. Methodology

The study adopts a descriptive approach to explain the observed phenomena. Its data was collected through observation and literature review. In particular, the study reviewed books, policy and legal documents, periodic reports from relevant bodies, journal articles, newspaper and magazine articles, and content from various online sources.

Theoretical Perspectives

This study is based on two theories, namely, theories of human settlement and aggregation. According to the theory of human settlement, human societies and human settlements evolve. This evolution is not only based on the material characteristics of these settlements. Instead, settlements, through their material depictions, reflect the evolved capacities of their occupiers to create, learn and communicate ideas, cultures, languages, myths, and social institutions (Bowen & Gleeson, 2019). According to the authors, this is in line with the general systems theory thinking wherein the culture and experience of a people define their understanding and shaping of systems. Furthermore, due to their unique abilities and being guided by their laws, human beings possess the capacity to communicate and create complex organisations, including cities (Bowen & Gleeson, 2019; Wilkiens, 2007).

Whereas it is possible to decompartmentalise various aspects of a system such as a city to know how they individually function, it is also true that the individual parts of systems (including cities) work in cooperation with, in response to, and in harmony with each other to bring forth the interactive-functional whole as perceived by Darwinist Structural Functionalism as well (Walonick, 1993). By and large, cities are an expression by their owners of their ability to organise, accumulate their efforts, and structure their lives in a way that gives meaning and fulfilment. They speak of man's ability to pursue his cognitive and linguistic abilities to solve problems and structure his society (Bowen & Gleeson, 2019).

The interactions of components do not follow any linearity. Similarly, their outcomes are most often random, though with some basic guiding principles that would apply to constitutions and city bylaws, which give skeletal direction on the projected development of a city. Walonick (1993) reports that systems such as cities can either be controlled (cybernetic) as applies in authoritarian administrations or uncontrolled (Wilkiens, 2007). Nairobi tends to operate in the middle. Here, whereas the invisible hand, though corruptible (Mwau *et al.*, 2020), sets foundational frameworks, a lot of the development is determined by market forces (Mwau, 2019). The general rules set by the government are meant to influence the role of each unique unit (a piece of infrastructure) in establishing generalised patterns. However, a high prevalence of corruption among stakeholders often results in these being ignored.

Another theory underpinning this paper, viewed as key in explaining Nairobi's growth trajectory, is the Concentric Ring theory, which postulates and describes a hypothetical ring-like land use pattern. The theory, developed by Burgess in 1925, views cities' growth as following a pattern that divides the city into seven concentric cycles (Rodrigue, 2020). These seven cycles divide the city into seven concentric zones (see Figure 1 below), with the CBD being at the core, followed by an industrial zone and transport terminals, low-cost housing—largely slum dwellings for factory workers. A residential zone for the working class and a higher quality housing zone with longer and costly commutes. On the other hand, the rich live in flashy suburbia located at the periphery, where life is largely comfortable but expensive (Burgess, 1925).

Land cost ordinarily reduces as one moves from the city's core. This motivates people to buy land and settle further (Macagba, 2016). Other than in the well-planned suburbia, which attaches estate construction to the installation of basic supporting infrastructure, the theory predicts that suburbanisation of formerly farming villages as people move further from the core of the city generally reduces accessibility, rent and population densities therein. Concerning rent, the figures can be reduced to zero on occasions when residents build or acquire their own homes. Whereas this explains the limited availability of infrastructure, others suggest that governments should prepare for and respond fast to the land-expansive urban growth and put these amenities in place to not only improve residents' quality of life but also instil citizen satisfaction and political cooperation (Addie, 2016; Hamel & Keil, 2016).

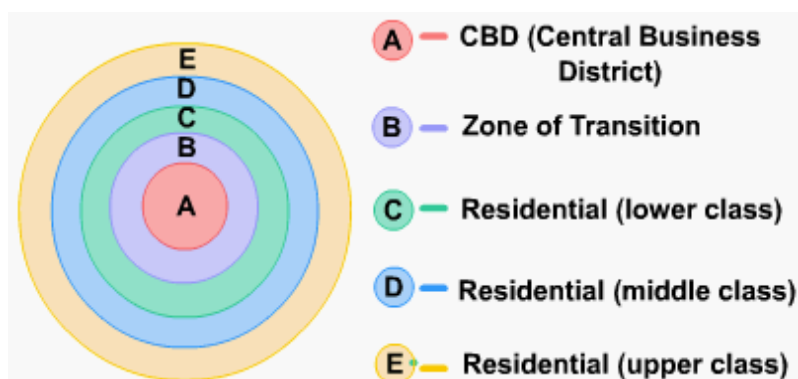


Figure 1: Burgess' 1923 Concentric Zone Theory Urban Land Use Model. Source: Thompson, M. (2014). *Original Theories of Urban Growth*. Link: <https://mt744.wordpress.com/2014/04/12/original-theories-of-urban-growth/>.

