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Sustainable Urban Street Design for Economic Regeneration: A Study of Nairobi's Eastern Central Business District

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Abstract

Nairobi, the capital city of Kenya, accounts for around 45% of the country's GDP, making it an important economic hub in East Africa. Amid this economic vibrancy, there has been a noticeable downturn in activity in the capital's once-thriving eastern Central Business District (CBD). This research aims to identify the several factors that contribute to this drop. Despite this, the Eastern Side of the CBD still generates about 25% of Nairobi's annual revenue. However, businesses have moved to other parts of the city, as evidenced by closed stores, empty spaces, lower tenancy rates, and offers on new leases for abandoned shops. The research examines every aspect of the situation; the available pedestrians' space, roadside parking, street width, cleanliness, traffic patterns, opening hours, shoppers' safety, turnover, land use patterns, availability of social spaces and amenities, high-rise development issues, residential availability, and regulations governing street use. The research examines these facets and uncovers the underlying causes of the economic downturn in Nairobi's Eastern CBD. By conducting this thorough analysis, the report offers concrete recommendations for stakeholders, urban planners, and legislators, helping them to formulate effective sustainable regeneration strategies. The research provides workable alternatives for regeneration, taking cues from the successful urban design interventions on Mama Ngina Street, where pedestrian-friendly enhancements resulted in a 27% fall in reported crime rates.

Keywords

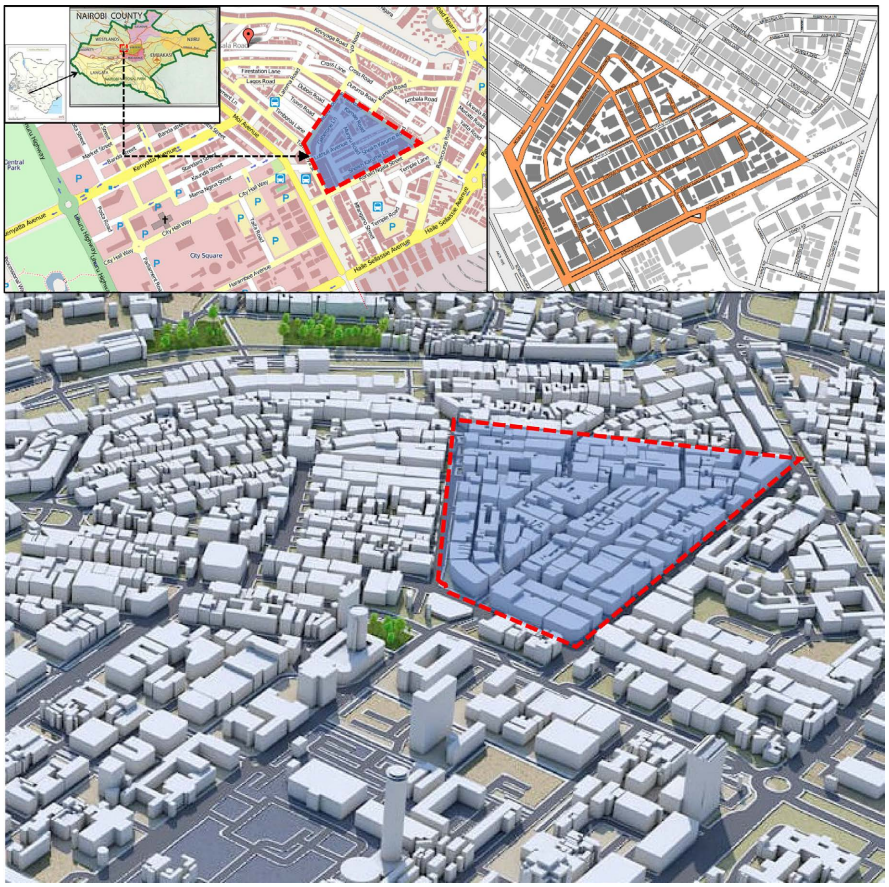
Nairobi, Kenya, Economic Hub, Economic Vibrancy, Annual Revenue, Tenancy, Sustainable, Regeneration, Revitalisation, Urban Design

1. Introduction

Kenya's vibrant capital city, Nairobi, is one of the continent's major economic

centres (Ese & Ese, 2020). Nairobi, which has a population of more than 4 million people (Kenya National Bureau of Statistics, 2018), contributes more than 45% of Kenya's GDP (World Bank, 2021) and is a major economic player in the country. This emphasizes how important it is as a key economic driver.

Historically known as a prosperous commercial corridor (Mitullah, 2004), Nairobi's Eastern CBD is located on the eastern side of the city (bordered by Tom Mboya Street, Ronald Ngala Street, Accra Road, and River Road; see **Figure 1**).



Source: Author, 2024.

Figure 1. Location of the study area in Nairobi's CBD.

However, the economic vitality of this neighbourhood has fallen significantly in recent years, raising concerns among residents, business owners, revenue collectors, and municipal officials alike (KNBS, 2019a, 2019b). Once bustling with activity and business, the street now faces several challenges that have contributed to the collapse of the local economy (KNBS, 2020a, 2020b).

Several elements have combined to produce an untenable circumstance on the East Side of the CBD. First and foremost, there is the issue of congestion, which is mostly due to the abundance of matatus (public minibuses) and abundant street parking. This congestion not only impedes automobile flow but also presents considerable obstacles for pedestrians, resulting in an unwelcoming and hectic

environment for both consumers and businesses.

In addition to the congestion, the absence of enough space for pedestrians exacerbates the problem. The Eastern Side of the CBD, which was originally built to handle both automotive and pedestrian traffic (Ese & Ese, 2020), today struggles to provide a safe and accessible environment for walkers. The narrow walkways and the encroachment of street vendors and parked vehicles have made it impossible for people to move about the neighbourhood pleasantly.

Furthermore, the abundance of dust, debris, and waste on the streets creates an unpleasant environment for shoppers and visitors. This not only reduces the area's aesthetic appeal but also raises hygiene and cleanliness concerns, deterring potential customers.

The inappropriate use of street parking exacerbates these problems. Important parking spots intended for customers and business owners are taken up by vehicles, many of which belong to people unrelated to the street's business activity. This abuse adds to the general traffic and chaos in the neighbourhood, in addition to restricting parking options for authorized users.

The decline in the Eastern Side of the CBD's economic vitality is consistent with the observations made by urbanist Jane Jacobs in her seminal work "Death and Life of Great American Cities" (Jacobs, 1961), which emphasized the value of lively, mixed-use streets in promoting both community involvement and economic vitality. Furthermore, the ideas of "The Image of the City" by Kevin Lynch (Lynch, 1960) and "Life Between Buildings" by Jan Gehl (Gehl, 2011) emphasize the importance of memorable urban areas and pedestrian-friendly surroundings in boosting both economic activity and quality of life.

Successful urban revitalization initiatives in other cities have proved the possibility for transformation, in contrast to the formerly prosperous area. According to "Planning and Design for Sustainable Urban Mobility" (UN-Habitat, 2013), establishing surroundings that support bicycling, walking, and public transportation is crucial to the concept of sustainable urban mobility. In addition to fostering economic activity, streets created with these characteristics in mind also support social cohesion and environmental sustainability (Moirongo, 2002).

The problems caused by urban sprawl, which is defined as the unplanned growth of cities, stand in sharp contrast to the deterioration of the Eastern Side of the CBD (Hamidi & Ewing, 2014). Reviving existing urban areas, such as the Eastern Side of the CBD, is consistent with the ideals of sustainable urban development (Oyugi & Moirongo, 2006), even though urban sprawl frequently results in worsening traffic, longer commutes, and environmental damage.

Notwithstanding these obstacles, Nairobi's Eastern Side of the CBD continues to be an important commercial corridor. According to data from the Kenya Revenue Authority (KRA), this region provides about 25% of Nairobi's annual revenue (KNBS, 2021a, 2021b). Recent patterns, however, point to a downturn in economic activity (KNBS, 2022), with companies closing their doors and moving to busier and more accessible areas.

In addition, the CBD's Eastern Side renovation may benefit urban safety in addition to its economic effects. A 27% drop in reported instances of insecurity was the result of recent rehabilitation efforts on Mama Ngina Street and Luthuli Avenue, which centred on boosting the pedestrian experience and upgrading street infrastructure (Njeru & Kinoshita, 2018).

The trend of companies moving to nearby streets is especially alarming because it underscores the need for redevelopment initiatives and reflects a change in consumer preferences. Rejuvenation efforts along Mama Ngina Street and Luthuli Avenue have shown promise, so this phenomenon is not exclusive to the Eastern Side of the CBD. A more welcoming and secure urban environment, improved accessibility, and an improved pedestrian experience were the main goals of these projects.

Furthermore, traditional street markets have lost customers and companies to the temptation of shopping malls, with their ease of use and contemporary facilities. This change underscores the necessity for the Eastern Side of the CBD to change to offer a competitive and welcoming environment for both customers and companies.

The research explores sustainable options as Nairobi faces the twin problems of urban sprawl and the economic downturn on the Eastern Side of the CBD (County, 2023). The research proposes implementable techniques by taking cues from internationally recognized restoration projects that have been successful, such as those in Medellin, Columbia, Bogotá, Brazil, Curitiba, Brazil, Portland Pearl District, Oregon, and New York City's Highline Park. This study offers policymakers, urban planners, and stakeholders' useful recommendations by addressing issues like high-rise development, residential availability, parking misuse, street width, cleanliness, accessibility for pedestrians, traffic congestion, and street use regulation policies.

This research develops a plan for reviving the Eastern Side of the CBD by adhering to the ideas of sustainable urban mobility and learning from the insights of prominent urban thinkers like Jane Jacobs and Jan Gehl. Attracting companies and customers, boosting its economic impact on Nairobi, and promoting a sustainable and liveable urban environment for everybody are the ultimate objectives.

