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Beyond the Geoportal: Reconsidering Spatial Data Infrastructure for Planning Information Governance in Lagos, Nigeria

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Abstract*—The growth of electronic land services and map portals has renewed interest in spatial data infrastructure (SDI) across African cities. Yet a portal, however useful, does not, by itself, establish the institutional conditions under which geographic information becomes dependable for planning. This article revisits a 2014 assessment of SDI use in Lagos planning agencies and considers what has changed following the introduction of electronic title workflows, the Lagos e-GIS portal, enterprise coordination and reported state-wide digital mapping. It adopts a critical narrative review, drawing on the author's earlier Lagos studies, African SDI research, current land-administration evidence, the United Nations Integrated Geospatial Information Framework and recent thinking on the wider geospatial information ecosystem. The review finds that the technical environment has advanced considerably since 2014. However, public evidence is much clearer about systems procured and services announced than about common identifiers, metadata, update responsibilities, local-government participation, data-quality assurance and the routine movement of authoritative records between agencies. These less visible matters determine whether an SDI can support development planning, planning permit administration, building control, infrastructure coordination and environmental management. A federated planning-SDI arrangement is proposed in which the e-GIS office provides shared services and coordination, while legally competent agencies retain and discharge custodial responsibility for authoritative datasets. The article also reconsiders the earlier proposal for a Lagos Urban Observatory, positioning it as a metropolitan monitoring and accountability node rather than another data warehouse. The central conclusion is that Lagos has moved beyond the need to demonstrate GIS technology. Its present task is to govern planning information as a continuing public infrastructure whose reliability, accessibility and use can be independently assessed.

***Index Terms*— Spatial Data Infrastructure, Planning Information, Data Governance, Interoperability, Urban Observatory, E-GIS, Lagos**

I. INTRODUCTION

Urban planning depends upon information. Before a proposal can be assessed, the planning authority needs to know the location and status of the land, the provisions of the applicable plan, the relationship to roads and public infrastructure, and the environmental conditions that may constrain development. The same information is required again when a permit is monitored, a building is inspected, an acquisition is considered or a neighbourhood plan is reviewed. Where these records are incomplete, outdated or held in offices that cannot exchange them, planning becomes slower and less defensible. Decisions may then be shaped by personal knowledge, unofficial copies and repeated site investigations rather than by a common institutional memory.

Geographic information systems (GIS) were introduced into public administration partly to address this difficulty. Their adoption improved the capacity to store, combine, analyse and display spatial information, but experience soon showed that the computerisation of separate departments did not necessarily produce integrated planning. Agencies could possess capable GIS installations and still collect the same data repeatedly, use incompatible classifications, withhold records from one another or retain information long after it had ceased to represent conditions on the ground. The spatial data infrastructure (SDI) concept emerged from the recognition that data, standards, communication networks, people, policies and institutional

relationships have to work together if spatial information is to be shared and reused [1], [2].

There is now a tendency to identify an SDI through its most visible component. A government establishes a geoportal, layers become viewable online, and the achievement is described as though an integrated infrastructure has arrived. The portal is important. It may widen access and substantially reduce the inconvenience attached to a manual service. It does not, however, disclose whether a parcel carries the same identifier in the land registry, planning permit database and property-address system; whether the zoning layer is the legally adopted version; who is expected to correct an error; or how an agency knows that the service on which it relies will remain available. These questions are not secondary technical details. They go to the meaning, authority and continuity of the information used in public decisions.

The distinction has become more important as geospatial information moves into the wider digital-government environment. Land records may now connect with electronic payments, identity systems, taxation, building applications, environmental evidence and platforms used by professionals or members of the public. A defect in a shared reference dataset can consequently pass into several transactions. By the same token, a well-maintained address or parcel service can reduce duplication across many agencies. The 2025 United Nations position paper on the future geospatial information ecosystem recognises this change, describing geospatial information as part of an interconnected digital environment rather than a specialised sector standing apart from it [3]. SDI remains relevant within this environment, but it has to be judged by use and governance, not merely by the presence of hardware and web applications.

Lagos offers an instructive case. The state has pursued different forms of computerised land and geographic information over several decades. Earlier studies drew attention to the geospatial requirements of managing the megacity and to the institutional weakness that accompanied otherwise significant technological investment [4], [5]. In 2014, a survey of state and local planning-related agencies found low access to communication infrastructure, limited use of web GIS, poor availability of fundamental datasets in digital form and weak arrangements for inter-agency sharing [6]. Since then, electronic signing of title documents, a public land-administration portal, an e-GIS office and renewed state-wide mapping have altered the technical setting. It is therefore necessary to reconsider the earlier diagnosis without assuming that conditions observed in 2014 still describe the agencies today.