Legal and Administrative Framework for Urban Planning in Nairobi City County

Mativo (2015) reports that urban planning laws in Africa, Asia and Latin America still need to work. This results in the construction of unapproved infrastructure, slum and squatter settlements, and general disregard for formal processes in day-to-day urban governance. Among the factors contributing to this menace include complex and inflexible legal and regulatory regimes that do not acknowledge the socio-economic realities in these countries, as well as corruption. Kenyan urban spaces, for instance, are notorious for haphazard growth and spontaneous development without conscious adherence to urban planning principles, legal and policy dictates, processes and capacities (Kitur, 2019). This is independent of the existence of robust legal and institutional frameworks in the country dating from the colonial error Town Planning Act and The Crown Lands Act instituted by the British government in 1902, the Town Planning Act of 1937, The Nairobi Master Plan of 1948, Sessional Paper Number 10 of 1965, the Human settlement Strategy of 1978, various mid to long term national economic plans including Kenya's Vision 2030 launched in July 2008 and several such laws (Kitur, 2019).

Today, land use in Kenya is governed by the Land Act No.6 of 2012 and its 2019 amendments, which categorises land tenure into public (government), community, and private ownership. These pieces of land can be acquired through purchase, leasehold or inheritance overseen by state land registries. The Act categorically spells out processes for transfer of land, land use regimes and sanctions for violation of laws (NCLR, 2012a). In addition to the Land Act 2012, two other pieces of legislation (the Land Registration Act 2012 and The National Land Commission Act 2012 were passed by Parliament to provide a holistic legal foundation on land governance and use. These work in tandem with Sessional Paper No. 1 of 2017 on the National Land Use Policy (Ministry of Lands and Physical Planning, 2017), which spells out a clear-cut policy and legal framework for land use governance and physical plans for the city. Whether these policies and laws are implemented in letter and spirit has historically been disputed (Mativo, 2015; Kalua, 2020).

In addition to land governance laws, Kenya's urban planning is guided by the Physical and Land Use Planning Act of 2019. The Act establishes physical and land use consultative forums at the national and county levels. In addition, it sets up a directorate of physical and land use planning headed by a director general. Housed within the Ministry of Lands and overseen by the National Land Commission, the directorate has well-spelt-out roles and responsibilities at national and county levels. It also calls on the need for stakeholders within the sector to cooperate nationally and locally to ensure effective land use planning, including by incorporating technology in supporting this effort (Republic of Kenya, 2019). The Act calls on the need to develop physical and land use plans that ensure equitable, sustainable and economically sound plans in adherence to national values set out in Kenya's 2010 Constitution.

Furthermore, Kenya has an Urban Areas and Cities Act 2011 and its 2019 amendment, which provides a rationale for the classification and establishment of urban areas and cities and governance and management of

the urban regions and cities. It lays down criteria for upgrading settlements into towns and cities. It establishes a board to oversee these urban agglomerations with organisational structures. These financing and accountability mechanisms meet the country's economic, social and environmental needs in line with its global commitments and ambitions (NCLR, 2012c). This set of laws is supported by others in the construction sector, which include the Architects and Quantity Surveyors Act, CAP 525 of 1978 and revised in 2010; the National Building Regulations of 2015 aimed at delivering a safer, attractive and well-planned built environment (Building Authority of Kenya, 2015).