The objectives of the study are:

1) To assess the spatial characteristics that influence the economic patterns of the Eastern Side of Nairobi's CBD.

2) To identify the challenges that have contributed to the economic decline of the Eastern Side of Nairobi's CBD.

3) To identify the spatial characteristics that can be modified for the economic regeneration of Nairobi's Eastern CBD.

4) To provide actionable street spatial design recommendations for revitalizing the Eastern Side of Nairobi's CBD.

2. Conceptual Framework for Economic Regeneration in Urban Spaces

The Conceptual framework of this study offers a theoretical and visual framework for comprehending the interactions between different elements in the context of

economic regeneration. The following conceptual framework unifies the different facets of urban space and regeneration that have been discussed (see Flowchart 1).

2.1. Core Concept: Economic Regeneration

Economic regeneration aims to bring life back to metropolitan areas to boost total urban vitality, promote economic growth, and improve living circumstances. Numerous interconnected aspects, including infrastructure, social dynamics, environmental sustainability, governance, and spatial design, have an impact on this process.

2.2. Key Components and Relationships

2.2.1. Spatial Design and Urban Form

Urban Layout: How roads, structures, and green areas are arranged. affects economic activity, accessibility, and attractiveness.

Patterns of Land Use: The dispersion of various land uses (commercial, residential, and mixed-use). impacts the vibrancy and variety of the economy.

Infrastructure: The standard of the nation's roads, utilities, and mass transit. affects the area's accessibility and allure for both businesses and residents.

2.2.2. Economic Variables

Rental Rates and Property Values: Take into account the area's investment potential and demand.

Business Diversity: A wide range of companies promotes growth and resilience in the economy.

Employment Levels: a clear indicator of the local economy's health.

Investment Projects: Innovations and advancements boost the economy.

2.2.3. Social Dynamics

Community Engagement: Projects are more relevant and effective when locals are involved in the regeneration process.

Demographics of the Population: Age, household size, and income level affect market demand and service requirements.

Quality of Life: Amenities, social services, and safety all affect how satisfied and long-term residents stay.

2.2.4. Environmental Sustainability

Green Spaces: Liveability and aesthetic appeal are enhanced by parks and other natural places.

Sustainability Practices: Long-term viability is supported by energy efficiency and waste management techniques.

2.2.5. Policy and Governance

Regulatory Environment: Development is shaped by building codes and zoning laws.

Public-Private Partnerships: Coordinating efforts among interested parties to finance and oversee revitalization initiatives.

Comprehensive plans to direct development and revitalization initiatives are known as urban planning strategies.

2.2.6. Technological Innovation

Digital Infrastructure: Mobile and broadband access improve corporate operations and draw in tech-focused capital.

Smart City Technologies: Advancements in urban planning and living conditions for inhabitants.

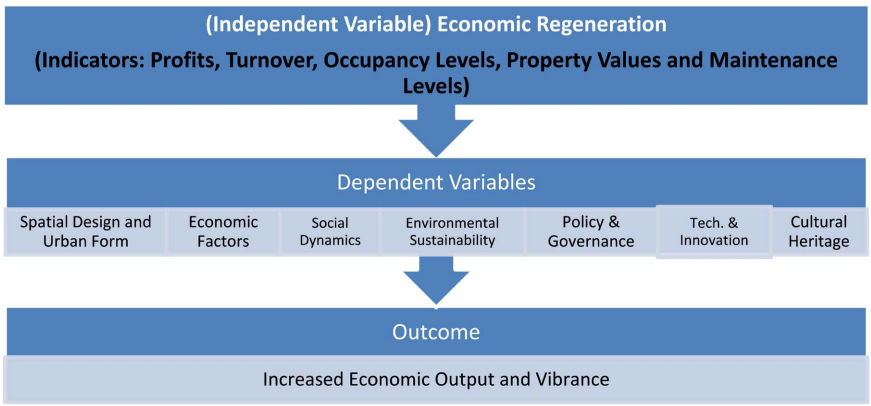
2.2.7. Cultural and Heritage Assets

Cultural Attractions: Landmarks, galleries, and museums add to the area's allure.

Heritage Preservation: Preserving the region's historical features enhances its appeal to tourists.

2.3. Visual Representation

- Several factors can be used to predict the economic performance of a region. These include profits, turnovers, occupancy levels, property values and maintenance levels. These economic performance variables can be affected by spatial, economic, social, environmental, governance, technology and culture of the region. These combine to enhance the economic vibrance or decline of a place as shown in Flowchart 1 below.



Source: Author, 2024.

Flowchart 1. Conceptual framework.

2.4. Description of Relationships

- By assessing an area's appeal for investment and commercial activity, spatial design and urban form have an impact on economic factors. Mixed-use, well-designed venues can improve economic performance.
- Social dynamics are influenced by economic factors in the form of better quality of life, more employment options, and higher property prices.
- The general quality of life is influenced by social dynamics and environmental sustainability, which in turn promotes economic expansion and revitalization.
- Policy and governance set the strategic direction and regulatory framework for

regeneration initiatives, either enabling or limiting the effects of other components.

- Technological innovation promotes social and economic growth by increasing the effectiveness of corporate operations and urban management.
- Cultural and historical resources provide the region with a special significance that draws tourists and strengthens the sense of place.

2.5. Discussion

The economic, social, and environmental dynamics of urban areas are significantly impacted by urban street design, which is a basic component of city planning (Jacobs, 1961). The conversation explores the intricate relationship between street design and economic revitalization, emphasizing significant findings from the literature review and making links to both theoretical frameworks and actual case studies.

The concept of the "complete street," which puts the interests of all users, including cyclists, pedestrians, and drivers, first, is one major theme that comes out of the literature review (Lynch, 1960). Complete streets encourage active mobility and dynamic urban environments by being safe, approachable, and welcoming to people of all ages and abilities (Gehl, 2013). Complete streets can boost economic development, raise property values, and improve public health outcomes by allowing a variety of travel modes and promoting pedestrian engagement (Garvin, 2016).

Additionally, the conversation delves into how public space contributes to economic revitalization, stressing the value of well-planned parks, plazas, and streetscapes as hubs for social interaction and community involvement (Whyte, 1980). Innovative public space design techniques have the potential to revive urban neighbourhoods, attract investment, and cultivate a sense of place, as exemplified by the High Line Park in New York and the Barcelona Superblocks (Gehl, 2013).

Furthermore, the conversation explores the connection between environmentally sustainable urban street design and street trees, rain gardens, and bioswales as examples of green infrastructure that can help reduce the effects of climate change, clean up the air and water, and increase urban biodiversity (Jacobs, 1961). Urban environments can be made more resilient and liveable while leaving a smaller ecological imprint when green components are incorporated into street design (Gehl, 2013).

Moreover, the conversation touches on the significance of community involvement and participatory planning methods in the design of urban streets, highlighting the necessity of incorporating a variety of stakeholders in the process of decision-making and design (Garvin, 2016). Cities may develop social capital, bolster civic pride, and promote a sense of ownership and belonging by giving local communities the power to design their streetscapes (Whyte, 1980).

In conclusion, the talk emphasizes how complex urban street design is and how much it affects social cohesiveness, economic growth, and environmental sustainability. Through the adoption of inclusion, accessibility, and sustainability principles, towns may design streetscapes that not only bolster economic growth but

also improve the general standard of living for both locals and tourists.

3. Research Methodology

3.1. Research Overview

The research examined the economic dynamics of Nairobi's Eastern CBD, concentrating on several economic variables in 33 CBD sample locations. The study examined the obstacles and possibilities encountered by businesses in these areas, suggesting measures for the area's rehabilitation.

The research used a mixed-methods approach, gathering data using both quantitative and qualitative techniques (Bryman, 2016). This method offered insightful information from both quantitative and qualitative data, enabling a thorough knowledge of the economic activity in the Eastern CBD.

The objective of the research design was to gather information at specific intervals to shed light on the region's economic situation (Mugenda & Mugenda, 2003). The study also concentrated on a sample of 33 spaces that were chosen through purposive sampling. The process involved selecting spaces that fulfilled the following criteria:

i. Location: The spaces selected were the ones located inside the study area; the Eastern Side of CBD.

ii. Length: The selected spaces were taken at 20m minimum length with shops on either side.

iii. Composition: The spaces were selected with (≥3) three or more openings or establishments.

iv. Variety: The spaces which were selected had the following as the minimum variety of establishments: Electronic Shops, Chemists, Hardware stores, offices and bookshops. Other establishments desired were stores, banks, religious centres, social amenities, government installations, residential spaces, cinemas and libraries.

The selection criteria helped guarantee balanced representation from various Eastern CBD regions.

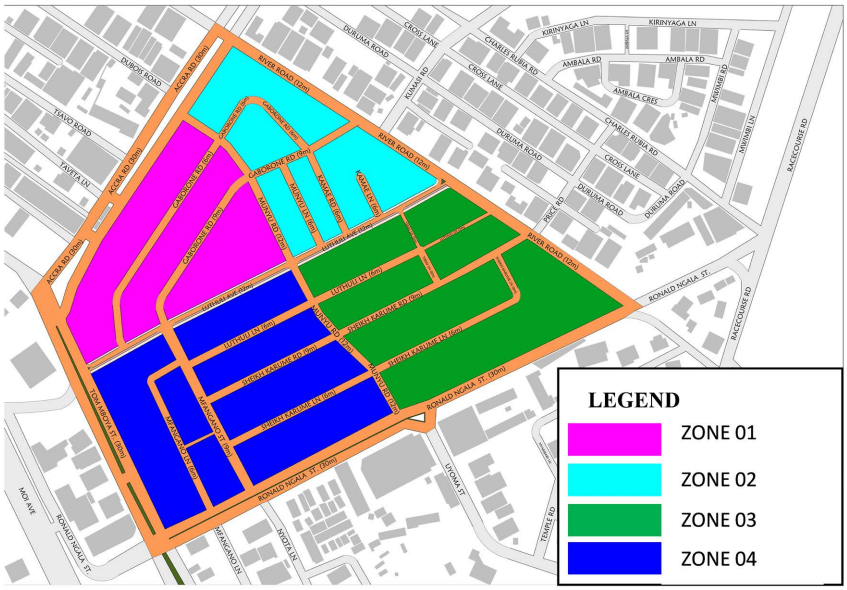
3.2. Population, Cluster and Sampling Size

3.2.1. Population

The Eastern CBD is home to over 750 establishments in total, dispersed throughout the region. A sample size of 33 spaces was chosen for the study from this group. The saturation concept in qualitative research served as the basis for determining this sample size (Mugenda & Mugenda, 2003). Saturation guarantees that the sample size is adequate to represent the variety of viewpoints and experiences present in the study community.

