Physical Planning Implications of Urban Vacant Lands in Jos Metropolis, Nigeria

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ABSTRACT

Urban vacant lands constitute an important but often poorly managed component of rapidly expanding cities. Their presence can create opportunities for urban redevelopment, affordable housing, green infrastructure and public facilities, but unmanaged vacant lands may also contribute to urban sprawl, inefficient infrastructure provision, environmental degradation, insecurity and fragmented urban development. This study explored the physical planning implications of urban vacant lands in Jos Metropolis, Nigeria. The study adopted a mixed-methods research design integrating remote sensing, Geographic Information Systems (GIS), field observations, questionnaires, interviews and documentary evidence. Multi-temporal Landsat imagery covering 1994, 2004, 2014 and 2024 was classified into six land-use/land-cover categories, while spatial analysis was used to examine the distribution and characteristics of vacant lands. The broader research employed ArcGIS, TerrSet Land Change Modeler, SPSS and field-based data collection techniques. Findings indicate that vacant lands are unevenly distributed across Jos Metropolis and have important implications for urban form, infrastructure provision, environmental management, housing development and urban security. The study further established a 365% increase in built-up land between 1994 and 2024, accompanied by substantial agricultural land loss. Spatial analysis identified concentrations of vacant land in peri-urban and physically constrained areas, including locations associated with steep slopes. Community evidence also indicated that some vacant plots are associated with illegal dumping, gully erosion, informal grazing and insecurity. The findings suggest that vacant lands should not be treated simply as unused spaces but as strategic components of urban land management. The study recommends integrating vacant-land inventories into statutory planning frameworks, prioritizing suitable sites for infill development, protecting environmentally sensitive areas, improving infrastructure coordination, strengthening development control, and promoting transparent and participatory land management in Jos Metropolis.

Keywords: Urban vacant land; Physical planning; GIS; Remote sensing; Urban sprawl; Infill development; Jos Metropolis; Nigeria; Sustainable urban development.

INTRODUCTION

Urban land is a fundamental resource for housing, transportation, infrastructure, economic activities, environmental management and community development. As cities expand, however, portions of land may remain undeveloped, underutilized or abandoned. Such spaces are commonly referred to as urban vacant lands. This study defines vacant lands as parcels that have not been transformed, modified or devoted to developmental activities within a planned urban area where land-use policies are applicable.

Urban vacant lands have become increasingly important in contemporary urban planning because they influence the spatial structure, efficiency and sustainability of cities. Their implications are not exclusively

negative. Vacant lands can provide opportunities for housing, public facilities, green infrastructure, urban agriculture, recreation and other forms of urban redevelopment. However, when they are unmanaged, they may contribute to fragmented urban form, urban sprawl, environmental degradation, insecurity and inefficient infrastructure provision. The study identifies vacant lands as both potential planning resources and manifestations of inefficiencies within urban systems.

In rapidly urbanizing Nigerian cities, the problem is particularly important because urban growth frequently occurs alongside infrastructure deficits, land-tenure problems, fragmented governance and weak development control. Vacant parcels may therefore remain embedded within expanding urban areas while new development continues outward. This creates a spatial contradiction in which cities consume additional land despite the existence of undeveloped areas within or around the existing urban fabric.

Jos Metropolis provides an important setting for examining this problem. The study area comprises Jos North and Jos South and has experienced considerable urban expansion. The study reports that built-up land increased substantially during the research period, while agricultural land declined. The spatial distribution of vacant lands was also found to be uneven, with significant concentrations occurring in peri-urban and physically constrained locations.

The importance of the issue is reinforced by the relationship between vacant land and land-use efficiency. The study adopts Land Use Efficiency theory, which views vacant or underutilized land as an inefficiently utilized urban resource and emphasizes the need to maximize the economic, social and environmental value generated from urban land.

Against this background, this Research is focus on exploring the physical planning implications of the urban vacant lands in Jos Metropolis, Nigeria.

The Research specifically examines how vacant lands affect urban form, infrastructure provision, housing opportunities, environmental management, urban security and future development planning.

Study Area

Jos Metropolis is located in Plateau State, Nigeria, and the study focuses principally on Jos North and Jos South Local Government Areas. The thesis identifies the Jos-Bukuru metropolitan area as the spatial framework for analyzing urban vacant lands. The broader study area used for the spatial analysis covers approximately 816.44 km².