Additionally, over time, Nairobi City County has developed policies to guide its development. These include the 1973 Nairobi Metropolitan Growth Strategy, the 1979 Land Use Rationalization Policies, and the 2013 Nairobi Integrated Urban Development Masterplan, which identifies critical development and conservation areas for sustainable socio-economic revitalisation of the city. Some areas covered in the 2013 policy include improving and modernising the transport, housing, power, water, sewer, stormwater, and telecommunication infrastructure, protecting the environment and strengthening the institutions mandated with governing the city based on vital underlying principles (Muema, 2016). Complementary legislation that guides urban planning and infrastructure development in Kenya and Nairobi City County consistent with this masterplan include:

- i. Road sector Laws such as the Kenya Roads Act No. 2 of 2007. The Act created institutions mandated for the construction, maintenance, and oversight of various categories of roads. These institutions include Kenya National Highways Authority, Kenya Rural Roads Authority and the Kenya Urban Roads Authority. The act stipulates the administrative structure of the authorities and delineates responsibilities for each, although this has often resulted in conflicts and confusion over road infrastructure management. It also finances the authorities (Republic of Kenya, 2007). Through it, the authorities work through collaborative and cooperation frameworks to deliver on their mandates, albeit with some conflicts (KENHA,2018). Additional legislation in this sector includes the Kenya Roads Board Act No.7 of 1999, the Kenya Ports Authority Act of 2012 and the Kenya Railways Corporation Act of 2012.
- ii. Article 43 of the Kenyan 2010 Constitution declares access to water a human right. The Water Act of 2012 is the mother law guiding ownership, control and ownership of water resources in Kenya. The law also establishes water boards at national and local levels to authorise, regulate and oversee the extraction and use of water resources by individuals and organisations (NCLR, 2012e). The Act and the National Sustainable Waste Management Policy guide the country's waste management regime (Republic of Kenya, 2018; Akosua et al., 2019).
- iii. The Constitution declares mandatory free primary education a right to every child in 53 (1) (b). Article 55 (a) of this constitution mandates the state to take appropriate measures to ensure every child accesses these rights. In addition, Kenya has an Education Act of 2011, which operationalises and institutionalises these constitutional dictates (NCLR, 2012f). Due to this robust policy and administrative framework, the country has invested massively in education, accounting for 5.3% of the GDP in 2018 (World Bank,2020c).
- iv. Like education and transport, healthcare is another public good that supports sustainable (decent) living and is guaranteed in Article 43 (1) (a) of the Kenyan 2010 Constitution. The country has The Health Act No. 21 of 2017, which sets rights and duties, establishes public health facilities, and establishes a governance structure for the country's healthcare, public health and reproductive health infrastructure (the Republic of Kenya, 2017). In addition, the government developed a Kenya Health Policy 2014-2020 aimed towards attaining the highest standard of health for the country (Republic of Kenya, 2014).

Kenya has several other global, regional, national, and local policies and legal commitments that guide these affairs. These cut across sectors and have resulted in her having vibrant emerging urban centres across the country. The policies and laws have also sustained Nairobi despite her immense challenges. Similarly, Nairobi, an independent county with a complete government, including a legislative assembly and an executive, has developed prudential guidelines that are locally customised to give relevant life to the national laws. The county government has relevant local units and officers in charge of these concerns, aligning with the devolved governance principle espoused in Kenya's constitution.

Dynamics of Human Settlement in Nairobi

Nairobi (shown in Figure 2) was created in 1899 by British Authorities in British East Africa during the construction of the East African (Uganda) railway (Otiso, 2012; Greenway & Monsma, 1989). It existed as a province and city managed by a provisional commission and a city council until 2010, when it was changed into one of the 47 counties created under devolved governance by Kenya's 2010 Constitution. The city, which is also Kenya's capital, has grown beyond bounds to become a flourishing commercial and industrial hub for the Horn of Africa Region. It hosts several multi-state agencies, including the Headquarters for the United Nations Environmental Programme (UNEP) and The United Nations Office in Nairobi (UNON); the African Continental

Headquarters of the UN, and only one of the UN's four such offices across the globe (Ministry of Foreign Affairs-MFA, 2018).

Although the initial forces that resulted in its creation were essentially colonial interests, the city's evolution has been influenced by its emerging economic, infrastructural and demographic character over the decades since its inception. Initially, its population was centred at the city's core due to the clustering of industries, commercial establishments, and human settlements close to each other, resulting in a town with a bustling and highly polluted core. This characteristic is not unique to Nairobi's history but characterises most of the world's cities, including London, New York, Beijing, Mumbai, and Lagos (Kitur, 2019).