3.2.2. Cluster

The intersection of Munyu Road and Luthuli Avenue created four zones that made up the study area (see **Figure 2**). These zones, which each represented a different geographic region within the Eastern CBD, acted as the clusters for sampling purposes.

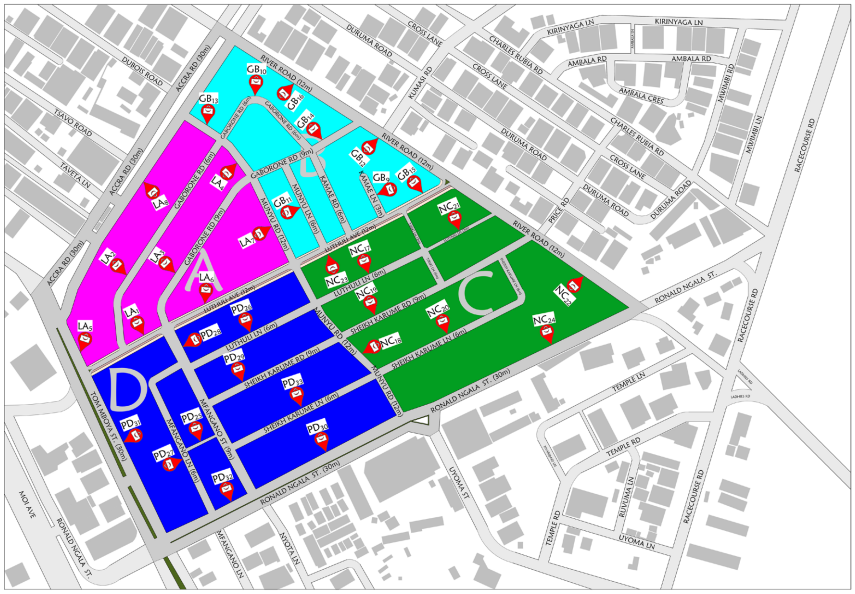


Source: Author, March 2024.

Figure 2. An illustration of the four (4) study zones and the circulation road widths within those zones.

3.2.3. Sampling Size

It was determined that 33 spots altogether, spread among the four zones, will be the sampling size for this study. The distribution of spaces that each zone will contribute is as follows (see **Figure 3**):



Source: Author, March 2024.

Figure 3. Distribution of the spaces from which data was collected for analysis.

- Zone 1: 8 spaces;
- Zone 2: 8 spaces;

- Zone 3: 8 spaces;
- Zone 4: 9 Spaces.

This distribution gave a thorough understanding of the economic dynamics in the Eastern CBD and guaranteed a fair representation of various business kinds within each zone.

3.2.4. Variables

Y—Map Variables (G)

G11—Axial Line Index drawn from the axial map.

Spatial Measurements Relating to the Space (K)

K28—Number of facades of buildings in the space that boarder a street.

K29—Number of doors in the space to the street.

Library Methods (L)

L22—Traffic accidents per year.

Movement Patterns (M)

Percentage of Pavement of Pavement Surface That Is:

M39—Uneven.

M51—Average number of vehicles using the street per minute.

M52—Average pedestrian speed in m/s.

M53—Traffic volume per minute.

M54—Traffic speed in m/s.

M55—Average noise levels in the street in dB(A).

Parking Facilities

M56—Number of parking lanes in the space.

Built Environment (P)

P11—Average length of a block of buildings.

Composition of the Establishments

U30—Land use mix measured by recording the total number of different types of uses (i.e., commercial, residential, office, industrial, etc) accommodated in the adjacent buildings to the space.

U38—Maintenance Level measured as the number of buildings rehabilitated or developed recently measured as a percentage of all buildings in the space.

U41—Property values measured as a percentage of the initial cost against the current cost.

U42—Rental rates measured as the cost of a rental amount per unit area of floor space in the space.

U43—Employment levels measured as the number of new employees as a percentage of the total number of employees for establishments in the space.

U44—Profit margins measured as a percentage of the total sales less the purchasing and running costs.

Economic Impacts

U45—Proportion of number of establishments that have closed down or moved from the space.

U46—Proportion of buildings that have changed usage to the total.
U53—Proportion of number of buildings with dirty or dusty facades.
U54—Proportion of number of buildings with weeds growing on them.
U56—average number of people in the establishments per space per hour.

Factors Discouraging Business

S22—Theft.
S23—People fear passing through lanes.
S24—Difficult to get business places in nearby streets.

Social Variables (T)

How do people use the space near the establishment?

Necessary Activities	Optional Activities	Social Activities
Window Shopping	Leisure walking	Listening and preaching
Waiting for a Bus	Standing and talking	Selling commodities
Going to Work	Seated and talking	Buying commodities
Going to School	Seated and sunbathing	Conversing
General Walking	Playing	Playing
	Seated and eating	Listening to music
	Generally seating	
Total Number of People		
Average Number of People		
Intensity (Average/Area of Est.) T50 =	T51 =	T52 =

Technological Patterns

T32—Percentage of the number of businesses that do online marketing to the whole number of the same establishment.

4. Results and Discussion

Data was collected for the 33 spaces over various spatial, economic, social and environmental variables. Variables which didn't show any correlation were filtered out and omitted such as ceiling hights, rough and smooth surfaces, surveillance, police patrols etc. The rest of the variables (37) thirty-seven which showed significant correlation were analysed for the 33 spaces and the summary calculated using the Statistical Package for the Social Sciences (SPSS) Software is shown below (Table 1).

4.1. Modelling Economic Performance Indicators

Economic performance indicators are important measurements that provide information on the soundness of a company's finances and operational effectiveness. These indicators aid in assessing how different spatial and infrastructural

elements impact the commercial areas' economic viability and vibrancy in urban studies and spatial analysis. Five important economic performance indicators—each of which represents a distinct facet of economic activity and property value—within Nairobi's Central Business District (CBD) on the Eastern Side are the subject of this study.

Table 1. Descriptive Statistics summary for the 33 spaces (Source: Author, 2024).

	Descriptive Statistics											
	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
G11	33	4	1	5	3.76	0.180	1.032	1.064	−0.568	0.409	0.081	0.798
K28	33	9	2	11	4.73	0.390	2.240	5.017	1.075	0.409	1.057	0.798
K29	33	12	1	13	5.70	0.615	3.531	12.468	0.625	0.409	−0.685	0.798
L22	33	10	1	11	4.39	0.428	2.461	6.059	0.865	0.409	0.438	0.798
M39	33	95.00%	0.00%	95.00%	26.6364%	5.90884%	33.94372%	1152.176	0.911	0.409	−0.733	0.798
M51	33	15	0	15	7.24	0.712	4.093	16.752	0.199	0.409	−0.656	0.798
M52	33	0.30	0.60	0.90	0.8152	0.01761	0.10115	0.010	−1.020	0.409	0.121	0.798
M53	33	18	11	29	19.42	0.797	4.576	20.939	0.110	0.409	−0.610	0.798
M54	33	20.0	0.0	20.0	9.864	0.9807	5.6337	31.739	0.032	0.409	−0.778	0.798
M55	33	22	57	79	70.36	0.846	4.859	23.614	−0.464	0.409	0.363	0.798
M56	33	2	0	2	0.82	0.147	0.846	0.716	0.368	0.409	−1.517	0.798
P11	33	11.0	1.0	12.0	9.333	0.4898	2.8137	7.917	−0.955	0.409	0.525	0.798
P16	33	0	1	1	1.00	0.000	0.000	0.000	—	—	—	—
P17	33	0	1	1	1.00	0.000	0.000	0.000	—	—	—	—
U30	33	12	1	13	6.00	0.577	3.317	11.000	0.536	0.409	−0.569	0.798
U38	33	11.00%	7.00%	18.00%	11.4545%	0.58564%	3.36425%	11.318	0.585	0.409	−0.620	0.798
U39	33	44.00%	12.00%	56.00%	37.9394%	2.31020%	13.27107%	176.121	−0.445	0.409	−0.938	0.798
U41	33	22.00%	71.00%	93.00%	81.2424%	0.93949%	5.39693%	29.127	−0.138	0.409	−0.478	0.798
U42	33	11000.0	2000.0	13000.0	6618.182	574.1175	3298.0538	10877159.09	0.436	0.409	−0.944	0.798
U43	33	23.00%	14.00%	37.00%	22.8182%	0.93790%	5.38780%	29.028	0.733	0.409	0.277	0.798
U44	33	21.00%	3.00%	24.00%	10.4848%	0.86397%	4.96312%	24.633	0.904	0.409	0.420	0.798
U45	33	21.00%	2.00%	23.00%	13.8485%	1.10279%	6.33503%	40.133	−0.338	0.409	−0.950	0.798
U46	33	43.00%	3.00%	46.00%	27.8788%	2.26751%	13.02583%	169.672	−0.435	0.409	−0.978	0.798
U53	33	42.00%	9.00%	51.00%	32.8182%	2.21456%	12.72167%	161.841	−0.403	0.409	−0.898	0.798
U54	33	15.00%	3.00%	18.00%	11.0909%	0.78861%	4.53020%	20.523	−0.336	0.409	−1.097	0.798
U56	33	32	2	34	14.67	1.485	8.528	72.729	0.423	0.409	−0.826	0.798
S22	33	17.00%	2.00%	19.00%	9.8788%	0.82888%	4.76155%	22.672	0.014	0.409	−1.039	0.798

