

Broken Cities: Who's Behind Ghana's Urban Chaos?

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Abstract

Ghana's cities continue to face persistent disorder despite decades of decentralization and reform. This study explores the structural and behavioral roots of urban dysfunction through a political economy and systems lens. It introduces the Multi-Actor Urban Disorder (MAUD) framework to model how fragmented authority, institutional overload, and civic noncompliance interact to produce chaos. Two additional tools, the Urban Governance Accountability Matrix (UGAM) and the Governance Load Index (GLI)—support the analysis by mapping accountability gaps and institutional stress. Simulation results show that partial or delayed reforms fail to reverse decay. Only early, coordinated, and high-intensity interventions that align mandates with capacity and build cross-actor accountability can stabilize the system. The findings offer a replicable model for diagnosing governance fragility and guiding reforms in rapidly urbanizing yet institutionally fragile sub-Saharan contexts.

Keywords: urban disorder, governance failure, MAUD model, decentralization, institutional overload, mindset shift, Ghana, accountability matrix

1. Introduction

Ghana's major urban centers—Accra, Kumasi, and Tamale—are beset by persistent spatial and functional disorder. Manifestations include unregulated construction, traffic congestion, informal settlements, sanitation failures, and the encroachment of public space. These problems go beyond the typical consequences of urban growth or resource scarcity; they reflect a deeper governance crisis shaped by fragmented authority, misaligned institutions, and enforcement fatigue.

Despite a decades-long decentralization agenda, Metropolitan, Municipal, and District Assemblies (MMDAs)—the statutory agencies responsible for land use planning under Act 936—remain structurally constrained. Chronic underfunding, low technical capacity, and political interference from the central government have weakened their effectiveness. Adding complexity, traditional authorities often allocate peri-urban land without oversight, while formal planning agencies are sidelined. Civic noncompliance—seen in unauthorized construction and widespread disregard for zoning and sanitation rules—further erodes regulatory systems.

What distinguishes Ghana's urban crisis is the co-production of dysfunction by multiple actors—state institutions, customary authorities, and citizens—each operating with divergent incentives and weak accountability mechanisms. Yet, policy responses have largely treated these issues in isolation, lacking a systemic framework to map interdependencies or explain the persistence of urban disorder. This study responds to that gap.

1.1 Background

Urban governance in Ghana has evolved from colonial-era top-down planning to post-independence efforts at reform, though implementation remains patchy due to capacity deficits and political instability (Grant & Yankson, 2003; Ayee, 2013). The Local Governance Act (Act 936) was designed to empower MMDAs, but their impact has been undermined by financial constraints and institutional fragmentation (Yeboah & Obeng-Odoom, 2010). In many peri-urban areas, traditional leaders continue to control land allocation outside formal planning regimes (Kasanga & Kotey, 2001).

Civic behavior has also played a role: illegal construction and poor sanitation practices exacerbate spatial disorder. Although policy frameworks such as the 2012 National Urban Policy exist, implementation remains weak, and the gap between planning and reality continues to widen.

1.2 Research Gap and Novelty

Urban studies in Ghana have often treated informality, housing, and land governance in disciplinary silos, producing fragmented diagnoses and overly technocratic solutions. These approaches tend to overlook how complex institutional entanglements and conflicting incentives reproduce disorder. Critically, enforcement gaps and uneven accountability across governance actors remain under-theorized.

This study addresses these shortcomings by offering a systems-level analysis that sees governance instability not as a singular failure but as a co-produced condition. It reimagines urban dysfunction as emerging from recursive interactions among central ministries, MMDAs, traditional authorities, professional planners, and citizens—all navigating incentives of evasion, inertia, or selective compliance. Importantly, it highlights that institutional breakdown is not solely due to weak capacity, but also to diffused responsibility and permissive enforcement cultures.

Three core contributions distinguish this work:

- **Integrated Accountability Mapping** – Reveals overlapping mandates and gaps between state and non-state actors, showing how institutional ambiguity sustains disorder.
- **Governance-Centered Diagnosis** – Moves beyond blaming urbanization or infrastructure deficits to position disorder as the outcome of disengaged actors and weak enforcement ecologies.
- **Simulation Tools for Reform** – Introduces three original frameworks—MAUD (Multi-Actor Urban Disorder), UGAM (Urban Governance Accountability Matrix), and GLI (Governance Load Index)—to identify reform leverage points and simulate policy outcomes.

By embedding urban dysfunction within wider institutional and behavioral ecosystems, the study adds to debates on informal governance, spatial justice, and the pluralization of authority. Its insights offer comparative relevance across cities in sub-Saharan Africa facing similar governance fragmentation. The conceptual orientation builds on the mindset-governance framework developed in *Asiedu (forthcoming)*, which emphasizes systemic accountability and behavioral adaptation as drivers of sustainable institutional reform.

1.3 Conceptual Framework: The Multi-Actor Urban Disorder (MAUD) Model

Ghana's urban disorder does not stem from isolated institutional failures. Instead, it emerges from a dynamic interplay among five key actors: central government, local authorities, traditional leaders, urban planners, and citizens.

The MAUD model conceptualizes disorder as an emergent property of recursive political, institutional, and behavioral interactions (Ostrom, 2005; Parnell & Robinson, 2012; Boamah, Gyimah, & Edwards, 2017). Each actor influences—and is influenced by—the others, generating feedback loops that sustain dysfunction. Rather than treating any actor as the sole cause of failure, the model emphasizes their mutual entanglement and the cyclical nature of disorder reproduction.

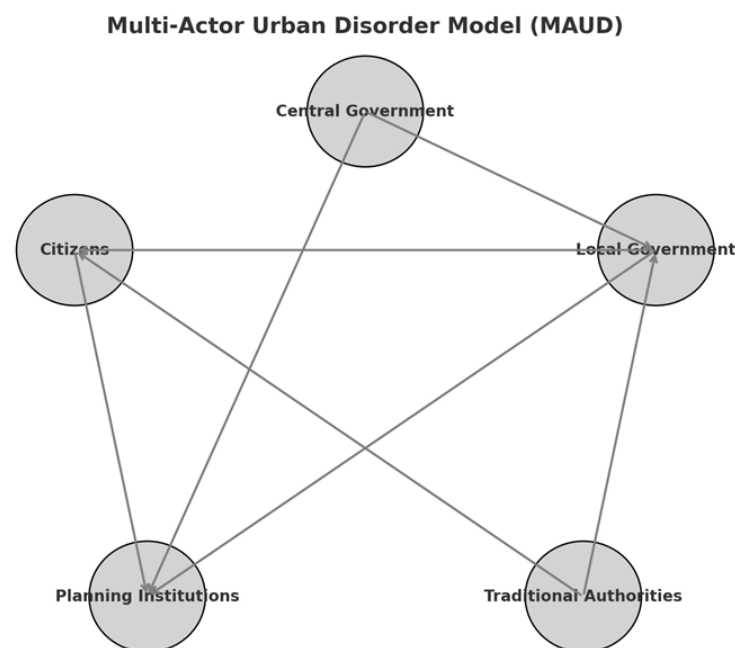


Figure 1. Actor Relationships in the MAUD Model

Note. *Author's conceptualization based on the Multi-Actor Urban Disorder (MAUD) framework (Asiedu, in press).*

The figure depicts the MAUD framework as a network of five interlinked actors. Arrows represent directional influences, capturing how authority, resources, and failures propagate across both top-down and horizontal relationships within Ghana's urban governance landscape.

Key Actor Interdependencies

Ghana's urban disorder is co-produced through dynamic interactions among the following actors:

- Central Government (CG): Sets policy mandates, controls funding, and influences MMDAs and planning institutions—yet often induces fragmentation through politicization and weak enforcement.
- Local Governments (MMDAs): Serve as the frontline regulators but suffer from limited fiscal autonomy, low capacity, and fragmented coordination.
- Traditional Authorities (TAs): Control land allocation in many areas without statutory oversight, frequently creating conflicts with formal planning regimes.
- Planning Institutions (PIs): Bodies like TCPD and LUSPA have technical authority but are politically sidelined and under-resourced.
- Citizens and Informal Builders (CIBs): Make decisions based on institutional ambiguity and selective enforcement, cumulatively shaping the informal urban form.

The figure illustrates how these actors form a feedback-driven system in which misalignments in land use, planning, or civic behavior can ripple through the network, amplifying disorder. This systemic framing justifies the need for coordinated reforms and underpins the simulation models introduced in subsequent sections.

1.4 Integrated Framework – MAUD, UGAM, and GLI in a Unified Diagnostic Approach

This research introduces a three-part analytical toolkit combining simulation, accountability mapping, and institutional stress diagnostics to uncover the structural roots of urban dysfunction in Ghanaian cities. The framework includes:

- **MAUD (Multi-Actor Urban Disorder):** A systems model that simulates how disorder arises from civic noncompliance, weak enforcement, land-use conflicts, and governance inertia.
- **UGAM (Urban Governance Accountability Matrix):** A tool that maps formal and informal accountability linkages, revealing areas of ambiguity and weak oversight.
- **GLI (Governance Load Index):** A metric that measures institutional stress by comparing an actor's statutory mandates with its actual capacity and autonomy.

Used together, these tools go beyond superficial explanations to identify deep governance failures, test reform scenarios, and benchmark interventions across cities facing similar challenges in sub-Saharan Africa. The integrated framework builds on the systems-governance foundations elaborated in *Asiedu (forthcoming)* and refined through simulation analysis in *Asiedu (in press)*.

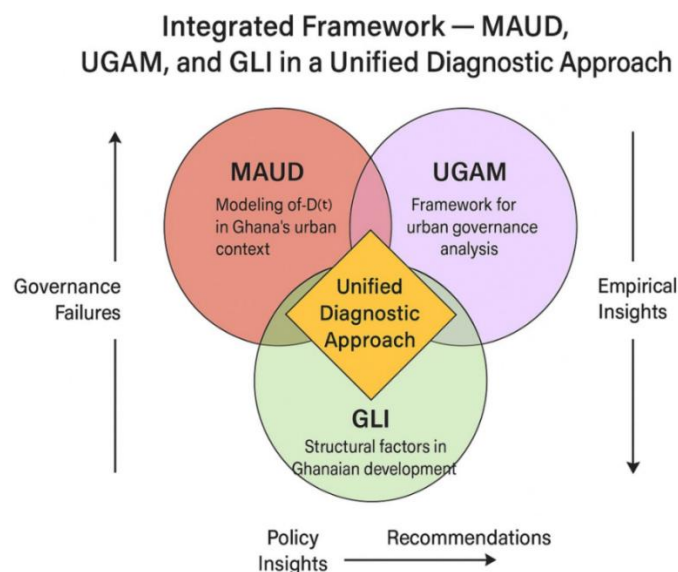


Figure 2. Integrated Framework – MAUD, UGAM, and GLI in a Unified Diagnostic Approach

Note. *Author's conceptualization based on the integrated diagnostic framework developed in Asiedu (in press).*

1.5 Objectives of the Study

This study aims to uncover the systemic drivers of Ghana's urban dysfunction through a multi-actor governance perspective, treating city-level disorder as the outcome of overlapping institutional, political, and behavioral breakdowns. Its key objectives are to:

- **Actor Mapping**

Clarify the roles, power asymmetries, and interaction patterns among central ministries, municipal authorities, traditional leaders, planning agencies, and citizens.

- **Governance Analysis**

Examine how enforcement gaps, mandate overlaps, traditional land control, and civic disengagement co-produce spatial and functional disorder.

- **Model Development**

Build an integrated simulation framework (MAUD, UGAM, GLI) to represent institutional dynamics and test theoretical assumptions.

- **Scenario Testing**

Explore how targeted interventions—at specific actors or leverage points—shift urban disorder trajectories and identify critical points for systemic transformation.

- **Policy Formulation**

Recommend actor-sensitive, evidence-based strategies to improve coordination, align mandates with capacity, and strengthen governance accountability.

1.6 Methodology and Simulation Design

This study employs a systems modeling approach to investigate Ghana's urban dysfunction through the lens of fragmented multi-actor governance. It operationalizes the MAUD, UGAM, and GLI frameworks via scenario-based simulations that explore how institutional alignments, incentive structures, and actor responses interact to produce tipping points—toward either disorder or stabilization.

1.6.1 Simulation Philosophy and Rationale

The model uses systems thinking grounded in feedback loop logic and agent-based interaction. Rather than aiming for precise forecasts, it is exploratory—designed to simulate emergent patterns across varying governance conditions. It shows how micro-level choices by actors aggregate into macro-level outcomes.