This article has three related objectives. First, it reviews what the 2014 investigation established and, equally, what its evidence cannot support. Secondly, it examines subsequent developments through current African and international thinking on integrated geospatial information management. Thirdly, it proposes a planning-centred and federated arrangement for Lagos, including a practical basis for assessing maturity. The argument is not that the present e-GIS initiative has failed, nor that earlier limitations remain unchanged. Rather, the point is that the next phase should be evaluated through the institutional movement of authoritative planning information, because a successful public launch is the beginning of that enquiry and not its conclusion.

II. REVIEW APPROACH AND EVIDENTIAL BOUNDARY

The study is a critical narrative review. Its historical point of departure is the 2014 conference paper, *Building Spatial Data Infrastructures for Spatial Planning in African Cities: The Lagos Experience*, supported by earlier work on GIS implementation and megacity management in Lagos [4]–[6]. These works are used to reconstruct the questions confronting planning agencies at the time; they are not treated as measurements of the present e-GIS environment.

The update draws from four bodies of evidence. The first comprises peer-reviewed studies of SDI implementation and local-government participation in Africa. The second covers digital land administration and the governance of public data, with particular attention to African experience. The third consists of institutional frameworks and standards, including the United Nations Integrated Geospatial Information Framework (UN-IGIF), the African Union Data Policy Framework, the United Nations Economic Commission for Africa's NSDI guidance and Open

Geospatial Consortium (OGC) specifications. The fourth is the available public record of recent Lagos initiatives. Official sources are preferred for the date and declared purpose of a government action. Reputable news reports are used to attribute announcements or statements where a more detailed primary record could not be located. Such reports are not taken as independent proof of system performance.

The search and verification were completed in August 2026. Recent material was checked for a stable institutional link or DOI, while the older sources were retained where they remain necessary to understand the evolution of SDI thought and Lagos practice. The review is interpretive rather than systematic: it does not calculate pooled effects, and the maturity framework is a synthesis intended for empirical testing. The operational e-GIS environment was not accessed as an administrator; metadata catalogues, application programming interfaces (APIs), service logs and data-quality reports were not audited; and no current official was interviewed for the article.

This evidential boundary calls for care in the language of the review. A ministerial report that orthophoto and light detection and ranging (LiDAR) mapping has been undertaken establishes that the output was announced and identifies its intended place in the programme. It does not establish coverage, positional accuracy, date of capture, licensing, update cycle or actual use by planning agencies. Similarly, the creation of GIS units across ministries, departments and agencies (MDAs) indicates organisational reach, but it does not on its own show that those units publish authoritative services or share common data definitions. Wherever public evidence is insufficient, the issue is presented as an item for verification rather than as an assumed deficiency.

III. PLANNING INFORMATION AS INFRASTRUCTURE

A. The planning agency and the flow of information

The planning agency has always been an information-processing institution. It observes the urban environment, maintains records of past decisions, prepares proposals and uses adopted policies to influence subsequent development. The quality of that process rests on a continuing flow between observation, analysis, decision and feedback. Digital technology can shorten the movement, permit several records to be considered together and make a decision easier to trace. It does not remove the need to determine which information is authoritative or how contradictory evidence should be resolved.

This is particularly evident in the administration of development. A planning permit relates a proposed activity to a parcel and an approved plan. Building control follows the permitted proposal into construction. Land administration records the interests affecting the parcel, while surveying establishes its spatial description. Transport, drainage, environmental management and urban renewal introduce additional layers of responsibility. Though these functions may be established under separate legal mandates, they act upon the same urban space. An information gap between them is therefore not a matter internal to government alone; it may be reflected in duplicated submissions, delayed approvals, development on reserved land, weak enforcement and uncertainty for citizens and investors.

SDI provides a means of organising this relationship. In its earlier formulation, it brought together fundamental datasets, metadata, standards, clearinghouses, communication technology, people and partnerships. Later scholarship broadened attention from the provision of data to the participation of users and the institutional processes through which an infrastructure is shaped [7]. This change is important for planning. A dataset has value not simply because it is available somewhere, but because planners can find it, understand its limitations, combine it with other evidence and apply it within a recognised procedure.

Four kinds of integrity are especially relevant. Spatial integrity concerns reference systems, geometry and the positional relationship between features. Temporal integrity asks when the record became valid, whether it has been superseded and which version was used for a decision. Semantic integrity concerns the meaning of classifications, statuses and identifiers. Institutional integrity arises from the authority and working arrangements of the body that maintains the record. A visually impressive map may fail any of these tests. For example, an accurate plan boundary may be of little statutory value if the adoption status and

operative date are not recorded; an up-to-date building layer may be unsuitable for legal title verification where its lineage is unknown.

