

RESEARCH ARTICLE

Regulating Urban Sprawl in a Planned African Capital City: Evidence from Planning and Development Professionals in Abuja, Nigeria

¹Theanyi Abaekwume, & ^{2,3*}Christopher Chimaobi Onyeneke

^{*1}Department of Urban & Regional Planning, Federal Capital Development Authority (FCDA), Abuja, Nigeria

²Department of Urban & Regional Planning, Federal University of Technology, Owerri, Nigeria

³School of Architecture & Planning, University of the Witwatersrand, Johannesburg, South Africa

*Corresponding Author's Email: Christopher.onyeneke@futo.edu.ng

ABSTRACT

Urban sprawl increasingly threatens the sustainability of rapidly expanding African cities, particularly where formal planning frameworks are weakened by implementation failures. This study examined the relationship between development-control implementation and urban sprawl in Abuja, Nigeria's purpose-built federal capital. A quantitative cross-sectional survey was conducted in 2024 using structured questionnaires administered to 220 development-control officers, registered town planners, and property-development professionals. Data were analysed using descriptive statistics, Pearson correlation, and simple linear regression. A supplementary GIS-based morphological analysis of settlement centres and major transport corridors was undertaken to illustrate the spatial pattern of urban expansion across the FCT. The findings revealed a high perceived magnitude of urban sprawl, with a grand mean of 4.20, characterised by rapid satellite-settlement growth, peri-urban land conversion, low-density development, and expansion ahead of infrastructure provision. Development-control mechanisms were recorded as low in effectiveness (grand mean = 2.82), while implementation constraints were severe (grand mean = 4.23), particularly weak enforcement capacity, inadequate monitoring, political interference, and low developer compliance. Development-control implementation was strongly and negatively associated with urban sprawl ($r = -.612$, $p < .001$). It also explained 34.0% of the variance in respondents' assessments of built-up-area expansion ($R^2 = .340$, $F(1,218) = 112.41$, $p < .001$). The GIS interpretation indicated a predominantly radial and corridor-led growth pattern, characterised by continuous suburban expansion around the planned core and satellite-town growth along major transport axes. The study concludes that strengthening implementation capacity, regulatory compliance, digital monitoring, and infrastructure-led growth management is essential for containing Abuja's peripheral expansion.

Keywords: *Built-up expansion; Development control; Regulatory compliance; Urban growth; Urban sprawl*

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1. INTRODUCTION

Urbanisation is no longer adequately understood as a demographic transition alone; it is equally a transformation, configuration and intensity of land occupied by cities. The United Nations' latest assessment confirms that cities and towns will absorb most future population growth, with the scale and speed of change particularly consequential for Africa (United Nations Department of Economic and Social Affairs [UN DESA], 2025). Yet urban land expansion is often discontinuous and weakly coordinated, producing low-density development, leapfrogging, fragmented settlements and the conversion of agricultural and environmentally sensitive land. These outcomes, commonly described as urban sprawl, extend beyond urban morphology. Dispersed growth increases infrastructure costs, intensifies dependence on motorised mobility, weakens ecological connectivity and transfers environmental and fiscal costs to the wider public (Amponsah et al., 2022; United Nations Statistics Division [UNSD], 2024). In African cities, these pressures intersect with housing deficits, informality, constrained municipal finance and uneven access to serviced land, making sustainable growth management difficult (Kamana et al., 2024). The central planning problem is therefore not simply that cities expand, but that expansion frequently occurs faster than institutions can coordinate land supply, infrastructure, development intensity and environmental protection. Determining whether development-control systems influence these outcomes is consequently essential to sustainable urbanisation.

The problem persists because formal plans and regulations do not implement themselves. Development control, operating through zoning, planning permission, building approval, density standards, monitoring and enforcement, is intended to translate spatial plans into decisions about where, when and how development occurs. Its effectiveness depends on more than the legal existence of these instruments. Regulatory agencies require adequate information, technical personnel, administrative coordination and enforcement credibility, while developers and landowners must perceive compliance as feasible and non-compliance as sufficiently costly. Evidence from rapidly urbanising African cities shows that these conditions are frequently weakened by bureaucratic delays, fragmented responsibilities, political influence, limited monitoring and inconsistent sanctions. In Harare, differences between approved land-use proposals and existing development were linked to political pressures, inflexible planning instruments and inadequate technical capacity for monitoring (Karakadzai et al., 2023). Research in Ghana similarly demonstrates that compliance supports more sustainable land-use outcomes, whereas weak enforcement permits departures from planning standards and encroachment on ecological assets (Asamoah et al., 2025). A city may therefore possess an elaborate master plan and extensive regulations while continuing to experience uncoordinated peripheral growth. This implementation paradox shifts attention from what policies prescribe to whether institutions can induce compliance and produce intended spatial outcomes.

Abuja provides an especially revealing setting in which to examine this paradox. Established as Nigeria's purpose-built federal capital, the city was conceived around a comprehensive master plan, phased development and a regulatory system intended to secure orderly growth and avoid the congestion and land-use disorder associated with older metropolitan centres. Nevertheless, the wider Abuja city-region has experienced sustained outward expansion, particularly through satellite settlements and peri-urban corridors. Scenario-based research shows that, despite urban and regional plans, leapfrogging and haphazard development have persisted and could increasingly threaten environmentally sensitive areas where planning restrictions remain ineffective (Enoguanbhor et al., 2022). More recent evidence indicates that settlement land within Abuja Municipal Area Council expanded from 18.5 km² in 1991 to 333.6 km² in 2021, while accessibility, demographic characteristics, and governance conditions contributed to the evolving pattern of sprawl (Mashi et al., 2025). This literature has improved knowledge of where Abuja is expanding and which forces accompany that expansion. However, geospatial

studies often infer regulatory weakness from land-cover change; governance studies commonly rely on qualitative accounts; and development-control studies identify enforcement problems without statistically estimating their association with sprawl. What remains insufficiently examined is whether variation in development-control implementation is systematically related to reported urban sprawl and built-up expansion in a planned African capital.

This paper addresses that gap by arguing that Abuja's urban sprawl is not only a consequence of population pressure, land markets, or infrastructure-led expansion, but also an outcome of the implementation capacity and compliance environment of its development-control regime. Conceptually, it connects Regulatory Compliance Theory, which explains how enforcement certainty, administrative efficiency and behavioural incentives shape adherence to rules, with Urban Growth Management Theory, which explains how regulation influences the location, timing and intensity of development. This integrated position enables development control to be evaluated as an institutional mechanism linking policy intentions to urban-growth outcomes. Empirically, the study analyses structured questionnaire data from 220 professionals involved in urban development and development-control activities across the Federal Capital Territory. It examines the perceived pattern and magnitude of sprawl, assesses the influence of development-control policy on built-up expansion, evaluates existing control mechanisms and identifies constraints limiting policy performance. Descriptive statistics establish the strength and distribution of these assessments, while Pearson correlation and simple linear regression test the relationship between policy implementation, the rate of sprawl, and the spatial extent of built-up expansion. The professional-assessment design does not replace longitudinal geospatial measurement; rather, it provides institutionally grounded evidence of how the regulatory processes underlying documented spatial change are understood by those responsible for managing development.