Continued

S23	33	17.00%	19.00%	36.00%	27.0303%	0.67348%	3.86882%	14.968	0.096	0.409	−0.349	0.798
S24	33	2.40%	10.00%	12.40%	11.4061%	0.09980%	0.57333%	0.329	−0.049	0.409	−0.864	0.798
T31	33	12.00%	62.00%	74.00%	67.2121%	0.66963%	3.84673%	14.797	0.217	0.409	−1.147	0.798
T32	33	8.04%	17.42%	25.46%	21.9679%	0.44865%	2.57731%	6.643	−0.217	0.409	−1.147	0.798
T33	33	3.96%	8.58%	12.54%	10.8200%	0.22098%	1.26942%	1.611	−0.217	0.409	−1.147	0.798
T34	33	13.00%	78.00%	91.00%	83.7879%	0.69870%	4.01371%	16.110	0.230	0.409	−1.107	0.798
T35	33	13.00%	58.00%	71.00%	63.6364%	0.70954%	4.07598%	16.614	0.309	0.409	−1.035	0.798
T50	33	0.00%	100.00%	100.00%	100.000%	0.0000%	0.0000%	0.000	—	—	—	—
T51	33	5.91%	35.45%	41.36%	38.0854%	0.31759%	1.82441%	3.328	0.230	0.409	−1.107	0.798
T52	33	15.60%	69.60%	85.20%	76.3636%	0.85145%	4.89118%	23.924	0.309	0.409	−1.035	0.798
Valid N	33											

- **Profit Margins and Employment Levels:** Profit margins are an indicator of the business's financial profitability; larger margins are indicative of successful firms. The backdrop of profitability is provided by employment levels, which are expressed as the percentage of new hires compared to the overall number of employees. A strong commercial sector that benefits from favourable conditions and high foot traffic is indicated by high-profit margins paired with rising employment levels. Lower employment and profit margins, on the other hand, can be signs of stagnant economic growth and financial challenges.
- **Property Values and Rental Rates:** The attraction and demand for commercial space are demonstrated by property values, which are stated as a percentage of the initial cost against the current cost, and rental rates (cost per unit area). Increased rental rates and rising property values are usually signs of a healthy economy. On the other hand, falling property values and decreased rental rates may indicate a decline in interest in the economy.
- **Maintenance Levels:** Buildings and public areas are evaluated for upkeep and condition at different maintenance levels. Environments that are kept up to date are more aesthetically pleasing, encourage higher property values, and improve corporate performance. Deteriorating conditions brought on by poor maintenance might inhibit investment and lower economic activity.
- **Noise Levels:** An area's amount of noise is frequently a good indicator of its level of business activity. Reduced commercial engagement may be indicated by lower noise levels, while higher noise levels typically reflect stronger business activity and a lively workplace.

By analysing these indicators in connection with infrastructural and spatial features, we want to accomplish the following goals for the study:

- **Objective 1: Assess the Current Spatial Characteristics:** Analyse the effects of geographical elements on profit margins, employment levels, property

values, rental rates, maintenance, cleanliness, and noise levels. Examples of these factors are street width, pedestrian accessibility, and closeness to business hubs.

- **Objective 2: Identify Economic Decline Challenges:** To highlight issues causing the economic decline, identify locations with low-profit margins, lower employment levels, dropping property values, lower rental rates, and poor levels of upkeep, sanitation, and noise.
- **Objective 3: Investigate Spatial Parameters for Regeneration:** Investigate how improving the physical environment can increase revenue, employment, property values, rental rates, and cleanliness. Examples of these changes include bettering infrastructure, creating more pedestrian paths, and improving waste management.
- **Objective 4: Provide Actionable Design Recommendations:** To revitalize Nairobi's Eastern Side, it is recommended that street spatial patterns improve cleanliness and upkeep, balance noise levels, and increase foot traffic, accessibility, and overall aesthetic appeal.

These indicators, when matched with the objectives of the research, allow us to fully address economic trends, pinpoint obstacles, and offer practical suggestions for reviving Nairobi's Eastern Side neighbourhood centre.

4.1.1. Modelling Profit Margins (U44)

Profit margins can be modelled as follows:

1) Model Summary

Profit margins variable (U44) was analysed as an independent variable against the other variables and the model summary as shown in the table below to obtain the specific predictors (see Table 2).

Table 2. Model summary for profit margins (Source: Author, 2024).

Model Summary									
Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	0.993[a]	0.985	0.844	1.95765%	0.985	6.989	29	3	0.067

a. Predictors: (Constant), U38, S24, M56, S23, P11, M39, M53, U43, K28, L22, G11, U41, M55, T51, S22, U30, U56, M54, U53, M52, U45, K29, U54, M51, U39, T32, U42, T52, U46.

Adjusted R Square: 0.844

This means that approximately **84.4%** of the variance in profit margins is explained by the predictors in the model. This is a strong indication that the model is a good fit.

2) Multiple Regression Model

The multiple regression model is derived from the data analysed as shown below (Table 3).

Table 3. Modelling profit margins against other variables (Source: Author, 2024).

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	−94.756	144.663		−0.655	0.559	−555.138	365.625
G11	−0.241	1.146	−0.050	−0.210	0.847	−3.888	3.407
K28	−0.114	0.852	−0.051	−0.133	0.902	−2.824	2.597
K29	−2.628	1.288	−10.869	−2.041	0.134	−6.725	1.470
L22	−1.762	0.862	−0.874	−2.044	0.134	−4.506	0.982
M39	0.020	0.040	0.136	0.499	0.652	−0.107	0.146
M51	−3.812	1.485	−3.144	−2.568	0.083	−8.537	0.912
M52	−133.426	45.504	−2.719	−2.932	0.061	−278.241	11.388
M53	1.779	0.619	1.640	2.873	0.064	−0.192	3.750
M54	1.111	0.550	1.262	2.019	0.137	−0.640	2.863
M55	1.132	0.381	1.108	2.969	0.059	−0.081	2.345
M56	−0.890	1.164	−0.152	−0.765	0.500	−4.595	2.815
P11	−0.162	0.288	−0.092	−0.563	0.613	−1.078	0.754
U30	−1.238	0.505	−0.827	−2.451	0.092	−2.845	0.370
U39	1.071	0.755	2.863	1.419	0.251	−1.331	3.473
U41	1.023	0.398	1.113	2.573	0.082	−0.242	2.288
U42	0.005	0.004	3.400	1.182	0.322	−0.009	0.019
U43	0.381	0.253	0.414	1.507	0.229	−0.424	1.186
U45	−1.708	1.045	−2.180	−1.634	0.201	−5.035	1.619
U46	−0.111	1.111	−0.291	−0.100	0.927	−3.646	3.425
U53	−0.055	0.249	−0.141	−0.221	0.839	−0.846	0.736
U54	−0.100	0.952	−0.091	−0.105	0.923	−3.129	2.929
U56	−0.627	0.242	−1.077	−2.593	0.081	−1.396	0.143
S22	1.114	0.498	1.069	2.238	0.111	−0.470	2.698
S23	0.102	0.143	0.079	0.712	0.528	−0.353	0.556
S24	0.115	1.431	0.013	0.080	0.941	−4.438	4.667
T32	3.805	2.223	1.976	1.712	0.185	−3.269	10.879
T51	−6.427	7.343	−2.362	−0.875	0.446	−29.797	16.943
T52	2.003	2.050	1.974	0.977	0.401	−4.522	8.527
U38	1.350	1.082	0.915	1.247	0.301	−2.095	4.795

The equation for the profit regression is:

$$\mathbf{Y}_{\text{Profit Margins}} = \beta_0 + (\beta_1 + (\beta_{11} \times M56) + (\beta_{12} \times P11) + (\beta_{13} \times U30) + (\beta_{14} \times U39) + (\beta_{15} \times U41) + (\beta_{16} \times U42) + (\beta_{17} \times U43) + (\beta_{18} \times U45) + (\beta_{19} \times U46) + (\beta_{20} \times U53) + (\beta_{21} \times U54) + (\beta_{22} \times U56) + (\beta_{23} \times S22) + (\beta_{24} \times S23) + (\beta_{25} \times S24) + (\beta_{26} \times T32) + (\beta_{27} \times T51) + (\beta_{28} \times T52) + (\beta_{29} \times U38)$$

where: β_0 is the intercept, β_1 to β_{29} are the coefficients for the corresponding variables G11, K28, K29, L22, M39, M51, M52, M53, M54, M55, M56, P11, U30, U39, U41, U42, U43, U45, U46, U53, U54, U56, S22, S23, S24, T32, T51, T52, and U38.

The multiple regression model's general form, devoid of individual coefficient values, is represented by this equation. With all other variables held constant, each β indicates the anticipated change in profit margins associated with a one-unit change in the related predictor.

$$Y_{\text{Profit Margin}} = -94.756 + [(-0.241 \times G11) + (-0.114 \times K28) + (-2.628 \times K29) + (-1.762 \times L22) + (0.020 \times M39) + (-3.812 \times M51) + (-133.426 \times M52) + (1.779 \times M53) + (1.111 \times M54) + (1.132 \times M55) + (-0.890 \times M56) + (-0.162 \times P11) + (-1.238 \times U30) + (1.071 \times U39) + (1.023 \times U41) + (0.005 \times U42) + (0.381 \times U43) + (-1.708 \times U45) + (-0.111 \times U46) + (-0.055 \times U53) + (-0.100 \times U54) + (-0.627 \times U56) + (1.114 \times S22) + (0.102 \times S23) + (0.115 \times S24) + (3.805 \times T32) + (-6.427 \times T51) + (2.003 \times T52) + (1.350 \times U38)]$$

3) Discussion on the Economic Performance of the Eastern CBD

The Eastern Central Business District (CBD) in Nairobi's multiple regression analysis provides important insights into the variables influencing profit margins in this sector. The model has a very strong explanatory power; its adjusted R-squared value of 0.844 shows that the included predictors can account for about 84.4% of the variance in profit margins.