Due to limited longitudinal data at the city level, the simulation draws on secondary sources, stylized facts, and parameter estimates from literature, policy documents, and expert interviews. Although this limits statistical generalizability, it is a robust diagnostic tool suited for data-scarce environments.

1.6.2 Actor Typologies and Behavioral Rules

The MAUD framework distinguishes five actor categories:

- **Central Government (CG)** – Sets urban policy, allocates resources, and oversees planning.
- **Local Governments (MMDAs)** – Implement plans, enforce regulations, and issue permits.
- **Traditional Authorities (TAs)** – Control peri-urban land and influence informal development.
- **Planning Institutions (PIs)** – Technical agencies like TCPD and LUSPA responsible for spatial planning.
- **Citizens and Informal Builders (CIBs)** – Households and developers who navigate institutional gaps to build, settle, or trade land.

Each actor type follows a behavioral rule matrix shaped by four governance parameters:

- P_e : (Enforcement Probability): Likelihood of penalties for non-compliance.
- I_s : Incentive Structure: Perceived cost–benefit of compliance.
- N_p : Peer Norm Index: Influence of neighboring behaviors.
- A_g : Governance Ambiguity: Degree of inconsistency in institutional directives.

For example, low enforcement ($P_e \downarrow$) and high ambiguity ($A_g \uparrow$), incentivize rule circumvention—especially if informal norms (N_p) reward non-compliance.

The rule matrix introduces behavioral heterogeneity, acknowledging that actors face different constraints and incentives.

They adapt over time, creating feedback cycles that shape disorder or reform trajectories (see Figure A3 in Appendix). To illustrate differential sensitivity, Table 1 summarizes dominant influences per actor category:

Table 1. Sensitivity of Actors to Governance Parameters

Actor Category	Most Sensitive Parameters	Typical Behavioral Tendency
Central Government	P_e, A_g	Strategic coordination or inertia
MMDAs	P_e, I_s	Budget-driven enforcement variation
Traditional Authorities	N_p, A_g	Customary discretion; land control
Planning Institutions	A_g, P_e	Procedural bottlenecks, delayed enforcement
Citizens/Informal Builders	I_s, P_e, N_p	Adaptive evasion or selective compliance

Note. Author's conceptualization based on simulation logic and actor-behavior analysis (Asiedu, in press).

This sensitivity matrix ensures that actor behavior is dynamic, contextual, and non-uniform—reflecting a core innovation of the MAUD framework.

1.6.3 Construction of the UGAM Matrix

The Urban Governance Accountability Matrix (UGAM) quantifies the gap between assigned responsibilities and observed actions across actor types:

$$UGAM(i, j) = R_{ij} - A_{ij} \quad (1)$$

Where:

- R_{ij} = Responsibility assigned to actor i for function j
- A_{ij} = Actual enforcement or action observed from actor i for function j

Larger discrepancies signify accountability asymmetry or governance vacuums. UGAM Scores are normalized between 0 (perfect alignment) and 1 (complete nonperformance).

Matrix values are drawn from:

- National Urban Policy Frameworks
- Ministry of Local Government functional mandates
- NDPC (National Development Planning Commission) and local government performance audits.

1.6.4 Governance Load Index (GLI) and System Stability

The Governance Load Index (GLI) simulates stress levels on urban enforcement capacity:

$$GLI = \frac{\sum_{i=1}^n D_i \cdot W_i}{C} \quad (2)$$

Where:

- D_i : Disorder-generating pressure (e.g., illegal construction, sanitation violations).
- W_i : Weighted responsibility of actor i (from UGAM).
- C : City enforcement capacity (proxy: inflation-adjusted MMDA budget per capita).

A GLI score > 1 indicates overload and heightened disorder risk, while < 1 suggests a manageable system.

To visualize systemic transitions, a phase portrait is generated showing GLI trends over time under alternative enforcement assumptions (see Sections 8.3 and 8.5.7)

1.6.5 Simulation Scenarios

Three scenarios were run using Vensim and Python modeling frameworks:

Scenario A: Business-as-Usual (BAU)

Low P_e , high A_g , static budgets, and role gaps.

Expected Outcome: persistent disorder equilibrium.

Scenario B: Targeted Reform (Policy-Driven)

+20% MMDA enforcement budget, reduced ambiguity via mandate clarity, incentivized compliance (e.g., sanitation rebates)

Expected Outcome: partial stabilization with delayed tipping.

Scenario C: Collaborative Governance Model

Cross-actor coordination protocols, civic engagement embedded in monitoring, inclusion of Trust Index and evolving social norms.

Expected Outcome: governance consolidation and disorder reversal. (See Figure 7)

1.6.6 Assumptions and Limitations

Key Assumptions

- Actors are boundedly rational but adapt their strategies over time.
- Compliance is probabilistic, shaped by enforcement probability (P_e), incentive structures (I_s), and peer norms (N_p).
- Institutional behavior reflects both resource constraints and political incentives.

Limitations

- No primary field data were collected; the model relies on policy reviews, secondary sources, and desk-based research.
- Inter-city variations (e.g., differences between Accra, Kumasi, and Tamale) are not explicitly modeled.
- Simulation outputs are exploratory and illustrative rather than predictive forecasts.

Despite these limitations, the simulation functions as a decision-support platform, illuminating reform levers, risk thresholds, and actor dynamics under multiple governance trajectories.

2. Problem Statement

Urban governance research in Ghana has often adopted a fragmented lens, focusing on discrete issues such as land markets, formal institutions, or service delivery. While valuable, such siloed studies overlook the interlocking relationships and feedback loops among actors whose competing interests, overlapping mandates, and behavioral adaptations generate persistent disorder. In the absence of a systems-level diagnosis, many urban reforms remain reactive, piecemeal, and ultimately unsustainable.

To address this gap, the present study introduces the Multi-Actor Urban Disorder (MAUD) model, a conceptual and mathematical framework that simulates how governance failures emerge from recursive interactions among five key actor types: central government ministries, Metropolitan, Municipal, and District Assemblies (MMDAs), traditional authorities, planning institutions, and citizens (particularly informal builders and traders).

The MAUD framework is complemented by two original diagnostic tools:

- Urban Governance Accountability Matrix (UGAM): Quantifies discrepancies between assigned responsibilities and actual enforcement actions, illuminating accountability vacuums and role misalignments.
- Governance Load Index (GLI): Measures the mismatch between governance mandates and institutional capacity, identifying tipping points of overload.

Together, MAUD, UGAM, and GLI form a unified diagnostic suite that advances understanding of the structural underpinnings of urban disorder. These tools move beyond descriptive accounts by offering a simulation-based reform platform that enables policymakers to identify where enforcement pressure is weakest, where institutional overload is greatest, and where coordination is most fragmented. In doing so, the framework contributes to wider policy debates on hybrid governance, state fragility, and informal urbanization in sub-Saharan Africa.

3. Structure of the Study

The paper is organized into eight sections:

1. Introduction – Presents the motivation for the study and outlines the core governance challenges in Ghana’s urban context.
2. Problem Statement – Defines the research gap and introduces the MAUD model as an integrated systems diagnostic.
3. Literature Review – Synthesizes key scholarship on decentralization, land dualism, informality, and urban governance models.
4. Methodology and Model Design – Details the construction and simulation of the MAUD, UGAM, and GLI frameworks.
5. Case Illustration: Kwabenya – Demonstrates how governance breakdowns manifest in practice through spatial and behavioral dynamics.
6. Simulation Results – Presents scenario analyses of alternative reform pathways, visualizing institutional stress and disorder evolution.
7. Conclusion and Policy Implications – Offers actionable recommendations for strengthening accountability, reducing overload, and improving governance synergy.
8. Limitations and Future Applications.

4. Literature Review

This review engages seven interrelated themes to situate Ghana’s urban disorder within both empirical patterns and theoretical debates.

4.1 Decentralization and Local Government Constraints

Despite the passage of Ghana’s Local Governance Act (Act 936), Metropolitan, Municipal, and District Assemblies (MMDAs) remain heavily dependent on central government funding and directives. This dependency undermines local autonomy, constraining their capacity for planning, budgeting, and regulatory enforcement (Ayee, 2013; Yeboah & Obeng-Odoom, 2010). The result is a structural misalignment between statutory responsibility and actual capacity.

4.2 Land Tenure Dualism

Approximately 70% of Ghana’s land is under customary control (Kasanga & Kotey, 2001), managed primarily by traditional authorities who often operate outside formal land planning systems (Ubink, 2008). This dualism creates institutional friction, fuels land conflicts, and weakens spatial coherence across urban areas.

4.3 Marginalization of Planning Institutions

Planning bodies such as the Town and Country Planning Department (TCPD) are chronically under-resourced and politically sidelined. Their limited enforcement capacity contributes to rampant informal expansion and undermines the authority of statutory spatial strategies (Grant & Yankson, 2003; Obeng-Odoom, 2011).

4.4 Civic Behavior and Informality

Urban disorder is not only institutional but also behavioral. Practices such as illegal construction, open defecation, and environmental degradation emerge as symptoms of weak institutional presence and selective enforcement.

These patterns of civic noncompliance are not merely acts of defiance but rational responses to governance ambiguity (Frimpong Boamah & Arku, 2015; Asiedu, 2025; Asiedu, forthcoming).

4.5 Systems Approaches to Governance

Recent scholarship urges a shift from static, rule-based reforms to systems thinking that models interaction effects, actor dynamics, and policy feedback (Luescher & B énit-Gbaffou, 2020; Onyango et al., 2022). Studies from Kenya, Nigeria, and South Africa highlight governance fragmentation and hybrid authority structures, emphasizing the need for integrated diagnostics capable of capturing such complexity. This perspective resonates with broader insights from African urban theory, which conceptualizes cities as negotiated and adaptive spaces rather than as rigidly governed entities (Myers, 2011). In a similar vein, Goodfellow and Titeca (2012) illustrate how informal governance and the “politics of survival” shape urban order in African contexts, underscoring the interdependence between formal institutions and informal actors. Together, these works provide a foundation for interpreting urban governance as a dynamic, multi-actor system rather than a fixed administrative framework.

4.6 Literature Review and Theoretical Positioning

Recent research in African urban governance has emphasized the inadequacy of technocratic, linear policy prescriptions

in cities characterized by institutional hybridity, overlapping mandates, and informal authority structures. Luescher and B'nit-Gbaffou (2020) advocate for systems thinking approaches that account for feedback loops, actor interdependence, and emergent behavior in urban policy environments. Similarly, Onyango et al. (2022) demonstrate how urban governance in Nairobi and Lagos unfolds through negotiated arrangements between formal institutions and informal actors, challenging conventional state-centric assumptions. Myers (2011) further extends this view by situating African cities within alternative theoretical paradigms that recognize complexity, adaptation, and social negotiation as defining features of urban life. Likewise, Goodfellow and Titeca (2012) provide empirical evidence that informal economies and survival politics are not peripheral anomalies but integral mechanisms through which governance functions in African urban systems.

This study builds on such insights by offering an original modeling suite—MAUD (Multi-Actor Urban Disorder), UGAM (Urban Governance Accountability Matrix), and GLI (Governance Load Index)—that jointly simulate disorder outcomes as the product of incentive misalignment, authority fragmentation, and weak cross-actor accountability. Theoretically, the MAUD framework draws on Ostrom's (2005) theory of polycentric governance, which views public service provision and collective action as shaped by multi-level institutional arrangements. It also echoes the political economy critique of top-down reforms advanced by Awortwi (2011) and Obeng-Odoom (2010), who emphasize the persistence of colonial-era institutional path dependencies in African cities.

Furthermore, the GLI operationalizes insights from the institutional capacity literature (Grindle, 1997) by measuring the stress placed on governance actors relative to their mandates and resources. This aligns with Andrews, Pritchett, and Woolcock's (2017) argument for context-sensitive and problem-driven governance diagnostics in development practice. The integration of these literatures not only grounds the modeling tools in established theory but also responds to recent calls for more rigorous, system-level frameworks in African urban studies—moving beyond ethnographic description to provide diagnostic and predictive value.

By positioning urban disorder as a structurally contingent phenomenon—emerging from the configuration of actors, mandates, and incentives—this study contributes a replicable systems-based methodology. It thereby complements and extends existing work in urban political economy, development studies, and institutional theory, offering analytical tools applicable to other cities grappling with governance complexity and institutional fragmentation. It thereby complements and extends existing work in urban political economy, development studies, and institutional theory, drawing conceptually from the mindset–governance framework expounded in *Asiedu (forthcoming)*, which emphasizes systemic accountability and behavioral adaptation as foundations for institutional reform. This builds on Asiedu (2025), which introduced the transformative mindset model explaining how behavioral adaptation mediates institutional performance in African governance systems.