As the wealth and inconveniences of the city increase, the demand for better living and working conditions has constantly resulted in a continuous mass migration. This is facilitated by expanding infrastructure and opening accessibility and liveability to initially remote city neighbourhoods. This brings forth suburbia, new industrial zones, and new trading complexes, which also get swallowed up in chaos with time as is characteristic of formerly wealthy suburbs such as Kilimani, Kileleshwa, Woodley, Milimani, Buruburu, South C and South B (Muau, 2019; Muema, 2016). Makena (2020) reports that land in these areas has become too expensive, making it impossible to accommodate single-family houses per unit of land. Such are being replaced by high-rise residential and office buildings that can accommodate more activities and increase income for property owners due to their proximity to the CBD (Muiruri, 2016). These trends are understandable, however. Cities such as Nairobi often get compartmentalised into specialised geographical, economic, and social zones, with occupants of such clusters determined by their financial and other forms of capital (Addie, 2016; Macagba, 2016).

Today, Nairobi City County has a population of 4,398,073 spread across 696 km² (269 square miles). However, the larger Nairobi Metropolitan Area has a population of 9,354,580, more than double that of the city-county (Kenya National Bureau of Statistics-KNBS, 2019). This indicates how far the city's population has sprawled outside its administrative boundaries. It also demonstrates how the city-county has integrated closely with her neighbouring counties, making them interdependent. Nairobi's population and, in effect, urban planning challenges have been transferred to her largely rural neighbouring counties of Machakos, Kiambu, and Kajiado without a reciprocal increase in funding to establish urban infrastructure therein, even as the old neighbourhoods in the inner city suffer state neglect in maintaining and upgrading such facilities (Makena, 2020). This explains the general infrastructure challenges that the metropolitan area is bedevilled with (Mutanu, 2020; Mwau et al., 2020; Mansour et al., 2017; Wanzala, 2016; Agence et al.- AFP, 2014; UNDP, 2011).

As an independent state-funded administrative unit, Nairobi is governed by a politically elected county governor who works closely with a county executive board and the county assembly, which is the legislative arm of the county government. These units further have departments and senior administrators who oversee their affairs. To coordinate planning and administration, the county works closely with similar administrative units in other counties that comprise the agglomerated metropolitan area shown in Figure 2 below. This collaboration also ropes in the National government through various ministries and the newly created Nairobi Metropolitan Services, which, overseen by the presidency of Kenya, is expected to fast-track infrastructure development and service delivery in selected sectors for the city (Otieno, 2020).

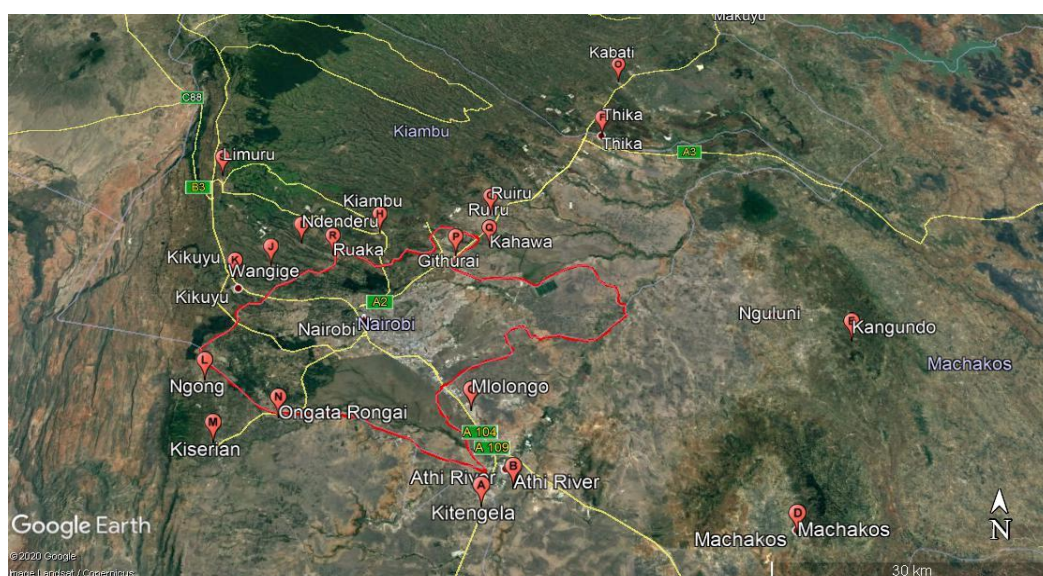


Figure 2: The aggressive growth of Nairobi's Metropolitan Area from its original size (with georeferenced boundaries in red) as it captures smaller towns. Its westward growth is limited by the Great Rift Valley, whose walls border Ngong Town.