4) Key Variables and Their Impacts

a. Negative Influences

Number of Accidents (L22): Higher accident rates have a detrimental effect on profit margins, as seen by the negative coefficient for the annual number of traffic accidents. This implies that regions that experience a high frequency of accidents could lose clients and incur higher operating expenses, which would lower profitability.

Number of Facades (K28): The quantity of building facades along a street impact negatively on business margins. This can be because larger building fronts come with higher maintenance and operating expenditures.

Number of Doors (K29): Lower profit margins are linked to more doors opening to the street, maybe as a result of higher maintenance and security expenses.

Number of Vehicles (M51): Profit margins are significantly impacted by the average number of vehicles utilizing the roadway each minute, perhaps as a result of noise and congestion detracting from the customer experience.

b. Positive Influences

Traffic Volume (M53): The traffic volume per minute has a positive coefficient, indicating that by making businesses more visible and accessible, more traffic can boost profit margins.

Traffic Speed (M54): Profit margins are positively impacted by higher traffic speeds measured in meters per second, which suggests that more customers can be drawn in by effective traffic management.

Noise Levels (M55): The average street noise level in dB (A) has a favourable impact on profit margins and may be a sign of a busy company environment that draws in more customers.

Land Use Mix (U30): Profit margins are positively impacted by a diversified land use mix, which is determined by the number of different types of applications in nearby buildings. This illustrates the advantages of mixed-use construction.

Employment Levels (U43): Increased employment levels, as indicated by the percentage of new hires compared to the total number of employees, have a beneficial impact on profit margins and signify a flourishing corporate environment that fosters job growth.

Rental Rates (U42): The cost per unit area of floor space, or rental rates, has a positive correlation with profit margins, indicating that higher rental values are indicative of more desirable commercial locations.

Percentage of Buildings with Dirty/Dusty Facades (U53): It is noteworthy that the percentage of buildings with unclean or dusty facades positively correlates with profit margins; the lower the margin, the higher the profit.

5) Implications for Eastern CBD

The results of the research illustrate the intricate interactions among a range of urban, infrastructure, and market-related variables that have shaped the Eastern CBD's economic environment. The robust impact of mixed-use development and infrastructural variables implies that programs targeted at increasing street traffic could greatly improve business performance. Here are some particular suggestions:

- **Infrastructure Improvement:** Improving infrastructure is essential, particularly when it comes to building upkeep and traffic control. Investing in building facades, pedestrian paths, and roadways can make an area more hospitable for people. More foot traffic is encouraged by improved infrastructure, which can increase business activity and profitability.
- **Safety and Security Measures:** More people may use the streets if strong safety and security measures are put in place to lower accident rates and boost consumer confidence. This could entail upgraded lighting, better pedestrian walkways, and better traffic control. A safer atmosphere attracts more shoppers and pedestrians, which can boost sales for local businesses.
- **Non-Motorized Transport (NMT) Integration:** Encouraging the usage of non-motorized transportation (NMT) choices, like cycling and walking, can benefit businesses. NMTs make the street a more pleasant and accessible place for walkers by lowering the number of cars on it. This change benefits local businesses by increasing foot traffic and improving the shopping experience.
- **Mixed-Use Development:** Promoting mixed-use development that combines residential, commercial, and office areas might improve the area's economic dynamism. Zoning laws should encourage a variety of land uses to promote different kinds of businesses and make the street seem busy and alive, which will bring more people.

- **Urban Planning and Management:** Effective urban design may enhance the general business environment and draw in more tourists by minimizing traffic and maximizing space utilization. This includes regulating traffic flow, improving public transportation, and finding better parking options. Businesses can notice an increase in foot traffic and sales by making the area more pedestrian-friendly and accessible.
- **Public Spaces and Amenities:** The streets can be made more appealing to visitors by creating public places and facilities like parks, benches, and leisure centres. These areas can act as hubs for activity and entice people to stay longer, which will tangentially help the companies in the neighbourhood.
- **Promotion of Local Businesses:** Growing visitor numbers in the region can be facilitated by marketing campaigns and other measures that support neighbourhood businesses. Emphasizing distinctive stores, eateries, and services can encourage more visitors to visit and explore the streets.

Policymakers and stakeholders may establish a more vibrant and financially successful business area by concentrating on tactics that increase the number of people on the streets, particularly through the promotion of NMTs. The results highlight the need for a comprehensive strategy that takes into account infrastructure, security, mixed-use development, and effective urban management to boost the Eastern CBD's economy and draw more tourists.

4.1.2. Modelling Property Values (U41)

Property values can be modelled as follows:

1) Model Summary

Property Values Variable (U41) was analysed as an independent variable against the other variables and the model summary as shown in the table below to obtain the specific predictors (see Table 4).

Table 4. Model summary for property values (Source: Author, 2024).

Model Summary									
Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	0.996[a]	0.992	0.913	1.58737%	0.992	12.652	29	3	0.029

a. Predictors: (Constant), T52, M56, S24, S23, P11, L22, M39, U43, S22, M53, G11, K28, U44, M55, U30, U38, M54, U56, U53, K29, U45, T31, M51, M52, U54, U39, U46, T51, U42.

According to this, the predictors in the model account for roughly 91.3% of the variance in property values. Given this large proportion, it is likely that the model fits the data quite well and captures the main variables affecting property prices. The model is robust and reliable in explaining the dynamics of property valuation, as evidenced by its excellent explanatory power.

2) Multiple Regression Model

The variables analysed against property values summarised in Table 5 help derive the multiple regression model for the independent variable.

Table 5. Analysing property values against other variables (Source: Author, 2024).

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	−191.102	86.121		−2.219	0.113	−465.177	82.973
G11	0.140	0.933	0.027	0.150	0.890	−2.829	3.108
K28	0.100	0.690	0.041	0.145	0.894	−2.097	2.297
K29	2.539	0.674	1.661	3.764	0.033	0.392	4.685
L22	1.728	0.417	0.788	4.149	0.025	0.403	3.054
M39	−0.016	0.032	−0.099	−0.486	0.660	−0.118	0.087
M51	3.461	0.800	2.625	4.324	0.023	0.914	6.009
M52	116.679	26.926	2.187	4.333	0.023	30.988	202.370
M53	−1.565	0.360	−1.327	−4.343	0.023	−2.711	−0.418
M54	−1.115	0.235	−1.164	−4.741	0.018	−1.864	−0.367
M55	−0.931	0.296	−0.838	−3.143	0.052	−1.873	0.012
M56	0.972	0.866	0.152	1.122	0.344	−1.784	3.728
P11	0.116	0.236	0.060	0.489	0.658	−0.636	0.867
U30	1.053	0.366	0.647	2.881	0.064	−0.110	2.217
U38	−1.392	0.724	−0.868	−1.922	0.150	−3.696	0.912
U39	−1.079	0.487	−2.654	−2.215	0.114	−2.630	0.471
U42	−0.004	0.004	−2.145	−0.939	0.417	−0.015	0.008
U43	−0.314	0.203	−0.313	−1.546	0.220	−0.959	0.332
U44	0.673	0.261	0.619	2.573	0.082	−0.159	1.505
U45	1.701	0.628	1.996	2.709	0.073	−0.298	3.699
U46	0.293	0.886	0.708	0.331	0.762	−2.527	3.114
U53	0.127	0.189	0.299	0.670	0.551	−0.476	0.730
U54	0.108	0.771	0.091	0.141	0.897	−2.344	2.561
U56	0.486	0.214	0.769	2.278	0.107	−0.193	1.166
S22	−1.001	0.318	−0.883	−3.149	0.051	−2.013	0.011
S23	−0.135	0.098	−0.097	−1.373	0.263	−0.447	0.177
S24	0.564	1.115	0.060	0.506	0.647	−2.982	4.111
T31	2.330	1.036	1.661	2.250	0.110	−0.966	5.626
T51	8.061	4.780	2.725	1.686	0.190	−7.151	23.273
T52	−2.518	1.236	−2.282	−2.037	0.134	−6.453	1.416

The equation for property value regression is:

$$Y_{\text{Property Value}} = \beta_0 + [(\beta_1 \times G11) + (\beta_2 \times K28) + (\beta_3 \times K29) + (\beta_4 \times L22) + (\beta_5 \times M39) + (\beta_6 \times M51) + (\beta_7 \times M52) + (\beta_8 \times M53) + (\beta_9 \times M54) + (\beta_{10} \times M55) + (\beta_{11} \times M56) + (\beta_{12} \times P11) + (\beta_{13} \times U30) + (\beta_{14} \times U38) + (\beta_{15} \times U39) + (\beta_{16} \times U42) + (\beta_{17} \times U43) + (\beta_{18} \times U44) + (\beta_{19} \times U45) + (\beta_{20} \times U46) + (\beta_{21} \times U53) + (\beta_{22} \times U54) + (\beta_{23} \times U56) + (\beta_{24} \times S22) + (\beta_{25} \times S23) + (\beta_{26} \times S24) + (\beta_{27} \times T31) + (\beta_{28} \times T51) + (\beta_{29} \times T52)]$$

where:

β_0 is the intercept.

β_1 to β_{29} are the coefficients for the corresponding variables.