The study makes three contributions to environmental planning and sustainability scholarship. First, it extends urban-sprawl research beyond physical measurement by explaining how implementation and compliance conditions contribute to urban form. This integration matters because the spatial effectiveness of a plan cannot be inferred from statutory sophistication; it must be assessed through the processes and behavioural responses connecting regulation to development outcomes. Second, the study provides quantitative evidence from Abuja, a planned capital whose peripheral expansion exposes the limits of master-plan-led urbanism when metropolitan growth exceeds administrative reach. By statistically examining the relationship between development-control implementation and sprawl, the paper complements recent geospatial and participatory research and helps distinguish demographic pressure from regulatory failure. Third, the findings have direct implications for sustainable urban governance by clarifying whether reform should prioritise new regulatory instruments or strengthen monitoring, approval systems, inter-agency coordination, sanctions, professional capacity and developer compliance. This distinction is critical for Abuja and comparable African city-regions, where revising plans may achieve little unless implementation becomes credible, consistent and spatially comprehensive. The paper therefore repositions development control from a routine administrative function to an environmental-governance mechanism through which rapidly urbanising cities can contain inefficient land consumption, protect sensitive landscapes and align metropolitan expansion with sustainable urban-development objectives.

2. LITERATURE REVIEW

Urban Sprawl and Development-Control Effectiveness

Urban sprawl is not synonymous with urban growth; it is a particular spatial form of growth characterised by low density, discontinuity, fragmentation, decentralisation, land-use separation and disproportionate outward land consumption. Dadashpoor and Shahhossein's (2024) systematic review of 130 definitions shows that, despite disciplinary differences,

inefficient and dispersed land development remains the concept's common core. This distinction matters because a city can expand without sprawling when new development is coordinated, adequately serviced, and consistent with planned densities. Expansion becomes sprawl when built-up areas leapfrog serviced land, fragment peri-urban landscapes, and convert non-urban land faster than population and infrastructure requirements justify. Sprawl should therefore be examined as the cumulative outcome of development decisions and regulatory conditions rather than as an automatic consequence of population increase. This outcome-oriented understanding provides the basis for assessing whether development-control implementation shapes Abuja's expansion.

The consequences of sprawl connect urban form directly to sustainability. Dispersed development consumes more land, increases the distances over which roads and utilities must be extended, and places agricultural land, forests, water systems and environmentally sensitive areas under pressure. Urban growth-management policies can therefore perform functions beyond containment by protecting ecological corridors, productive landscapes and climate-regulating ecosystems (Kirby et al., 2023). These concerns are especially pressing in Africa, where urban agglomerations expanded spatially faster than their populations between 2015 and 2020, while many local governments continued to face infrastructure, finance and technical-capacity constraints (Organisation for Economic Co-operation and Development [OECD], 2025). Kamana et al. (2024) similarly identify fragmented planning, inadequate infrastructure, housing shortages and environmental degradation as mutually reinforcing urban challenges. Sprawl is consequently not merely an inefficient morphology; it is a governance and environmental problem requiring institutions capable of coordinating land conversion with infrastructure, housing and ecological protection.

Development control is the regulatory mechanism through which spatial plans are translated into individual development decisions. It encompasses development permission, zoning, density standards, building regulations, subdivision control, monitoring, inspection and sanctions against unauthorised development. Its effectiveness cannot be inferred from the formal existence of these instruments; it must be evaluated through their influence on developer behaviour and spatial outcomes. Evidence from Ho Municipality in Ghana shows that compliance with land-use regulations supports orderly development and environmental protection, whereas inconsistent implementation permits incompatible uses and encroachment (Asamoah et al., 2025). An effective system therefore combines transparent approvals, routine monitoring, consistent enforcement, and sanctions capable of deterring violations. The relevant question is not whether Abuja possesses development-control regulations, but whether those regulations are implemented strongly enough to moderate outward expansion and guide built-up growth.

The persistence of sprawl in cities with statutory plans reveals an implementation paradox. Formal regulation often coexists with informal land delivery, customary claims, speculative markets, administrative delays, and overlapping institutional mandates. Anane and Cobbinah (2022) show that peri-urban planning in African cities is shaped by negotiations and power relations between statutory and customary authorities, allowing outcomes to depart from official plans. Amponsah et al. (2022) likewise caution that containment instruments transferred from strongly institutionalised settings may underperform where land governance and enforcement capacity differ. Policy design alone is therefore an inadequate measure of performance. The ability of development control to contain sprawl depends on the institutional environment through which rules are interpreted, administered and enforced, thereby linking urban morphology to the regulatory processes examined in this paper.

Regulatory Compliance and Urban Growth Management

Regulatory Compliance Theory explains why the effects of development-control policies depend on the responses of regulated actors. The theory assumes that developers and landowners do not comply automatically simply because regulations exist. Their behaviour is influenced by the clarity of rules, accessibility of procedures, legitimacy of regulators, likelihood of detection, and anticipated consequences of violation. Ayres and Braithwaite's (1992) responsive-regulation model proposes a graduated enforcement system that begins with information, persuasion and assistance but escalates towards stronger sanctions when voluntary compliance fails. In urban planning, this implies that efficient permission systems and clear guidance should be combined with routine inspection and credible penalties. Where applications are costly or unpredictable, monitoring is infrequent and unauthorised development attracts little consequence, circumventing formal regulation may become a rational development strategy. Regulatory Compliance Theory thus explains the behavioural pathway through which administrative and enforcement weaknesses can become land-use violations and, cumulatively, urban sprawl.

Recent evidence indicates that planning compliance is both instrumental and normative. Instrumental explanations emphasise the calculated costs and benefits of obeying regulations, whereas normative explanations consider perceptions of legitimacy, fairness, land rights and the moral acceptability of regulatory requirements. Anokye et al. (2026) found that non-compliance with urban-development regulations in Ghana could not be explained by deterrence alone; weak enforcement and corruption undermined instrumental regulation, while beliefs about land ownership and regulatory legitimacy also influenced behaviour. Asamoah et al. (2025) similarly show that institutional cooperation and public acceptance are important to the sustainability effects of land-use regulation. These findings suggest that enforcement capacity remains essential but cannot substitute for transparent, accessible, and procedurally legitimate regulation. In Abuja, developer compliance is consequently understood as an operational product of both institutional credibility and enforcement certainty, linking development-control implementation to physical development outcomes.