4.7 Theoretical Integration

Contemporary theoretical contributions deepen the conceptual underpinnings of this study. Gisselquist (2021) critically revisits the notion of “good governance,” underscoring the inherent tensions between legitimacy and performance—tensions that are directly reflected in the MAUD framework's focus on behavioral compliance and institutional accountability. DiMaggio and Powell's (1983) concept of institutional isomorphism offers a lens to understand the persistence of informal governance structures despite formal reform efforts, illuminating patterns of inertia within African urban systems. Fox (2015) provides empirical meta-evidence on the efficacy of social accountability mechanisms in urban governance, further justifying the construction of the Urban Governance Accountability Matrix (UGAM) as a diagnostic instrument. From a spatial systems standpoint, Batty (2008) highlights the nonlinearity of urban development, calling for models capable of capturing feedback dynamics, adaptive behavior, and scaling effects.

Building on these insights, this study synthesizes Ostrom's (2005) theory of polycentric governance, Forrester's (1969) systems dynamics, and political economy perspectives on urban governance in Africa (Awortwi, 2011; Yeboah & Obeng-Odoom, 2010). Disorder is conceptualized not as the product of isolated failures, but as an emergent property of fragmented institutional arrangements, incentive distortions, and poorly aligned enforcement mechanisms. Governance is thus framed as a complex, multi-actor system characterized by interaction effects, role ambiguity, recursive failure, and endogenous feedback loops.

The integrated MAUD–UGAM–GLI framework proposed in this study reflects the institutional pluralism of African cities. It builds on Ostrom's (2005, 2010) conception of polycentric governance, emphasizing that effective management of complex urban systems requires overlapping centers of authority capable of mutual monitoring and adaptation. This perspective underscores that governance resilience emerges not from centralized control but from interactive, multi-level arrangements where state and non-state actors share responsibility. The framework therefore serves as both a diagnostic tool and a reform-oriented model—anchored in theoretical rigor yet designed for application in real governance settings.

5. Case Illustration: Kwabenya and Systemic Urban Dysfunction

Kwabenya, a rapidly expanding periphery of Accra, exemplifies the dynamics of fragmented governance and institutional ambiguity that fuel chronic urban disorder. Once a peri-urban settlement, it has morphed into a dense residential-commercial zone plagued by infrastructural gaps, land-use conflicts, and environmental degradation. This case grounds the MAUD–UGAM–GLI framework, illustrating how disorder arises from recursive interactions among actors operating under misaligned mandates rather than from isolated policy failures.

5.1 Informal Growth Beyond Statutory Planning

Kwabenya's urban growth has occurred largely outside the oversight of statutory bodies such as the Accra Metropolitan Assembly and the Ga East Municipal Assembly. Traditional authorities allocate land autonomously under Ghana's dual tenure system, often without coordination with formal planning agencies. This creates a disconnect where construction outpaces the provision of roads, drainage, sanitation, and public services.

As emphasized in the MAUD model, Traditional Authorities hold legitimacy without legal obligations to enforce planning codes (Kasanga & Kotey, 2001; Ubink, 2008). The result is a fragmented, inaccessible urban form with overlapping claims and unmanaged service deficits—a product of systemic actor misalignment.

5.2 Municipal Weakness and Accountability Gaps

Though the Ga East Assembly holds formal authority over planning and enforcement, its actions are constrained by limited resources and political pressures. Building permits are rarely enforced, inspections are infrequent, and legal action is virtually absent.

As diagnosed in the UGAM framework (Section 7.4), three accountability failures are evident:

- Weak oversight from central government,
- Lack of downward accountability between traditional and statutory actors,
- Sparse horizontal coordination.

The Assembly also avoids conflict with powerful chiefs or political elites, deepening institutional inertia. These dynamics contribute to what the Governance Load Index (GLI) quantifies as rising systemic strain.

5.3 Civic Disengagement and Institutional Erosion

Residents frequently construct without permits, ignore sanitation laws, and dispose of waste informally—not necessarily due to ignorance but as rational responses to inconsistent governance. Deteriorating trust in both municipal and traditional authorities undermines collective action and civic responsibility.

As modeled in MAUD, civic disengagement arises as credibility erodes and enforcement becomes selective, pushing citizens toward informal norms and further weakening state legitimacy.

5.4 Kwabenya as a Simulatable Node of Collapse

When Kwabenya's characteristics are simulated within the MAUD–UGAM–GLI model suite, the following patterns emerge:

- Low coherence due to parallel chieftaincy and state authority,
- Weak accountability linkages across all governance levels,
- Overburdened municipal capacity, captured in GLI scores,
- Absence of feedback between land allocation and planning,
- High rates of informal behavior and noncompliance.

These patterns reproduce the real-world dysfunction, validating the model's explanatory power and demonstrating that disorder stems from structural and behavioral misalignments—not random failures.

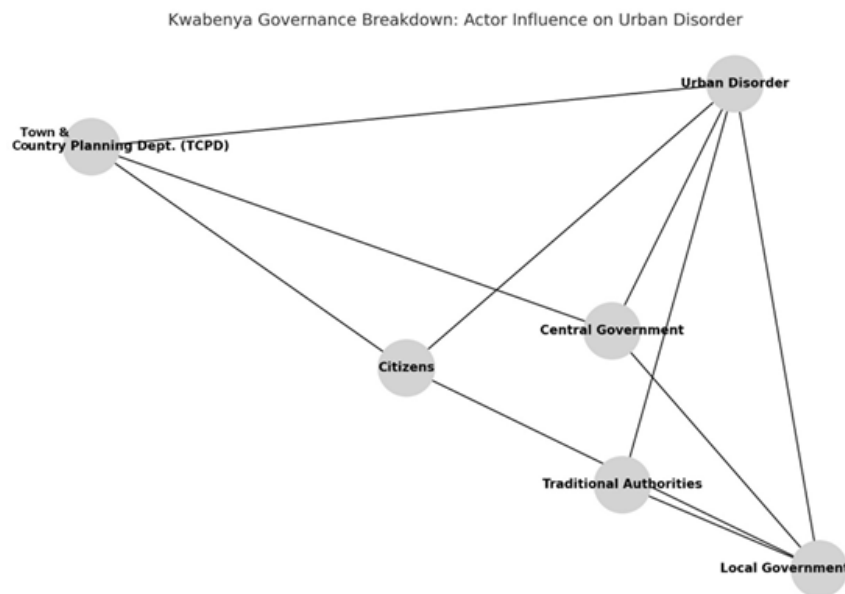


Figure 3. Actor Interaction Diagram – Governance Breakdown in Kwabenya

Note. Visualization of actor influence pathways contributing to urban disorder in Kwabenya, showing directional relationships among the Town and Country Planning Department (TCPD), Local Government, Traditional Authorities, Central Government, and Citizens. Author's simulation based on MAUD framework (Asiedu, in press).

This diagram visualizes the fragmented interaction landscape among Ghana's five key urban governance actors: the central government, local government (MMDAs), traditional authorities, the Town & Country Planning Department (TCPD), and citizens. Lines represent influence pathways or regulatory flows contributing to urban disorder. All actors contribute to systemic dysfunction but lack coordinated authority or shared incentives for collective urban order. The accumulation of urban disorder (top-right node) reflects the outcome of misaligned interactions, overlapping mandates, and weak enforcement.

The figure underscores the MAUD model's central argument: urban dysfunction does not stem from the failure of a single actor, but from a systemic governance collapse rooted in misaligned incentives, overlapping mandates, and the absence of coordinated enforcement mechanisms.

6. Theoretical Framing: Reframing Urban Dysfunction as Multi-Actor Institutional Fragility

This interpretation extends earlier work on mindset transformation as a structural determinant of institutional performance (Asiedu, 2025), situating behavioral drift within a broader governance and accountability framework.

Urban dysfunction in Ghana is often explained through technocratic lenses—blaming infrastructure gaps, poor planning, or weak state capacity. This study goes deeper, conceptualizing Ghana's urban crisis as multi-actor institutional fragility: a breakdown arising from overlapping mandates, fragmented authority, and behavioral drift. The framework draws on hybrid governance, complexity theory, and institutional political economy.

6.1 Co-Production of Disorder

Urban disorder is not solely the product of failed states or informal encroachment, it is co-produced by interactions among state, traditional, civic, and informal actors. Institutions like MMDAs, planning authorities, and chieftaincy institutions do not operate in isolation; they engage strategically based on incentives, histories, and perceived legitimacy.

As Luescher and B énit-Gbaffou (2020) argue, disorder emerges from mutual disengagement—states retreat from enforcement while citizens adapt. In Ghana, chiefs sell land outside planning schemes, MMDAs avoid confrontation, and residents seek expedient informal solutions. These recursive patterns are captured by the **MAUD framework**, which models disorder as an emergent outcome of institutional and behavioral feedback loops.

6.2 Institutional Permissiveness and Asymmetry

Weak enforcement is not just logistical failure, it reflects institutional permissiveness: tolerance of illegal spatial practices due to political, structural, or incentive-based reasons. Ghana's governance system shows asymmetric

accountability:

- Weak upward accountability to central government;
- Undermined downward accountability to citizens due to low engagement;
- Fragmented horizontal accountability between agencies.

The **UGAM matrix** maps these asymmetries, identifying where responsibilities are diffused and feedback loops break down—especially in hybrid systems that blend formal and customary governance.

6.3 Systemic Fragility and Behavioral Drift

Urban fragility is compounded by behavioral drift—the slow normalization of noncompliance. When violations go unchecked, informal norms solidify into entrenched governance practices. This reflects systems thinking (Ostrom, 2005, 2010; Pritchett et al., 2010): institutions evolve nonlinearly, with minor tolerance for encroachment or illegal permits triggering long-term dysfunction. Ostrom’s (2010) work further clarifies how **polycentric governance systems** can adapt through self-organization and mutual accountability—principles directly relevant to addressing Ghana’s urban governance fragmentation.

The Governance Load Index (GLI) quantifies this strain, showing how misalignment between mandates and capacity leads to systemic overload. Simulations using GLI demonstrate how unresolved governance burdens accumulate over time, pushing cities toward collapse unless fundamental reforms are introduced.

Summary

This reframing challenges reductionist explanations of urban crisis as mere state failure. Instead, it positions disorder as the outcome of fragile, hybrid systems where multiple actors interact without alignment or accountability. The MAUD, UGAM, and GLI models offer practical tools to simulate breakdown and resilience. This perspective contributes to broader debates on governance pluralism and institutional reform across sub-Saharan Africa.

7. Research Design

This study employs a multi-stage research design that integrates conceptual abstraction with simulation modeling to investigate the systemic underpinnings of urban disorder in Ghanaian cities. Rather than relying on fragmented sectoral analyses, the approach synthesizes institutional theory, urban governance literature, and quantitative simulation to provide a holistic framework for understanding urban fragility. The primary objective is to translate the Multi-Actor Urban Disorder (MAUD) framework into an analytically testable and policy-relevant model.

7.1 Data Sources

The research draws exclusively on secondary data, enabling conceptual generalization and simulation without the need for field-based human subject research. Three categories of materials inform the study:

- Academic Literature: Peer-reviewed studies on urban governance, land tenure systems, decentralization, and hybrid institutions in Ghana and sub-Saharan Africa. These provide both theoretical grounding and empirical benchmarks for modeling assumptions.
- Policy and Legal Documents: Core national and local policy texts, including:
 - The Local Governance Act (Act 936)
 - National Urban Policy Framework (2012)
 - Ghana Statistical Service reports
 - District Development Plans and MMDA guidelines
 These documents specify the structural features and legal mandates of governance actors.
- Empirical Estimates: Previous case studies (e.g., Boamah et al., 2017; Afenah, 2012; Yankson & Bertrand, 2011) provide estimates of enforcement failure rates, land conflicts, informal activity growth, and intervention effectiveness. These serve as calibration inputs for the simulation parameters.

7.2 Model Development

To operationalize the MAUD framework within a dynamic system, a first-order differential equation was developed to model urban disorder $D(t)$ as a function of four interacting drivers:

This formulation builds on the simulation design and analytical logic established in *Asiedu (in press)*.

$$\frac{dD(t)}{dt} = \alpha \cdot E(t) + \beta \cdot L(t) + \gamma \cdot C(t) - \delta \cdot R(t) \quad (3)$$

Where:

- $D(t)$: Cumulative level of urban disorder at time t
- $E(t)$: Degree of enforcement failure (e.g., lapses by MMDAs, weak policing of building codes)
- $L(t)$: Rate of unregulated land allocation (e.g., plots sold by traditional authorities outside statutory plans)
- $C(t)$: Extent of civic noncompliance (e.g., informal construction, open defecation, unauthorized trading)
- $R(t)$: Intensity and scope of reform efforts (e.g., governance reforms, planning policy revisions)
- $\alpha, \beta, \gamma, \delta$: Positive coefficients representing the relative influence of each factor

This formulation provides a systems-level representation of disorder, capturing both its cumulative dynamics and the moderating effect of reforms. It translates the MAUD logic into a policy-testing apparatus.