B. From SDI to a wider geospatial information ecosystem

The UN-IGIF provides a contemporary basis for addressing these issues. Its nine strategic pathways cover governance and institutions, policy and law, finance, data, innovation, standards, partnerships, capacity and education, and communication and engagement [8]. The framework is useful because it makes clear that technology cannot compensate indefinitely for uncertainty in the other pathways. Funding, custodianship and professional capability are not conditions to be considered after a platform has been installed; they are part of the platform's ability to continue.

Global implementation remains uneven. A 2024 survey by the UN-IGIF High-Level Group recorded 66 Member States using or implementing the framework and another 27 considering it, but many participating countries were still at awareness, assessment or planning stages [9]. The lesson for Lagos is not to reproduce a national framework at city scale. It is to use the pathways as a disciplined set of questions around an existing programme: who exercises authority, what law permits or limits exchange, how recurrent costs are carried, which datasets are fundamental, how standards enter contracts, and how users influence priorities.

Recent international work goes further by placing SDI within a dynamic geospatial ecosystem characterised by diverse data sources, machine-readable services, artificial intelligence and a stronger relationship with digital public infrastructure [3]. This expansion creates opportunities for planning, particularly where earth observation, sensors, administrative records and community information can be combined. It also increases the importance of context. Automated processing can circulate an error more quickly than a paper map, while a model may produce a persuasive result from data that was collected for a different purpose. Human oversight, provenance and lawful use remain indispensable.

Evidence from public administrations outside Africa also shows that SDI contributes more effectively to digital-government transformation when it is connected to wider strategies, institutional responsibilities and reusable public services, rather than maintained as an isolated geospatial programme [10]. The lesson is applicable, although the institutional model must remain sensitive to the legal and administrative realities of Lagos.

Open standards are part of the response. The OGC API family offers web-oriented methods through which applications can request features and other geospatial resources without exchanging entire files [11]. A service-based arrangement reduces the circulation of ageing copies and allows the custodian to improve a dataset at source. It does not follow that every layer should be made publicly downloadable, or that an API makes data reliable. Interfaces need documented schemas, stable identifiers, security controls, service expectations and a responsible institution. Standards become useful when they reduce friction in an actual planning workflow.

IV. WHAT THE 2014 LAGOS STUDY ESTABLISHED

A. A baseline situated in its time

The 2014 survey was conducted within the Ministry of Physical Planning and Urban Development and related agencies at state and local levels. It covered access to information and communication technology, GIS use, awareness and use of the then LAGIS enterprise service, availability of core planning datasets, inter-agency relations, and perceived benefits and barriers. Responses were obtained from the state-level bodies approached, while local responses covered agencies located across 12 of the 20 local government areas. The tables reported 22 institutional respondents for most items [6].

The descriptive findings showed a planning system in which general computer use had advanced further than spatially enabled work. Personal computers, laptops, printers and office applications were common, but only 18.2% of respondents reported ArcGIS use and 9.1% reported web-GIS applications. Although 55% were aware of LAGIS, 23% indicated that they had successfully accessed and used it for planning

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purposes. Communication infrastructure was also uneven: 63.6% reported internet access, while local-area network and wide-area network access stood at 36.4% and 22.7%, respectively. These figures describe organisations, not the individual competence of every planner, but they support the conclusion that the enterprise investment had not been translated into routine access across the planning agencies.

The availability of planning data presented a related problem. Across the categories examined, the study reported that 73% of agency responses indicated that fundamental datasets were unavailable, 15% had them in paper form, and only 12% reported a digital or combined paper-and-digital form. Approved private layouts and development-permit registers were among the better represented records, whereas environmental, geodetic and several sectoral datasets were largely absent from the responding offices. The point was not that the state possessed none of these datasets. Rather, the planning agencies expected to use them did not report dependable access.

Data sharing was less developed than the technology used to display data. The draft geoinformation policy had not created an operational exchange framework, pricing posed difficulties even between government bodies, and custodial interests continued to inhibit access. Respondents nevertheless understood the potential benefits. Improved communication and speed received the strongest positive assessment, followed by lower operating costs, time savings, and improved design output. Revenue generation, which often attracted political attention in land-information programmes, was the least strongly supported benefit. This difference is revealing: the working planner saw SDI primarily through its contribution to the planning process, whereas government investment could be justified through a more immediate financial return.

Table I restates the historical evidence in a form suitable for comparison with the present programme. It distinguishes the 2014 observation from the question that should now be examined; it does not claim that the earlier condition has persisted.