The formula for the Property Value regression model with specific values is:

$$Y_{\text{Property Value}} = -191.102 + (0.140 \times G11) + (0.100 \times K28) + (2.539 \times K29) + (1.728 \times L22) + (-0.016 \times M39) + (3.461 \times M51) + (116.679 \times M52) + (-1.565 \times M53) + (-1.115 \times M54) + (-0.931 \times M55) + (0.972 \times M56) + (0.116 \times P11) + (1.053 \times U30) + (-1.392 \times U38) + (-1.079 \times U39) + (-0.004 \times U42) + (-0.314 \times U43) + (0.673 \times U44) + (1.701 \times U45) + (0.293 \times U46) + (0.127 \times U53) + (0.108 \times U54) + (0.486 \times U56) + (-1.001 \times S22) + (-0.135 \times S23) + (0.564 \times S24) + (2.330 \times T31) + (8.061 \times T51) + (-2.518 \times T52)]$$

Without designating particular coefficient values, this equation presents the multiple regression model's structure. If all other factors stay constant, each β0 represents the expected change in property values for every unit increase in the related predictor variable.

3) Discussion on the Economic Performance of the Eastern CBD

Using multiple regression analysis, the Eastern Central Business District (CBD) of Nairobi's property values was able to provide important insights into the factors that influence property values in this area. At 0.913 for adjusted R-squared, the model indicates that the predictors account for roughly 91.3% of the variance in property values. The selected predictors have a significant explanatory power, as indicated by the high adjusted R-squared value. This shows that the factors impacting property values in the Eastern CBD are effectively captured by the variables.

4) Key Variables and Their Impacts

a. Positive Influences

- **Traffic Volume (M53):** Increased traffic flow can improve property exposure and accessibility, which can raise property prices. Higher traffic volume per minute has a positive coefficient.
- **Traffic Speed (M54):** Higher traffic speeds appear to increase property values by facilitating smoother transit and boosting the area's desirability, as indicated by the positive coefficient for traffic speed.
- **Noise Levels (M55):** Higher property values are linked to positive noise levels, which may indicate a thriving and dynamic business environment that enhances the area's appeal.
- **Land Use Mix (U30):** Property values are positively impacted by a diversified land use mix, which reflects the many kinds of nearby buildings and emphasizes the advantages of mixed-use complexes.

- **Employment Levels (U43):** Increased employment levels, measured as the proportion of new hires to total employees, have a favourable impact on property values and are a sign of a strong economy that can sustain increased demand for real estate.
- **Rental Rates (U42):** Higher rental rates may be a sign of more attractive locations because there is a positive correlation between the cost per unit area of floor space, rental rates, and property prices.
- **Percentage of Buildings with Dirty/Dusty Facades (U53):** There is an inverse relationship between property values and the fraction of buildings with dusty or unclean facades.

b. Negative Influences

- **Number of Accidents (L22):** The coefficient for the annual number of traffic accidents is negative, indicating a negative correlation between the number of accidents and property prices. Regular mishaps could discourage development and investment, which would lower the value and desirability of the property.
- **Number of Facades (K28):** Property prices are negatively impacted by more building facades, probably because extensive building fronts require more upkeep and operations.
- **Number of Doors (K29):** There appears to be a negative correlation between the number of doors opening onto the street and property values, presumably as a result of increased upkeep and security needs.
- **Traffic Volume (M51):** The average number of cars per minute has a considerable detrimental effect on property values, maybe as a result of noise and traffic, which can make a property less appealing.

5) Implications on Eastern CBD

The results of the property value research highlight how several factors interact intricately to shape property values in the Eastern CBD. The large impact of infrastructure and mixed-use development variables indicates that property values can be significantly increased by targeted policies and deliberate enhancements. Here are a few suggestions:

- **Infrastructure Enhancements:** It is essential to invest in infrastructure upgrades, especially those that deal with building upkeep and traffic control. Improvements to building facades, pedestrian walkways, and roadways can raise the value and appeal of a property.
- **Safety and Security Measures:** Improving security and safety can lower accident rates, increase the area's allure, and draw in additional investment. This entails enhanced pedestrian amenities, enhanced traffic management, and enhanced illumination.
- **Promotion of Non-Motorized Transport (NMT):** Promoting cycling and walking can raise property prices by easing traffic and making an area more pedestrian-friendly. This change broadens accessibility while simultaneously enhancing a property's appeal.
- **Mixed-Use Development:** Encouraging mixed-use developments that combine

residential, commercial, and office areas can increase the value of real estate by fostering a lively and dynamic atmosphere. To draw in a variety of investors, zoning laws should support a variety of land uses.

- **Efficient Urban Planning:** Property values can be positively impacted by efficient urban planning that minimizes traffic and maximizes the use of available space. Enhancements to traffic control, public transportation, and parking options can improve the area's appeal and accessibility.
- **Development of Public Spaces:** By improving the area's appeal and liveability, public places like parks, benches, and leisure centres can raise property values. These areas function as hubs for social interaction and can raise the value of surrounding houses.
- **Organization of Events and Activities:** Organizing markets, events, and cultural activities can improve the area's reputation and draw more tourists. These pursuits have the potential to boost foot traffic and property prices.
- **Promotion of Local Businesses:** By improving the area's reputation and drawing more tourists, local businesses can be promoted through marketing tactics that increase property prices.

A more dynamic and financially stable Eastern CBD can be created by concentrating on these tactics, especially through the development of NMTs. The analysis emphasizes how crucial it is to take a complete approach that incorporates infrastructure, security, mixed-use development, and efficient urban management to raise property prices and stimulate local economic growth.

4.1.3. Modelling Maintenance Levels (U38)

1) Model Summary

Maintenance Levels (U38) variable is an indicator of how frequent properties in the space are maintained ranging from cleaning, renovations or cleaning. When the variable was analysed as against the other variables, the summary was as shown in Table 6 below.

Table 6. Model summary for maintenance levels (Source: Author, 2024).

Model Summary									
Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	0.997[a]	0.994	0.937	0.84739%	0.994	17.289	29	3	0.019

a. Predictors: (Constant), U41, S24, M56, S23, P11, M54, K28, M39, M53, U43, U44, S22, G11, U30, T52, M55, L22, U56, U53, K29, U45, M52, U54, U39, M51, T32, T51, U42, U46.

This indicates that the model's predictors account for about 93.7% of the variation in maintenance levels. This significant ratio demonstrates the excellent fit of the model and shows how well it captures the important variables affecting maintenance levels. The model's strong explanatory capacity highlights how trustworthy and resilient it is in illuminating the dynamics underlying property upkeep.

2) Multiple Regression Model

The table below (Table 7) summarises maintenance level as a variable.

Table 7. Analysing maintenance level against other variables (Source: Author, 2024).

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	−4.431	66.898		−0.066	0.951	−217.330	208.468
G11	−0.236	0.481	−0.072	−0.491	0.657	−1.766	1.294
K28	−0.044	0.369	−0.029	−0.119	0.913	−1.218	1.130
K29	1.222	0.494	1.283	2.473	0.090	−0.351	2.794
L22	0.677	0.425	0.495	1.594	0.209	−0.675	2.029
M39	−0.006	0.018	−0.060	−0.340	0.756	−0.062	0.050
M51	1.601	0.683	1.947	2.343	0.101	−0.574	3.775
M52	52.907	23.808	1.591	2.222	0.113	−22.861	128.674
M53	−0.701	0.325	−0.954	−2.156	0.120	−1.736	0.334
M54	−0.431	0.268	−0.722	−1.607	0.206	−1.285	0.422
M55	−0.416	0.222	−0.601	−1.872	0.158	−1.124	0.291
M56	0.321	0.519	0.081	0.619	0.580	−1.330	1.972
P11	0.060	0.126	0.051	0.479	0.665	−0.341	0.462
U30	0.451	0.275	0.445	1.640	0.200	−0.424	1.326
U39	−0.675	0.163	−2.661	−4.131	0.026	−1.194	−0.155
U42	−0.002	0.002	−2.398	−1.377	0.262	−0.008	0.003
U43	−0.176	0.103	−0.282	−1.705	0.187	−0.506	0.153
U44	0.253	0.203	0.373	1.247	0.301	−0.393	0.898
U45	0.906	0.337	1.705	2.687	0.075	−0.167	1.978
U46	−0.020	0.482	−0.076	−0.041	0.970	−1.552	1.513
U53	0.087	0.096	0.329	0.905	0.432	−0.219	0.393
U54	−0.129	0.406	−0.173	−0.317	0.772	−1.421	1.163
U56	0.237	0.129	0.602	1.837	0.164	−0.174	0.649
S22	−0.421	0.255	−0.596	−1.653	0.197	−1.232	0.390
S23	−0.054	0.059	−0.062	−0.905	0.432	−0.242	0.135
S24	0.411	0.573	0.070	0.717	0.525	−1.412	2.233
T32	−1.160	1.175	−0.889	−0.987	0.396	−4.900	2.580
T51	5.105	1.999	2.769	2.554	0.084	−1.255	11.466
T52	−1.486	0.550	−2.160	−2.702	0.074	−3.236	0.264
U41	−0.397	0.206	−0.636	−1.922	0.150	−1.053	0.260

The following equation is the general form of the multiple regression model for

forecasting maintenance levels (U38):

$$Y_{\text{Maintenance Level}} = \beta_0 + [\beta_1 \times G11 + \beta_2 \times K28 + \beta_3 \times K29 + \beta_4 \times L22 + \beta_5 \times M39 + \beta_6 \times M51 + \beta_7 \times M52 + \beta_8 \times M53 + \beta_9 \times M54 + \beta_{10} \times M55 + \beta_{11} \times M56 + \beta_{12} \times P11 + \beta_{13} \times U30 + \beta_{14} \times U39 + \beta_{15} \times U42 + \beta_{16} \times U43 + \beta_{17} \times U44 + \beta_{18} \times U45 + \beta_{19} \times U46 + \beta_{20} \times U53 + \beta_{21} \times U54 + \beta_{22} \times U56 + \beta_{23} \times S22 + \beta_{24} \times S23 + \beta_{25} \times S24 + \beta_{26} \times T32 + \beta_{27} \times T51 + \beta_{28} \times T52]$$

In this model, every coefficient β_i denotes the approximate shift in maintenance levels linked to a single unit modification in the related predictor variable, while maintaining uniformity across all other variables. The initial state of maintenance, when every predictor is zero, is represented by the constant term β_0.

