

Capacity Building Workshop for Countries of the Africa Region
Data Ethics, Governance, and Quality in a Changing Data
Ecosystem-Nairobi, Kenya - September 2025



Africa's Integration of Geospatial and Statistical Information

This presentation explores how African nations are implementing the Global Statistical Geospatial Framework (GSGF) to transform data-driven development planning and evidence-based policy formulation across the continent.

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Introduction

Overview of geospatial-statistical integration in Africa

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The GSGF Framework

Understanding the five principles and their relevance

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Future Trajectory

Africa's path toward sustainable data ecosystems

Introduction

Across Africa, the rising demand for precise, location-based data has driven governments, companies, and civil society to rapidly adopt geospatial technologies and standards, as reflected in national spatial data infrastructure initiatives and census modernization projects (ECA, 2023; ECA, 2024).

The United Nations emphasizes the critical role of geospatial-statistical integration for implementing:

- Agenda 2030
- Agenda 2063
- Sustainable Development Goals (SDGs)



What is the Global Statistical Geospatial Framework?

The GSGF was developed by the UN Statistical Commission (UNSC) and the UN Committee of Experts on Global Geospatial Information Management (UN-GGIM).

A universal, principles-based approach to harmonizing the integration of statistical and geospatial information for improved decision-making, comparability, and efficient data management.

The framework provides guidance that is adaptable to national contexts while ensuring global consistency (UN-GGIM, 2018; UNSC/UN-GGIM, 2019).



The Five Principles of GSGF

Principle 1
Use of Fundamental Geospatial
Infrastructure and Geocoding

Principle 5
Accessible and Usable Geospatially
Enabled Statistics



Principle 2

Geocoded Unit Record Data in a Data
Management Environment

Principle 3

Common Geographies for
Dissemination of Statistics

Principle 4

Statistical and Geospatial
Interoperability

Each principle addresses critical aspects of integration, from building robust infrastructures to ensuring data accessibility for diverse users (EFGS, 2023; UN-GGIM, 2018).

Principle 1: Fundamental Geospatial Infrastructure

Africa's Progress

- Establishment of national spatial data infrastructures
- Collaboration between mapping agencies and statistical offices
- Development of custodianship and stewardship models
- Maintenance of authoritative geocoding systems

Example: Adoption of digital mapping and GPS technology in census operations has enabled precise delineation of enumeration areas, optimized field logistics, and improved survey coverage (ECA, 2025).



GSGF Connection: This principle is foundational for subsequent GSGF principles, as robust

Principle 2: Geocoded Unit Record Data



Africa's Implementation

A paradigm shift is observed in African national statistics offices:

- Linking geocoded microdata with comprehensive data management systems
- Balancing data quality with privacy safeguards
- 86% of African countries surveyed collected GPS data for enumeration areas
- 70% captured building-level coordinates (ECA, 2024)

GSGF Connection: Consistent, well-documented geocodes enable aggregation/disaggregation of data, facilitating multidimensional analyses and comparisons over time.



ECA Training Initiatives for Principle 2

Intensive Training Workshops

The ECA organized workshops focused on integrating geospatial data into census databases, equipping practitioners with essential skills.

Skills Development

Training covered spatial analysis techniques, database integration, and small-area estimation methodologies.

Technical Support

Ongoing technical assistance provided to national statistical offices implementing geocoded data management systems.

Principle 3: Common Geographies

Effective data dissemination relies on agreed-upon geographic units for reporting and visualization.

Digital Administrative Boundaries

African statistical and mapping agencies have developed digital boundaries ranging from national down to land-parcel levels, supporting robust census atlases and interactive dashboards.

Unified Population Grids

The adoption of unified population grids has enabled standardized cross-border comparisons and harmonization of regional development planning.

African Spatial Statistical Framework

Common geographic boundaries support consistent data collection and analysis across national borders.

GSGF Connection: GSGF advocates for the use of common geographies – whether administrative, statistical, or grid-based – to enhance data usability and comparability at local and international levels.

Principle 4: Interoperability

Standards Adoption

African countries increasingly adopt:

- Open Geospatial Consortium (OGC) standards
- ISO best practices
- Service-oriented architectures

These fuel data linkage between statistical and geospatial repositories (ECA, 2023).

