

The Government Interoperability Maturity Framework (GIMF): Advancing Digital Governance in Sub-National Governments

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Abstract

Sub-national governments are the level of government most directly encountered by citizens, yet substantial gaps persist between national and local digital government capacity. The United Nations E-Government Survey 2024 and the World Bank's GovTech Maturity Index 2025 both document persistent disparities in digital maturity, particularly across Africa. While digital government is associated with improved efficiency, transparency, and accountability, these benefits depend on interoperable data systems and complementary institutional reforms rather than digitization alone. The same constraint applies to artificial intelligence, which relies on digitized and connected administrative data. This paper makes two contributions. First, it reconceptualizes civic-tech and government technology as interconnected domains linked through government data interoperability. Second, it introduces the Government Interoperability Maturity Framework (GIMF), a five-stage analytical framework developed inductively from qualitative field research across four Nigerian sub-national contexts. The study draws on direct institutional observation, site visits, workshops, and key informant interviews conducted between 2025 and 2026, engaging 93 government officials and stakeholders. The GIMF maps digital capacity from Stage 1 (paper-based operations) to Stage 5 (connected digital governance) and introduces two field-derived refinements: stage fragmentation, in which different functions operate at different maturity levels, and the digital facade, in which external digital visibility is not matched by internal administrative capacity. Drawing on interoperability scholarship, the framework distinguishes technical, syntactic, semantic, and organizational interoperability and relates digital maturity to governance capacity and accountability. Developed from Nigerian field evidence, the framework is proposed as an analytical tool for broader application and validation across sub-national governments.

Keywords: Civic-tech; Digital maturity; GovTech; Interoperability; Sub-national government

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1. Introduction

Sub-national governments, the state (or provincial) and local governments responsible for roads, water, primary health, sanitation, and day-to-day administration, are the tier of the state that most citizens encounter most often. They are also, on the available evidence, the tier where digital government is weakest. The United Nations E-Government Survey 2024 reports substantial global progress, with the share of the world's population lagging in digital government development falling from 45.0 per cent in 2022 to 22.4 per cent in 2024; it also finds that the regional average for Africa remains below the global mean, and that its Local Online Service Index continues to record persistent gaps between national and local performance (United Nations, 2024). The World Bank's GovTech Maturity Index 2025 records a parallel pattern: progress is real but uneven, and the gap in average scores between the most and least mature groups widened from 0.677 in 2022 to 0.722 in 2025, with disparities evident in Africa (World Bank, 2025). These gaps carry economic weight, and the case for addressing them rests on that weight rather than on the appeal of technology. The available evidence associates digital government with lower administrative and regulatory burdens for citizens and firms, stronger transparency and accountability when public-sector data is collected and made systematically accessible, and, under certain conditions, reduced opportunities for corruption through greater traceability and fewer discretionary interactions (Martins, 2026). The same evidence makes it clear that these benefits are conditional rather than automatic: digitizing existing procedures without redesigning underlying processes and data arrangements may not deliver the anticipated gains (Martins, 2026). For sub-national governments, which serve the populations most exposed to digital divides, the economic consequences of weak data systems fall directly on service delivery and on citizens. A related consideration concerns artificial intelligence. Artificial intelligence has increasingly become a focus of contemporary public-sector reform discussions, and the UN Survey identifies both its opportunities and its risk of widening existing gaps between the least and most digitally developed settings (United Nations, 2024). Its application, however, presupposes digitized, structured, and connected data. Where records remain on paper, as in much of the sub-national tier examined here, the benefits of AI are out of reach until that data foundation is in place; the investment now flowing toward AI cannot be drawn upon by a government whose core processes are not yet digital.