Nairobi's Urban Planning and Governance Bottlenecks

The most glaring challenge facing the city's core (within the 10km radius of the CBD is congestion. Describing this chaos that characterises vast parts of estates such as Pipeline, Umoja, Fedha, Imara Daima, Kayole, Mukuru, Githurai, Kahawa, Kagemi, Kitengela, Ongata Rongai, Kibera, Kariobangi, and several similar classes of residential areas housing the bulk of the city dwellers, Mwau (2020) writes:

'On a hot and hazy Sunday afternoon, Nairobi's concrete tenements loom over the city's shacks (or 'slums'). Men and women hang clothes on rooftops and balconies – making the buildings appear as a patchwork of fabric mosaics. The streets below buzz with activity: hawkers, stallholders, water vendors, and pedestrians bustle among shops, betting joints, cafes, and bars. People stream in and out of the tenement's ground floor gates. Children play. Some tenants pass their time on the balconies, which are the only places where the building opens up to the outside air. This is a luxury – many tenants have inward-facing balconies or live on floors with only artificial lighting. Neither sunlight nor fresh air finds its way through here. Meanwhile, water starts to run again from the only tap on the floor (sometimes the only one in the building), and queues are building up. The building caretaker scales the floors, letting tenants know the vital service is on again. Back outside, as the evening closes in, pedestrians pour to and from the matatu pick-up point. Matatu is Nairobi's informal public transport, including buses, minibuses, and vans.

In many estates, including the Kibera, Kayole, Soweto, Lunga Lunga, Mukuru, and Kariobangi slums, male members of the family and their children are accustomed to spending as much time outside the house as possible to avoid crowding in their single-room dwellings. For neighbourhoods that also lack designated sporting grounds and formal markets, men tend to pass their time in illegal brew sheds imbibing cheap contaminated alcohol, bars, betting shops, and in pay TV rooms watching the English Premier League and movies. On the other hand, children try to make the most of any available free space (often yet-to-be-developed plots) playing, as women and other shoppers buy from stalls that line up in front of houses and atop stormwater runoff channels along roads. These conditions contribute immensely to sexual depravity, drug abuse, and diseases, as well as gang and criminal activities among adults and children (Vidija, 2018).

Whereas human settlement is often influenced by infrastructure expansion and deliberate government opening up of initially remote areas, this is not the case for Nairobi. The expansion of the city is primarily stimulated by inconveniences at the city's core, such as crowding, poor quality of housing, high crime rates, high cost of land and housing, and lack of environmental sanity (Mwau, 2019), which pushes the middle class to seek alternatives at the peripheries. It is, furthermore, a product of an aggressive private investment environment, particularly in the sale of land and houses, public transport, private water supply, private education, and healthcare. The assumed serenity and cleanliness, in addition to the lure of having necessities such as water supply (albeit salty borehole water), electricity, some private academy, and proximity to a tarmacked road (from 0-10 kilometres to a tarmacked road or one that is earmarked for tarmacking in years to come) are often attractants used to bait people into buying property and relocating into suburban neighbourhoods, often with the assumption of saving on rent. Unbeknown to them, this is a trade-off with high transport and living costs at the periphery (Mwau et al., 2020).

The government's supply of these essential public infrastructure services is often significantly delayed, sometimes by over a decade (Mwau, 2019; Wanzala, 2016). Most early 2000s suburbs are yet to be connected to clean tapped water, public schools and health services, and bitumen or macadamized roads. The new conurbations largely depend on expensive private academies and hospitals charging exorbitant fees due to lack of competition and government regulation of fees, and tagging of these neighbourhoods by market forces as affluent. A significant chunk of Nairobi's metropolitan area is not covered by the government-piped water supply, the city's sewer system, or the tarmacked city road network. Secondly, the city lacks transport infrastructure and alternatives like roads, walkways, cycling paths, and railways. It characteristically manifests heavy traffic jams during peak hours, water shortage and hawking, long queues in hospitals and water points, and unhygienic fresh food kiosks established atop drainages (Wanzala, 2016; Mwau, 2019; Mwau et al., 2020).