GSGF Connection: Interoperability is fundamental to GSGF, supporting integrated analysis and ensuring that geospatially enabled statistics can be aggregated, visualized, and disseminated across domains.

Regional Capacity Building

Workshops and technical missions in countries like Uganda, Mali, and Burundi have focused on:

- Establishing cross-domain governance
- Developing collaborative workflows
- Harmonizing data models

The goal is seamless integration of statistical and geospatial data (ECA, 2025).

Principle 5: Accessibility and Usability

45+

Countries with
Repositories

African nations
maintaining spatial data
repositories and
providing web-based
census dashboards

100s

Statistical Atlases

Visual publications
making complex data
accessible to diverse
audiences

24/7

API Services

Open API services
democratizing access
for planners,
researchers, and the
public

GSGF Connection: Principle 5 guides countries to prioritize end-user access and functional usability, fostering data-driven innovation and evidence-based decision-making.





Africa's Implementation Journey

Census Modernization and Geocoding

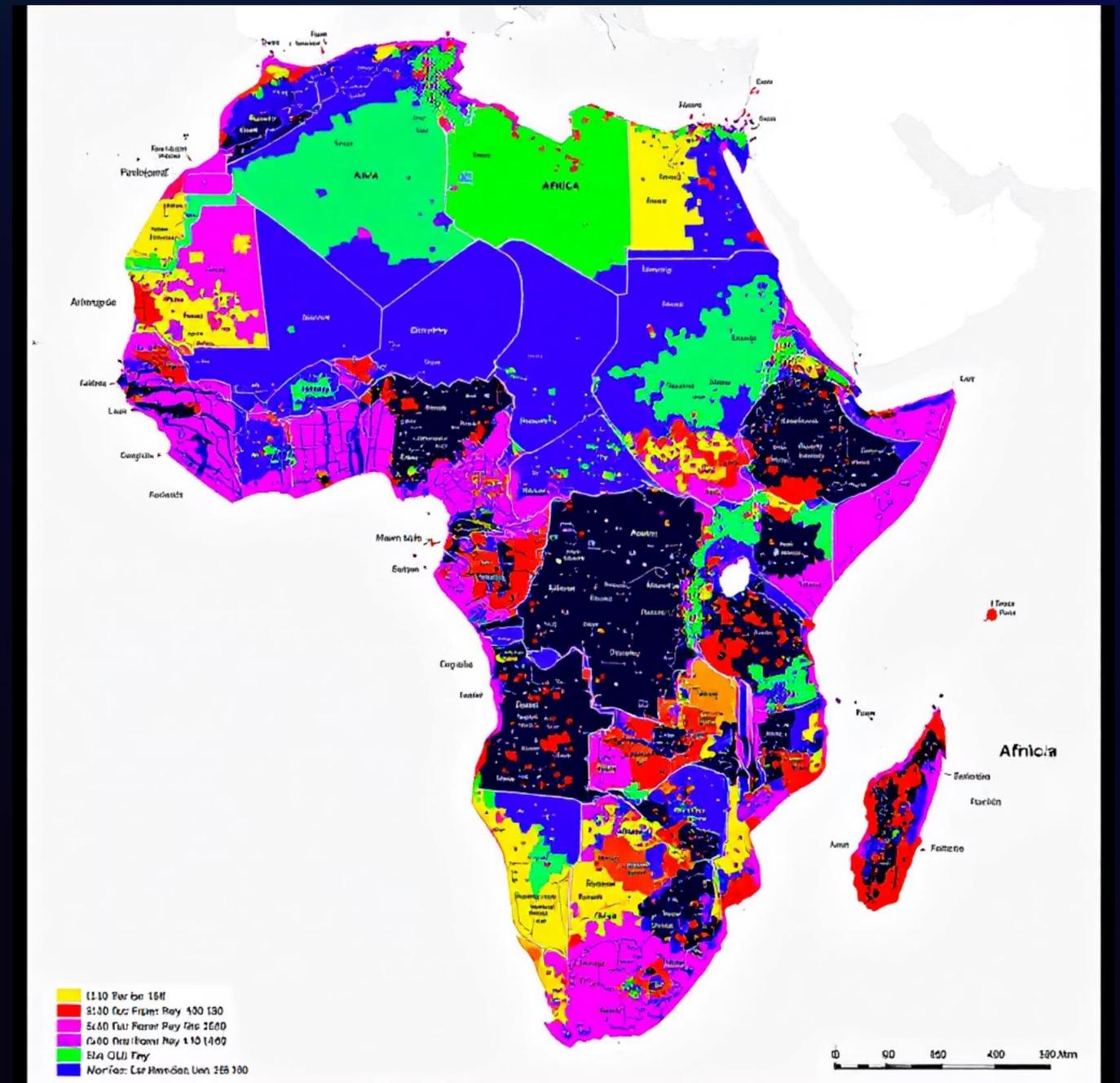
The 2020 census round marked a major breakthrough in Africa, with **32 countries** adopting geospatial technologies for census planning, mapping, and data collection (ECA, 2024).