TABLE I. HISTORICAL EVIDENCE FROM THE 2014 LAGOS STUDY AND QUESTIONS FOR CURRENT ASSESSMENT

2014 area of enquiry	Evidence reported in the study	Appropriate interpretation	Question for a current assessment
Digital working environment	Computers and office software were common, but GIS, web GIS and agency networks had limited reach	General computerisation had not become integrated spatial planning	Do planning, permit and building-control offices now use shared geospatial services in routine work?
Access to LAGIS	Awareness exceeded successful access and reported planning use	A central enterprise resource had not become an infrastructure for its intended agency users	Which MDAs and local offices consume e-GIS services, for what transactions and at what service level?
Fundamental datasets	Most responding agencies reported no access; paper records were more common than digital records	Data may have existed elsewhere, but usable institutional access was weak	Are core datasets discoverable, current, documented and linked to responsible custodians?

2014 area of enquiry	Evidence reported in the study	Appropriate interpretation	Question for a current assessment
Sharing and coordination	No effective operational framework for exchange was identified	Institutional and policy arrangements constrained technical potential	Are exchange rules, identifiers, interfaces and conflict-resolution procedures now implemented?
Skills and organisational support	Staff training, awareness, specialist personnel, standards and long-term vision emerged as concerns	SDI required organisational capability beyond a central GIS unit	Are data-stewardship, planning-use, legal, procurement and technical roles now defined and sustained?

B. Methodological caution and continuing value

The original paper also used principal component analysis to reduce 19 perceived barriers. Two components accounted for 67.3% of the variance, and high loadings were associated with long-term vision, standards and policy, data quality, software cost, executive support, specialist personnel, awareness and training. These results were useful for generating an institutional agenda. They should, however, be read with restraint. The responding sample was small for factor analysis, the reported Kaiser-Meyer-Olkin statistic was 0.587, and the institutions were not a probability sample of all staff or users. The analysis does not provide a stable hierarchy that can be projected to 2026.

Its continuing value lies elsewhere. The factors drew attention to relationships that a purely technical inventory would have missed. A web service could not solve weak executive commitment; software procurement could not establish a sharing rule; and a training course would have limited effect where staff returned to an office without access to the required data. This institutional reading was consistent with African SDI research at the time and remains a sound basis for constructing present-day questions, even though the questions now require new evidence.

V. LAGOS AFTER 2014: A CHANGED PLATFORM AND AN UNFINISHED ENQUIRY

A. Developments evident in the public record

The technical and administrative landscape has changed substantially. In September 2022, the Lagos State Ministry of Justice reported the commencement of electronic signing of title documents on the e-GIS platform [12]. The action is significant because it connects geospatial information with an authorised legal workflow rather than treating GIS as a map-production service. It also increases the need for audit trails, role-based access and version control, since an electronic title process must preserve the basis upon which an official act was performed.

The land-administration portal launched in January 2024 extended the public face of the system. Reported functions included applications for land titles, title searches, certified true copies and requests for government surveys [13]. These services address long-standing difficulties associated with physical visits, manual files and dependence on informal intermediaries. A current Lagos State service page also directs users to online land and property functions, indicating that electronic access is no longer presented merely as a pilot [14].

A ministerial briefing in May 2025 described a broader programme. According to the official statements reported, the e-GIS office had been formally established in 2021 and was coordinating automated land administration, a central data portal, orthophoto and LiDAR mapping, and GIS units in MDAs [15]. If these components are maintained and connected, they provide a much stronger technical base than the agencies examined in 2014 possessed. Contemporary imagery and elevation data can support base mapping, flood analysis, infrastructure design and development monitoring, while an enterprise

centre can reduce the fragmentation that followed earlier project-based installations.

The improvement should be acknowledged without exaggeration. There is a material difference between offices that could not gain reliable access to the LAGIS service and a setting in which citizens can initiate land transactions online. Likewise, the electronic signing of title documents shows that spatial information has entered a high-value administrative process. These are not cosmetic changes. They indicate a movement from stand-alone GIS production towards digital service delivery.

B. What remains to be demonstrated

Land service automation is not the same as a planning SDI. Land registration, physical planning and building control have related but distinct responsibilities. A portal may improve title processing while the planning authority continues to receive survey plans as uploaded documents, re-enter property information or consult a separate zoning record. Conversely, an integrated back-office system may already be operating even though its architecture is not publicly described. The present review found too little independent or technical documentation to reach a conclusion either way.

Five matters require verification. The first is identity: whether parcels, addresses, plans, applications and buildings carry persistent identifiers that remain meaningful across systems. The second is custodianship: whether every core dataset has a named authority, data steward, update trigger and procedure for correction. The third is quality and lineage: whether users can determine the source, date, legal status, accuracy and known limitations of a layer. The fourth is exchange: whether priority data moves through documented services and agreed schemas rather than through occasional file transfer. The fifth is use: whether the information is applied routinely in plan preparation, permit assessment, inspection, enforcement and capital planning.