7.3 Simulation Methodology

Equation (3) was simulated over a 20-year horizon using numerical methods to model the evolution of disorder under different governance conditions. Three key assumptions guided calibration:

- Behavioral Dynamics of Inputs:
 - $E(t), L(t), C(t)$ were treated as constant or gradually increasing functions, reflecting the persistence of enforcement gaps, unregulated land allocation, and civic disengagement.
 - $R(t)$ was modeled as a linear or exponential growth function, capturing the cumulative effect of progressive governance reforms.

- Coefficient Parameters:

Based on policy literature and comparative governance estimates, the following values were applied:

$$\alpha = 1.0, \beta = 0.8, \gamma = 0.9, \delta = 1.2$$

- Output Metrics:
 - $D(t)$: Total disorder accumulation
 - $\frac{dD}{dt}$: Rate of change of disorder

These outputs enabled scenario comparisons (e.g., baseline vs. reform), identification of tipping points, and evaluation of reform effectiveness over time. The simulation thus provided a platform for visualizing how disorder evolves under isolated interventions, coordinated reforms, or institutional inertia—advancing both theory-building and practical diagnosis.

7.4 Integrated Governance Diagnostics: UGAM and GLI within the MAUD Framework

To support the simulation of urban breakdown modeled through the MAUD framework, this section introduces two diagnostic tools: the Urban Governance Accountability Matrix (UGAM) and the Governance Load Index (GLI). Together, they provide a multidimensional assessment of governance performance in Ghana's urban systems, identifying accountability asymmetries and institutional overload.

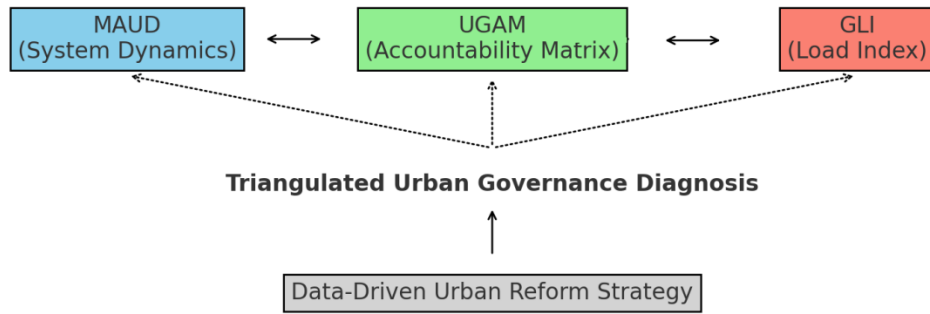


Figure 4. Triangulated governance diagnostics—integrating MAUD (dynamic disorder), UGAM (accountability mapping), and GLI (load measurement) to inform reform strategy

Note. This diagram illustrates the interaction among the three diagnostic components—MAUD (System Dynamics), UGAM (Accountability Matrix), and GLI (Load Index)—within a unified framework for data-driven urban governance reform. The triad enables scenario testing, actor-specific targeting, and system-level stress detection. Adapted from the author's conceptual framework (Asiedu, in press).

7.4.1 Urban Governance Accountability Matrix (UGAM)

UGAM evaluates five key governance actors—Central Government (CG), MMDAs, Traditional Authorities (TAs), Planning Institutions (PI), and Citizens & Informal Builders (CIBs)—across four governance dimensions: Authority, Capacity, Responsiveness, and Compliance Pressure. It detects mismatches between assigned responsibility and actual action, highlighting where coordination and enforcement are weakest.

Simplified matrix representation.

Let the actor order be (1) CG, (2) MMDAs, (3) TAs, (4) PI, (5) CIBs. UGAM can be represented as a set of four accountability matrices, each capturing one dimension of performance among actors:

$$UGAM = \{A^{(1)}, A^{(2)}, A^{(3)}, A^{(4)}\}, A^{(k)} \in [0,1]^{n \times n}, k \in \{1, \dots, 4\}. \quad (4)$$

Here $A_{ij}^{(k)}$ is the accountability score from actor i to actor j on dimension k .

Example: $A_{2,5}^{(3)} = 0.30$ indicates that MMDAs ($i = 2$) exhibit a Responsiveness score of 0.30 toward CIBs ($j = 5$).

Advanced Tensor representation.

For compactness, UGAM can be modeled as a 3D tensor:

$$U \in [0,1]^{n \times n \times d}, d = 4, U_{ij}^{(k)} = A_{ij}^{(k)} \quad (5)$$

This embeds all four matrices in one object, enabling aggregation, simulation, and network analysis.

Aggregated actor accountability score.

An actor's overall accountability performance is:

$$A_i = \frac{1}{nd} \sum_{j=1}^n \sum_{k=1}^d U_{ij}^{(k)} \in [0,1]. \quad (6)$$

A higher A_i indicates stronger outward accountability across all counterparties and dimensions.

7.4.2 Governance Load Index (GLI)

GLI measures institutional stress as the ratio of disorder pressure to enforcement capacity (see Section 8.3):

$$GLI(t) = \frac{Pressure(t)}{Capacity(t)}$$

Values greater than 1.0 indicate institutional overload and elevated risk of breakdown.

For actor-level diagnostics (useful for targeting reforms), decompose pressure and capacity into observable components and normalize to $[0,1]$:

$$GLI_i = \frac{\omega_1 Mandate_i + \omega_2 Fragmentation_i}{\omega_3 Capacity_i + \omega_4 Autonomy_i} \quad \sum \omega. = 1 \quad (7)$$

- **Mandate:** The workload or responsibilities assigned to the actor.
- **Fragmentation:** Coordination frictions or overlaps that increase pressure.
- **Capacity:** Resources, skills, and competencies available to the actor.
- **Autonomy:** Freedom to act independently of political interference, expanding effective capacity.

City-level stress can be aggregated as:

$$GLI_{city} = \pi_i GLI_i$$

where π_i reflects actor centrality or mandate share of actor i .

Application: GLI facilitates comparisons across cities, informs reform sequencing, and provides early-warning signals of institutional overload.

7.5 Ethical Considerations

This study did not involve human participants, primary data collection, or intervention trials. As such, it was exempt from institutional ethics review. Nonetheless, ethical rigor was ensured through:

- **Transparent use of secondary data:** All inputs were sourced from public, credible, and citable publications, including peer-reviewed studies, government reports, and international databases.
- **Proper attribution:** Foundational frameworks and parameter estimates are credited to their original sources.
- **Reproducibility and integrity:** The simulation logic and theoretical models are presented transparently, with internal coherence to enable replication by other scholars.
- **Respect for epistemic limits:** The study contributes to critical debates in urban governance without over-claiming causal certainty, acknowledging the limitations of model-based abstractions in complex social systems.

This research design bridges theory and practice by combining conceptual innovation with mathematical simulation. By modeling disorder as a function of multi-actor institutional interactions and testing reform trajectories, the study delivers both analytical depth and actionable insights for governance transformation in Ghana and similar fragile urban contexts.

8. Results and Discussion

This section reports simulation findings using the MAUD–UGAM–GLI suite, focusing on (i) disorder dynamics, (ii) institutional overload, and (iii) reform effectiveness.

8.1 Urban Disorder Simulation (Baseline)

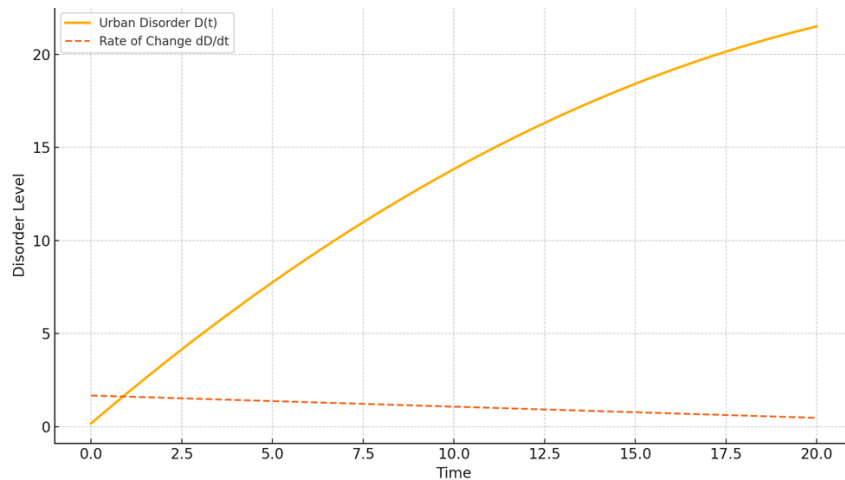


Figure 5. Simulated urban disorder $D(t)$ and growth rate $\frac{dD}{dt}$ under baseline calibration (20-year horizon)

The figure is generated under a scenario where enforcement failure persists, land allocation remains unregulated, and civic noncompliance is elevated. Reform efforts increase only gradually over time.

- The solid line represents the total urban disorder $D(t)$, which rises steadily.
- The dashed line shows the rate of change $\frac{dD}{dt}$. While it declines gradually as reforms are introduced, it remains positive throughout the simulation period, indicating that disorder continues to grow.

Key takeaway: Incremental reforms may slow the rate of deterioration but are insufficient to reverse disorder dynamics.

Stronger and earlier interventions are required to drive $\frac{dD}{dt}$ below zero and achieve system stabilization.

8.2 Gradual Reform Scenario

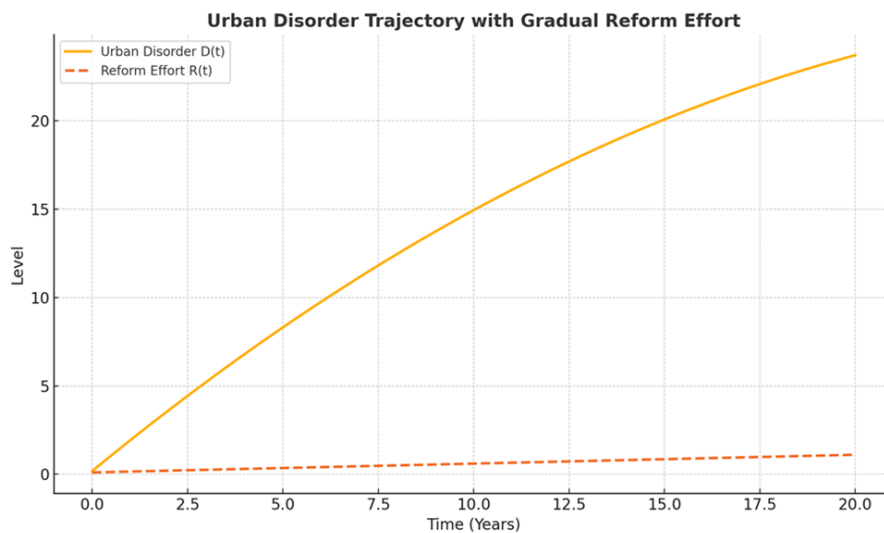


Figure 6. Disorder trajectory with gradual reform: deceleration without reversal.

This figure simulates a scenario in which reform efforts increase linearly over time, while underlying drivers of disorder remain high and unaddressed. Urban disorder $D(t)$ rises rapidly in the early stages and then decelerates modestly as reform efforts accumulate. However, no tipping point is reached— $D(t)$ continues its upward trajectory with no inflection into decline.

Policy implication:

Incremental and uncoordinated reforms may create a false sense of progress—they reduce the rate of deterioration but fail to reverse it. Structural transformation requires early, decisive, and coordinated interventions.