Urban Growth Management Theory complements this behavioural perspective by explaining how policy instruments shape the location, timing, density and servicing of development. Growth management seeks to accommodate necessary urbanisation while preventing inefficient land conversion and uncoordinated peripheral expansion. Relevant instruments include phased development, infrastructure programming, density regulation, urban growth boundaries, infill incentives and the protection of agricultural or environmentally sensitive land. Ewing et al. (2022) conclude that the effectiveness of these tools varies considerably across jurisdictions, largely because implementation capacity and the wider planning environment determine their practical influence. Kirby et al. (2023) further argue that growth-management policies should be evaluated through their broader ecological, social and spatial functions rather than containment alone. Recent empirical evidence also shows that stronger state planning environments can increase urban density and reduce sprawl by reinforcing the effects of commonly used local planning instruments (Grover & Anthony, 2026). Growth management therefore provides the spatial explanation for how regulatory decisions aggregate into compact or dispersed metropolitan forms.

The integration of the two theories produces the analytical logic of this study. Regulatory Compliance Theory explains how the design and implementation of development control influence the decisions of developers and landowners, while Urban Growth Management Theory explains how those decisions accumulate into city-regional outcomes. Strong regulatory clarity, efficient approval, credible monitoring and consistent enforcement should increase conformity with permits, land-use designations and development standards. Higher compliance should, in turn, reduce unauthorised land conversion, leapfrogging and low-density peripheral development. Conversely, political interference, administrative delay, institutional fragmentation and weak technical capacity may reduce implementation credibility and weaken the influence of regulation on

urban form. As illustrated in Figure 1, the study examines a direct relationship between development-control implementation and urban-growth outcomes while recognising regulatory compliance as the principal theoretical pathway through which this relationship occurs. The figure therefore presents an explanatory mechanism rather than a mediation model.

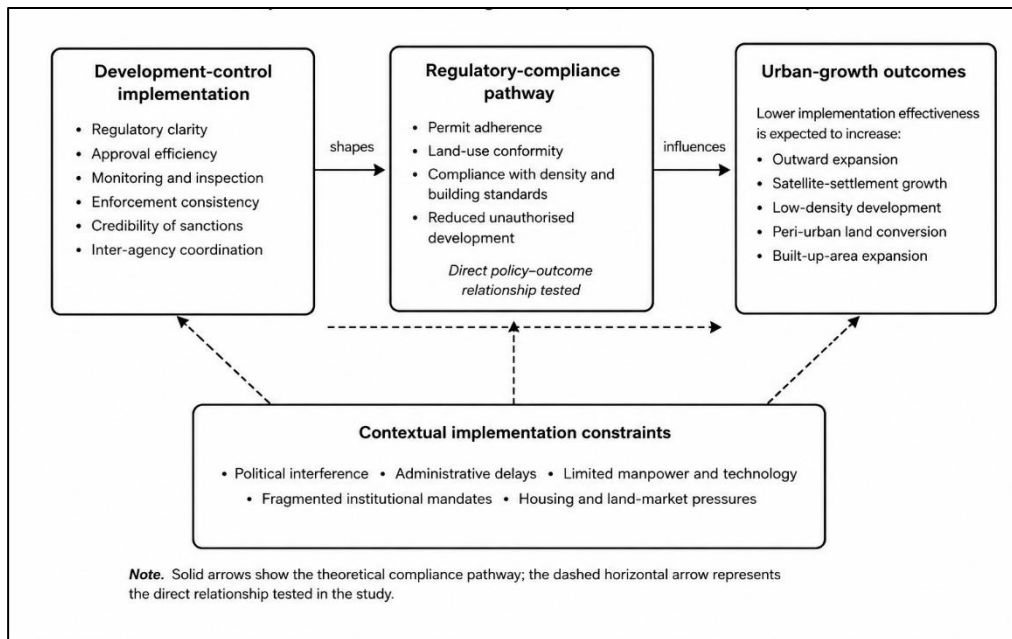


Figure 1. Conceptual framework linking development control to urban sprawl

Development Control and Urban Sprawl in African Cities

The African urban context demonstrates why development control must be evaluated within rapidly changing city-regions. OECD (2025) projections covering more than 11,000 African urban agglomerations indicate that future growth will occur in metropolitan centres, intermediate cities and expanding peripheral settlements. This transformation requires both the intensification of existing urban areas and the anticipation of future expansion through land reservation, connectivity and environmental protection. Yet Kamana et al. (2024) show that many planning systems operate under shortages of finance, serviced land, technical personnel, and reliable data. These conditions create a gap between plan preparation and implementation. As urban demand exceeds the supply of formally planned and affordable land, households and developers increasingly depend on incremental or informal processes. Peripheral growth consequently reflects both structural housing pressures and the limited reach of development-control institutions.

Peri-urban areas make this implementation gap especially visible because they combine agricultural production, ecological value, customary tenure, speculative investment and metropolitan housing demand. Anane and Cobbinah (2022) demonstrate that planning in these settings is shaped by political bargaining between traditional and statutory authorities. Amponsah et al. (2022) identify densification, growth direction and containment as potentially useful strategies, but stress that such policies must reflect local institutions and land-delivery practices. Stronger legal restrictions alone may therefore be insufficient. Where formal land supply is inaccessible, approvals are slow or jurisdictional authority is contested, restrictions may displace development rather than guide it. Development-control effectiveness must instead be understood through the interaction of enforcement, compliance, administrative efficiency and the wider land-governance system.

The empirical literature remains divided between studies of spatial outcomes and institutional processes. Remote-sensing research documents built-up growth, fragmentation and environmental conversion but often treats weak planning as an

inferred explanation. Governance research identifies political interference, limited resources, corruption, delayed approvals, and institutional fragmentation, yet commonly relies on qualitative evidence that does not estimate relationships between implementation and urban-growth outcomes. Ewing et al. (2022) note that rigorous evidence on growth-management effectiveness remains limited because instruments differ and are usually implemented in packages. The challenge is greater in African cities, where comparable longitudinal administrative data are scarce. Consequently, spatial studies show that sprawl is occurring and institutional studies explain why control is difficult, but fewer studies test whether stronger implementation is associated with reduced sprawl. This gap is central to deciding whether reform should prioritise new plans or the operational credibility of existing controls.

Abuja Context, Research Gap and Analytical Proposition

Abuja is a critical case because extensive urban expansion has occurred within a city-region created explicitly through master planning and phased development. The Federal Capital Territory was intended to provide a spatially ordered alternative to the pressures associated with Nigeria's former capital, while land-use plans were designed to coordinate development and protect the natural environment. Enoguanbhor et al. (2019) nevertheless documented substantial built-up growth and a widening mismatch between designated land uses and actual development. Their later simulation showed that business-as-usual expansion would continue in leapfrogged and haphazard patterns, particularly across peri-urban and satellite settlements, with greater potential degradation of environmentally sensitive areas than scenarios involving effective planning restrictions (Enoguanbhor et al., 2022). Abuja's challenge is therefore not an absence of spatial vision, but a growing divergence between planned geography and the urban landscape produced in practice.