Published evidence available before the 2024 portal helps to explain why this enquiry is necessary. Alagbe and Ojo [16] found that GIS was being used in Lagos land registration, but departmental relationships and limited interdepartmental links constrained its wider effectiveness. Their study cannot describe the system introduced later. It nevertheless identifies the organisational transition against which the enterprise programme should be assessed: has a new platform altered the way offices rely on one another's records?

Coverage is another concern. A recent World Bank analysis of land-administration indicators found that registry and cadastral coverage was more closely associated with land-access outcomes than the mere provision of digital public services; digital services were, however, strongly related to transparency, while interoperability was associated with faster transfers [17]. Though this is cross-country evidence and should not be applied mechanically to Lagos, it offers an important warning. Digitising a service that reaches only a limited or unrepresentative part of the territory may improve the experience of existing users without closing the underlying information gap. For a planning SDI, the coverage of informal and rapidly changing areas is therefore as important as the sophistication of the portal.

VI. LESSONS FROM AFRICAN AND INTERNATIONAL EXPERIENCE

A. Policy must acquire an operating form

African SDI reviews have for many years reported a gap between formal intention and sustained implementation. Makanga and Smit [1] found that awareness of SDI had not generally been matched by complete policy, coordination, funding and access arrangements. Guigoz et al. [18] later identified continuing gaps in datasets, standards and institutional development, while Mwange et al. [2] demonstrated considerable variation among national initiatives. These studies differ in date, coverage and method, but their combined implication is clear: an SDI is not implemented once. It has to be enacted through budgets, assigned duties, standards in everyday use and services that remain available.

The Mozambican case illustrates the influence of political, legal, financial and human-capacity conditions on SDI development [19]. South African experience brings local government directly into the discussion. Siebritz et al. [20] found that municipalities require capacity related to their operational responsibilities and must be connected to

the wider SDI as producers, not regarded only as end users. This is highly relevant to Lagos, where local institutions encounter building activity, street conditions, drainage problems, informal development and service demands at close range. A state-level platform will lose much of its value if the local level cannot update, challenge or use its information.

The United Nations Economic Commission for Africa's NSDI guidelines similarly recognise leadership, policy, fundamental data, standards, access, financing and capacity as interdependent matters [21]. The guidance should not be interpreted as a prescription for one central database. It supports an arrangement in which the responsibility for authoritative themes is distributed, but the means of discovery and exchange is coordinated. Lagos already has the potential institutional centre for such coordination in the e-GIS office; what needs clarification is the compact between that centre and the agencies with statutory responsibilities.

B. Digital land administration shows the importance of institutional continuity

Land administration experience elsewhere in Africa also warns against treating digital transition as a software event. Ghana's development of a digital land information system extended over two decades and was shaped by changes in institutional design, workflow, data conversion and project support [22]. The experience demonstrates persistence, but also the difficulty of maintaining coherence across phases. Fit-for-purpose initiatives reviewed by Chigbu et al. [23] likewise show that locally appropriate methods, participation and institutional legitimacy remain necessary even where contemporary geospatial tools are available.

These lessons apply to Lagos in two ways. Historical records must be reconciled rather than simply scanned, because an electronic image of an uncertain record preserves its uncertainty. At the same time, the state requires the capacity to continue after a vendor contract or administration changes. Contracts should therefore cover data ownership, schema documentation, migration, security, administrator training and service continuity. The state does not need to write every line of software; it needs sufficient knowledge and contractual authority to avoid becoming a passive user of its own infrastructure.

Open-source software and open data can reduce some licensing constraints and enlarge the community able to contribute, but they do not remove the requirement for support and governance [24]. The choice between proprietary and open technologies should follow service requirements, internal capability and total cost rather than institutional fashion. Interoperability is the more durable principle. Data and functions should be accessible through documented arrangements that survive a reasonable change in application.

C. Access, privacy and public confidence

Planning information cannot be placed under one rule of access. Approved development plans, zoning provisions, general hazard information and public service locations have a strong claim to public visibility because citizens are expected to comply with or benefit from them. Transaction evidence, personal identifiers, security-sensitive infrastructure and some valuation records require control. Professional users and partner agencies may need a level of access between the public and the custodian. An effective SDI must distinguish these categories rather than choose between complete openness and institutional secrecy.

The African Union Data Policy Framework places human rights, trust, security and public value within the development of African data ecosystems [25]. Nigeria's Data Protection Act provides a more immediate legal obligation for the processing of personal data, including principles and rights that public institutions have to observe [26]. In practical terms, the planning SDI should incorporate purpose limitation, appropriate access control, retention rules, audit logs and a route through which an affected person can seek correction or redress. Privacy is not a reason to withhold every spatial dataset; neither is the public value of planning a reason to expose personal records.