8.3 Governance Load Index (GLI) Simulation

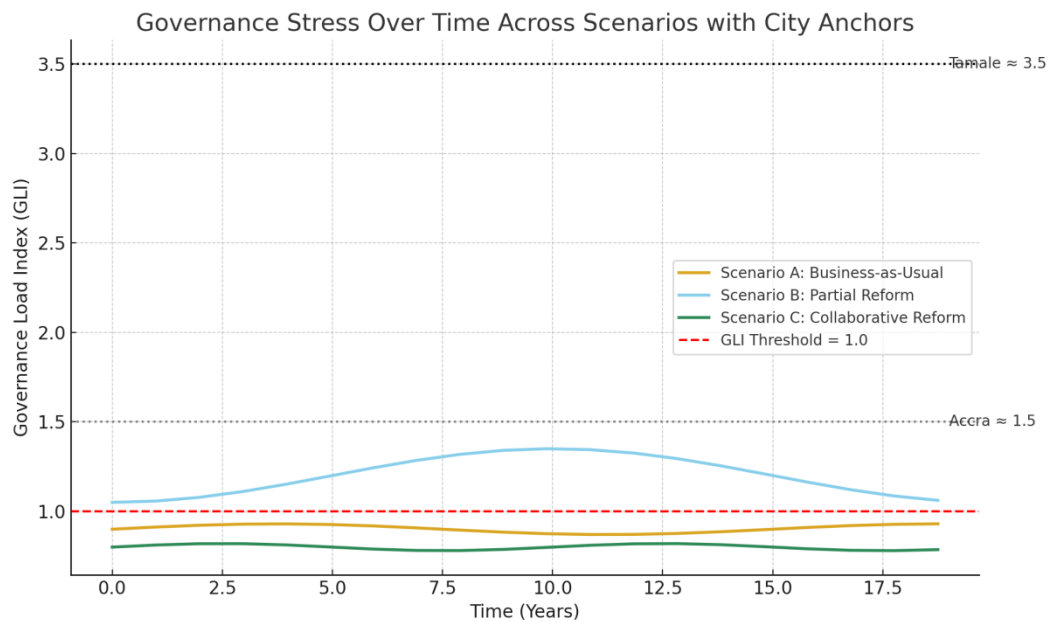


Figure 7. Governance Stress Trajectories Across Scenarios with Urban Anchors (Accra and Tamale)

This figure plots the Governance Load Index (GLI) over time under three reform scenarios—business-as-usual, partial reform, and collaborative reform—alongside threshold markers for two anchor cities: Accra and Tamale. The red dashed line indicates the critical stress threshold (GLI = 1.0), above which institutional capacity is considered overloaded.

Interpretation:

- Tamale's GLI (≈ 3.5) reflects acute governance stress, driven by fragmented authority, enforcement breakdowns, and limited civic coordination.
- Accra's GLI (≈ 1.5), though lower, still exceeds sustainable limits, indicating systemic strain even in the capital's relatively better-resourced context.
- All scenarios fail to bring GLI below the safe threshold unless collaborative, multi-actor reforms are introduced early and decisively.

Conclusion:

Urban resilience is not simply a function of funding or formal institutional capacity. It is relational—built through clear mandates, cross-actor accountability, and trust-based enforcement systems. Only governance architectures that align incentives and responsibilities can durably reduce the GLI and restore sustainable urban functionality.

Note. Author's simulation of GLI trajectories under three reform scenarios, based on the analytical framework developed in Asiedu (in press).

8.4 UGAM: Accountability Matrix

Whereas the GLI quantifies overload, the Urban Governance Accountability Matrix (UGAM) pinpoints where accountability gaps emerge among specific actors. This diagnostic helps clarify why reforms succeed or fail depending on the distribution of responsibilities and actions across the governance network.

UGAM reports gaps between assigned responsibilities and observed actions (0 = no gap; 1 = full neglect). The illustrative matrix below retains the five canonical actors.

Table 2. UGAM matrix (simplified; values 0–1 indicate accountability gaps)

Function / Actor	CG	MMDAs	TAs	PI	CIBs
Land-Use Regulation	0.30	0.60	0.80	0.50	0.90
Sanitation Enforcement	0.40	0.70	0.20	0.60	0.60
Zoning & Planning	0.50	0.40	0.70	0.55	0.80
Permitting & Inspection	0.60	0.50	0.30	0.45	0.70
Public Education	0.20	0.30	0.10	0.25	0.50

Note. Author's simulation based on Ghana's urban-governance mandates and implementation trends, developed within the UGAM analytical framework (Asiedu, in press).

Interpretation: Traditional actors and informal builders show large gaps in land-related functions; CG/MMDAs perform unevenly amid capacity–mandate frictions; PIs exhibit implementation bottlenecks.

Policy Implication: No single actor can resolve systemic disorder; clarity + shared accountability + monitoring are necessary.

8.5 Comparative and Sensitivity Analysis of Urban Reform Dynamics

8.5.1 Comparative City Dynamics: Timing and Capacity Matter

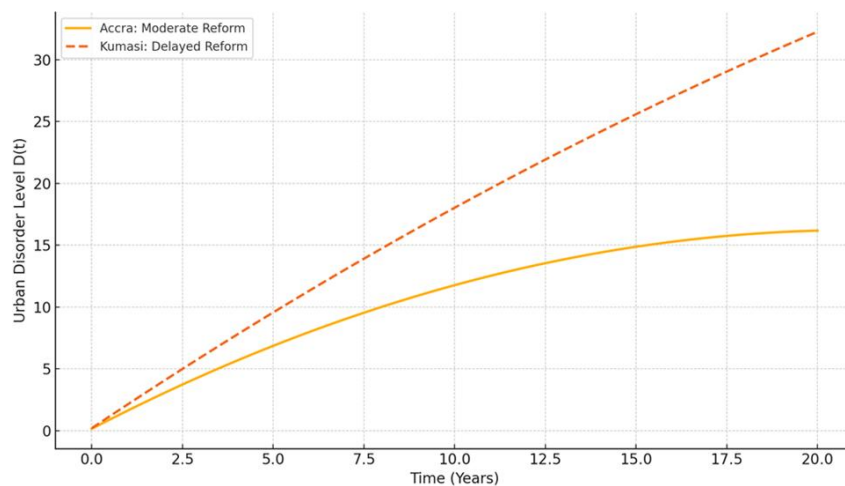


Figure 8. Comparative Urban Disorder Dynamics: Accra vs. Kumasi

This simulation compares the evolution of urban disorder levels $D(t)$ under two scenarios:

- Accra: Moderate reform implemented early
- Kumasi: Delayed reform and fragmented response

Key Insight:

- Early reform in Accra flattens the disorder growth curve, limiting long-term escalation, though not reversing it.
- Delayed reform in Kumasi allows disorder to compound, locking the city into a path-dependent deterioration trajectory.

Interpretation:

Timeliness and coordination in governance reform are decisive. Without early intervention, even well-resourced cities risk entering feedback loops of disorder, making reversal costlier and politically harder. Conversely, early reform can slow down dysfunction accumulation, but only collaborative reform (as modeled in Scenario C) can bend the curve downward.

8.5.2 Capacity-Driven Reform Effectiveness: Accra vs. Tamale

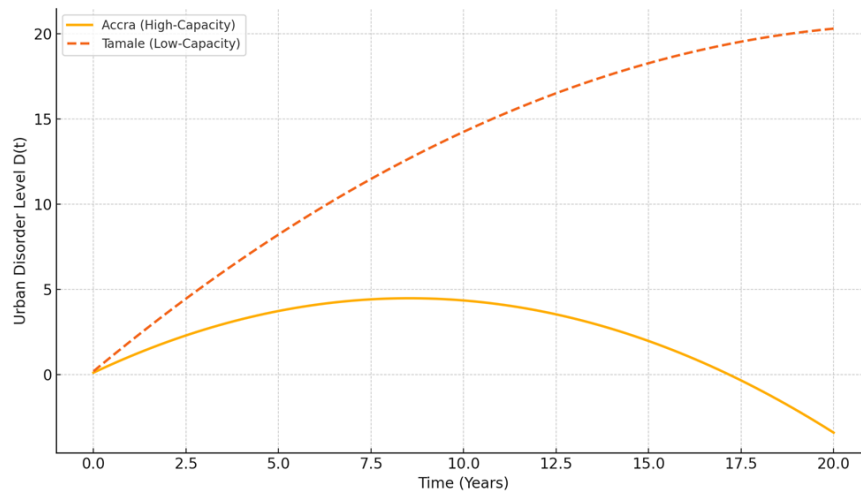


Figure 9. Reform effectiveness under constant intensity

This simulation holds reform intensity constant while varying city governance capacity. Accra (high-capacity) and Tamale (low-capacity) are used as illustrative anchors.

Findings:

- Accra's higher institutional capacity results in slower accumulation of urban disorder and eventually achieves reversal over time.
- Tamale's weaker capacity leads to faster disorder buildup and limited responsiveness to reform inputs.

Interpretation:

Capacity is not neutral; it shapes not only reform outcomes but also the very dynamics of disorder. In low-capacity environments, reforms are often absorbed or distorted by weak institutional enforcement, poor coordination, and data blind spots.

Policy Takeaway:

Effective reform is sequenced reform.

- In high-capacity cities, policy layering can work early.
- In low-capacity cities, pre-investments in staffing, coordination mechanisms, and data infrastructure must precede any major reform rollout.

8.5.3 Sensitivity to Reform Intensity

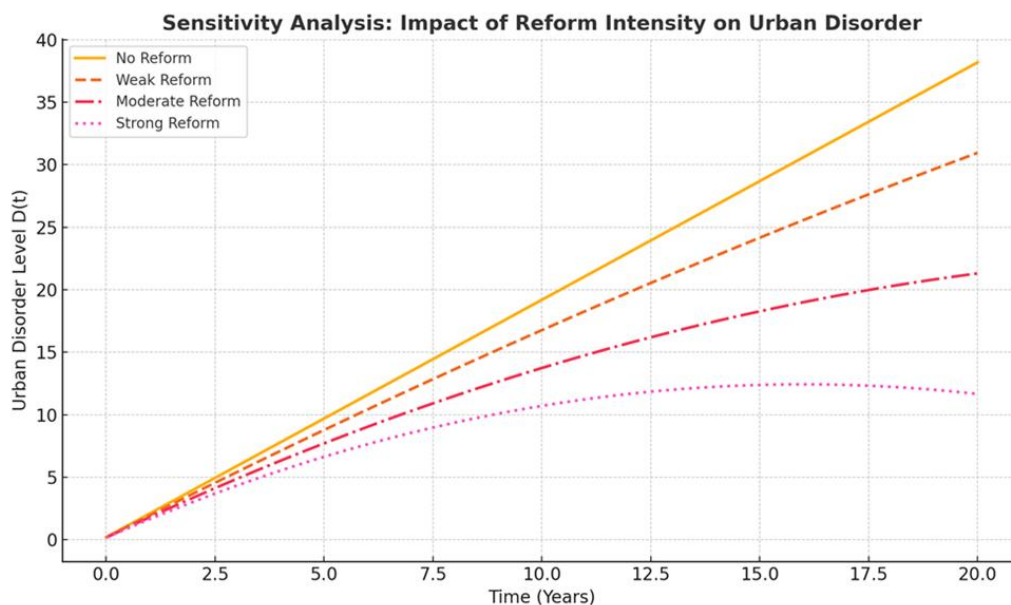


Figure 10. Sensitivity to reform intensity

This simulation holds all other disorder drivers constant while varying reform intensity.

Findings:

- No reform produces near-linear to exponential growth in disorder.
- Weak reform slows the pace marginally, but disorder continues to accumulate unchecked.
- Moderate reform flattens the curve but fails to reverse the trend ($\frac{dD}{dt} > 0$ throughout).
- Strong, coordinated reform achieves a turning point where disorder peaks and then declines ($\frac{dD}{dt} < 0$), indicating a true reversal dynamic.

Interpretation:

Urban systems exhibit threshold effects. Reform does not yield proportionate gains at all levels—only beyond a critical intensity does the system tip from worsening to recovery.

Policy Implication:

Reform impact is nonlinear and path-dependent. Half-measures prolong disorder; only bold, systemic efforts—adequately sequenced and resourced—can reverse decay.