This paper is concerned with that sub-national tier and begins with a bounded claim about where the binding constraint lies. The findings suggest that the principal constraint on effective sub-national digital governance is often not the absence of technology itself, but the absence of interoperable data infrastructures and institutional arrangements that support information exchange across government functions. When government records are fragmented, inconsistent, or invisible, both internal decision-making and external accountability are constrained. The paper relates two fields that are usually treated separately. Civic-tech, the citizen-facing platforms for transparency, participation, and accountability, often led by civil society, is typically studied and funded apart from government technology, the internal systems through which governments manage data, finances, assets, and workflows (Tauberer, 2012; Townsend, 2013). The two are treated here as a single continuum joined at the point of government data. Civic-tech tools surface information that already exists in usable, connected form; a budget-transparency portal presupposes structured budget data, and a service-monitoring tool presupposes accessible service records. Where the underlying government data is siloed and non-interoperable, the prevailing condition documented below, civic-tech rests on an unstable foundation. The connective layer between the two fields is the government's own data infrastructure, and building it, modular and interoperable by design, is a precondition for the outcomes associated with civic-tech rather than a separate administrative concern. The paper introduces the Government Interoperability Maturity Framework (GIMF), a five-stage analytical framework grounded in field research to locate a sub-national government on the path from paper-based operations to connected digital governance and to identify the appropriate intervention for that location.

2. Literature Review

This review covers four bodies of scholarship that situate the contribution of this paper. The first is the e-government maturity literature, from which the framework inherits its staged logic and against whose limitations it is defined. The second is the literature on civic-tech and government technology, which the

paper relates rather than treats separately. The third concerns the capacity and data governance conditions of subnational governments in Sub-Saharan Africa. The fourth is evidence on the socioeconomic stakes of digital government, which establishes why sub-national digital maturity is an economic question, not merely an administrative One.

2.1 E-Government Maturity Models: A Maturing Field

The proposition that governments progress through stages of increasing digital sophistication was set out by Layne and Lee (2001), whose four-stage model, cataloguing, transaction, vertical integration, and horizontal integration, remains among the most cited frameworks in the field. Its contribution was to identify integration as both the hardest and the most valuable phase of digital government, a point this paper takes up directly. The model was extended by Andersen and Henriksen (2006), who shifted the emphasis from technical capability toward activity and the end user, and the stage-model tradition has since been elaborated by national audit bodies, consultancies, and international organizations.

This body of scholarship provides an important foundation for understanding the progression of digital government capacity, and the present framework builds directly on these contributions. At the same time, systematic reviews have identified recurring limitations of stage-based models: a tendency toward oversimplification and near-duplication across frameworks; an assumption of broadly linear, whole-of-government progression; and limited attention to context, particularly in resource-constrained and sub-national settings (Bannister & Connolly, 2015; Hujran et al., 2023). Partly in response, the field has moved toward multidimensional and enabler-based models that foreground strategy, institutions, and skills rather than a single linear sequence (Gil-Garcia & Pardo, 2005, and subsequent work). These models capture mechanisms of impact more fully, but they also impose data and analytic requirements that are difficult to meet in low-documentation sub-national governments. Table 1 sets out the principal strengths of the major models and tools, as well as the specific gaps that the GIMF addresses.

Table 1: Strengths of Existing Maturity Models and Tools, and the Gaps the GIMF Addresses

Model / Tool	Principal strengths	Gaps the GIMF addresses
Four-Stage Model (Layne & Lee, 2001)	Established the logic of staged e-government progression (cataloguing, transaction, vertical and horizontal integration); identified integration as the hardest and most valuable phase.	Oriented to national governments and citizen-facing service delivery; assumes broadly linear, whole-of-government progression; gives limited attention to internal data interoperability as a distinct condition.
Extension of the Four-Stage Model (Andersen & Henriksen, 2006)	Shifted emphasis from technical capability toward activity and customer-centric outcomes, refining the Layne & Lee sequence.	Remains service-delivery oriented; does not address sub-national or resource-constrained settings, or simultaneous multi-stage operation within One government.
Stage-based critiques (Bannister & Connolly, 2015; Hujran et al., 2023)	Documented the oversimplification of linear stage models and the proliferation of near-identical frameworks; called for contextual sensitivity.	Diagnostic rather than constructive; critique the models without offering a sub-national, interoperability-centred alternative grounded in field evidence.
Enabler-Based Models (Gil-Garcia & Pardo, 2005)	Moved beyond linear stages toward multidimensional enablers (strategy, institutions, skills), capturing mechanisms of impact more fully.	Impose higher data and analytic requirements; difficult to apply as a rapid assessment in low-capacity sub-national governments with limited documentation.
UN E-Government Development Index (EGDI) and Local Online Service Index (LOSI) (United Nations, 2024)	Provide global and local benchmarking of online service maturity (via the Local Online Service Index, LOSI); document national-local disparities.	Measure external online-service presence rather than internal data systems; a strong external presence can coexist with paper-based internal operations.
GovTech Maturity Index (World Bank, 2025)	Multidimensional assessment including core government systems and enablers across 197 economies; designed to guide intervention, not to rank.	Operates at the level of national economies; does not diagnose individual sub-national governments or capture within-government stage variation.