Open-data experience has shown that publication may fail to produce meaningful use where data is difficult to locate, poorly documented, out of date or released under uncertain conditions [27]. A planning portal should accordingly show more than a map. The user

needs to know the responsible body, date of update, geographical coverage, status, licence or access condition, quality statement and contact point. For legally significant plans and boundaries, superseded versions should remain traceable. Trust arises partly from an institution's willingness to state what its data can and cannot establish.

VII. A FEDERATED PLANNING-SDI ARRANGEMENT FOR LAGOS

A. Coordination without the loss of custodial responsibility

The institutional complexity of Lagos makes complete centralisation neither necessary nor desirable. The survey authority, land registry, physical planning bodies, building-control agency, environmental agencies, transport institutions and local governments create different parts of the spatial record under different mandates. Transferring every responsibility to one technical office could weaken the connection between the record and the process that keeps it current. Continued fragmentation is equally unsatisfactory. A federated arrangement offers a practical middle course.

Under this arrangement, the e-GIS office would maintain shared capabilities: the geodetic and base-reference environment; identity and access management; an enterprise catalogue; exchange specifications; common services for parcels, addresses and imagery; monitoring of service availability; and technical support for cross-agency integration. A planning-SDI council, established through an appropriate legal or administrative instrument, would agree priorities, access classes and service responsibilities. Its membership should extend beyond the major state MDAs to local government, professional planning and surveying bodies, universities, utilities and other legitimate users. The council would not administer individual planning applications. Its task would be to ensure that the information moving between such processes remains intelligible and accountable.

Custodians would retain authority for their themes. A planning agency would maintain adopted plans and planning designations; the competent land body would maintain legal interests; the surveying authority would maintain control and cadastral standards; and the building-control agency would maintain inspection and completion status. Each custodian should designate a data owner at management level and an operational steward. The owner answers for purpose, authority and resources. The steward manages definitions, quality checks, updates and user issues. Where two records conflict, an agreed procedure should determine who investigates, how the provisional status is communicated and how the resolution is recorded.

This approach changes the meaning of ownership. An agency does not lose ownership because another authorised user consumes its service. On the contrary, custodianship becomes clearer because the authoritative source is named and unofficial copies can be identified. What should be discouraged is treating public data as departmental property whose release depends on personal discretion.

B. Begin with governed information products

Attempting to integrate every available dataset at once would repeat the project-centred approach that has weakened earlier initiatives. Lagos could begin with a small group of governed information products selected because several planning functions depend upon them. An information product is more than a layer. It combines defined content, identifiers, metadata, a custodian, an update rule, a service expectation, access conditions and a known group of users.

A parcel-and-address product would provide the joint reference for land, planning, building control, emergency response, property revenue and public works. An approved-plans product would record boundaries, provisions, legal status, adoption date and superseded versions. A development-activity product could connect applications, permissions, inspections and completion, with personal details protected. A resilience product could bring together elevation, drainage, flood evidence, wetlands, coastline, critical facilities and approved infrastructure schemes. These products should be developed around real information flows, not around what happens to be easiest to publish.

The choice also creates a basis for financing. The recurrent cost of the parcel-and-address service, for

example, should be recognised across the agencies whose work depends upon it. Open public components can be funded as civic infrastructure, while specialised services may have transparent and lawful cost-recovery arrangements. Charging one government agency an unpredictable price each time it requires another agency's fundamental data is unlikely to support coordinated planning. The financial model should reward maintenance and use, not the creation of barriers.

C. Local government and the observation of change

State-wide mapping provides a valuable reference, but cities change between mapping campaigns. New streets are opened, plots are subdivided, buildings appear, drains are obstructed and public facilities change function. Local planning and service institutions are often the first public bodies to encounter these events. The SDI should provide a controlled process through which they can propose an update, attach evidence and follow its validation. Without such a process, local officers may return to separate spreadsheets and paper maps because the enterprise layer no longer reflects the area they manage.

Participation does not mean that every local edit should enter an authoritative dataset immediately. It requires a workflow that separates observation from validation. A local office may report a new road or development; the competent custodian reviews the evidence and publishes the accepted change. The history of the transaction remains visible. This gives the state a practical feedback system while protecting data quality.

D. The Lagos Urban Observatory reconsidered

The 2014 paper proposed a Lagos Urban Observatory as a model clearinghouse for corporate SDI. The proposal remains relevant, but the role should be adjusted to the present enterprise environment. There is little value in creating another warehouse that competes with e-GIS or copies datasets already maintained by agencies. The observatory should be an institution of use, metropolitan monitoring and public learning.