Institutional evidence identifies implementation as a major element of this divergence. Enoguanbhor et al. (2021) combined spatial analysis with expert evidence and identified inadequate plan implementation, insufficient funding, limited technical capacity, weak political commitment, political interference, and corruption among the key challenges confronting planning in the Abuja city-region. These findings connect land-use change to the capacity and governance of planning institutions. However, the study's broader concern with land-use planning and environmental assessment did not isolate development-control implementation as a measurable predictor of sprawl. It therefore established plausible mechanisms without determining how strongly enforcement, monitoring, approvals and compliance are associated with expansion. The unresolved policy question is whether Abuja principally requires revised spatial plans or whether the more immediate problem is limited implementation of controls already intended to realise them.

Recent evidence has strengthened the diagnosis without fully resolving this issue. Mashi et al. (2025) combined multitemporal geospatial analysis, surveys of 600 peri-urban households, and logistic regression, showing that settlement land in Abuja Municipal Area Council increased from 18.5 km² in 1991 to 333.6 km² in 2021. Their findings demonstrate that Abuja's sprawl reflects demographic, socioeconomic, accessibility, perceptual, and governance factors rather than a single cause. They also highlight the need to incorporate institutional and policy variables into models of urban expansion. However, household perceptions and spatial determinants do not directly measure the operational performance of development-control agencies and professionals across the wider Federal Capital Territory. The literature therefore offers compelling evidence of rapid expansion and multiple drivers but limited quantitative evidence on the relationship between implementation and the rate and spatial extent of sprawl.

This paper addresses that deficiency by linking development-control processes to reported urban-growth outcomes. Guided by these research questions, it examines the magnitude and pattern of sprawl, the influence of policy on built-up expansion, the effectiveness of control mechanisms, and constraints on regulatory performance. Approval efficiency, monitoring,

enforcement, sanctions, and developer compliance are conceptualised as interconnected dimensions of implementation, while outward expansion, satellite-settlement growth, low-density development and peri-urban conversion represent manifestations of sprawl. Two analytical expectations follow: stronger development-control implementation will be associated with a lower rate of urban sprawl, and development-control policies will significantly influence the spatial extent of built-up expansion. By testing these propositions using evidence from planning and development professionals, the paper complements geospatial and household-based studies and directly evaluates the policy–outcome relationship at the centre of Abuja’s growth-management challenge.

3. MATERIALS AND METHODS

The study employed a quantitative, cross-sectional and explanatory survey design to examine the relationship between development-control implementation and urban-sprawl outcomes in Abuja. A quantitative design was appropriate because the study sought to obtain standardised assessments from professionals, construct comparable measures of the principal variables, and test the stated relationships statistically (Creswell & Creswell, 2018; Saunders et al., 2019). The design was cross-sectional because the primary data were collected during 2024, while its explanatory orientation enabled the analysis to move beyond describing urban expansion and regulatory performance to estimating the association between policy implementation and reported spatial outcomes. The individual professional was the unit of data collection, whereas the analytical constructs represented respondents' assessments of the wider development-control system and urban-growth conditions in the Federal Capital Territory (FCT).

Abuja was selected because it is a purpose-built national capital whose master plan, phased-development strategy and statutory development-control system provide a clear benchmark for evaluating regulatory performance. The FCT lies in central Nigeria, approximately between latitudes 8°25' and 9°25' N and longitudes 6°45' and 7°45' E, and comprises six area councils: Abaji, Bwari, Gwagwalada, Kuje, Kwali and Abuja Municipal Area Council. Rapid expansion from the planned city into satellite and peri-urban settlements has made the territory a particularly relevant setting for examining the gap between formal planning intentions and development outcomes. Figure 2 presents the location and administrative structure of the study area.

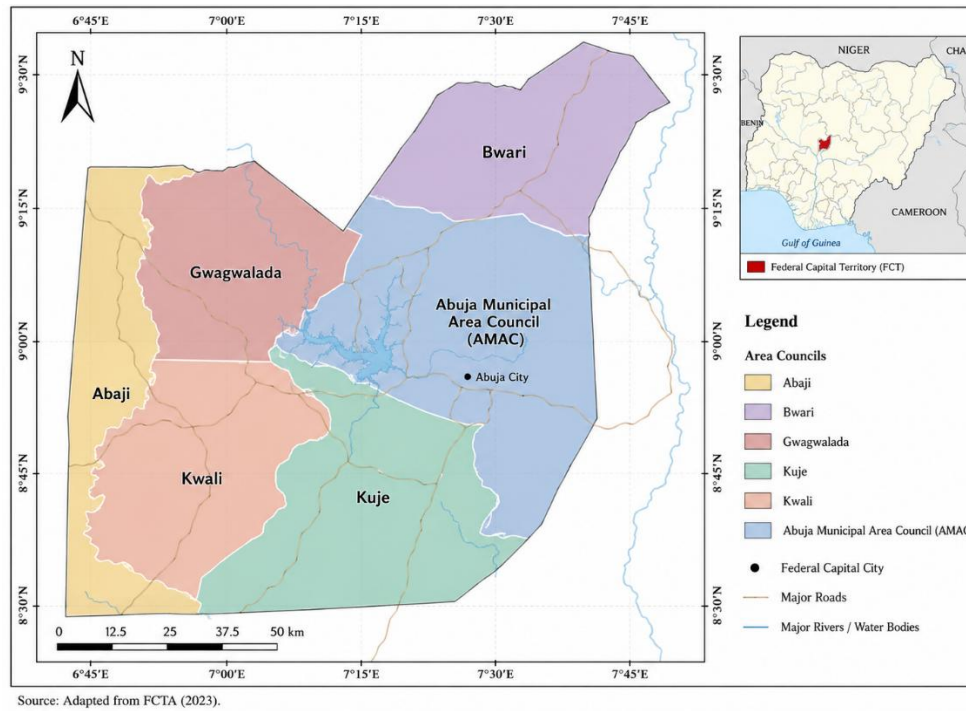


Figure 2. Location and Area-Council Structure of the Federal Capital Territory, Abuja

Note. Council boundaries are presented for study-area orientation; the survey covered professionals operating across the FCT. Area-council boundaries adapted from BlueSahelian (2024, CC0); locator inset adapted from Himalayan Explorer (2010, CC BY-SA 3.0).

To complement the questionnaire evidence, a supplementary GIS-based morphological analysis was undertaken to depict the spatial nature and pattern of Abuja's urban expansion. Administrative-boundary, settlement-centre and major transport-corridor layers were organised in WGS 84 / UTM Zone 32N (EPSG:32632). Euclidean-distance bands around the planned core, satellite settlements and corridor axes were then used to distinguish the planned urban core, continuous suburban expansion, corridor- and satellite-town growth, and the wider peri-urban influence zone. The final cartographic layout incorporated a coordinate grid, north arrow, scale bar, legend, and enlarged metropolitan inset to support transparent interpretation.