The World Bank (2020b) reports that a good chunk of Nairobi's burgeoning population has been pushed into informal and low-income formal settlements where access to water and sanitation services is limited. However, Work is underway to improve the water supply and sewerage services by installing new pipelines and catchment areas for these services. The impact of these upgrades, however, remains uncertain. It is also unlikely that they will reach all the suburbia where residents consume commercialised services with prohibitive pricing and unreliable quality (Mwau et al., 2020; Wanzala, 2016; K'Akumu & Apidda, 2006). The cost of living here is increased by spending on bottled drinking water and privately procured exhaust services for domestic toilet waste disposal (Mwau et al., 2020; Mansour et al., 2017; UNDP, 2011).

Liaros (2018) states that cities are shaped by their ecosystem's prevailing economic, governance, social, political, and technological narratives. All contributions by these aspects of society will work for the good or the bad of the systems within which they exist. Consequently, in its development, a city like Nairobi is also shaped by these forces, which portray the ideals of the society within which it exists. Moreover, true to his assertion, this

is the trend in the country where government public infrastructure service delivery tends to come late after human settlement (Mwau *et al.*, 2020). Maintenance of such facilities is also often delayed and inconsistent, resulting in extensive damages, vandalism, and hefty restoration costs (Maake, 2015; Oronje *et al.*, 2014). However, Some milestones are reported due to devolved governance, improving state planning and financing under Kenya's Vision 2030, and the drafting of new laws to establish legal, institutional and financing frameworks for sustainable development in counties, towns and cities alike (World Bank, 2018).

The public investment challenges and the seeming haphazard mushrooming of suburbs do not necessarily connote a lack of planning. To a great extent, cities such as Nairobi's expansion and growth trajectory happen in response to government policies and plans, some of which have been highlighted in this document. The Kenyan government, for instance, came up with devolved governance in 2013, as demanded in the 2010 constitution. This initially opened up dying towns as headquarters of regional governments. The initially sleeping shopping centres and small towns, upon being accorded these statuses in shaping the development of their regions, started expanding into major urban nodes, with Nairobi being one such (Splinter & Leynseele, 2019). It is experiencing a rapid rate of urbanisation of between 5-7.5% (Makena, 2020; Mwau *et al.*, 2020; Makworoa & Mireri, 2011).

The land tenure system in Kenya's towns, such as Nairobi, limits land ownership to 99 years of leasehold (National Land Commission, 2017). This makes potential homeowners reluctant to purchase land within city bounds. It is particularly so because land in the neighbouring counties of Machakos, Kiambu, and Kajiado, located a few kilometres away, which also form part of the greater Nairobi metropolitan area, can be purchased on freehold title deeds with unlimited tenure (Wanzala, 2016; The Land Act, 2012). The three counties are generally within a radius of 15-20 kilometres from Nairobi's CBD. Their affordable and freehold land attracts millions of potential homeowners. Consequently, with time, their used-to-be farmlands that border Nairobi City County have been converted into suburbia where homeowners build on an eighth or a quarter of an acre. The areas consist of second-generation immigrants seeking a new identity in town and the lucky newcomers (Makena, 2020; Rodrigue, 2020; Mwau *et al.*, 2019; Wanzala, 2016).

Nairobi's aggressive expansion has overcome administrative barriers, a national park, and forest reserves that initially marked the end of the city. Some sections of the Nairobi National Park and forests, such as Ngong, Ololua, Karen, and Karura, have been encroached on by these expansion activities to make way for infrastructures such as roads and railway lines, factories, warehouses, and human settlements (Mutanu, 2020). Courtesy of these activities, wildlife migration corridors have been swept away, resulting in a reduction in their numbers (Agence France Presse- AFP, 2014). Furthermore, tree cover in forests acts as water towers and carbon sinks; hence, a lung and an ecological lifeline for the sprawling city has reduced significantly. Even the remaining patches of these forests have been invaded by recreational activities, theft (of seedlings, wood, red soil for gardening and other rare forest resources), and dumping of earth excavated from construction sites. They are also used as shortcuts to other parts of the city by pedestrians. These activities threaten their regeneration, and the trends perhaps indicate this society's anthropocentric attitudes towards natural resources, their dominance and use by humans (Koech, 2019; Perry, 2019; Onyango, 2015).