Source: Author's synthesis of the cited literature and benchmarking tools (compiled 2026).

2.2 The Civic-Tech / GovTech Divide

Civic-tech is commonly defined in relation to civil society and citizen engagement: transparency portals, participatory budgeting, election monitoring, and service-delivery feedback, with a theoretical basis in the link between access to information and democratic participation (Gaventa & Barrett, 2012; Fox, 2015). Government technology is discussed in the idiom of public administration and digital transformation: enterprise systems, workflow automation, financial management, and data integration. The two are related here as a single continuum joined at the point of government data. Because civic-tech tools surface information that the government itself holds, their usefulness is bound by the quality, structure, and connectedness of that data. The GTMI 2025 records continued weakness in citizen-facing service portals,

where core government systems remain underdeveloped (World Bank, 2025), a pattern consistent with the proposition that citizen-facing maturity rests on internal systems maturity. The evidence suggests that citizen-facing civic-tech initiatives may struggle to produce durable gains where underlying government data infrastructures remain fragmented or non-interoperable.

2.3 Sub-National Government Capacity and Data Governance in Sub-Saharan Africa

Sub-national governments in Sub-Saharan Africa operate under distinctive constraints: fiscal dependence on central transfers limits investment; staff turnover and skills gaps constrain implementation; and political incentives often favour visible expenditures over foundational data infrastructure (Heeks, 2002; Ndou, 2004). Evidence from capacity-constrained settings indicates that digital reforms translate into benefits only where foundational elements, skills, infrastructure, and institutional arrangements are addressed in parallel (Martins, 2026). Data fragmentation is central to this account: where finance, work, health, and personnel each maintain separate records with no shared standards, decisions rest on partial information, and citizens cannot access what the government itself does not hold in usable form.

2.4 The Socioeconomic Stakes of Digital Government

The evidence on socioeconomic outcomes establishes why sub-national digital maturity is an economic question. Digital government is associated with lower administrative and regulatory burdens for citizens and firms, and with gains in transparency and accountability where public-sector data is collected and made systematically accessible; under certain conditions, increased traceability and reduced discretionary interaction are associated with lower corruption (Martins, 2026). These associations are conditional. Evidence cited by UNU-EGOV, including forthcoming work on digital case management in Brazilian courts, indicates that transferring analogue workflows into digital form does not, by itself, reduce backlogs (Martins, 2026), a finding consistent with the distinction this paper draws between connected data systems and digitization in appearance. Digital divides operate within countries as well as between them, so aggregate gains can coincide with widening inequality (Martins, 2026; World Bank, 2025); the UN Survey notes that, absent targeted effort, the African region will continue to trail global averages, and that the diffusion of artificial intelligence may widen these gaps further (United Nations, 2024). On this evidence, sub-national digital maturity is a determinant of whether public resources, and the newer technologies layered upon them, translate into services and accountability.