The accessible population consisted of 480 professionals and stakeholders with direct knowledge of planning regulation and development activity in Abuja. It comprised development-control officers working in relevant planning authorities, registered town planners in public and private practice, and property-development professionals. These groups were selected because their roles expose them to development applications, planning approvals, monitoring, enforcement, compliance, and the physical consequences of land development. Restricting the population to respondents with direct professional experience strengthened the relevance of the responses and reduced error arising from limited familiarity with the subject (Saunders et al., 2019). Table 1 summarises the population and proportionate sample allocation.

Table 1. Accessible Population and Proportionate Sample Allocation

Respondent category	Population (N)	Population (%)	Sample (n)
Development-control officers	180	37.5	82
Registered town planners	160	33.3	73
Property-development professionals	140	29.2	65
Total	480	100.0	220

The minimum sample size was determined with Yamane's (1967) finite-population formula using $N = 480$ and a 5% margin of error at the 95% confidence level. The calculation produced 218.18, which was rounded to 218 and increased to 220 to protect the required analytical sample against incomplete or unusable returns.

$$n = 480 / [1 + 480(0.05^2)] = 218.18 \approx 218; \text{adjusted sample} = 220$$

A proportionate stratified random-sampling procedure was then applied. The three professional categories constituted the strata, and the number allocated to each stratum was proportional to its share of the accessible population. Within each stratum, eligible respondents were selected randomly from staff lists, professional registers and institutional records. Where an initially selected person declined participation or did not return a usable questionnaire, another respondent was randomly selected from the same stratum so that proportional representation was preserved. The questionnaires were hand-delivered and retrieved during 2024 through departmental offices, professional practices, consultancy offices, development organisations and project locations. The final dataset comprised 220 valid responses.

Data were collected with a structured, self-administered questionnaire composed entirely of closed-ended items. The instrument first recorded respondents' professional characteristics and then measured the major constructs derived from the research questions and conceptual framework. Substantive items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Related items were aggregated to create composite mean scores. Higher development-control scores represented stronger perceived implementation, whereas higher urban-sprawl and built-up-expansion scores represented more extensive reported outward and inefficient development. The constructs and their analytical treatment are presented in Table 2.

Table 2. Operationalisation of the Principal Constructs

Construct	Indicative dimensions	Measurement	Primary analysis
Development-control implementation	Regulatory clarity; approval efficiency; monitoring; inspection; enforcement; sanctions; compliance	Five-point items; composite mean	Descriptive statistics and Pearson correlation
Urban-sprawl magnitude	Outward expansion; satellite-settlement growth; low-density and fragmented development; peri-urban conversion	Five-point items; composite mean	Descriptive statistics and Pearson correlation
Built-up-area expansion	Plan conformity; unapproved development; land-consumption control; peripheral expansion	Five-point items; composite mean	Descriptive statistics and simple linear regression
Mechanism effectiveness and constraints	Approval, monitoring, enforcement and coordination; manpower, technology, delays, political interference and developer compliance	Five-point items; item and scale means	Descriptive statistics

Content validity was established by aligning every item with the research objectives, theoretical constructs, and reviewed literature. The draft questionnaire was examined by the research supervisor for relevance, clarity, sequencing, and coverage, while face validity was strengthened through straightforward wording and a coherent layout suitable for professionally

informed respondents. Before the main survey, the instrument was piloted among eligible professionals who were excluded from the final sample. Internal consistency was evaluated using Cronbach's alpha, with $\alpha \geq .70$ adopted as the acceptance criterion (Nunnally & Bernstein, 1994). All retained scales met this criterion. Reliability was further supported by identical instructions and standardised administration across the respondent categories.

Completed questionnaires were coded, screened, and entered into a statistical software package. Data cleaning included checks for missing values, inconsistencies and outliers; the distributions and relationships were also examined for normality and linearity before inferential testing. Frequencies and percentages described respondent characteristics, while means and standard deviations summarised urban-sprawl indicators, development-control influence, mechanism effectiveness and implementation constraints. Pearson's product-moment correlation estimated the strength and direction of the association between the composite development-control implementation and urban-sprawl scores. The policy effect on built-up expansion was estimated with the single-predictor model $BAE_i = \beta_0 + \beta_1 DCI_i + \epsilon_i$, where BAE denotes assessed built-up-area expansion, and DCI denotes development-control implementation. Statistical decisions were made at $\alpha = .05$. Because the evidence was cross-sectional and based on professional assessments, the coefficients were interpreted as associations and predictive effects rather than definitive causal estimates.

The GIS output was interpreted descriptively alongside the survey findings. Its mapped classes and transport-corridor patterns provided spatial context for the questionnaire-based constructs, but the GIS layer was not treated as a multitemporal satellite-derived land-cover classification. Accordingly, no historical change rates, built-up-area totals, or causal estimates were calculated from the mapped classes, and the GIS variables were not entered into the Pearson correlation or regression models.

Participation was voluntary and based on informed consent. Respondents received information on the study's purpose, the academic use of the data, and their right to decline or withdraw without penalty. Names and other direct identifiers were not collected, and findings were reported only in aggregated form. Completed questionnaires and electronic data were securely stored and restricted to the researcher. The questions addressed professional and institutional processes rather than sensitive personal matters, thereby minimising foreseeable risk. Administrative permission was obtained from the relevant offices before questionnaire distribution, and the study was conducted under institutional and supervisory oversight.

4. RESULTS AND DISCUSSION

The analysis was based on 220 valid questionnaires completed by professionals involved in urban development and development-control activities within the Federal Capital Territory. Since the study employed a cross-sectional survey, the results represent professional assessments of Abuja's urban-growth patterns and regulatory performance rather than direct measurements derived from satellite imagery or longitudinal land-cover data. The descriptive and inferential findings are summarised in Tables 3 and 4.