UN-Habitat's guidance presents urban observatories as arrangements through which data can be assembled, analysed and communicated in support of policy and sustainable urban development [28]. More recent research on urban data platforms stresses the importance of enduring institutional purpose, stakeholder relationships and long-term support beyond the initial technology project [29]. For Lagos, the observatory could draw upon governed services to produce urban indicators, monitor plan implementation, examine inequalities in service access, support scenario studies and publish reproducible methods. Universities and professional institutions would have a clear role, but the observatory would not displace the legal authority of data custodians.

Such an institution would also expose information gaps. If a neighbourhood-level indicator cannot be produced because addresses are incomplete, population and spatial units do not align, or building records cannot be linked, the constraint becomes visible as an investment need. The second edition of the Global Statistical Geospatial Framework is relevant here because it emphasises consistent integration between statistical and location information while protecting confidentiality [30]. The observatory could become the place where this integration is tested against questions of planning consequence, not merely displayed as another dashboard.

VIII. FROM INSTALLATION TO MATURITY: AN ASSESSMENT FRAMEWORK

SDI maturity cannot be represented adequately by the number of computers, mapped layers or staff trained. These are inputs and outputs, and they remain necessary. The more difficult evidence concerns whether information is current, whether agencies actually rely on it, whether failures are corrected and whether public outcomes improve. Recent NSDI reviews continue to emphasise the combination of governance, policy, standards, people and evolving technology rather than a portal-only assessment [31], [32].

Table II sets out a planning-centred framework. It is deliberately organised as three conditions rather than a numerical league table. Development will not always proceed uniformly: an agency may have mature imagery services and weak planning metadata, or a

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strong legal mandate and inadequate local capacity. The framework is intended to show where the next intervention is required.

The baseline assessment should examine documents and practice together. Relevant evidence would include laws and administrative instruments, data dictionaries, catalogues, service agreements, API documentation, access classifications, quality reports, transaction logs, help-desk records, staffing arrangements, and procurement provisions. Interviews should include producers, users at various levels, and public professionals interacting with services. Policies not in workflow shouldn't be assessed the same as active rules.

TABLE II. PLANNING-CENTRED FRAMEWORK FOR ASSESSING SDI MATURITY

Dimension	Emerging condition	Operational condition	Dependable public-infrastructure condition
Purpose and authority	Projects state broad objectives and responsible institutions	Priority services have named owners, mandates and user groups	Investment, authority and performance are reviewed against planning and public-value outcomes
Fundamental data	Important datasets are inventoried and some are digitised	Custodians, identifiers, update triggers, metadata and quality rules are implemented	Authoritative services are routinely used, monitored and supported by traceable histories
Interoperability	Data is exchanged on request, often as files	Priority workflows use documented schemas, services and access controls	Interfaces are reusable, tested, secured and governed through service agreements
Institutional coordination	Coordination depends on projects or individual relationships	A council, stewardship roles and issue-resolution procedures operate	Agencies and local governments jointly maintain products and resolve conflicts through auditable processes
Access, privacy and redress	Some information is publicly viewable	Data is classified; licences, privacy controls and correction routes are defined	Access decisions are transparent, proportionate, reviewable and supported by evidence of compliance
Capacity and continuity	A central technical team and periodic training exist	Technical, planning, legal, security and stewardship roles have support and succession arrangements	Knowledge is retained across contracts and administrations, with continuing professional and institutional development

Dimension	Emerging condition	Operational condition	Dependable public-infrastructure condition
Use and outcomes	Equipment, layers and transactions are counted	Quality, service availability, update time and user activity are measured	Independent evaluation connects SDI use to planning speed, consistency, inclusion, resilience and public confidence

The baseline assessment should examine documents and practice together. Relevant evidence would include laws and administrative instruments, data dictionaries, catalogues, service agreements, API documentation, access classifications, quality reports, transaction logs, help-desk records, staffing arrangements and procurement provisions. Interviews should cover producers and users at state and local levels, along with professionals and members of the public who interact with the services. A policy that has not entered a workflow should not receive the same assessment as a rule that can be observed in operation.

Two or three cross-agency transactions would provide a useful test. A development proposal can be followed through title verification, survey evidence, planning conformity, permit issue, inspection and completion. A public infrastructure scheme can be followed through design, affected parcels, rights-of-way, environmental review, compensation and a subsequent update of the base record. At each stage, the assessment should ask which dataset was used, how its version was identified, which institution was responsible and whether the result was returned to the shared environment. This is more revealing than demonstrating that the relevant layers can be placed on one map.

The assessment should also measure absence and failure. Unavailable services, unresolved discrepancies, delayed updates, and repeated requests for the same information are part of infrastructure performance. So are unequal patterns of coverage. If electronic services work well in formal schemes but provide weak evidence in informal or peri-urban areas, the limitation should be reported as a planning and inclusion issue. Modernisation becomes credible when it exposes these gaps and directs investment towards them.