Jos has experienced substantial urban expansion accompanied by changes in its land-use structure. The metropolitan area contains residential, commercial, institutional, agricultural, vegetated and environmentally constrained areas. The combination of rapid urbanization, changing land values, physical terrain, infrastructure requirements and land-management challenges makes the metropolis suitable for investigating the physical planning implications of vacant land.

MATERIALS AND METHODS

Research Design

The study adopted a mixed-methods research design. The methodology combined quantitative and qualitative approaches to address the research objective. The research employed multiple data sources, sampling techniques, instruments, analytical procedures and validation approaches.

Particular emphasis was placed on spatial evidence obtained from remote sensing and GIS, supported by field observations, questionnaires, interviews and documentary information.

Remote Sensing and GIS Data

Multi-temporal Landsat imagery for 1994, 2004, 2014 and 2024 was used to investigate land-use changes. The study reports that the imagery was geo-referenced, processed and classified using GIS techniques. The land-use/land-cover classification consisted of:

i Built-up land;

ii Vegetation;

iii Water bodies;

iv Rock outcrop;

v Agricultural land; and

vi Vacant land.

The imagery covered a 30-year period and provided the basis for examining changes in the physical planning implications of urban vacant lands of Jos Metropolis.

GIS and Spatial Analysis

ArcGIS was used for mapping and spatial analysis, while TerrSet/IDRISI Land Change Modeler was used for land-change and predictive modelling. SPSS was used for statistical analysis. The study also incorporated a Digital Elevation Model for topographic and slope analysis.

The spatial analysis considered the distribution, extent and pattern of vacant lands. Hotspot and spatial autocorrelation analyses were also employed. The study reported a Moran's I value of 0.42 ($p < 0.01$), indicating significant positive spatial clustering.

Field and Qualitative Data

The mixed-methods component incorporated questionnaires, interviews, focus group discussions, observations and documentary review. Community mapping and focus group activities were conducted in selected wards, with qualitative evidence used to explain spatial patterns identified from satellite imagery.

The mixed-methods design enabled satellite observations to be complemented by community and institutional evidence. For example, spatial analysis identified clusters while community evidence helped explain the persistence of vacant lands in areas affected by steep slopes, erosion concerns and high development costs.

Accuracy and Validation

The broader land-use classification achieved reported Kappa coefficients of at least 0.87, indicating a high level of classification agreement. The research also used triangulation to compare satellite observations, survey responses, interviews and documentary evidence.

RESULTS

Spatial Distribution and Physical Planning Significance

The study found that vacant lands are unevenly distributed throughout Jos Metropolis rather than occurring as a uniform component of the urban landscape. The study indicates that vacant lands are particularly associated with peri-urban areas, hilly terrain and locations with physical or environmental constraints.

Spatial analysis further identified clustering of vacant land. The reported Moran's I value of 0.42 with $p < 0.01$ indicates that the observed spatial pattern is significantly clustered rather than randomly distributed. The study

associated some remaining vacant land with slopes exceeding 12 degrees and elevations within approximately 886–1,514 metres.

This pattern has direct implications for physical planning because vacant land located on steep or environmentally sensitive terrain cannot necessarily be treated as readily developable land. Development decisions therefore require site-suitability analysis rather than simply calculating the total quantity of vacant land.

Urban Sprawl and Fragmented Urban Form

One of the most important planning implications identified in the research is the relationship between vacant land and urban expansion.

The study reports that built-up land increased by approximately 365% between 1994 and 2024. At the same time, vacant land declined after reaching a peak in 2004.

The coexistence of vacant parcels and outward urban expansion suggests an inefficient pattern of land consumption. Instead of fully utilizing suitable land within the existing urban fabric, development pressure can extend into peri-urban areas. Such development may increase the distance between residential areas, employment centres, services and infrastructure.

The planning implication is that vacant land should be considered in urban-growth management strategies. Integrating suitable vacant parcels into development plans could support infill development and reduce unnecessary outward expansion.

Infrastructure Provision

Vacant land has implications for the efficiency of infrastructure provision. Discontinuous development can make the extension of roads, water supply, drainage, electricity and other services more difficult and expensive.

The research identifies infrastructure gaps as an important issue affecting vacant land and notes that the absence of roads, electricity, water and drainage can prevent development of otherwise suitable parcels.

From a physical planning perspective, this creates a cycle in which infrastructure is extended toward new development areas while suitable land closer to existing infrastructure remains underutilized.

Consequently, planning authorities should incorporate vacant-land inventories into infrastructure investment decisions and prioritize areas where existing infrastructure can support compact and efficient development.