Table 3. Descriptive results for urban sprawl and development-control performance

Construct and indicator	Mean	SD	Interpretation
Urban-sprawl indicators			
Increasing development in satellite towns	4.34	0.68	High
Conversion of peri-urban land to urban use	4.26	0.71	High
Rapid outward expansion beyond the city core	4.21	0.73	High
Development occurring ahead of infrastructure provision	4.17	0.76	High
Fragmented and uncoordinated land development	4.12	0.79	High
Low-density residential development	4.08	0.81	High
Grand mean	4.20	—	High magnitude of sprawl
Regulatory guidance and containment			
Policies guide where development occurs	3.12	0.88	Moderate
Policies limit excessive land consumption	3.05	0.86	Moderate
Built-up expansion follows approved plans	2.94	0.91	Moderate–low
Cluster mean	3.04	—	Moderate regulatory guidance
Implementation failure and regulatory slippage			
Peripheral expansion reflects implementation gaps	4.31	0.68	High
Weak enforcement encourages expansion into unplanned areas	4.22	0.71	High
Development proceeds without full regulatory approval	4.18	0.75	High
Cluster mean	4.24	—	High implementation failure
Development-control mechanisms			
Regulations are clearly communicated	3.21	0.84	Moderate
Approval procedures are timely and efficient	2.88	0.93	Low–moderate
Compliance with approved plans is high	2.83	0.87	Low–moderate
Monitoring of ongoing development is adequate	2.74	0.91	Low
Enforcement against non-compliant development is effective	2.67	0.89	Low
Sanctions deter unauthorised development	2.61	0.95	Low
Grand mean	2.82	—	Low effectiveness
Implementation constraints			
Weak enforcement capacity	4.36	0.62	Very high
Low compliance by developers	4.32	0.65	Very high
Inadequate monitoring and inspection	4.29	0.68	Very high
High demand for housing and land	4.27	0.71	Very high
Political interference	4.24	0.69	Very high
Insufficient manpower and technical resources	4.18	0.73	High
Delays in development approval processes	4.11	0.77	High
Weak inter-agency coordination	4.09	0.79	High
Grand mean	4.23	—	Severe constraints

Note. The positively and negatively framed built-up-expansion items were analysed as separate directional clusters to avoid combining items with opposing substantive meanings.

The findings indicate that urban sprawl is perceived as an extensive and well-established feature of Abuja's contemporary development. All six indicators recorded mean scores above 4.00, producing a grand mean of 4.20. The growth of satellite settlements received the highest rating ($M = 4.34$, $SD = 0.68$), followed by peri-urban land conversion ($M = 4.26$, $SD = 0.71$) and outward expansion beyond the city core ($M = 4.21$, $SD = 0.73$). The comparatively small standard deviations indicate considerable agreement among the professionals that Abuja's urbanisation is increasingly peripheral, fragmented and land-extensive.

These findings correspond with definitions of urban sprawl that emphasise discontinuity, decentralisation, low-density development and excessive outward land consumption (Dadashpoor & Shahhossein, 2024). They also reinforce geospatial evidence from the Abuja city-region. Enoguanbhor et al. (2019) documented substantial built-up growth and increasing divergence between designated land uses and actual development, while subsequent modelling projected continuing leapfrogging and poorly coordinated expansion under a business-as-usual planning scenario (Enoguanbhor et al., 2022). The present results extend this literature by demonstrating that professionals directly involved in urban development recognise the same processes identified through spatial analysis. The convergence of professional assessment and geospatial evidence

strengthens the conclusion that Abuja's expansion represents more than routine metropolitan growth; it reflects a departure from the compact and phased development principles on which the capital was founded.

To provide spatial context for these professional assessments, Figure 1 presents a morphological GIS interpretation of the nature and pattern of urban sprawl in Abuja. The map does not substitute for multitemporal land-cover analysis; instead, it organises the metropolitan structure around the planned core, major settlement centres and transport-corridor axes so that the dominant form of outward growth can be interpreted alongside the survey results.

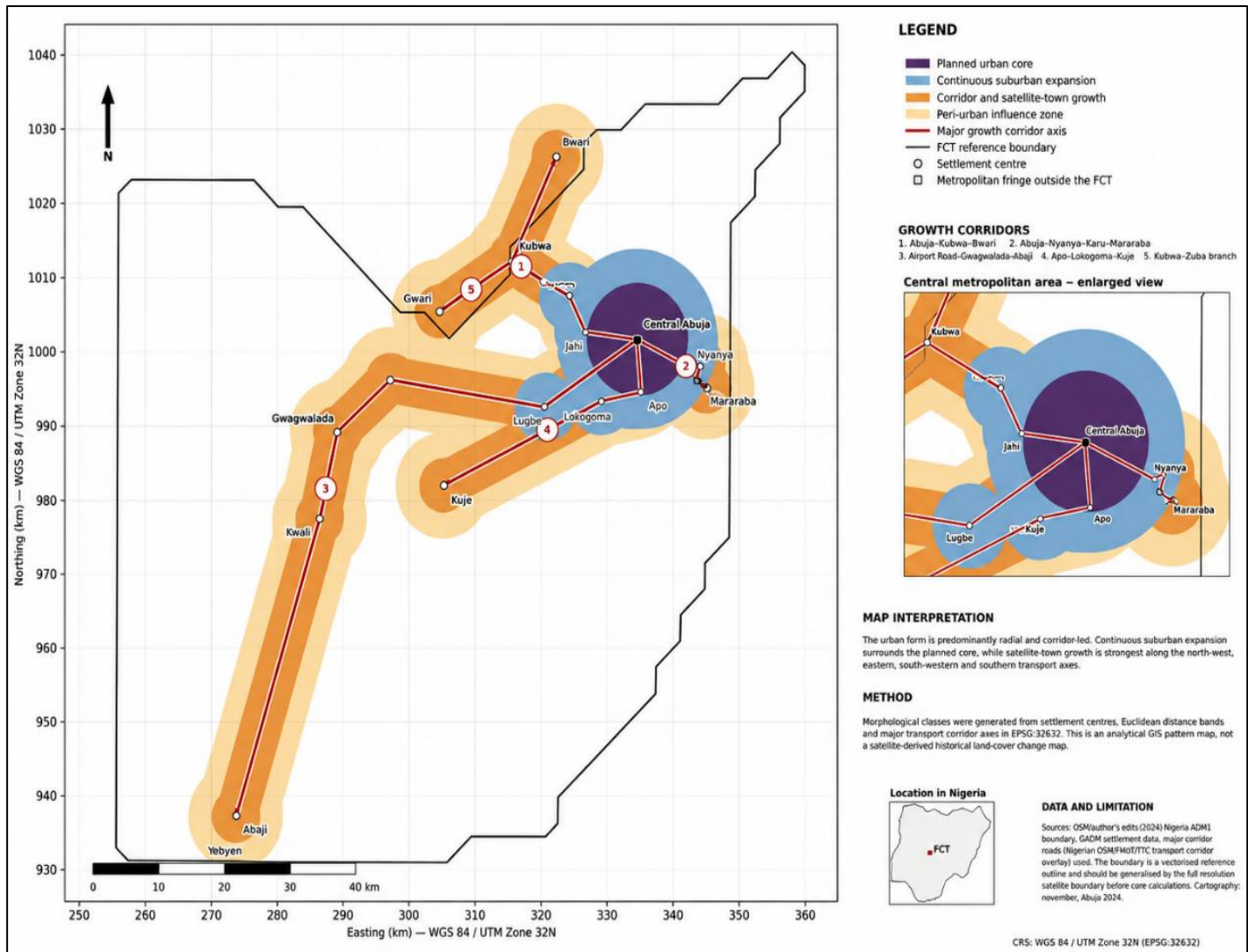


Figure 3. Nature and pattern of urban sprawl in Abuja

Settlement and transport-corridor-based morphological GIS interpretation in WGS 84 / UTM Zone 32N (EPSG:32632) is shown in Figure 3. The figure indicates the relative spatial structure of the planned core, suburban expansion, satellite-town growth, and peri-urban influence. It is an analytical pattern map rather than a multi-temporal satellite-derived measurement of historical built-up change. Source: Author's GIS analysis (2026), using the geoboundaries/GRID3 Nigeria ADM1 reference boundary, selected settlement-centre gazetteer coordinates, and published FCT transport-corridor descriptions.