Justifying Determinants of Socio-Economic Character of the City's Neighbourhoods

Burgess (1925) and Rodrigue (2020) consider urban growth as a process of conversion and expansion of land use. Macagba (2016) describes it as a process of invasion through which urban development overcomes administrative divisions to develop a new urban form with its own unique urban spatial structure. It is also accompanied by succession, whereby new social groups and land use patterns gradually emerge to replace the former. This occurs in the city's core, the suburbia, and rural areas where residences and farms are replaced by industrial-commercial hubs and residential estates (Macagba, 2016). Also accompanying this, according to the author, is a process of segregation where the city's population is grouped according to preferences, which are further informed by capabilities and prejudices. In effect, the wealthy leave the congested and slum-like urban core to the poor and the working class to seek a quieter life in the periphery.

As individuals hop through the economic classes, they will relocate and get accepted in the unique environment characterised by their newly acquired socio-economic identity through assimilation and accommodation. The individuals go through a process of filtering, which determines their belongingness to a particular urban community and the unique socio-economic cocoons within these geographical locations. Depending on the changes in their land use and types of occupants, administrative areas in cities will also go through a similar process that individuals go through. This process would see former slums become high-end estates or industrial complexes and vice versa. The undercurrents also determine the value and general cost of living in the emerging socio-economic neighbourhoods. This is analogous to the Darwinian survival of the fittest principle (Macagba, 2016), which also discriminates land (geography) by its economic worth, often, based on the environmental services it offers and attitudes towards its utility.

On this basis, therefore, the mass migration of Nairobi's middle-class residents to the city's outskirts is not only understandable but necessary. Whereas the involvement of private investors in this by providing amenities whose supply is otherwise a preserve of the government would be excusable in the short term due to the rapidly increasing demand for the same, the state's persistent laxity in quickly filling the emerging gap cannot be justified. Coupled with poor regulation of the service providers, the situation results in the supply of low-quality yet expensive basic amenities such as public transport, water, drainage, sewerage, education, and health services and the poor state of roads. This lowers the quality of life for *Nairobians* as well as stifles the development of a city commonly referred to as the gateway to the East and Horn of Africa region. This position is admired and greatly contended by other fast-emerging cities such as Addis Ababa, Kigali, and Dar Es Salam (African Development Bank, 2019; Mwangi & Kibe, 2014).

There is hope that ongoing projects, including the national government's introduction of affordable national housing, will offset the challenges (CAHF, 2019). The fact that Kenya is experiencing these challenges can be attributed to the lack of a stable democratic government between 1978 and 2002 (Goldsmith, 2020; Akech, 2014). The subsequent governments have tried to put in place policies and capital investments to restore the country and Nairobi city on their path to sustainable development as demanded by the Sustainable Development Goals (2015-2030) and their precursor Millennium Development Goals (2000-2015) (SDGs Kenya Forum, 2019). Forces such as underinvestment and corruption still limit the gains made in expanding access to basic infrastructure in Nairobi and across the country. Still, improved awareness and agitation by the citizens are bearing some fruit (TI-Kenya, 2017). It is highly expected that the current and future governments will pump more resources into developing all parts of the city, which is playing catch up against its contemporaries across the globe.

III. Conclusion And Recommendations

Reviewed literature indicates that Nairobi's population is growing very fast. Although reduced by devolved governance, the sprawl has taken a bit of the population pressure resulting from rural-to-urban migration and is expected to continue. Through its relatively uncontrolled expansion, the city is also absorbing more initially rural land into suburbia even as it merges with other smaller towns within its neighbourhood to form the Nairobi Metropolitan conurbation. This growth in Nairobi's population and geography puts pressure on essential public infrastructure services, which must be rapidly expanded in line with Nairobi's emerging urban dynamics.

Nairobi's growth pattern seems to adopt a ring model consistent with Burgess' Concentric Rings theory (Rodrigue, 2020). Its land use pattern appears to have a concentric cycle spectre expanding from the CBD (downtown) to the suburbs. The quality of housing and lifestyles generally improves as one moves further from the CBD. However, this comes at a cost as houses become more expensive, and commodity prices shoot due to social tagging of residents as 'rich'. For a city with one Central Core, which also hosts most of the jobs, those living in suburbia generally spend more time and money commuting to access their workplaces. In Nairobi-Kenya, as already stated, the quality of life in the suburbia is also affected by endemic unavailability of public amenities, namely hospitals, schools, water, roads, sewer systems, and sometimes, electricity (Matata, 2004; World Bank, 2020a). With time, the neighbourhoods also attract slums due to the lack of affordable housing in their proximity to the houses of low-income people who work within them. Such can force further outward migration, turning the city into an unending jungle of unplanned, chaotic communities and structures. These pillars of sustainable urban and community development are envisioned within the SDGs. They are also crucial in poverty eradication. A country with a poor city population will have more poverty in its rural communities.