Housing and Urban Development Opportunities

Vacant land represents a potential land reserve for addressing urban housing and public-service requirements. The research identifies affordable housing, public facilities, green infrastructure and economic activities among the potential productive uses of vacant land.

However, not every vacant parcel is suitable for housing or intensive development. Physical planning decisions should consider:

i Accessibility;

ii Availability of infrastructure;

iii Slope;

iv Environmental sensitivity;

v Existing zoning;

vi Ownership and tenure;

vii Proximity to public facilities; and

viii Compatibility with surrounding land uses.

The implication is therefore not simply to develop vacant land but to classify vacant land according to its most appropriate future function.

Agricultural Land Loss

The study identified a substantial decline in agricultural land during the period investigated. The study reports approximately 33.8% agricultural land loss and identifies urban expansion as a major component of the changing land-use structure.

The conversion of agricultural land to urban uses has important physical planning implications. If urban growth continues without effective land-use controls, agricultural areas around Jos may progressively be absorbed into the urban footprint.

This creates a need for stronger urban growth boundaries, agricultural-land protection measures and careful assessment of development proposals in peri-urban areas.

Environmental Implications

The study identifies several environmental consequences associated with unmanaged vacant lands. Community evidence indicated that vacant plots may become locations for illegal dumping, gully erosion and informal grazing. The qualitative findings also associated some empty plots with insecurity and their use as hide-outs.

The physical characteristics of some vacant areas further increase environmental vulnerability. The study identifies steep slopes and erosion-prone locations among areas where vacancy persists.

This means that vacant land management should not be based exclusively on development objectives. Environmentally constrained parcels may be more appropriately allocated for:

i Green infrastructure;

ii Erosion control;

iii Urban forestry;

iv Recreational open space;

v Storm-water management;

vi Ecological conservation; or

vii Other compatible low-impact uses.

Urban Security and Social Implications

The research also identified security as an important planning consideration. Community findings indicated that some vacant plots are associated with illegal activities, dumping and insecurity. In the qualitative evidence, residents described some empty plots as becoming hide-outs.

From a planning perspective, unmanaged vacant spaces can therefore create poorly supervised areas within neighbourhoods. Appropriate temporary or permanent uses, improved accessibility, lighting, surveillance, landscaping and community participation may reduce these risks.

Governance and Development Control

The physical planning implications of vacant land are closely connected to institutional arrangements. The study reports that only 34% of the metropolis had a digital parcel map according to the cited key-informant evidence, while the Surveyor General's office was reported to still rely on older paper-based cadastral information. The study also reports overlapping jurisdiction among planning institutions.

Such conditions make it difficult to establish an accurate and current inventory of vacant land and to determine ownership, development status and planning suitability.

Effective physical planning therefore requires stronger spatial information systems, coordinated institutional responsibilities and accessible land information.

DISCUSSION

The findings demonstrate that urban vacant land in Jos Metropolis represents both a planning challenge and a planning opportunity.

From the challenge perspective, vacant parcels can fragment the urban fabric, encourage outward growth, increase infrastructure costs and create environmental and security problems. The substantial increase in built-up land between 1994 and 2024 demonstrates the intensity of urban expansion, while the loss of agricultural land highlights the pressure placed on surrounding land resources.

From the opportunity perspective, suitable vacant parcels constitute an important reserve for urban infill. The research explicitly argues that vacant lands can be used for redevelopment, green-space creation and other strategic purposes and recommends integrating them into city development plans.

The findings are consistent with the study's application of Land Use Efficiency theory. Under this perspective, vacant land within an expanding city represents an opportunity to improve the productivity and sustainability of the existing urban footprint rather than continuously consuming new peripheral land.

The results also demonstrate that vacant land should not be treated as a homogeneous category. Some parcels may be suitable for housing, commercial activities or public facilities, while others may be unsuitable for intensive development because of slope, erosion, environmental sensitivity or inadequate infrastructure.

Consequently, a physical planning approach to vacant land in Jos should combine spatial inventory, land suitability assessment, infrastructure planning, development control, environmental protection and community participation.