This particular formula for forecasting maintenance levels (U38) is derived from the regression coefficients:

$$Y_{\text{Maintenance Level}} = -4.431 + [(-0.236 \times G11) + (-0.044 \times K28) + (1.222 \times K29) + (0.677 \times L22) + (-0.006 \times M39) + (1.601 \times M51) + (52.907 \times M52) + (-0.701 \times M53) + (-0.431 \times M54) + (-0.416 \times M55) + (0.321 \times M56) + (0.060 \times P11) + (0.451 \times U30) + (-0.675 \times U39) + (-0.002 \times U42) + (-0.176 \times U43) + (0.253 \times U44) + (0.906 \times U45) + (-0.020 \times U46) + (0.087 \times U53) + (-0.129 \times U54) + (0.237 \times U56) + (-0.421 \times S22) + (-0.054 \times S23) + (0.411 \times S24) + (-1.160 \times T32) + (5.105 \times T51) + (-1.486 \times T52)]$$

The multiple regression model for maintenance levels is described in this equation, although the precise coefficient values are not given. With all other variables held constant, each β indicates the projected change in maintenance levels corresponding to a one-unit rise in the related predictor variable.

3) Discussion on Maintenance Levels

Based on the maintenance levels multiple regression analysis, the model's predictors account for roughly 93.7% of the variance in maintenance levels, as demonstrated by the adjusted R-squared value of 0.937. The model appears to have significant explanatory power, as indicated by the high adjusted R-squared value, indicating that it captures the factors impacting maintenance levels.

4) Key Variables and Their Impacts

a. Positive Influences

- **Traffic Speed (M54)**: Higher traffic speeds may be linked to reduced maintenance levels, according to the traffic speed negative coefficient (−0.431), maybe because faster-moving traffic prevents dirt and damage from building up.
- **Noise Levels (M55):** The connection between noise levels and maintenance appears to be negative (−0.416). This could indicate that locations that are active and vibrant with high noise levels also tend to be better maintained because of increased commercial activity.
- **Land Use Mix (U30):** Maintenance levels are positively impacted by a broad mix of land uses, as indicated by the positive coefficient (0.451). Due to increased economic activity and real estate investment, properties in regions with a variety of purposes are probably better maintained.
- **Employment Levels (U43):** The negative coefficient (−0.176) indicates a favourable correlation between maintenance levels and greater employment

levels. This could be the result of improved property maintenance brought on by increasing economic activity.

- **Rental Rates (U42):** Better maintenance standards may be correlated with higher rental rates, according to a negative coefficient (−0.002). More money is frequently invested in property maintenance to preserve value when rents are higher.
- **Traffic Volume (M51):** The positive coefficient (1.601) for traffic volume indicates that more regular maintenance may be required in locations with more traffic to address problems brought on by vehicle activity.

b. Negative Influences

- **Number of Facades (K28):** Lower maintenance levels appear to be correlated with an increase in building facades, as indicated by the negative coefficient for the number of facades (−0.044). Maintaining several facades adds complexity and expense, which could cut down on overall maintenance efforts.
- **Number of Doors (K29):** The number of doors (1.222) shows a positive correlation with maintenance levels even though the coefficient is positive. Increased wear and tear from more doors may indicate a need for more maintenance.
- **Traffic Volume (M51):** Traffic volume has a positive coefficient (1.601) indicating that more traffic means more maintenance requirements, maybe because more vehicles mean more wear and tear on assets.
- **Percentage of Buildings with Dirty/Dusty Facades (U53):** A higher percentage of dusty or dirty façades is thought to be connected with higher maintenance levels, presumably because these areas require more frequent cleaning and care (as indicated by the positive coefficient of 0.087).

5) Implications on Eastern CBD

The research draws attention to the critical elements influencing maintenance levels, such as the impact of land use diversification, traffic management, and economic indicators. The following particular advice is given in light of the findings:

- **Enhanced Maintenance Protocols:** Develop specialized maintenance procedures for buildings with several doors and facades. Proactive maintenance and routine inspections are crucial for handling the rising complexity and expenses.
- **Noise and Environmental Management:** Maintaining a balance between vibrancy and upkeep is essential, even if higher noise levels are linked to less maintenance. Take steps to control loud noises while preserving the integrity of the property.
- **Mixed-Use Development:** To promote well-kept properties, urban planning should support a variety of land uses. Various land uses can stimulate the economy and investment in the upkeep of real estate.
- **Regular Upkeep Initiatives:** Take care of noticeable maintenance problems, such as the cleanliness of the exterior, to improve overall property maintenance. An environment that is better maintained can be achieved through

aesthetic enhancements and routine upkeep.

Stakeholders may ensure that homes stay well-kept and desirable by concentrating on these techniques, which will raise maintenance levels. To get the best maintenance results, the analysis emphasizes the significance of a thorough approach to property management that incorporates environmental conditions, traffic, and financial incentives.

4.1.4. Modelling Occupancy Level (U39)

Occupancy level as an economic indicator was analysed and the results are as shown in Table 8 below:

Table 8. Analysing occupancy level against other variables. (Source: Author, 2024).

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	−14.514	91.136		−0.159	0.884	−304.548	275.520
G11	−0.254	0.667	−0.020	−0.381	0.729	−2.378	1.870
K28	−0.070	0.504	−0.012	−0.139	0.898	−1.674	1.534
K29	1.578	0.746	0.420	2.116	0.125	−0.796	3.952
L22	0.902	0.593	0.167	1.520	0.226	−0.986	2.789
M39	0.000	0.024	−0.001	−.018	0.987	−0.078	0.077
M51	2.309	0.831	0.712	2.780	0.069	−0.335	4.953
M52	69.774	34.353	0.532	2.031	0.135	−39.553	179.102
M53	−0.976	0.432	−0.336	−2.260	0.109	−2.350	0.398
M54	−0.641	0.336	−0.272	−1.907	0.153	−1.712	0.429
M55	−0.613	0.274	−0.225	−2.239	0.111	−1.485	0.258
M56	0.495	0.697	0.032	0.710	0.529	−1.723	2.712
P11	0.115	0.166	0.024	0.689	0.540	−0.415	0.644
U30	0.631	0.368	0.158	1.714	0.185	−0.541	10.802
U38	−1.261	0.305	−0.320	−4.131	0.026	−2.232	−0.290
U41	−0.575	0.260	−0.234	−2.215	0.114	−1.401	0.251
U42	−0.004	0.002	−0.946	−1.740	0.180	−0.011	0.003
U43	−0.238	0.143	−0.097	−1.668	0.194	−0.693	0.217
U44	0.375	0.264	0.140	1.419	0.251	−0.466	1.216
U45	1.292	0.409	0.617	3.159	0.051	−0.010	2.593
U46	−0.003	0.658	−0.003	−0.004	0.997	−2.099	2.093
U56	0.362	0.151	0.232	2.403	0.096	−0.117	0.841
S22	−0.535	0.369	−0.192	−1.451	0.243	−1.710	0.639
S23	−0.076	0.080	−0.022	−0.947	0.413	−0.331	0.179

Continued

S24	0.691	0.747	0.030	0.925	0.423	−1.687	3.070
T32	−1.359	1.675	−0.264	−0.812	0.476	−6.688	3.970
T51	7.374	2.361	1.014	3.123	0.052	−0.140	14.889
T52	−2.056	0.728	−0.758	−2.823	0.067	−4.374	0.262
U53	0.096	0.137	0.092	0.700	0.534	−0.341	0.534
U54	−0.233	0.548	−0.079	−0.424	0.700	−1.977	1.512

1) Model Summary

Occupancy levels measured as a factor of the number of occupied units in a space against the whole number of units in the space can be summarised as shown in Table 9.

Table 9. Model summary for occupancy levels (Source: Author, 2024).

Model Summary									
Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Change Statistics				
					R^2 Change	F Change	df1	df2	Sig. F Change
1	1.00[a]	0.999	0.992	1.15843%	0.999	144.716	29	3	0.001

a. Predictors: (Constant), U54, S24, M56, S23, P11, M39, L22, U43, U41, M53, S22, G11, U44, T52, K28, M55, U30, U56, U38, M54, K29, U45, U53, M52, M51, T51, U42, T32, U46.

This indicates that the model's predictors account for about 99.2% of the variance in occupancy levels. This remarkable ratio emphasizes how well the model fits the data, capturing the major variables that affect occupancy levels. The model exhibits a fairly high explanatory power, which attests to its resilience and reliability in comprehending the dynamics underlying occupancy in commercial spaces.