Case Study: Ghana, Kenya, Sierra Leone, Tanzania

Key Achievements

- Rapid release of preliminary census results (within 3 months)
- Implementation of digital mapping platforms
- GPS-enabled enumeration for precise location data
- Improved data quality and coverage

These countries demonstrated how geospatial integration accelerates the census process while enhancing accuracy (ECA, 2025).



Digital mapping platforms enabled rapid visualization and analysis of census data,

Case Study: Uganda Bureau of Statistics (UBOS)



Comprehensive Geodatabase

Creation of a geodatabase for 120,000 enumeration areas using international WGS84 reference systems



GIS Implementation

Extensive use of GIS for boundary determination and road mapping



Field Data Collection

Mobile technology for real-time data capture with location coordinates



Data Visualization

Interactive dashboards for public access to census results

Uganda's experience demonstrates how comprehensive geospatial integration can transform national statistical operations (ECA, 2025).

Case Study: Burundi



ECA Technical Mission Results

- Establishment of spatial databases aligned with international standards
- Development and deployment of interactive geoportals
- Updated GIS field guidelines for data collection
- Robust geocoding implementation
- Improved dissemination strategies reaching diverse stakeholders

This case demonstrates how targeted technical assistance can rapidly advance a country's geospatial-statistical capabilities (ECA, 2024).

Institutional and Technical Capacity Building



ECA Workshops

Facilitated training sessions in English- and French-speaking countries to address geospatial knowledge gaps



Data Management

Strengthened capabilities for integrating and maintaining geospatial databases



Geocoding Schemes

Support for implementing standardized geocoding for thematic census analyses

National frameworks have also benefited from inter-agency memoranda of understanding, steering committees, and shared service agreements, fostering institutional cooperation and reducing duplication (ECA, 2025).

Regional Frameworks and Cross-Border Harmonization

African Action Plan on Global Geospatial Information Management

Comprehensive strategy covering 2016–2030 to guide continental geospatial development

These frameworks facilitate standardized approaches across national boundaries, enabling continental-scale analysis and planning (ECA, 2025).

Integrated Geospatial Information Framework (IGIF)

Supports country-level implementation and regional interoperability



Challenges in Implementation

Human Capacity Gaps

Shortage of geospatial/statistical expertise, particularly in advanced technologies such as AI and satellite imagery analysis (ECA, 2025).

Infrastructure and Standards

Fragmented data storage, inconsistent standards, and insufficient digital infrastructure in some countries (ECA, 2023).

Legal and Institutional Frameworks

Need for stronger governance models, data custodianship agreements, and privacy protocols (ECA, 2023; ECA, 2024).

Funding Limitations

Budget constraints hinder comprehensive adoption of new technologies and cross-agency capacity building (ECA, 2025).

Opportunities for Advancement

Strategic Partnerships

- International organizations
- Academic institutions
- Private sector players

Collaborative approaches can accelerate capacity building and technology transfer.

Technological Innovation

- Cloud-based data architectures
- Open data policies
- Machine learning for spatial analysis

Emerging technologies offer cost-effective solutions for resource-constrained environments.