3. Methodology

This paper uses a qualitative, field-based research design across four Nigerian sub-national contexts, with evidence of varying strength across them. The design is exploratory and framework-building rather than hypothesis-testing. Its purpose is analytic rather than statistical generalization: the aim is to ground and refine an analytical framework, in the sense in which case-based research supports generalization to theory rather than to populations (Yin, 2018; Eisenhardt, 1989). The inductive and theory-building orientation follows established grounded and engaged-scholarship traditions (Glaser & Strauss, 1967; Van de Ven, 2007). The variation in evidentiary strength across contexts is stated rather than smoothed over, consistent with standards of transparency in qualitative research (Tracy, 2010).

3.1 Study Setting

Field research was conducted between July 2025 and March 2026 across four sub-national contexts in Nigeria: three States, Nasarawa, Ogun, and Kwara, and the Federal Capital Territory (Abuja). Approximately ninety-three officials and stakeholders were engaged in total. The states and participants were selected purposively based on access and their involvement in government administration and service delivery. The objective was to capture diverse institutional perspectives across state and local government contexts to support framework development and analytical generalization, rather than statistical representativeness. Nasarawa State was engaged at the level of state ministries and agencies through direct institutional observation of data systems and workflow processes, together with key-informant interviews with senior officials, including a Permanent Secretary, Commissioners, Executive Directors, and Directors, across five institutions; 11 officials were engaged. This is the strongest evidence in the study because systems were observed directly. Ogun State was engaged at the local-government tier through a convened general meeting with approximately twenty-eight stakeholders, eighteen Local Government Chairmen and

ten further officials, followed by direct site visits to six Local Government Areas, with officials engaged at each; the engagement reached roughly fifty-nine participants and combined observation with key-informant accounts. The Federal Capital Territory (Abuja) was engaged through a workshop with 18 stakeholders, of whom 3 were local-government officials, including a representative of the Association of Local Governments of Nigeria (ALGON), and council administrations, whose characterization of their processes as predominantly paper-based is reported as participant self-report rather than direct observation. Kwara State (Ilorin) is represented by key informant interviews with five government officials and is reported as a corroborating account rather than a fully observed case. Table 2 summarizes the engagement.

Table 2: Stakeholders Engaged, by Context

Context	Tier	Method	Stakeholders engaged	Number engaged
Nasarawa State	State ministries and agencies	Direct observation; key-informant interviews	Five institutions: senior leadership (Permanent Secretary, Commissioners, Executive Directors, Directors) and officials	11
Ogun State	Local governments	General meeting; site visits to six LGAs	Eighteen Chairmen and ten officials (meeting); officials across six LGAs (site visits)	59
FCT (Abuja)	Local governments, national association	Stakeholder workshop (self-report)	Eighteen participants: three local government officials, including ALGON	18
Kwara State (Ilorin)	State / Local	Key-informant interviews (self-report)	Five government officials	5
Total participants engaged				93

Stages were assigned by coding observed process characteristics against the five-stage framework presented in Section 4, where direct observation was possible (Nasarawa and the six Ogun Local Government Areas), and from key informant accounts otherwise (Abuja and Kwara). Triangulation across the State tier (Nasarawa), the local tier (Ogun), and a national-association perspective (ALGON, in Abuja) supports analytic generalization. At the same time, the limits of the self-reported elements are acknowledged.

4. Results: The Government Interoperability Maturity Framework (GIMF)

4.1 The Framework

This section presents the framework itself, the study's principal analytical output, developed from the methodology in Section 3; the empirical findings for each context are reported separately in Section 5. The GIMF was developed inductively from the field research described in Section 3 and informed by the literature reviewed in Section 2. Its inductive grounding reflects the study's emphasis on observed institutional conditions rather than assumed administrative capacity. Established e-government maturity models were largely developed outside sub-national African contexts and often embed assumptions about infrastructure, administrative capacity, and institutional standardization that do not consistently hold in the settings examined here. The framework therefore seeks to reflect the distribution of digital and organizational capacity observed in the field. The GIMF is presented as an analytical framework rather than

a scored instrument; its operationalization into a structured scoring rubric, with indicators and assessment questions, is left to future work.