8.5.4 Isolated vs. Coordinated Reforms

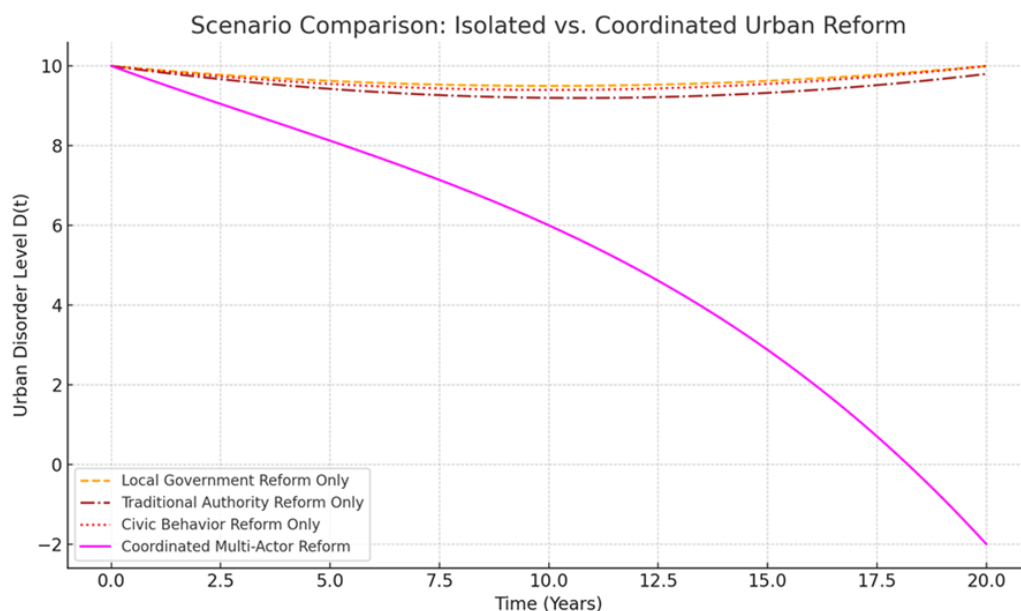


Figure 11. Disorder trajectories under gradual, coordinated reform, showing moderation effects

The figure compares urban disorder trajectories ($D(t)$) over 20 years under four reform scenarios:

1. Local government reform only
2. Traditional authority reform only
3. Civic behavior reform only
4. Coordinated multi-actor reform

While isolated efforts (1–3) yield minimal and often unsustained improvements, the coordinated strategy produces a sharp and lasting decline in disorder, eventually reversing urban decay. The simulation highlights that synchronization across actors—rather than siloed interventions—is essential to achieve systemic change.

8.5.5 Dysfunction Thresholds: When Reform Fails

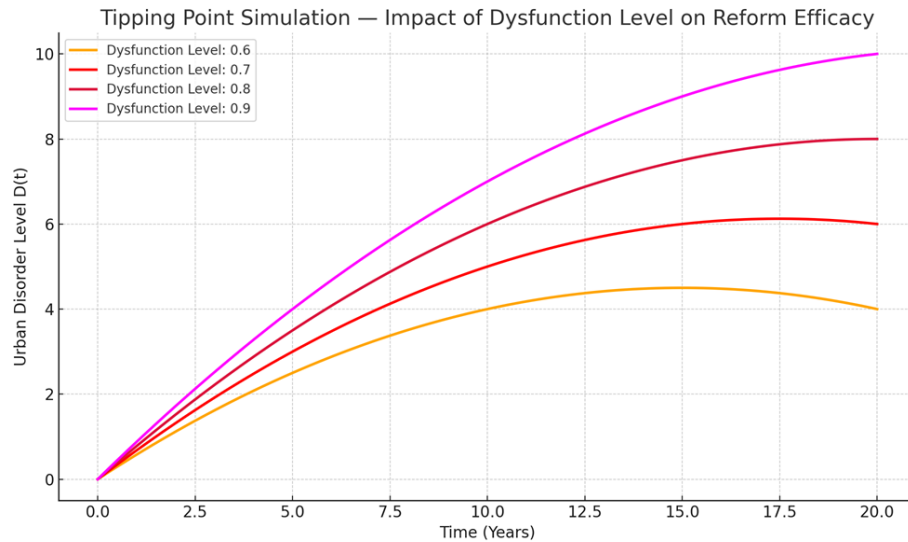


Figure 12. Tipping-point dynamics: late reforms face structural lock-in, with diminishing returns even under large interventions

This simulation explores how pre-existing dysfunction levels influence the effectiveness of reform interventions over time.

As dysfunction levels rise—from 0.6 to 0.9—urban disorder becomes increasingly difficult to reverse, even when reform efforts are significant. Higher baseline dysfunction locks the system into elevated trajectories of disorder, reducing reform responsiveness.

Interpretation: A tipping point exists beyond which even large, well-coordinated interventions may yield only marginal gains. The orange curve (Dysfunction Level: 0.6) shows a clear peak and decline in disorder, while the purple curve (Dysfunction Level: 0.9) shows continuous growth with no reversal.

Policy Lesson:

To avoid reform ineffectiveness or collapse into disorder traps, governments must:

- Monitor early warning indicators (e.g., institutional overload, public distrust),
- Act early and decisively before dysfunction escalates, and
- Avoid normalization of dysfunction through denial or incrementalism.

8.5.6 Time-to-Threshold (Urgency) Analysis

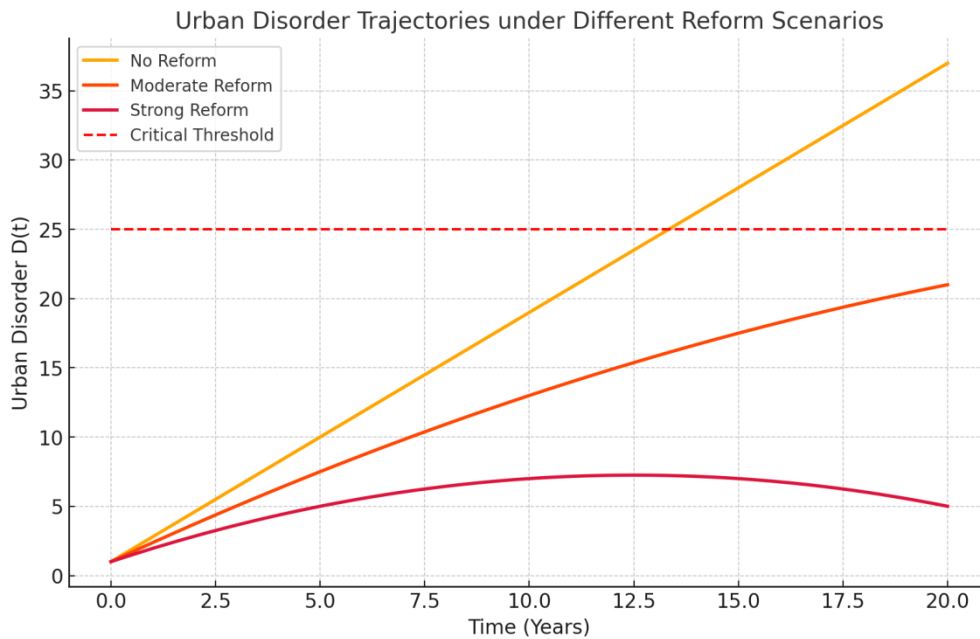


Figure 13. Time-to-threshold dynamics: only strong, early reforms prevent breach of critical dysfunction

This figure simulates how quickly different reform strategies approach or avoid a critical urban disorder threshold (set at $D(t)=25$), highlighting the temporal urgency of intervention.

- No Reform: The system breaches the critical threshold around Year 13, indicating collapse is inevitable without corrective action.
- Moderate Reform: Disorder rises more slowly but still approaches the danger zone; resilience remains precarious.
- Strong, Coordinated Reform: Disorder levels off and eventually declines. The threshold is never breached, reflecting long-term system stabilization.

Conclusion:

Urban governance systems are time-sensitive and fragile. Reform effectiveness is not only a matter of intensity but also timing. Delayed or hesitant reforms allow disorder to build momentum, often rendering even intensified later efforts ineffective.

8.5.7 Phase Portrait: Stability Conditions

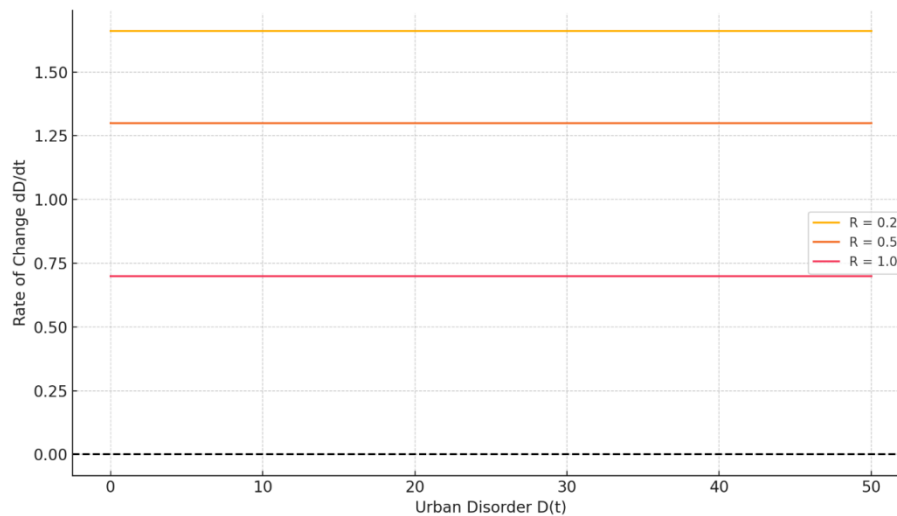


Figure 14. Phase portrait: stabilization ($\frac{dD}{dt} < 0$) occurs only under strong, coordinated reforms

This phase portrait illustrates how the rate of change in disorder ($\frac{dD}{dt}$) varies with reform intensity (R) under different policy conditions.

- Weak Reform ($R \approx 0.2$): $\frac{dD}{dt} \approx 1.6$ — disorder continues to grow rapidly.
- Moderate Reform ($R \approx 0.5$): $\frac{dD}{dt} \approx 1.3$ — growth slows but remains positive.
- Strong, Coordinated Reform ($R \gtrsim 1.0$): $\frac{dD}{dt}$ approaches zero and eventually turns negative, signaling genuine stabilization.

Finding:

Sustained stability requires both reform intensity and coordination among governance actors. Reform energy without institutional alignment merely slows disorder; it does not reverse it.

Summary of Insights:

- Trajectory: Disorder persists under weak or fragmented reforms but declines when reforms are early, coordinated, and intensive.
- Capacity and Timing: Reform success depends on institutional capacity and the timing of interventions; delays magnify dysfunction.
- Diagnostics: Tools such as the Governance Load Index (GLI) and Urban Governance Accountability Matrix (UGAM) help identify overload and accountability gaps, informing where and when to act.

9. Conclusion and Policy Recommendations

Urban dysfunction in Ghana is not merely the result of administrative oversight—it is a systemic outcome rooted in fragmented mandates, overlapping jurisdictions, and exhausted accountability structures. This paper offers a systems-based diagnostic and reform toolkit by integrating three original frameworks: MAUD (Multi-Actor Urban Disorder) for dynamic disorder modeling, UGAM (Urban Governance Accountability Matrix) for mapping accountability asymmetries, and GLI (Governance Load Index) for assessing institutional stress.

The findings underscore that fragmented, uncoordinated, or delayed reforms are inadequate. Achieving meaningful and lasting urban order requires integrated, actor-specific, and sequential interventions that match governance mandates with institutional capacity while reinforcing accountability and citizen engagement. Rather than focusing solely on infrastructure or legal amendments, this study emphasizes the need to realign incentive structures, reform accountability flows, and strengthen multilevel coordination.

A national urban governance dashboard constructed around the MAUD–UGAM–GLI triad could enable real-time detection of systemic stress, early identification of governance bottlenecks, and tailored policy responses calibrated to the unique conditions of each city.

Strategic Policy Imperatives

- Mandate–Capacity Realignment: Strengthen the operational capacities of Metropolitan, Municipal, and District Assemblies (MMDAs) by aligning their legal mandates with appropriate fiscal resources, staffing, and enforcement authority.
- Statutory–Customary Integration: Harmonize formal urban planning regimes with customary land tenure systems to reduce land disputes, foster coherent spatial growth, and ensure equitable urban expansion.
- Institutionalization of Diagnostic Tools: Embed MAUD, UGAM, and GLI into national and local planning, monitoring, and evaluation frameworks to enhance evidence-based policy formulation and implementation.
- Climate–Governance Synergy: Mainstream climate resilience and disaster preparedness within spatial development frameworks using the MAUD–UGAM–GLI triad to inform strategic investment and land-use decisions.

Together, these tools create a triangulated system for diagnosing dysfunction and prioritizing reforms. UGAM identifies accountability asymmetries; GLI reveals institutional overload thresholds; and MAUD models the dynamic interactions driving disorder. Applied holistically, this integrated approach equips policymakers with data-driven, locally adaptable strategies for restoring order and advancing urban resilience—not just in Ghana, but across similarly fragile urban

systems in the Global South.

Reflecting on Model Limitations and Future Applications

While the MAUD model offers a powerful framework for diagnosing and projecting urban disorder dynamics in Ghanaian cities, several limitations warrant consideration:

First, the model is grounded in theoretical constructs and policy-informed assumptions, rather than empirical field data. Although parameter values ($\alpha, \beta, \gamma, \delta$) were logically inferred and guided by secondary literature, they are not based on statistically calibrated measurements. This limits the model's quantitative precision, and caution is needed when interpreting numerical outputs beyond their indicative value.