Regional Cooperation

- African Geodetic Reference Frame
- SDG Data Alliance
- Cross-border data sharing initiatives

Continental collaboration maximizes limited resources and expertise.



Strategic Recommendations Linked to GSGF

Principle 1



Standardized Geocoding

Adopt standardized geocoding infrastructures and procedures, prioritizing point-based approaches



Custodianship Models

Establish custodianship models and legal frameworks to regulate data stewardship

These recommendations ensure that fundamental geospatial infrastructure is robust, standardized, and properly governed.



Strategic Recommendations Linked to GSGF

Principle 2

Integrate geocoded microdata into comprehensive national data warehouses, with privacy and validation controls.

This ensures that individual-level data is properly geocoded, securely managed, and ready for aggregation at various geographic levels.

Strategic Recommendations Linked to GSGF

Principles 4 & 5

Service-Oriented Systems

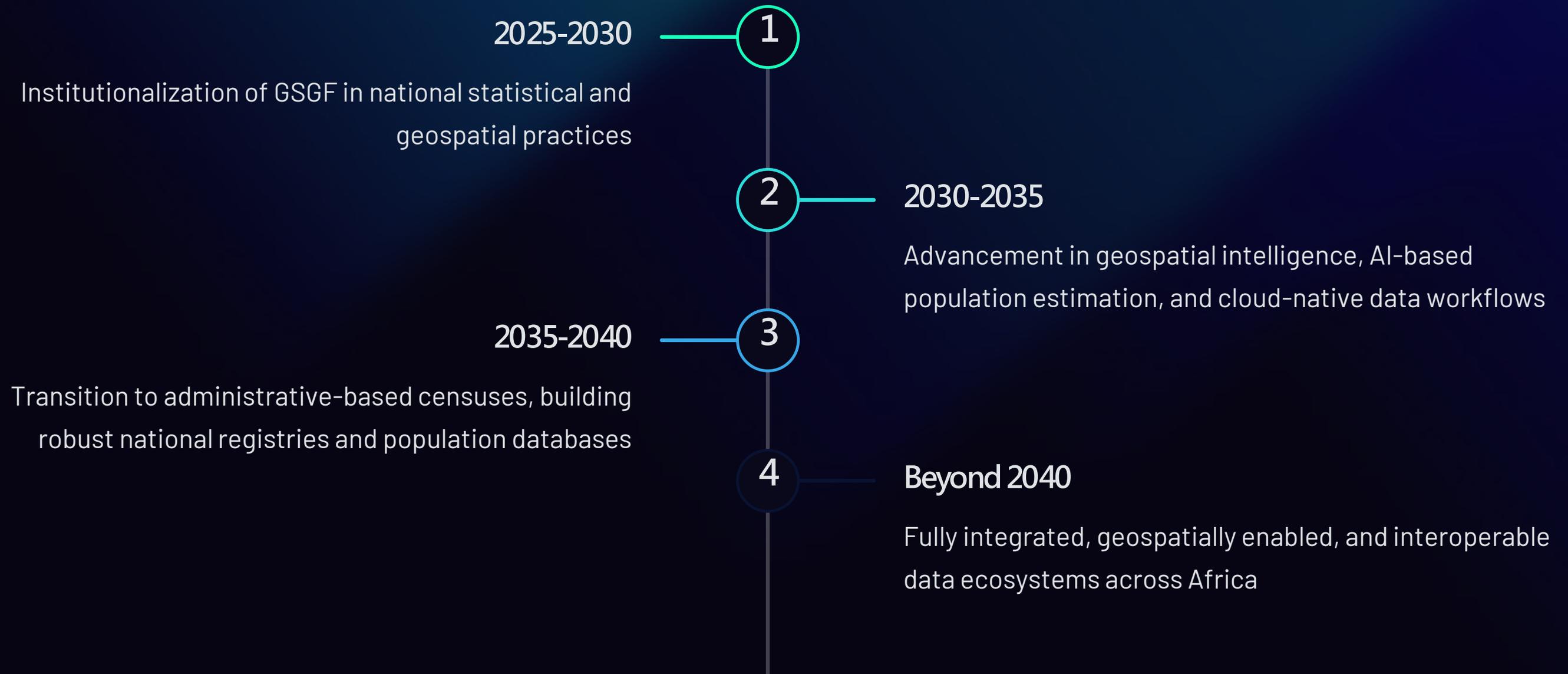
Build service-oriented systems for accessibility, promote open data licensing, and facilitate user engagement for product design

Continuous Training

Invest in continuous training programs and inter-agency collaboration to address capacity gaps and ensure sustainability

These recommendations focus on making geospatially enabled statistics interoperable, accessible, and usable for diverse stakeholders, while building the human capacity needed for long-term success.