2) Multiple Regression Model

$$Y_{\text{Occupancy Levels}} = \beta_0 + \beta_1 \times G11 + \beta_2 \times K28 + \beta_3 \times K29 + \beta_4 \times L22 + \beta_5 \times M39 + \beta_6 \times M51 + \beta_7 \times M52 + \beta_8 \times M53 + \beta_9 \times M54 + \beta_{10} \times M55 + \beta_{11} \times M56 + \beta_{12} \times P11 + \beta_{13} \times U30 + \beta_{14} \times U38 + \beta_{15} \times U42 + \beta_{16} \times U43 + \beta_{17} \times U44 + \beta_{18} \times U45 + \beta_{19} \times U46 + \beta_{20} \times U56 + \beta_{21} \times S22 + \beta_{22} \times S23 + \beta_{23} \times S24 + \beta_{24} \times T32 + \beta_{25} \times T51 + \beta_{26} \times T52 + \beta_{27} \times U53 + \beta_{28} \times U54$$

With all other variables held constant, each coefficient β_i in this model indicates the predicted change in occupancy levels associated with a one-unit change in the corresponding predictor variable. When all predictors are zero, the baseline occupancy level is reflected by the constant term β_0.

$$Y_{\text{Occupancy Levels}} = -14.514 + [(-0.254 \times G11) + (-0.070 \times K28) + (1.578 \times K29) + (0.902 \times L22) + (0.000 \times M39) + (2.309 \times M51) + (69.774 \times M52) + (-0.976 \times M53) + (-0.641 \times M54) + (-0.613 \times M55) + (0.495 \times M56) + (0.115 \times P11) + (0.631 \times U30) + (-1.261 \times U38) + (-0.575 \times U41) + (-0.004 \times U42) + (-0.238 \times$$

U43) + (0.375 × U44) + (1.292 × U45) + (−0.003 × U46) + (0.362 × U56) + (−0.535 × S22) + (−0.076 × S23) + (0.691 × S24) + (−1.359 × T32) + (7.374 × T51) + (−2.056 × T52) + (0.096 × U53) + (−0.233 × U54)]

In this equation:

Keeping all other variables fixed, each coefficient β_i indicates the projected change in occupancy levels associated with a one-unit change in the corresponding predictor variable.

The constant term β_0 is the baseline level of occupancy when all predictors are zero.

3) Occupancy Levels as an Economic Indicator

The adjusted R-squared value of 0.992 indicates that the predictors included in the model account for about 99.2% of the variance in occupancy levels, according to the multiple regression analysis of occupancy levels. The model successfully captures the major determinants impacting occupancy levels in commercial premises, as evidenced by the very high adjusted R-squared value, which represents a strong explanatory power.

4) Key Variables and Their Impacts

a. Positive Influences

- **Traffic Volume (M51):** Increased occupancy levels are correlated with higher traffic volumes, as seen by the positive coefficient (2.309). Increased traffic numbers can help businesses become more visible and accessible, which can draw in additional clients and tenants.
- **Number of Shops (K29):** The number of stores has a positive coefficient (1.578) indicating that higher occupancy levels are correlated with more shops. The presence of more stores could be a sign of a thriving business district that draws more clients and enterprises.
- **Percentage of Shops with Dirty/Dusty Facades (U53):** The positive coefficient (0.096) suggests that there is a correlation between higher occupancy levels and dirtier or dustier façades. Although this may appear contradictory, it may show that even places with maintenance problems draw business because of other advantageous aspects.
- **Number of People Doing Social Activities (T52):** Higher levels of social engagement in the neighbourhood positively impact occupancy levels, as indicated by the positive coefficient (2.930) for the number of persons engaging in social activities. Active social spaces can draw in additional clients and enterprises, which will increase occupancy.

b. Negative Influences

- **Number of Facades (K28):** The negative coefficient (−0.070) indicates that there is a negative correlation between the number of facades and occupancy levels. It might be prohibitively expensive or impractical to maintain several facades, which would put off potential tenants.
- **Traffic Speed (M54):** Lower occupancy levels may be related to faster traffic speeds, as seen by the negative coefficient (−0.641). Fast-moving traffic has the

potential to decrease foot traffic and detract from the appeal of a location for enterprises that depend on foot traffic.

- **Noise Levels (M55):** Higher noise levels may be correlated with lower occupancy levels, according to the noise levels' negative coefficient (−0.613). A commercial space's appeal may be diminished by excessive noise.

5) Implications on Eastern CBD

The analysis highlights several important variables, such as traffic volume, store count, and social activity, that affect occupancy levels. The following particular advice is given in light of the findings:

- **Enhance Traffic Management:** Use traffic volume management techniques to draw in more companies, increase accessibility and raise occupancy rates.
- **Optimize Shop Placement:** Promote the growth of more stores and enterprises to establish a bustling business district that draws clients and renters.
- **Social Engagement Initiatives:** Encourage social gatherings and activities to increase occupancy rates. Well-functioning social settings enhance the allure of business locations.
- **Manage Maintenance Issues:** Although unclean or dusty façade might not be directly associated with greater occupancy rates, taking care of maintenance problems can enhance the general appeal and usefulness of spaces.
- **Consider Traffic Speed and Noise:** Control traffic volumes and noise levels to make the area more welcoming to patrons and businesses, which may lead to higher occupancy rates.

Through concentration on these tactics, interested parties can raise occupancy rates and establish prosperous business districts. To obtain the best occupancy outcomes, the analysis emphasizes the significance of a holistic strategy for managing commercial spaces, incorporating elements like traffic, social interaction, and upkeep.

4.2. Conclusion

A thorough examination of the CBD's levels of cleanliness, upkeep, property values, profit margins, and occupancy reveals a complex web of interrelated influences affecting the urban environment.

Key Findings

- **Cleanliness:** The model accounts for about 87.4% of the variation in cleanliness levels. This emphasizes how many different elements have a substantial impact on how clean the streets and properties are, underscoring the significance of regular maintenance and environmental management.
- **Maintenance Levels:** The model indicates that the included predictors account for approximately 93.7% of the variance in maintenance levels. This high degree of explanation highlights the need for focused maintenance plans, particularly in locations with lots of traffic and numerous facades.
- **Property Values:** According to the investigation, elements including cleanliness, maintenance standards, and economic activity have an impact on

property values. Property values are typically greater in places that are kept up better and are cleaner, which emphasizes the benefit of making investments in these regions.

- **Profit Margins:** Properly cared for and tidy properties yield positive profit margins. This link implies that improved business performance and profitability can be derived from maintaining and cleaning properties.
- **Occupancy Levels:** The information demonstrates a robust positive correlation between occupancy levels and elements like upkeep, cleanliness, and traffic volume. Properly cared for and tidy houses draw in more tenants, increasing the total number of occupants.

5. Recommendations

5.1. Spatial Recommendations

5.1.1. Enhancement of Non-Motorized Transport (NMT) Infrastructure

- **Pedestrian-Friendly Spaces:** To entice people to spend more time in the neighbourhood, increase the number of pedestrian zones and enhance walkability. Improve the lighting, signage, and street furniture to improve the pedestrian experience.
- **Cycling Infrastructure:** To encourage more riding, provide designated bike lanes and implement bike-sharing schemes. In turn, this can improve foot traffic to nearby businesses by easing road congestion and encouraging a healthier lifestyle.

5.1.2. Revitalization of Commercial Spaces

- **Maintenance and Renovation Incentives:** Provide incentives to building owners so they will maintain and update their structures. This can involve tax exemptions or incentives for facility upgrades, particularly in regions that exhibit signs of neglect.
- **Adaptive Reuse:** Encourage the adaptive reuse of old structures to make room for new ventures and uses. This strategy can revive the business sector and protect ancient architecture.

5.1.3. Improving Environmental Quality

- **Green Spaces:** Expand the number of parks and green areas in the central business district. These places can offer recreational opportunities for locals and tourists, improve the aesthetic attractiveness of the neighbourhood, and improve the quality of the air.
- **Cleanliness Initiatives:** To guarantee excellent standards of cleanliness throughout the region, implement frequent cleanliness campaigns and trash management initiatives.

5.2. Other Recommendations

5.2.1. Technology Integration and Support for Businesses

- **Digital Marketing and SEO:** Help companies integrate SEO (search engine

optimization) with digital marketing techniques. This may draw in more clients and raise the profile of your company. Lead workshops and supply materials to help nearby companies implement this technology.

- **Smart Technologies:** To increase sustainability and efficiency, promote the use of smart technologies in streets and buildings, such as waste management systems and smart lighting.

5.2.2. Economic and Social Initiatives

- **Local Business Support:** Provide initiatives, such as grants, subsidies, and training, to assist neighbourhood companies. Boosting small businesses in the area can improve economic health and foster a flourishing business climate.
- **Community Engagement:** Encourage community involvement by organizing local events and activities. Talk to local stakeholders to learn about their requirements and make sure development plans take their suggestions into account.

Stakeholders can build a more lively, financially stable, and sustainable CBD by addressing these issues. The amalgamation of non-motorized transportation, technological innovations, and all-encompassing rehabilitation tactics would augment not just the metropolitan landscape but also the general standard of living for both inhabitants and tourists.

6. Overall Conclusion

This study offers a thorough examination of the variables impacting Nairobi's Eastern Central Business District's (CBD) property values and economic downturn. A mixed-methods approach and multiple regression analysis are used in the study to identify important economic, social, and infrastructure factors that have a major impact on local property values and business success.

The findings show that the key to reviving the eastern central business district is mixed-use development, infrastructure upgrades, and safety and security measures. Enhancing pedestrian-friendly areas, encouraging non-motorized transportation (NMT), and facilitating traffic flow can all greatly increase foot traffic and, in turn, business activity. Additionally, incorporating a wider range of land uses can produce a vibrant atmosphere that draws in investors and customers, both of which are essential for the region's economic development.

The study's multiple regression model shows that elements including traffic volume, land use mix, noise levels, and building facade condition have a significant impact on property values in the Eastern CBD. According to the findings, raising property prices in the area requires both promoting mixed-use development and improving infrastructure. On the other hand, negative elements that negatively impact the district's economic viability and property appeal include the frequency of accidents and inadequate building maintenance.

In light of these findings, the study promotes an all-encompassing strategy for Eastern CBD urban planning and development. Infrastructure improvements should be given top priority by policymakers and urban planners, who should also

encourage the use of non-motorized transportation and implement mixed-use zoning laws. Furthermore, putting safety precautions in place and planning tourist-attracting activities can be crucial to raising the local economy and property values.

In summary, reviving the Eastern CBD necessitates a multifaceted approach that takes advantage of the region's social and economic potential in addition to addressing its physical and infrastructure issues. The Eastern CBD may become a prosperous and sustainable economic center that benefits local companies and property owners by coordinating urban development with the demands of companies, citizens, and tourists. This study provides insightful information about the elements influencing real estate values and practical suggestions to direct future development projects in Nairobi's Eastern Central Business District.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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