The GIMF distinguishes five stages of digital maturity (Table 3). Consistent with the field's movement beyond strictly linear stage models, these stages are treated not as a rigid ladder through which all government units progress uniformly, but as reference conditions against which individual functions, departments, and governments can be situated. This distinction becomes particularly important in understanding the condition described below as stage fragmentation.

Table 3: The Government Interoperability Maturity Framework (GIMF)

Stage	Label	Description
Stage 1	Paper-Based Operations	Predominantly manual workflows. Files are stored physically; approvals require physical signatures; records are easily misplaced or delayed. Internal digital systems do not support any external presence (such as a social media page).
Stage 2	Basic Digital Tools	A mix of paper and office software (for example, Word processing and spreadsheets). Some digitization, but data is neither searchable nor connected across functions.
Stage 3	Disjointed Computer Solutions	Stand-alone departmental applications, spreadsheets, and email. Departments operate in silos with no shared visibility or common data standards.
Stage 4	Partial System Adoption	Some enterprise or sector-specific systems are used for particular functions, but systems remain fragmented; data is not yet interoperable across the organization.
Stage 5	Connected Digital Governance	Modular, interoperable systems exchange data across functions, supporting shared visibility, real-time decisions, and the data foundation on which civic transparency depends.

Source: Author's own, developed from field research (2025–2026).

4.2 Levels of Interoperability

Interoperability is the organizing concept of the framework and a layered condition rather than a single threshold. The four levels used here are drawn from established interoperability scholarship and frameworks, not from the field research. The European Interoperability Framework distinguishes legal, organizational, semantic, and technical layers (European Commission, 2017), and the information-systems literature has long separated the ability to exchange data from the ability to interpret it (Heiler, 1995). Following this body of work, Table 4 sets out four levels relevant to sub-national governments: technical interoperability allows systems to exchange data; syntactic interoperability ensures the data is structured so it can be parsed; semantic interoperability ensures it is understood, with shared meaning across systems; and organizational interoperability provides the mandates, agreements, and incentives that sustain data sharing over time. The distinction matters for diagnosis, since a government may achieve technical exchange between two systems while failing at the semantic level, so that data moves without being usable. Movement toward Stage 5 requires progress across all four levels, not only the installation of compatible software.

Table 4: Levels of Interoperability

Level	What it requires	Illustration
Technical	Systems can physically exchange data through compatible formats, protocols, and interfaces (for example, shared file standards and application programming interfaces).	Two departments can transmit data to One another, though the receiving system may not interpret it correctly.
Syntactic	Data is structured according to shared formats and schemas so that the receiving system can parse it.	A financial system and an asset register use a common data schema for asset records.
Semantic	Shared meaning, so the same terms and codes refer to the same things across systems and exchanged data is understood, not merely received.	"Ward," "facility," or "vendor" denote the same entities in health, work, and finance records.
Organizational / governance	Aligned processes, mandates, agreements, and incentives that authorize and sustain data sharing across units.	Memoranda of understanding, data-sharing policies, and clear data ownership allow integration to persist beyond a single project.

Source: Adapted from the European Interoperability Framework (European Commission, 2017) and related interoperability scholarship (Heiler, 1995).

4.3 Stage Characteristics and Intervention Implications

Stage 1 governments, predominantly paper-based, lack a digital data layer for civic-tech tools to act on, so appropriate interventions begin with foundational digitization and record-keeping. Stage 2 and Stage 3 governments have some digital tools but lack integration, standards, and shared visibility, leaving civic tech on a fragile foundation. Stage 4 governments have made partial enterprise-system investments yet remain functionally siloed, which creates a risk that the presence of a system is taken for governance capacity. Stage 5, connected digital governance achieved across the four interoperability levels, is the condition under which civic-tech can function reliably. No government among the contexts studied was observed at Stage 5; it is presented as a reference end-state that remains rare at the sub-national tier rather than as an observed condition.