Second, the model adopts a linear and additive structure to represent governance–civic interactions. In practice, these relationships may be non-linear, threshold-sensitive, or path-dependent. For example, civic noncompliance might escalate exponentially beyond critical density points—triggering tipping points the current differential equations cannot fully capture. Feedback loops, delayed institutional responses, and time-lagged enforcement effects are also only partially modeled.

Third, MAUD currently operates at a nationally aggregated level. This may obscure spatial and institutional heterogeneity across different cities or districts. Enforcement regimes, land tenure patterns, and governance capacity vary widely between, for instance, Accra and Tamale or between municipal centers and peri-urban zones. Disaggregated city-level modeling would enhance granularity and policy relevance.

Despite these limitations, the model is intentionally designed to be extensible. Future iterations should integrate field data, particularly time-series metrics on enforcement actions, land transactions, informal settlements, and compliance behavior. Incorporating Geographic Information Systems (GIS) and real-time monitoring tools could further enable spatial simulations of disorder hotspots and the impact of targeted interventions.

Additionally, scenario-based forecasting under stress conditions—such as reform shocks, fiscal contractions, or demographic transitions—can help policymakers assess the resilience of urban governance systems. Such simulations would enhance anticipatory governance and inform better-aligned reforms. Ultimately, MAUD, UGAM, and GLI collectively offer a flexible yet robust foundation for transforming urban governance. Their integration into Ghana's policy architecture could support a long-overdue transition from reactive urban management to proactive, systems-informed governance. This approach builds upon the broader mindset–governance framework advanced in *Asiedu (forthcoming)*, which emphasizes systemic accountability, behavioral adaptation, and institutional transformation as the cornerstones of sustainable development.

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Authors' contributions

The author was responsible for study design and revising. He was responsible for data collection, drafting of the manuscript and revised it. The author read and approved the final manuscript.

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Data sharing statement

No additional data are available.

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Appendix A: Simulation Foundations and Actor-Based Diagnostics

This appendix anchors the MAUD framework in applied diagnostics by detailing two core simulation tools: the Urban Governance Accountability Matrix (UGAM) and the Governance Load Index (GLI). These instruments translate the framework's conceptual elements into quantifiable parameters, enabling the dynamic simulations explored in Sections 8 of the main manuscript.

It clarifies model assumptions, derivation methodologies, and sensitivity to reform scenarios, ensuring empirical robustness, interpretability, and transparency in the simulation architecture.

A.1 UGAM: Accountability Dimensions and Actor Profiling

UGAM evaluates five core governance actors:

- CG – Central Government
- MMDAs – Metropolitan, Municipal and District Assemblies
- TAs – Traditional Authorities
- PI – Planning Institutions (TCPD, LUSPA)
- CIBs – Citizens and Informal Builders

Each actor is scored across four governance dimensions:

1. Authority
2. Capacity
3. Responsiveness
4. Compliance Pressure

These dimension scores (Table A1) integrate institutional evidence from Sections 4.1–4.4, behavioral insights from Section 6, and modeling rules from Section 7.2 to inform the UGAM structure.

Table A1. UGAM Actor Attributes (Qualitative Baselines)

Actor Group	Authority	Capacity	Responsiveness	Compliance Pressure
CG	High	High	Medium	Medium
MMDAs	Medium	Low	Low	Low
TAs	High	Medium	High	Low
PI	Medium	Low	Low	Low
CIBs	Low	Medium	Medium	Medium

Note. Author's qualitative classification of actor attributes derived from the Urban Governance Accountability Matrix (UGAM) framework (Asiedu, in press).

A.2 UGAM Accountability Network and Matrix

The UGAM Network Graph (Figure A1) visualizes directional accountability flows among the five actors. Each directed edge $i \rightarrow j$ carries a normalized score $[0,1]$, where higher values denote stronger oversight or responsiveness.

Figure A1. UGAM accountability network—directional flows among CG, MMDAs, TAs, PI, and CIBs.

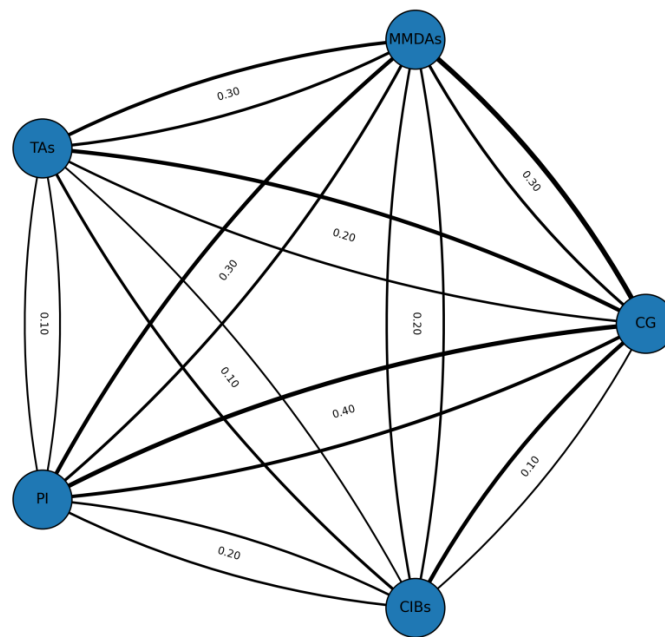


Figure A1. UGAM Accountability Network

Note. Author's simulation of directional accountability flows among central government (CG), Metropolitan, Municipal, and District Assemblies (MMDAs), traditional authorities (TAs), planning institutions (PI), and citizen/informal builders (CIBs), developed from the UGAM analytical framework (Asiedu, in press).

Directional accountability flows among CG, MMDAs, TAs, PI, and CIBs.

Illustrative flows (simulated):

- CG → MMDAs = 0.30: moderate oversight
- TA → MMDAs = 0.40: strong customary influence
- TA → CIBs = 0.10: weak civic oversight
- CIBs → MMDAs = 0.20, CIBs → PI = 0.20: low bottom-up feedback

These patterns expose:

- Asymmetries (e.g., TAs influence CIBs but lack reciprocal accountability)
- Bottlenecks (e.g., PIs receive inputs but lack enforcement)
- Missing feedback loops (especially CIB → CG/PI)

Table A2. UGAM Accountability Grid (Simulated Scores)

From \ To →	CG	MMDAs	TAs	PI	CIBs
CG	—	0.70	0.50	0.60	0.50
MMDAs	0.30	—	0.40	0.50	0.20
TAs	0.20	0.30	—	0.10	0.30
PI	0.40	0.30	0.10	—	0.20
CIBs	0.10	0.20	0.10	0.20	—

Note. Author's simulations based on institutional analysis described in Sections 4 and 7.2 and developed within the UGAM analytical framework (Asiedu, in press).

A.3 UGAM Sensitivity: Reform-Type Simulations

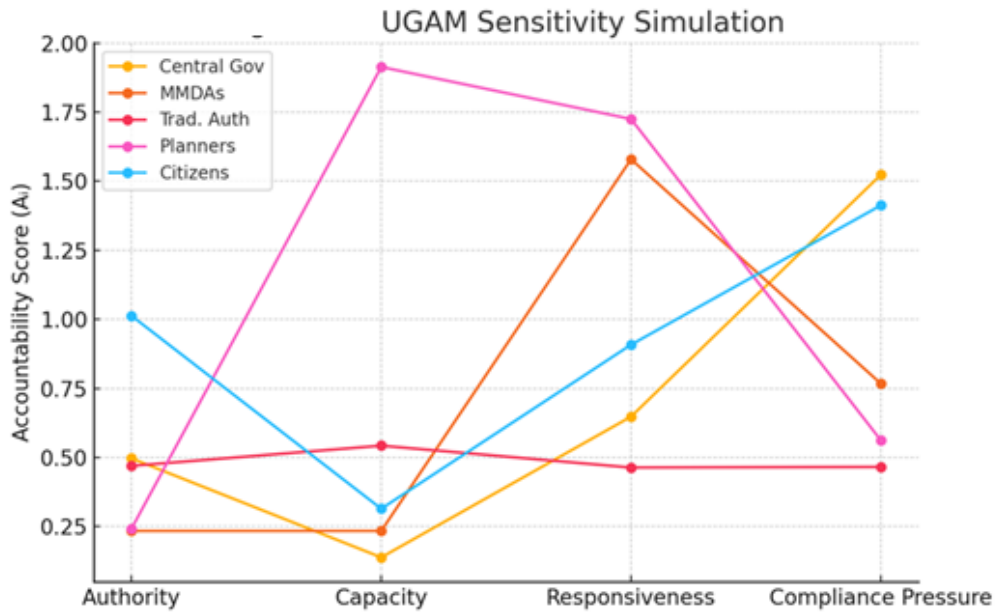


Figure A2. UGAM Sensitivity Simulation

Note. Author's simulation illustrating actor-level sensitivity within the UGAM framework, developed from the accountability modeling logic presented in Asiedu (in press).

The figure illustrates how different governance actors respond when a single reform dimension is intensified—Authority, Capacity, Responsiveness, or Compliance Pressure—while the other parameters remain fixed. This sensitivity analysis helps reveal which actors are most responsive to specific types of reform shocks, based on their baseline characteristics within the UGAM framework.

Key Insights:

- Capacity-enhancing reforms produce the strongest response among MMDAs and Planning Institutions, indicating that improvements in technical and operational capabilities are critical for these actors.
- Compliance pressure boosts citizen accountability, but its effectiveness plateaus if not accompanied by institutional reforms that enable enforcement and feedback loops.
- Authority-based reforms alone risk worsening existing accountability asymmetries, especially if they are not complemented by mechanisms that promote transparency, inclusiveness, and bottom-up oversight.

This simulation underscores the importance of tailored reform design—showing that the same intervention can yield divergent outcomes depending on actor type and institutional context.

A.4 Governance Load Index (GLI)

GLI quantifies governance strain:

$$GLI(t) = \frac{Pressure(t)}{Capacity(t)}$$

At the actor level, GLI is calculated using:

$$GLI_i = \frac{\omega_1 Mandate_i + \omega_2 Fragmentation_i}{\omega_3 Capacity_i + \omega_4 Autonomy_i} \quad \sum \omega = 1$$

Table A3. GLI Component Scores and Actor Strain (Simulated)

Actor Group	Mandate	Fragmentation	Capacity	Autonomy	GLI Score
CG	High	Medium	High	Medium	1.25
MMDAs	High	High	Low	Low	3.00
TAs	Medium	Medium	Medium	High	0.83
PI	High	High	Low	Low	3.00
CIBs	Low	Low	Medium	Low	0.67

Note. High GLI values (e.g., MMDAs, PI) indicate governance overload, supporting the reform urgency discussed in Sections 7.4.2 and 8.3. Author's simulation based on the Governance Load Index (GLI) framework advanced in Asiedu (in press).

Table A4. Simulation Parameters and Reform Intensity Levels

Core coefficients for modeling the MAUD equation (Equation (3), Section 7.2):

Parameter	Description	Value
α	Enforcement-failure coefficient	1.0
β	Land-allocation-failure coefficient	0.8
γ	Civic-noncompliance coefficient	0.9
δ	Reform-effort responsiveness	1.2

Note. Author's parameter calibration for the MAUD simulation model described in Section 7.2, developed within the systems-governance framework (Asiedu, in press).

Reform effort levels applied to $R(t)$:

$$R \in \{0.0, 0.2, 0.5, 1.0\}$$

- $R = 0.0$: No reform (baseline)
- $R = 0.2$: Weak reform
- $R = 0.5$: Moderate reform
- $R = 1.0$: Strong, coordinated reform
- These levels were applied to produce threshold curves and tipping points in Figures 8–13 (Section 8.5).

A.5 Notation and Symbols (UGAM–GLI–MAUD)

Actors and dimensions

- Actors $\mathcal{N} = \{1, \dots, 5\}$:
1 CG (Central Government), 2 MMDAs, 3 TAs (Traditional Authorities), 4 PI (Planning Institutions), 5 CIBs (Citizens & Informal Builders).
- Accountability dimensions $\mathcal{D} = \{1, \dots, 4\}$:
1 Authority, 2 Capacity, 3 Responsiveness, 4 Compliance Pressure.

MAUD disorder model (main text Equation (3), Section 7.2)

$$\frac{dD(t)}{dt} = \alpha \cdot E(t) + \beta \cdot L(t) + \gamma \cdot C(t) - \delta \cdot R(t) ,$$

where $D(t)$ is cumulative disorder; E, L, C are enforcement failure, unregulated land allocation, and civic

noncompliance; R is reform intensity; $\alpha, \beta, \gamma, \delta > 0$ are coefficients.