Africa's Future Trajectory



The vision encompasses building resilient, future-proof data ecosystems that leave no one "and no 'where'" behind (ECA, 2025).

Continental Coordination

Key Coordinating Bodies

- African Space Agency
- SDG Data Alliance
- UN-GGIM: Africa
- African Union Commission

These organizations drive continental standards, capacity building, and collaborative initiatives.



Continental coordination is essential for harmonizing approaches, sharing resources, and

Detailed Examination: Principle 1

Use of Fundamental Geospatial Infrastructure and Geocoding

This principle focuses on establishing the foundational elements needed for consistent geocoding:

- Authoritative boundary datasets
- Addressing systems and location references
- Geodetic frameworks and coordinate systems
- Naming conventions and identifiers

African implementation highlights:

- National mapping agencies leading boundary delineation
- Statistical offices adopting international geocoding standards
- Development of African Geodetic Reference Frame
- Increasing use of unique identifiers for geographic features

This principle ensures that all statistical data can be consistently linked to geographic locations using standardized references (UN-GGIM, 2018).

Detailed Examination: Principle 2

Geocoded Unit Record Data in a Data Management Environment

This principle focuses on attaching geographic references to individual statistical records (microdata) within a secure data management environment.

Key Requirements

Standardized location identifiers, metadata documentation, quality assurance processes, and privacy safeguards

African Progress

Implementation of geocoded household surveys, census microdata with coordinates, and health facility data with precise locations

This principle enables flexible aggregation of statistics to different geographic levels while protecting confidentiality (UNSC/UN-GGIM, 2019).



Detailed Examination: Principle 3

Common Geographies for Dissemination of Statistics

This principle focuses on using standardized geographic areas for data aggregation and dissemination:

- Administrative boundaries (provinces, districts)
- Statistical areas (enumeration areas, dissemination zones)
- Grid-based systems (1km² cells, hexagons)
- Functional areas (watersheds, ecosystems)



Detailed Examination: Principle 4

Statistical and Geospatial Interoperability

Common Standards
ISO, OGC, and statistical standards for data exchange

Common Vocabularies
Shared definitions and classifications



Metadata

Comprehensive documentation of datasets and methods

APIs

Standardized interfaces for data access and integration

This principle ensures that statistical and geospatial data can be easily combined, regardless of their source or format, enabling integrated analysis and visualization (EFGS, 2023).

Detailed Examination: Principle 5

Accessible and Usable Geospatially Enabled Statistics

This principle focuses on making geospatially enabled statistics available to users in formats that meet their needs:

Key Components

- Open data policies and licenses
- User-centered design of data products
- Multiple access channels (web, mobile, API)
- Visualization tools and interactive maps

African Implementation

- National data portals with geospatial capabilities
- Census atlases and thematic maps
- Mobile applications for field data collection
- Community engagement in data design





Census Modernization: Technology Adoption

32

Countries

African nations adopting geospatial technologies for census operations

86%

GPS Collection

Countries collecting GPS coordinates for enumeration areas

70%

Building Data

Nations capturing building-level coordinate data

The 2020 census round marked a significant technological leap for African statistical offices, with most countries incorporating some form of geospatial technology (ECA, 2024).

Census Modernization: Key Benefits



Improved Accuracy

GPS-enabled field operations reduced coverage errors and improved the precision of population distribution data.



Faster Results

Digital data collection and geospatial processing accelerated the release of preliminary results from years to months.



Enhanced Analysis

Geocoded data enabled sophisticated spatial analysis, small area estimation, and integration with other datasets.