IX. IMPLICATIONS FOR AFRICAN CITY-REGIONS

The Lagos experience suggests that the urban scale deserves more attention in African SDI policy. National infrastructure provides geodetic reference, broad fundamental themes, standards, and an enabling policy environment. Yet much of the information through which residents experience government is produced within cities: addresses, permits, inspections, service assets, transport operations, local plans and daily environmental observations. These records change rapidly and cross institutional boundaries repeatedly. An urban SDI is therefore not simply a smaller national clearinghouse. It is a means of coordinating transactional and planning information around a common geography.

Incremental development is appropriate where resources are limited, but it should not be confused with fragmented development. A city can start with two information products and one cross-agency workflow if the custodianship, identifiers and exchange method can support later extension. A large central platform may appear more advanced while agencies continue to depend upon unofficial records outside it. Maturity lies in a repeatable institutional arrangement, not in the amount of data shown at one time.

The relationship with informality also requires care. Many African cities contain settlements and land interests that are not fully represented in formal registries. Their exclusion from the SDI does not make them disappear; it makes planning evidence

incomplete. Remote sensing, community mapping and local observations can improve knowledge, but they should not be presented as though they automatically settle legal interests. The appropriate response is to record provenance and status clearly, distinguish observation from adjudication and create lawful routes through which records may be improved. Fit-for-purpose thinking is useful precisely because it relates technology to institutional and social realities rather than demanding an unattainable complete system before any improvement can begin [23].

Finally, public legitimacy is part of infrastructure. A planning SDI changes who can discover information, who can combine it and how decisions may be challenged. Professional bodies, communities, universities and private organisations should have defined avenues for engagement, but responsibility must remain transparent. Communication should continue after the launch event. It should explain what the data represents, which version is authoritative, why access is restricted where necessary, and how an error can be reported. In this respect, the SDI becomes part of planning governance rather than a service reserved for geospatial specialists.

X. RESEARCH PRIORITIES AND LIMITATIONS

The principal limitation of this article is the absence of a current institutional survey and technical audit. Publicly available sources establish major programme milestones, but they do not disclose enough about back-office integration, service performance or the experience of local planning agencies. The framework proposed here therefore remains to be tested. It should not be interpreted as an assessment score for Lagos.

The first research priority is to repeat the institutional enquiry using a design suited to the present system. The unit of analysis should be clear: agencies, offices, professional staff, data stewards and external users answer different questions and should not be combined without distinction. A larger and more deliberate sample would permit a defensible comparison across planning permit, building control, land, survey, environment, transport and local government. Qualitative interviews are necessary because many SDI problems arise through informal working arrangements that a checklist will miss.

A second priority is a service and data audit. It should examine coverage, metadata, identifier consistency, lineage, update time, downtime, correction processes and access decisions for a defined group of information products. Where possible, results should be published in a form that protects security and personal information while enabling independent learning. A third priority concerns outcomes. Turnaround time, repeated document requests, planning consistency, enforcement follow-up and user experience could be compared before and after integration. Such evaluation would move the discussion from declared benefits to observed public value.

There is also need to investigate the position of local government. The 2014 study recorded low local response and limited infrastructure, but the present capability and responsibilities of local offices require fresh evidence. Their participation should be considered in relation to the state's legal and administrative structure, not assumed from models developed elsewhere. In addition, research should examine whether the benefits and coverage of digital services extend to informal, low-income and peri-urban communities whose land and development conditions are often the least well documented.

XI. CONCLUSION

Lagos no longer needs to demonstrate that GIS can be applied to land administration. Electronic title workflows, the land-administration portal, enterprise coordination and renewed state-wide mapping provide a much stronger platform than the planning agencies examined in 2014 possessed. The issue has consequently moved from the availability of technology to the governance of information across institutions.

The earlier study remains useful because it revealed a gap between central geospatial investment and the agencies expected to use it. Its descriptive findings on access, fundamental data and coordination have historical value, while its exploratory factor analysis should not be treated as a current or conclusive ranking

of barriers. What is required now is a new assessment based on identifiers, custodianship, metadata, service exchange, local participation, lawful access, continuity and actual planning use.

A geoportal permits information to be seen. A planning SDI enables the same information to be relied upon, questioned, corrected and reused without losing its meaning or authority. The federated arrangement proposed in this article places the e-GIS office at the centre of shared services and coordination, but keeps custodial responsibility with the competent agencies. It also gives the Lagos Urban Observatory a renewed purpose as a node for metropolitan monitoring, research and accountability rather than as another repository.

The practical task is not to connect every dataset at once. It is to establish a small number of governed information products, test them through cross-agency planning transactions and make performance visible. If this is pursued with institutional patience and public accountability, Lagos can provide African city-regions with evidence of how a major geospatial investment becomes a lasting planning infrastructure.

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