4.4 Stage Fragmentation

The first of two refinements concerns the assumption in older linear models that a government occupies a single stage. The field evidence instead indicates that a single government commonly operates at several stages at once: a finance function using a sector system (Stage 4) alongside a health or works function operating largely on paper (Stage 1), all within One administration. The paper terms this condition stage fragmentation. It generates internal interoperability gaps before any cross-government integration is attempted, since units at different stages cannot readily share data. Stage fragmentation suggests that digital maturity should be assessed at both the functional and whole-of-government levels, and that a single headline stage can conceal substantial internal variation. The observation gives a concrete sub-national form to the field's broader movement away from strictly linear stage models noted in Section 2.

4.5 The Digital Facade

The second refinement concerns the relationship between a government's external digital presence and its internal capacity. In the field, several institutions maintained an outward-facing presence, most often a social-media page used in place of an official website, while conducting internal operations on paper. The paper terms this the digital facade, an external appearance of digital activity unsupported by internal

capacity. The distinction is analytically important because external presence can lead assessors, funders, and citizens to overestimate maturity, a risk heightened by benchmarking tools that, by design, measure external online service presence rather than internal systems (United Nations, 2024). For the GIMF, a government with an active social-media page but paper-based internal operations is at Stage 1.

4.6 The Interoperability Prerequisite

Interoperability functions in the framework as a prerequisite for accountability rather than as a late-stage feature. In the field, the principal barrier to effective civic-tech was not the absence of digital tools but the fragmentation of those that existed: governments with more digital investment did not necessarily hold greater accountability capacity, because their systems did not communicate, a pattern long identified as the hardest phase of digital government (Layne & Lee, 2001) and as a determinant of success or failure (Gil-Garcia & Pardo, 2005). Fragmented data leaves the government opaque regardless of intent. Although connected and interoperable systems do not, by themselves, guarantee accountability, they constitute a necessary precondition for it.

5. Empirical Findings

Table 5 summarizes the GIMF stage assigned to each context and the basis for the assignment; the subsections that follow present the supporting evidence.

Table 5: GIMF Stage Assignments by Context

Context	Tier	Evidence basis	GIMF stage
Nasarawa State	State ministries and agencies	Direct observation	Predominantly Stage 1–2 (stage fragmentation across functions)
Ogun State (six LGAs)	Local government	Direct observation	Stage 1
Federal Capital Territory (Abuja)	Local government / national association	Self-report (workshop)	Stage 1 (indicative)
Kwara State (Ilorin)	State / local government	Self-report (interviews)	Not assigned ¹ ; accounts consistent with Stage 1

Source: Author's field research (2025–2026).

5.1 Nasarawa State

Engagement in Nasarawa State reached senior leadership across five ministries and agencies: the Ministry of Health, the Ministry of Education, the Ministry of Urban Development, the Nasarawa Investment and Development Agency (NASIDA), and the Ministry of Environment and Natural Resources. The observed pattern was a combination of limited digitization and paper-based core processes. Several institutions had adopted basic office software, a Stage 2 characteristic, while substantive workflows, approvals, record-keeping, and file management remained paper-based, a Stage 1 characteristic. Physical files were retained in offices, and records frequently lacked digital backup. Digital practices varied across institutions and functions, with paper and digital processes operating in parallel. Limited outward-facing digital presence was also observed in some institutions despite predominantly manual internal operations. Based on these observations, Nasarawa State is best characterized as operating predominantly between Stages 1 and 2 of the GIMF.

5.2 Ogun State

Engagement in Ogun State centred on the local government tier. A convened general meeting brought together approximately 28 stakeholders, including 18 Local Government Chairmen and 10 additional

¹ Kwara State is not assigned a stage because the evidence rests on self-report rather than direct observation; the accounts obtained are consistent with the Stage 1 pattern.

officials. It was followed by direct site visits to six Local Government Areas: Ijebu East, Ijebu North-East, Remo North, Ifo, Ijebu Ode, and Odogbolu. Across all six local governments, operations were overwhelmingly paper-based. Administrative processes relied on physical files and manual workflows, with little evidence of connected systems supporting financial management, asset management, or service delivery. The consistency of this pattern across all six local governments indicates a predominantly Stage 1 level of digital maturity within the contexts examined.