PHYSICAL PLANNING IMPLICATIONS

Based on the findings, the major implications for physical planning in Jos Metropolis can be summarized as follows:

Planning Dimension	Implication	Planning Response
Urban form	Vacant land contributes to fragmented development and potential sprawl	Promote compact development and infill
Housing	Suitable vacant parcels represent potential housing land	Identify and reserve suitable parcels for affordable housing
Infrastructure	Dispersed development increases infrastructure-extension requirements	Prioritize development around existing infrastructure

Agriculture	Urban expansion consumes agricultural land	Protect strategic agricultural areas
Environment	Some vacant lands experience erosion, dumping and degradation	Apply environmental suitability assessment and green infrastructure
Security	Unmanaged plots can become insecure spaces	Encourage productive use, surveillance and community management
Urban aesthetics	Neglected vacant parcels can contribute to blight	Landscaping, temporary uses and redevelopment
Governance	Fragmented land information limits effective management	Establish an integrated digital vacant-land inventory
Development control	Uncoordinated development may worsen fragmentation	Strengthen zoning and development-control mechanisms
Future growth	Continued expansion may consume additional land	Use historical land-change data for growth management

The thesis itself recommends that urban planning should integrate vacant lands into development plans, use historical data to understand future trends, apply appropriate zoning and land-use policies, strengthen planning institutions, improve transparency, and provide adequate infrastructure and services.

PLANNING POLICY RECOMMENDATIONS

Establish a Metropolitan Vacant-Land Inventory

A GIS-based inventory should be established and continuously updated to identify the location, size, ownership, accessibility, land-use status and development potential of vacant parcels.

Promote Infill Development

Suitable vacant land within or adjacent to existing developed areas should be prioritized for infill development before further outward urban expansion is permitted.

Introduce Vacant-Land Suitability Classification

Vacant parcels should be categorized into:

i Development-suitable land;
ii Environmentally sensitive land;
iii Agricultural conservation land;
iv Green/open-space land;
v Infrastructure reserve land; and
vi Land requiring further investigation.

Protect Environmentally Sensitive Areas

Steep slopes, erosion-prone areas and other environmentally vulnerable vacant lands should be protected from inappropriate development.

Integrate Vacant Land into Master Planning

Future master plans and development plans for Jos should explicitly identify vacant land and assign appropriate future land uses.

Improve Infrastructure Coordination

Infrastructure agencies should coordinate investment decisions with vacant-land and urban-growth information so that development occurs where services can be delivered efficiently.

Strengthen Development Control

Planning authorities should ensure that development on vacant parcels conforms to zoning, environmental and infrastructure requirements.

Encourage Productive Temporary Uses

Where permanent development is not immediately possible, suitable vacant land could be used for community gardens, recreation, green spaces or other temporary productive activities.

Improve Inter-Agency Coordination

The reported fragmentation among institutions requires stronger coordination, common spatial databases and clearly defined institutional responsibilities.

Incorporate Security into Vacant-Land Planning

Security considerations should be incorporated into site design, accessibility, lighting, surveillance, landscaping and land-use decisions for vacant parcels.

CONCLUSION

This study demonstrates that urban vacant lands have substantial physical planning implications for Jos Metropolis. They are simultaneously a manifestation of inefficient land utilization and a potential resource for improving the structure and sustainability of the city.

The findings show that vacant lands are unevenly distributed and occur in both potentially developable and physically constrained locations. Their relationship with rapid built-up expansion, agricultural land loss, infrastructure requirements, environmental degradation and security concerns demonstrates that vacant land cannot be addressed through isolated land-development decisions.

The study therefore concludes that vacant land should be incorporated explicitly into the physical planning system of Jos Metropolis. Rather than treating vacant parcels as residual spaces, planning authorities should identify their characteristics, assess their development suitability and assign appropriate future uses.

A coordinated GIS-based vacant-land inventory, supported by zoning reform, infill development, environmental protection, infrastructure coordination, development control and stakeholder participation, would provide a stronger basis for sustainable urban development.

Ultimately, the effective management of vacant land provides Jos Metropolis with an opportunity to accommodate future growth more efficiently, reduce unnecessary urban sprawl, protect environmental resources and improve the overall quality and resilience of the urban environment.

RECOMMENDATIONS FOR FURTHER RESEARCH

Future studies should investigate:

i Parcel-level ownership and tenure characteristics of vacant land;

ii Accessibility of vacant parcels to roads and public infrastructure;

iii Economic valuation of vacant land;

iv Environmental suitability of vacant parcels;

v Community preferences for vacant-land reuse;

vi Effectiveness of alternative infill-development scenarios;

vii Long-term monitoring using higher-resolution satellite imagery; and

viii Comparative vacant-land studies across Nigerian metropolitan areas.

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