Better Dissemination

Interactive maps and geospatial dashboards made census data more accessible and usable for diverse stakeholders.



Institutional Capacity Building: Approaches

Training Programs

- Technical workshops on geospatial tools and methods
- Leadership seminars on geospatial strategy
- Train-the-trainer programs for sustainable knowledge transfer
- Academic partnerships for long-term education

Institutional Arrangements

- Inter-agency memoranda of understanding
- Geospatial coordination committees
- Shared service agreements
- Joint data stewardship protocols

These approaches foster institutional cooperation, reduce duplication of efforts, and build sustainable capacity for geospatial-statistical integration (ECA, 2025).

Regional Frameworks: Continental Coordination



African Action Plan on Global Geospatial Information Management

Comprehensive strategy covering 2016–2030 that aligns continental efforts with global frameworks while addressing Africa-specific challenges and opportunities.

Integrated Geospatial Information Framework (IGIF)

Provides practical guidance for developing, strengthening, and modernizing geospatial information management, adapted to African contexts and priorities.

African Geodetic Reference Frame

Continental initiative to establish a unified coordinate reference system, enabling seamless data integration across national boundaries.

Human Capacity Challenges: Detailed Analysis

Specific Skill Gaps

- Advanced spatial analysis techniques
- Satellite imagery processing and interpretation
- Machine learning for geospatial applications
- Database management for large spatial datasets
- Web-based mapping and visualization

Institutional Challenges

- High staff turnover in technical positions
- Limited training budgets and opportunities
- Siloed expertise between statistical and geospatial domains
- Difficulty attracting and retaining specialized talent

These capacity gaps represent a significant barrier to full implementation of the GSGF across Africa, requiring sustained investment in education and professional development (ECA, 2025).

Infrastructure and Standards Challenges

Fragmented Data Storage

Many countries maintain separate systems for statistical and geospatial data, complicating integration and increasing maintenance costs.

Inconsistent Standards

Varying data models, classification systems, and metadata standards between agencies and countries hinder interoperability.

Digital Infrastructure Gaps

Limited internet connectivity, computing resources, and power reliability in some regions constrain implementation of advanced geospatial systems.

Legacy Systems

Outdated technology platforms and paper-based processes persist in some institutions, creating barriers to digital transformation.

Addressing these infrastructure and standards challenges requires coordinated investment and policy harmonization (ECA, 2023).

Legal and Institutional Framework Challenges

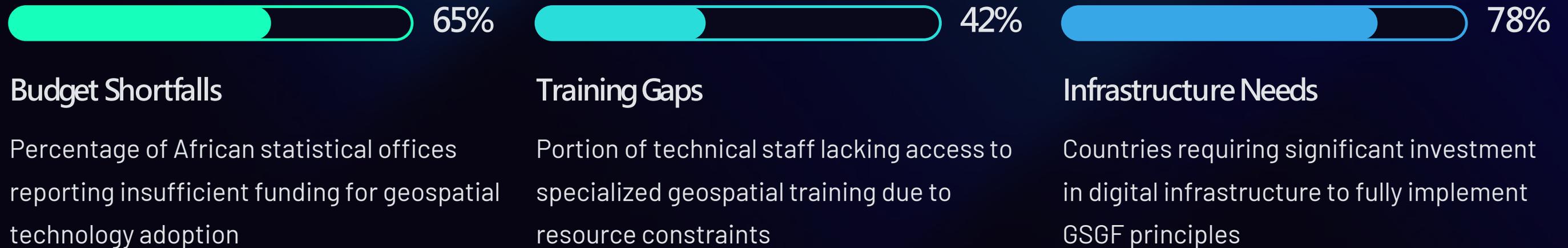


Key Governance Issues

- Outdated or absent data protection legislation
- Unclear mandates for geospatial data custodianship
- Limited frameworks for data sharing between agencies
- Insufficient protocols for privacy protection in geocoded data
- Restrictive policies limiting open data access

These governance challenges can impede the development of integrated geospatial-statistical systems that balance openness with privacy and security (ECA, 2023; ECA, 2024).