Instantaneous stability threshold:

$$R^*(t) = \frac{\alpha E(t) + \beta L(t) + \gamma C(t)}{\delta}; \quad R(t) > R^*(t) \Rightarrow \frac{dD}{dt} < 0.$$

UGAM (accountability)

- Matrix form:

$$UGAM = \{A^{(k)}\}_{k=1}^4, \quad A^{(k)} \in [0,1]^{n \times n}; \quad A_{ij}^{(k)} \text{ is accountability from actor } i \text{ to actor } j \text{ on dimension } k.$$

- Tensor form: $\mathcal{U} \in [0,1]^{n \times n \times d}$ with $\mathcal{U}_{ij}^{(k)} = A_{ij}^{(k)}$
- Aggregated outward accountability (actor i):

$$A_i = \frac{1}{nd} \sum_{j=1}^n \sum_{k=1}^d \mathcal{U}_{ij}^{(k)} \in [0,1].$$

- Sensitivity experiments: emphasize a dimension via a reform weight vector $\lambda = (\lambda_1, \lambda_2, \lambda_3, \lambda_4)$, $\sum \lambda_k = 1$, holding others constant to assess marginal effects.

GLI (governance load)

- Conceptual (system/city): $GLI(t) = \frac{\text{Pressure}(t)}{\text{Capacity}(t)}$; $GLI > 1.0$ indicates overload (Section 7.4.2).
- Actor-level diagnostic (Section 8.5.4):

$$GLI_i = \frac{\omega_1 \text{Mandate}_i + \omega_2 \text{Fragmentation}_i}{\omega_3 \text{Capacity}_i + \omega_4 \text{Autonomy}_i}, \quad \sum \omega_i = 1$$

- City aggregation: $GLI_{city} = \sum_i \pi_i GLI_i$, with π_i as mandate share/centrality weights.

Reform intensity

- Discrete levels used in scenarios (Section 7.2 and 8.5.3): $R \in \{0.0, 0.2, 0.5, 1.0\}$ = no/weak/moderate/strong.

A.6 Recursive Actor Feedback Simulation

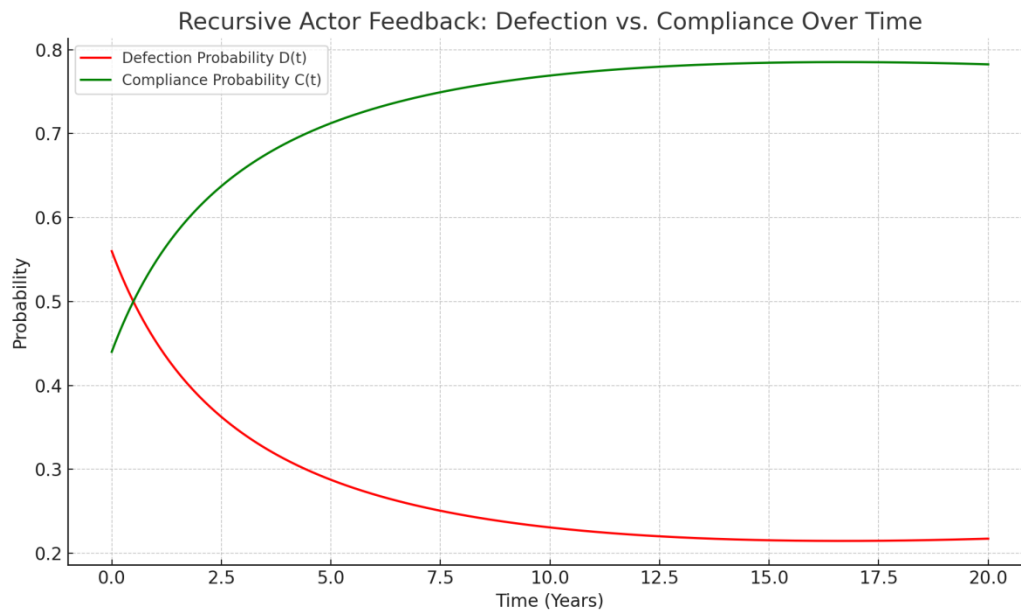


Figure A3. Recursive Actor Feedback Simulation

The figure shows how the probability of defection $D(t)$ evolves over time in response to varying enforcement strength P_e , ambiguity A_g , and peer pressure N_p . Initially, weak enforcement and strong peer defection increase disorder, but recursive adaptation and gradual reform shift behavior toward compliance over time.

Explanation:

- **Red Curve:** Probability of *Defection* over time $D(t)$
- **Green Curve:** Probability of *Compliance* $C(t) = 1 - D(t)$

Interpretation:

- When **peer pressure and ambiguity** are high and **enforcement** is weak, **defection initially rises**.
- Over time, even mild enforcement begins to suppress defection through **feedback effects**—individuals react to observed behaviors and outcomes.
- The system begins to stabilize as actors recursively adjust behavior based on perceived outcomes, peer norms, and enforcement signals.

A.7 Methods and Transparency in Derivation

To enhance replicability, all scores and parameters were derived via:

- Policy document synthesis (Act 936, Urban Policy Framework)
- Expert-elicited scoring and literature calibration
- Monotonic scaling: Low = 0.2, Medium = 0.5, High = 0.8
- Matrix normalization ($0 \leq \text{score} \leq 1$) for UGAM and GLI
- Sensitivity tests varied $\alpha - \delta$ by $\pm 20\%$ to check robustness.

A.8 Summary: Appendix Utility

This appendix serves as the **computational engine** behind the MAUD governance simulations. It ensures:

- Transparency of assumptions and actor logic
- Methodological grounding in political economy (Section 6) and simulation theory (Section 7.2)
- Replicability across national and city-level applications

- Diagnostic precision for accountability mapping and overload detection

By embedding UGAM and GLI within a unified simulation platform, the study offers a rigorous and exportable framework for diagnosing and reforming urban governance under stress.

A.9 Data Sources, Scoring, and Calibration

Sources (consistent with Section 7.1)

1. Peer-reviewed literature on decentralization, land tenure, informality, and urban governance (Ghana/sub-Saharan Africa).
2. Policy/legal documents: Local Governance Act (Act 936), National Urban Policy Framework (2012), Ghana Statistical Service reports, District Development Plans/MMDA guidelines.
3. Institutional materials & audits: NDPC reviews, MLGRD directives, sectoral performance reports.
4. Expert elicitation (structured interviews/surveys where available) to resolve ambiguities and parameterize hard-to-observe links.

Qualitative → quantitative mapping

- For actor attributes in Table A1, map categories to the unit interval with monotone anchors (default; adjust if empirical estimates exist):
Low = 0.20, Medium = 0.50, High = 0.80.
- For directional UGAM links in Table A2 and Figures A1 and A2, derive values from documentary evidence and expert priors, then normalize to [0,1] via min–max scaling across actor pairs.

Normalization and weighting

- All UGAM entries $u_{ij}^{(k)} \in [0, 1]$.
- GLI components (Mandate, Fragmentation, Capacity, Autonomy) are scaled to [0,1].
- Choose dimension weights λ (UGAM sensitivity) and GLI weights ω by:
 - (i) equal weighting (baseline), or
 - (ii) evidence-informed weights (e.g., higher ω_2 where coordination failures dominate).
- City aggregation weights π_i were derived from actor mandate shares or network centrality. No supplementary table was used.

Calibration and checks

- Coefficients $(\alpha, \beta, \gamma, \delta) = (1.0, 0.8, 0.9, 1.2)$ per Table A4 (Used in Section 7.2).
- **Face validity:** Simulated dynamics were checked against stylized facts—e.g., observed overload of MMDAs and Planning Institutions, and strong traditional authority influence over land allocation.
- Sensitivity analysis: Parameters λ, ω , and π were varied $\pm 20\%$ to assess the robustness of key thresholds and actor rankings.
- Specification note: As outlined in Sections 7.2 and 7.3, the core dynamic model assumes a “memoryless” system: the current level of disorder $D(t)$ does not influence its rate of change. Instead, disorder evolves based solely on the policy levers, enforcement $E(t)$, land regulation $L(t)$, civic compliance $C(t)$, and reform intensity $R(t)$:

$$\frac{dD}{dt} = f(E(t), L(t), C(t), R(t))$$

Because $D(t)$ itself does not appear on the right-hand side, the system exhibits no endogenous self-correction or feedback. In practical terms, this means that:

- Waiting for visible signs of breakdown **before** intervening is counterproductive.
- Delayed action increases the cost and effort required to restore order, due to growing path dependence.

The model defines a reform **threshold** as the minimum level of effort needed to reverse disorder:

$$R^*(t) = \frac{\alpha E(t) + \beta L(t) + \gamma C(t)}{\delta}$$

Where:

If $R(t) \leq R^*(t)$, disorder continues to accumulate.

If $R(t) > R^*(t)$, disorder eventually declines—typically after a lag.

Note: This behavior is model-contingent. The “memoryless” property can be modified by introducing endogenous damping terms—e.g., $-\kappa D(t)$ —which slow the system’s response as disorder increases. However, our baseline deliberately isolates policy-controllable levers to highlight their standalone effects on stability.

Reproducibility (Minimal Steps)

1. Compile source data and extract actor-level and dimension-specific evidence.
2. Translate qualitative attributes into normalized numerical scores.
3. Construct the UGAM tensor $\mathcal{U}$ and compute actor-level accountability scores A_i ; populate Table A2 and Figure A1.
4. Compute Governance Load Index scores GLI_i (Table A3); aggregate by actor group if needed.
5. Simulate Equation (3) under various reform intensity scenarios R ; generate dynamic results used in Figures (Section 8).
6. Archive all mappings, weights, and source code with version and date stamps for full reproducibility.

Caveats

- The illustrative scores in the appendix are provided for methodological demonstration only; they should be replaced with city-specific data where available.
- Where empirical measures are limited, authors should report uncertainty intervals and, where feasible, visualize variability using sensitivity or tornado-style plots within the main text or figures.

Appendix: Technical Definitions and Simulation Variables

A. Institutional and Governance Actors

- **CG – Central Government:** National-level ministries and agencies that set urban policy, allocate funds, and oversee national development strategy.
- **MLGRD – Ministry of Local Government and Rural Development:** Oversees the decentralization framework, local governance policies, and functional mandates for MMDAs.

- **MMDAs – Metropolitan, Municipal, and District Assemblies (Local Governments):** Decentralized authorities tasked with local planning, service delivery, and by-law enforcement.
- **TAs – Traditional Authorities:** Customary institutions and chiefs who exert control over land allocation, cultural practices, and community norms, particularly in peri-urban areas.
- **PIs – Planning Institutions:** Technical and statutory agencies such as the Town and Country Planning Department (TCPD) and the Land Use and Spatial Planning Authority (LUSPA), responsible for spatial planning, zoning, and regulation.
- **CIBs – Citizens and Informal Builders:** Includes both urban residents and informal actors—such as traders, artisans, and self-builders—whose behavior shapes and responds to institutional environments.
- **NDPC – National Development Planning Commission:** Ghana’s statutory body responsible for preparing national development plans, coordinating sectoral and district planning, and conducting monitoring and evaluation of performance.

B. Frameworks and Models

- **MAUD – Multi-Actor Urban Disorder:** Analytical framework simulating urban disorder dynamics by modeling actor interactions, enforcement failures, and institutional asymmetries (Section 7.2).
- **UGAM – Urban Governance Accountability Matrix:** Diagnostic model mapping actor-to-actor accountability flows and evaluating authority, capacity, responsiveness, and compliance pressure (Section 7.4).
- **GLI – Governance Load Index:** Metric quantifying the governance burden on institutions by integrating policy mandate, fragmentation, capacity, and autonomy (Section 7.4.2).
- **GQ – Governance Quality:** Composite performance measure combining effectiveness, transparency, participation, and accountability dimensions in urban management.

C. Simulation Variables and Parameters

- **A_i – Actor Accountability Score:** Score for actor i , reflecting how effectively it performs and responds to reforms under different UGAM scenarios.
- **$R(t)$ – Reform Intensity:** Discrete levels $\{0.0, 0.2, 0.5, 1.0\}$ representing no/weak/moderate/strong reform interventions applied over time.
- **λ – Reform Weight Vector:** Parameter in sensitivity analysis assigning priority to one behavioral dimension while holding others constant.
- **$\alpha, \beta, \gamma, \delta$ – Core simulation coefficients used in the MAUD model,** representing enforcement failure, land allocation failure, civic noncompliance, and reform responsiveness, respectively (see Equation (3), Section 7.2).