5.3 Federal Capital Territory, Abuja

Engagement in the Federal Capital Territory took the form of a workshop with 18 stakeholders, including 3 local government officials, a representative of the Association of Local Governments of Nigeria (ALGON), and representatives from the council administrations. These participants characterized their internal processes as predominantly paper-based, consistent with Stage 1. Because these observations were derived from participant accounts rather than direct institutional observation, they are treated as corroborating rather than primary evidence. Accordingly, the stage assignment is considered indicative rather than definitive.

5.4 Kwara State, Ilorin

Key-informant interviews with five government officials in Kwara State (Ilorin) provided accounts consistent with the broader pattern of paper-dominant processes and limited internal data connectivity. Because the evidence was based on participant accounts rather than direct observation of systems and workflows, the findings are treated as corroborating evidence and no definitive GIMF stage is assigned.

5.5 Cross-Cutting Patterns

Three patterns recur across the observed contexts. First, paper-based operations remain prevalent, particularly at the local government tier, where all six Ogun Local Government Areas exhibited Stage 1 characteristics. Second, stage fragmentation was evident wherever digital tools had been introduced. In several Nasarawa institutions, basic digital applications coexisted with paper-based processes, resulting in varying levels of maturity within the same administrative system. Third, elements of the digital facade were observed where outward-facing digital presence was not matched by corresponding internal administrative capacity.

Across all contexts, the principal constraint was not the complete absence of digital activity but the lack of connected, interoperable data systems. While some institutions had adopted digital tools, these tools generally operated in isolation and did not support the exchange, integration, or shared interpretation of data across functions. This pattern suggests that interoperability, rather than digitization alone, remains a central challenge for sub-national digital governance.

6. Discussion

The findings point to a key implication for practice: interventions in sub-national governments tend to underperform unless they are matched to the government's actual GIMF stage and, given stage fragmentation, to the stage of the specific function in question. A Stage 1 local government cannot make use of a sophisticated transparency portal; a Stage 4 Ministry does not need a further stand-alone application but the interoperability layer that connects the systems it already has. This reading is consistent with evidence that reforms misaligned with foundational capacity fail to deliver expected gains (Martins, 2026). Because civic-tech depends on government data, and that data is usable only to the extent that interoperability allows, the most consequential civic-tech investment in a low-maturity setting may not be a citizen-facing application but the interoperable data infrastructure that makes such applications viable. That infrastructure is conventionally classified as GovTech, yet its effect is civic, since it determines whether transparency and accountability tools can function. When understood as interconnected domains linked through government data infrastructure, the two fields together indicate where scarce resources are most usefully directed. This emphasis is consistent with a wider literature rather than a single source: Layne and Lee (2001) identify integration as the most demanding phase of digital government, Gil-Garcia and Pardo (2005) treat cross-system integration as central to e-government success, and the benchmarking evidence of the United Nations (2024) and the World Bank (2025) records comparable internal-systems weakness across settings.

The field evidence is drawn from Nigeria, but the pattern it documents is not confined to it. The GTMI 2025 records the widening of the digital divide internationally even as average maturity rises, and identifies weaknesses in citizen-facing services, where core government systems are themselves underdeveloped (World Bank, 2025). The persistence of legacy systems and departmental silos in well-resourced governments suggests that fragmentation is a structural feature of sub-national governance rather than a condition specific to lower-income settings. The framework's logic, diagnosing maturity by interoperability across functions, allowing for stage fragmentation, and separating visibility from capacity, is accordingly portable. The Nigerian cases therefore appear illustrative of broader structural dynamics rather than exceptional national conditions, and a companion study extends the framework comparatively across additional contexts.