Considering, for instance, the dire needs created by the lack of basic sanitation and transport infrastructure, this paper recommends continuous modelling, mapping, planning, financing, and development of basic infrastructure in emerging urban constellations. Among the forces to be employed includes provisional privatisation of the installation of amenities such as storage and piping of clean water and drainage to the areas where they are urgently needed. The same can apply to schools, health centres, community roads and proximate low-cost housing. The tolling of water services can accompany this to recuperate investments, followed by a handing over of the facilities to line government authorities once investments and feasible profits have been generated. The approach has already been adopted for road use in various cities, with Nairobi's first toll road (Mombasa Road) currently under construction.

Tolled water and sewerage service access can be connected to the mainstay city network and billed for a particular duration by investors before being reverted to the government on a cost recovery and profit-sharing framework. Such undertakings will see private finances and operational (machines and oversight) instruments deployed in efficient and cost-effective delivery of services (through a public-private partnership), which, if left to the government bureaucracies to undertake, may take another decade or more before being realised. Doing this reduces delayed access to basic fundamental rights by the people, a direct acknowledgement of the utility of these amenities in improving city dwellers' access to high-quality basic public infrastructure and, in effect, better and affordable living standards. More importantly, streamlining these sectors will weed out cartels that have been

blamed for deliberate vandalism of city infrastructure such as hospitals, water, schools, and sewerage pipelines to privately provide these services to city dwellers and profiteers from them. Cases exist where public servants mandated to provide these services deliberately hamper their availability and then set up competing alternatives to generate own income.

For instance, due to limited investment by the state in laying down the water supply and sewerage infrastructure, water supply and sewer exhaust services in many urban neighbourhoods are operated by informal private service providers in a cartel-like arrangement, which constricts municipal service provision to fill the gap through privately owned bowzers, pipelines and tankers at exorbitant prices and hence make themselves billions from poor Kenyan urban dwellers (Akosua *et al.*, 2019).

In addition, in the wake of the geographical expansion of the city, more stringent zoning and systemwide planning and control of neighbourhood houses and other infrastructure layouts and designs should be put in place. This will ensure that the city acquires a standard form (identity) and beauty instead of careless mix-and-match approaches, which turn city neighbourhoods into a chaotic mishmash (cocktail) of all types of structures and land use types. This requires vigilant planning and monitoring of land use, as well as the use of natural resources (including forests, heritage sites, public amusement parks, and national conservation areas like the Nairobi National Park) which should be coupled with stringent measures to curb corruption by cartels at the land registries and by urban planning officials who approve land use and spare illegal structures from demolition without strict adherence to regulations (Alushula, 2019; Angote, 2018; TI- Kenya, 2017; Theuri, 2020; Kariuki & Ng'etich, 2016; NCLR, 2012b; Southall, 2005; NCLR, 2012d).

As the city evolves and grows, its planning should be continuously researched and improved. This entails employing spatiotemporal analysis, which examines the relationship between space and time. There is a need to establish how fast the city grows or degrades continuously, how this compares with trends in other cities, and which lessons can be derived from these growth dynamics and their impacts on people and the environment to better model the urban living-working-visit experience for those who interact with Nairobi's urban environment. This is in recognition that built environments such as Nairobi and mother nature have generally been looked at with an anthropocentric lens for a long time.

The development of built environments primarily aims to improve human interactions with such environments. Unfortunately, as anthropocentric as space development is, it often results in calamitous impacts on the man whom it is meant to serve, with Nairobi not being an exception. The anthropocentric approach has caused or exacerbated environmental and man-made disasters due to limited environmental considerations of the effects of human settlements (Copnina *et al.*, 2018). Government planning and investment offset these excesses to ensure the sustainability of urban growth and development for cities such as Nairobi, whose experiences with flooding, building collapse, disease outbreaks, fire incidences, high instances of crime, pollution, poor waste management, and substandard water and sanitation services (Mwau, 2019; Mwau *et al.*, 2020) attest to this necessity. This is in recognition that urban ecosystems work as an ecological whole. A failure in any aspect of its planning and governance will ultimately poison the whole system and derail the sustainable development of Nairobi and other cities within the region.

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