Funding Limitation Challenges



Budget Shortfalls

Percentage of African statistical offices reporting insufficient funding for geospatial technology adoption

Training Gaps

Portion of technical staff lacking access to specialized geospatial training due to resource constraints

Infrastructure Needs

Countries requiring significant investment in digital infrastructure to fully implement GSGF principles

Budget constraints hinder comprehensive adoption of new technologies and cross-agency capacity building, often resulting in partial implementation of geospatial-statistical integration (ECA, 2025).



Strategic Partnerships: Opportunities



International Organizations

UN agencies, World Bank, and regional development banks provide technical assistance, funding, and knowledge transfer



Academic Institutions

Universities offer research collaboration, curriculum development, and specialized training programs



Private Sector

Technology companies provide innovative solutions, cloud services, and public-private partnerships

Strategic partnerships can accelerate capacity building, technology transfer, and sustainable implementation of geospatial-statistical systems across Africa.

Technological Innovation: Opportunities

Cloud-Based Architectures

Cloud computing offers scalable, cost-effective solutions for data storage, processing, and dissemination, reducing the need for expensive local infrastructure.

Open Data Policies

Open standards and licenses maximize the value of geospatial-statistical data by enabling broader use, innovation, and integration across sectors.

These technological innovations offer cost-effective solutions for resource-constrained environments while expanding capabilities (ECA, 2025).

Machine Learning

AI techniques can automate feature extraction from satellite imagery, improve data quality, and generate insights from integrated datasets.

Mobile Technologies

Smartphone-based data collection and access expand the reach of geospatial-statistical systems to remote areas and diverse user groups.

Regional Cooperation: Opportunities



African Geodetic Reference Frame

Continental initiative to establish a unified coordinate system, enabling seamless data integration across national boundaries

SDG Data Alliance

Collaborative platform for sharing methodologies, tools, and datasets to monitor and achieve sustainable development goals

Cross-Border Initiatives

Joint projects addressing shared challenges like watershed management, disease surveillance, and transportation planning

Continental collaboration maximizes limited resources and expertise while addressing transboundary issues that require coordinated approaches.

Future Vision: Administrative-Based Censuses

Transition by 2040

Africa's vision includes transitioning from traditional field-based censuses to administrative-based approaches by 2040, leveraging:

- Comprehensive population registers
- Integrated administrative data systems
- Geocoded address databases
- Advanced statistical modeling

This transition represents a fundamental shift in how population data is collected and managed, requiring sustained investment in geospatial-statistical integration (ECA, 2025).

Benefits

- More frequent population updates
- Reduced field enumeration costs
- Improved temporal consistency
- Enhanced integration with other data sources
- Continuous geospatial-statistical outputs



Future Vision: Geospatial Intelligence and AI

Advanced technologies will transform how Africa collects, processes, and utilizes geospatial-statistical data:

AI-Based Population Estimation

Machine learning algorithms combining satellite imagery, mobile data, and survey information to generate high-resolution population estimates

Predictive Analytics

Forecasting models using integrated geospatial-statistical data to anticipate development needs, natural disasters, and demographic changes

Cloud-Native Workflows

End-to-end data processing in cloud environments, enabling real-time analysis and visualization of complex geospatial-statistical information

Leaving No One and No "Where" Behind

The integration of geospatial and statistical information is fundamentally about ensuring that:

- Every person is counted and represented in data
- Every location is accurately mapped and understood
- Every decision is informed by precise spatial context
- Every community benefits from evidence-based planning

This principle of inclusivity drives Africa's commitment to geospatial-statistical integration (ECA, 2025).



Complete geospatial coverage ensures that remote, marginalized, or informal communities



Conclusion

Africa's integration of geospatial and statistical information, guided by the Global Statistical Geospatial Framework, is transforming national capacities for evidence-based governance, sustainable development, and international collaboration.

Significant Progress

African countries have made remarkable strides in adopting geospatial technologies, modernizing census operations, and building institutional capacity.

Ongoing Challenges

Human capacity gaps, infrastructure limitations, legal frameworks, and funding constraints continue to require strategic attention.

Future Potential

With continued implementation of GSGF principles, Africa is positioned to develop resilient, future-proof data ecosystems that drive impactful progress across the continent.