The mapped pattern is predominantly radial and corridor-led. A compact planned urban core remains discernible around Central Abuja, while a broad zone of continuous suburban expansion extends towards Gwarimpa, Jabi, Lokogoma, Apo and Lugbe. This configuration suggests that the core has not enlarged uniformly in all directions. Instead, suburban development has spread unevenly along accessible axes, producing an urban structure in which contiguous expansion near the centre is combined with elongated growth towards peripheral settlements.

The strongest corridor-and-satellite-town pattern is evident along the Abuja–Kubwa–Bwari corridor and the Kubwa–Zuba branch in the north-west; the Abuja–Nyanya–Karu/Mararaba corridor in the east; the Airport Road–Gwagwalada–Abaji axis in the south-west; and the Apo/Lokogoma–Kuje corridor in the south. These extensions create a polycentric morphology: Central Abuja remains the principal node, but Kubwa, Bwari, Nyanya, Karu, Mararaba, Gwagwalada, Kuje and related settlements function as secondary concentrations around which peri-urban influence broadens. The eastern extension into Karu and Mararaba also illustrates functional metropolitan growth beyond the FCT reference boundary, demonstrating that the urban region is not fully contained by a single administrative jurisdiction. The discontinuous spaces between some corridors and settlement clusters are consistent with leapfrog and fragmented development rather than a continuous compact edge.

Figure 3 therefore provides a spatial counterpart to the descriptive findings in Table 3. The prominence of satellite-settlement and corridor growth corresponds with the high rating for increasing development in satellite towns ($M = 4.34$, $SD = 0.68$). The broad peri-urban influence zones around outer settlements are also consistent with respondents' assessments of peri-urban land conversion ($M = 4.26$, $SD = 0.71$), while the elongated axes extending beyond the continuous suburban zone reflect the reported rapid outward expansion beyond the city core ($M = 4.21$, $SD = 0.73$). The map and survey evidence consequently point to the same general urban form: decentralised growth guided strongly by accessibility and satellite-settlement development.

The mapped morphology also helps explain why infrastructure and development-control pressures are likely to be spatially uneven. Corridor-led expansion increases the linear extent over which roads, water, drainage, public transport and social facilities must be provided, while satellite-town growth creates multiple development fronts requiring simultaneous monitoring. Where development-control capacity is limited, these dispersed fronts can outpace inspection and infrastructure sequencing. Nevertheless, Figure 1 should be interpreted as an analytical pattern map, not as a direct measurement of the date, rate, or quantity of built-up change. Its role in this study is to clarify the spatial logic of the respondents' assessments; causal and temporal claims would require multitemporal satellite imagery, development-permit records, and land-consumption indicators.

The high rating assigned to development occurring ahead of infrastructure provision ($M = 4.17$) is especially important. Urban Growth Management Theory maintains that development should be coordinated with the timing and capacity of infrastructure investment. Where settlements expand before roads, water systems, drainage, schools, and other public facilities are provided, government agencies are compelled to extend services retrospectively across increasingly dispersed areas. This raises per-capita infrastructure costs and reinforces spatial inequality between the planned urban core and peripheral settlements. The result supports Ewing et al.'s (2022) conclusion that growth-management instruments are most effective when development regulation, infrastructure sequencing and land-use planning operate as an integrated system.

The results relating to built-up expansion reveal a pronounced contrast between the formal presence of development-control policies and their practical implementation. The three positively worded items produced a cluster mean of 3.04, indicating that respondents recognised a moderate degree of regulatory guidance. Development-control policies were perceived to

provide some direction regarding where development should occur ($M = 3.12$) and some capacity to limit excessive land consumption ($M = 3.05$). However, the proposition that built-up expansion follows approved development plans received a lower mean of 2.94.

In contrast, the implementation-failure items produced a substantially higher cluster mean of 4.24. Respondents strongly agreed that peripheral expansion reflects gaps in development-control implementation ($M = 4.31$), that weak enforcement encourages growth in unplanned locations ($M = 4.22$), and that development frequently proceeds without full regulatory approval ($M = 4.18$). These results identify an implementation deficit rather than a complete absence of planning policy. Abuja possesses plans, regulations, and development-control institutions, but their capacity to influence actual development locations is weakened by inconsistency between formal requirements and operational practice. This finding is consistent with Enoguanbhor et al. (2021), who identified limited implementation resources, institutional inconsistencies, political constraints, and weak coordination as central challenges to land-use planning in Abuja.

The analysis of specific regulatory mechanisms reinforces this interpretation. Development-control mechanisms recorded a low overall effectiveness score of 2.82. Communication of regulations performed comparatively better ($M = 3.21$), but this clarity did not translate into effective monitoring, enforcement, or compliance. Monitoring of ongoing development received a mean of 2.74, enforcement against non-compliant development scored 2.67, and the deterrent effect of sanctions recorded the lowest mean of 2.61. The frequency distribution produced a similar pattern: 51.4% of respondents assessed the mechanisms negatively, 17.7% were neutral, and only 30.9% provided positive assessments.

This distinction between regulatory communication and regulatory credibility is central to Regulatory Compliance Theory. Development actors may understand planning requirements but still disregard them where inspections are infrequent, enforcement is selective, or sanctions are unlikely to outweigh the gains from unauthorised development. Ayres and Braithwaite's (1992) responsive-regulation framework suggests that effective compliance systems require both accessible regulatory procedures and a credible capacity to escalate enforcement where cooperation fails. The Abuja findings indicate that the system performs better at communicating formal expectations than at ensuring conformity with them. This is consistent with Asamoah et al. (2025), who found that the contribution of land-use regulation to sustainable urban development depends on institutional cooperation, enforcement consistency, and actual compliance rather than the mere existence of statutory provisions.

The constraints reported by respondents show that this regulatory weakness is systemic. All eight constraints recorded mean scores above 4.00, with a grand mean of 4.23. Weak enforcement capacity was the most severe challenge ($M = 4.36$), followed by low developer compliance ($M = 4.32$), inadequate monitoring and inspection ($M = 4.29$), high demand for housing and land ($M = 4.27$), and political interference ($M = 4.24$). Overall, 87.7% of respondents agreed or strongly agreed that the identified constraints substantially undermine development-control effectiveness.