The economic stakes set out in Section 2.4 bear directly on the findings. If digital government's benefits, lower administrative burden, stronger transparency, and reduced corruption operate through connected, interpretable data (Martins, 2026), then governments concentrated at Stages 1 and 2, as the observed contexts are, are largely unable to realize those benefits, because the data layer through which they would operate is absent. The same constraint applies to artificial intelligence: the investment now directed at AI in the public sector cannot be drawn upon where core processes remain on paper, since AI depends on digitized, connected data that the lower stages lack (United Nations, 2024). The concentration of local governments at Stage 1 is therefore not only an administrative observation but an economic one: it marks the point at which public resources are least likely to translate into measurable improvements in services and accountability. Because divides operate within countries as well as between them (Martins, 2026; World Bank, 2025), the cost of remaining at the lower stages falls disproportionately on the populations that sub-national governments serve. The returns to closing the interoperability gap are, on this reasoning, plausibly larger at the sub-national tier, where maturity is lowest, and the affected populations are most exposed, than the administrative framing alone would suggest.

7. Recommendations

The recommendations below are framed as conditional implications derived from the findings and the wider literature, rather than as universal prescriptions. Their applicability depends on institutional context, existing levels of digital maturity, and the presence of complementary administrative and organizational capacities.

The findings suggest that the effectiveness of digital-government interventions depends less on the deployment of isolated applications than on the extent to which systems are designed for future interoperability. Both field evidence and the wider literature indicate that introducing advanced digital systems into Stage 1 or Stage 2 environments often yields limited results when foundational data infrastructures and administrative processes remain underdeveloped (Martins, 2026). Even incremental digitization efforts are therefore more likely to be sustainable when data is captured in structured, standardized formats that support future integration and interoperability. Many of the challenges observed in later stages arise not from the absence of digital systems, but from the accumulation of disconnected systems that cannot readily exchange or interpret data.

The study further suggests that investments in interoperable data infrastructure may yield greater governance benefits than the continued expansion of stand-alone digital applications. However, these gains remain conditional on complementary factors, including administrative capacity, workforce skills, organizational coordination, and process redesign (Martins, 2026). The findings support the use of staged and function-specific maturity assessments to guide investment decisions, sequence reforms toward greater interoperability, and establish clear responsibilities for data stewardship. For development partners and funders, interventions are likely to be more effective when they support not only citizen-facing technologies but also the underlying interoperability infrastructure and institutional capacities required to sustain them. Finally, the findings point to the need for further research on sub-national digital governance. Future work should test and refine the GIMF across broader comparative settings, examine the persistence and implications of stage fragmentation and the digital facade, and investigate the conditions under which increases in digital maturity translate into measurable socioeconomic outcomes. Additional research is also

needed to develop measures of sub-national digital governance that capture internal interoperability and administrative integration rather than external digital presence alone.

8. Conclusion

This paper has introduced the Government Interoperability Maturity Framework as a field-based analytical framework for sub-national governments and has related civic-tech and GovTech as a single continuum, joined at the layer of interoperable government data. Building on established maturity scholarship while addressing its documented gaps, the framework draws on existing interoperability scholarship to specify four levels of interoperability. It adds two field-derived refinements, stage fragmentation and the digital facade, that capture conditions older linear models tend to miss. The evidence from four Nigerian sub-national contexts indicates that paper-based operation prevails, most clearly at the local tier; that governments commonly operate at several stages at once; and that external presence can mask the absence of internal capacity. Most institutions observed sit at Stages 1 and 2, and Stage 5 is rare.

The implications are both economic and administrative. The available evidence indicates that the benefits of digital government, lower burdens, stronger transparency, and improved accountability are real but conditional on connected data systems, complementary reforms, and attention to equity, and that divides may widen even as averages improve. The same logic extends to artificial intelligence: the attention and investment now directed at AI in the public sector cannot reach governments whose processes and data remain trapped on paper, because AI draws on the digitized and connected data that the lower stages of the framework lack. In this sense, interoperable data infrastructure is a prerequisite not only for civic-tech initiatives but also for the effective deployment of AI-enabled public-sector systems. Sub-national governments are where citizens meet the state most directly, and where the absence of interoperable data infrastructure imposes the clearest cost, disproportionately on the populations they serve. On this account, advancing toward connected digital governance therefore requires not only technological investment but also institutional alignment, staged implementation, and sustained attention to interoperability.

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