These factors appear to form a mutually reinforcing cycle. Limited staffing and technical resources restrict routine monitoring; inadequate monitoring reduces the likelihood that violations will be detected; politically influenced or inconsistent enforcement weakens the credibility of sanctions; and diminished regulatory credibility encourages further non-compliance. Administrative delays may also increase the incentive to bypass formal approval procedures, particularly where housing demand and peripheral land transactions proceed more rapidly than planning decisions. The findings therefore caution against interpreting Abuja's sprawl as an enforcement problem in isolation. It reflects the interaction of regulatory capacity, land and housing pressures, administrative efficiency, institutional coordination and political influence.

Table 4. Inferential relationship between development-control implementation and urban-growth outcomes

Analysis	Statistic	Value	Decision
Development-control implementation and urban-sprawl rate	Pearson's r	-0.612	Reject H_{01}
Development-control policy and assessed built-up expansion	p	< .001	Reject H_{02}
	R	0.583	
	R^2	0.340	
	Adjusted R^2	0.337	
	Standard error of estimate	0.512	
	$F(1, 218)$	112.41	
	p	< .001	

Note. $n = 220$. The regression outcome represents respondents' assessments of built-up-area expansion

The inferential findings provide further support for the central argument. Development-control implementation was strongly and negatively associated with the reported rate of urban sprawl, $r = -.612$, $p < .001$. Stronger implementation was therefore associated with lower professional assessments of sprawl, while weaker implementation corresponded with greater outward and fragmented growth. The first null hypothesis was consequently rejected. This result supports both theories underpinning the study: Regulatory Compliance Theory explains how monitoring and enforcement influence developer behaviour, while Urban Growth Management Theory explains how those individual decisions accumulate into metropolitan spatial patterns. The regression model was also statistically significant, $F(1, 218) = 112.41$, $p < .001$, and accounted for 34.0% of the variance in respondents' assessments of built-up-area expansion ($R = .583$, $R^2 = .340$, adjusted $R^2 = .337$). Development-control policy implementation is therefore an important explanatory correlate of perceived expansion, although it is not its only determinant. Approximately 66% of the variance remained outside the model, indicating the likely importance of housing demand, land prices, population growth, accessibility, infrastructure investment and other governance factors. This interpretation aligns with Mashi et al. (2025), who conceptualise Abuja's sprawl as a multidimensional process shaped by demographic, socioeconomic, accessibility and institutional conditions.

Taken together, the results demonstrate a clear mismatch between Abuja's formal planning framework and the operational capacity of its development-control regime. The city's planned origin has not prevented extensive satellite-settlement growth, peri-urban conversion and development ahead of infrastructure because regulatory clarity has not been matched by efficient approvals, sustained monitoring, credible enforcement and high compliance. The study therefore connects the institutional implementation weaknesses identified in previous Abuja research with quantified professional assessments of urban-growth outcomes. Nevertheless, because the evidence is cross-sectional and perception-based, the relationships should be interpreted as statistically significant associations rather than definitive causal effects or direct geospatial measurements. Future research should integrate professional and institutional data with multitemporal satellite imagery, development-permit records, and land-consumption indicators to test whether the relationships identified here are reproduced in objectively measured spatial change.

5. CONCLUSION

This study examined the relationship between development-control implementation and urban sprawl in Abuja, Nigeria's purpose-built federal capital. The findings reveal a substantial implementation gap between the city's formal planning framework and its contemporary development trajectory. Respondents reported pronounced satellite-settlement growth, peri-urban land conversion, low-density expansion, fragmented development, and construction occurring ahead of infrastructure provision. Although development-control policies continue to provide some regulatory direction, their

practical effectiveness is constrained by weak monitoring, inconsistent enforcement, limited deterrence, administrative delays, political interference, and low developer compliance.

The inferential findings reinforce this interpretation. Development-control implementation was strongly and negatively associated with the reported rate of urban sprawl, while development-control policy accounted for a meaningful proportion of the variation in respondents' assessments of built-up expansion. These results suggest that Abuja's spatial transformation cannot be attributed exclusively to population growth, housing demand or land-market pressures. Rather, it is also connected to the capacity of planning institutions to translate statutory regulations into predictable development behaviour and spatial outcomes. The persistence of outward and fragmented growth therefore reflects not only the intensity of development pressure but also the operational weakness of the institutions responsible for guiding and regulating that growth.

The study contributes to planning scholarship by integrating Regulatory Compliance Theory and Urban Growth Management Theory within an empirical assessment of a planned African capital. It demonstrates that development control influences urban form not simply through the existence of plans and regulations, but through the credibility, efficiency, and consistency of approval, monitoring, enforcement, and compliance systems. In this respect, the study shifts attention from the formal strength of planning instruments to the institutional conditions under which those instruments produce measurable urban-development outcomes. However, because the analysis was based on cross-sectional professional assessments, the reported relationships should be interpreted as statistically significant associations rather than definitive causal effects or direct measurements of land-cover change.

The policy implications are clear. Reform should prioritise implementation capacity rather than the preparation of additional regulations that may remain weakly enforced. The Federal Capital Territory Administration should strengthen development-control agencies through increased professional staffing, improved field logistics, geospatial monitoring technology and routine inspection of rapidly transforming satellite and peri-urban settlements. Monitoring should occur throughout the development process, from application and site preparation to construction and occupancy, rather than primarily after violations have become established and difficult to reverse.

Development-approval procedures should also be simplified, digitised and made more transparent. Clearly defined documentation requirements, statutory processing timelines and coordinated inter-agency review would reduce administrative delays and limit the incentives for developers to bypass formal approval channels. The digital integration of planning applications, land records, inspection reports, enforcement notices and compliance certificates would improve institutional coordination, strengthen accountability and provide a more reliable basis for tracking development activity across the Federal Capital Territory.

At the same time, enforcement should operate through a consistent and graduated framework. Regulatory guidance and compliance assistance should be combined with stop-work notices, proportionate financial penalties and corrective measures where violations persist. Sanctions must be applied transparently and independently of political or socioeconomic influence if they are to deter unauthorised development and restore confidence in the regulatory system. Development control should also be integrated with infrastructure investment, affordable housing provision and planned land release, since controlling peripheral expansion will remain difficult where households and developers cannot access adequately serviced and affordable land within approved development areas.

Future research should complement professional assessments with multi-temporal satellite imagery, development-permit records, land-consumption indicators, density measurements and longitudinal institutional data. Such an integrated approach would make it possible to determine whether improvements in implementation capacity produce measurable changes in

Abuja's urban form over time. Ultimately, Abuja's experience demonstrates that master planning alone cannot secure orderly urban development. The sustainability of planned cities depends on institutions capable of converting spatial intentions into credible, enforceable, and socially responsive development outcomes.

6. COMPETING INTERESTS

None to declare.

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