INTERNATIONAL TELECOMMUNICATION UNION

ITU POLICY ANALYSIS
Strengthening National Broadband Mapping Systems in Kenya

Africa Broadband Maps

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List of Acronyms and Abbreviations

AI	-	Artificial Intelligence
AKOS	-	Agency for Communication Networks and Services of the Republic of Slovenia
API	-	Application Programming Interface
AU	-	African Union
AWS	-	Amazon Web Services
BB	-	Broadband
BDT	-	National Regulatory Authorities
BEREC	-	Body of European Regulators for Electronic Communications
CA	-	Communications Authority
CEF	-	Connecting Europe Facility (CEF Digital)
CRS	-	*Coordinate reference system*
CSDGM	-	Content Standard for Digital Geospatial Metadata
CSDI	-	Continental Spatial Data Infrastructure
CSOs	-	Civil Society Organisations
DCs	-	Data Collectors
DESI	-	Digital Economy and Society Index
DNA	-	Digital Networks Act
DQA	-	Data quality assurance
DQP	-	Data Quality Protocol
DQP	-	Data Quality Protocol
DSB	-	Dispute Settlement Body
DSS	-	Decision-making support systems
EAC	-	East African Community
EACO	-	East African Communications Organisation
EC	-	European Commission
EECC	-	European Electronic Communications Code
EU	-	European Union
FAQs	-	Frequently Asked Questions
FGDC	-	Federal Geographic Data Committee's
FTTB/FTTH	-	Fibre to the building or home/premises
GDP	-	Gross Domestic Product
GEA	-	Government Enterprise Architecture

GIA	-	Generalised Implementation Agreement
GIS	-	Geographic Information System
GNI	-	Gross National Income
GNSS	-	Global Navigation Satellite System
GPS	-	Global Positioning System
GSMA	-	Global System for Mobile Communications Association
ICT	-	Information and Communications Technology
IGAD	-	Intergovernmental Authority on Development
IoT	-	Internet of Things
ISO	-	Organization for Standardization
ISOK	-	Internet Society Kenya Chapter
ITU	-	International Telecommunication Union
JSON	-	JavaScript Object Notation
KDEAP	-	Kenya Digital Economy Acceleration Program
KeNHA	-	Kenya National Highways Authority
KETRACO-		Kenya Electricity Transmission Company
KICA	-	Kenya Information and Communications Act, 1998
KICTANET-		Kenya ICT Action Network
KODI	-	Kenya Open Data Initiative
KPLC	-	Kenya Power and Lighting Company
KSA	-	Kenya Space Agency
LiDAR	-	Light Detection and Ranging
MICDE	-	Ministry of Information Communication and the Digital Economy
MNOs	-	Mobile Network Operators
MoUs	-	Memoranda of Understanding
NASA	-	National Aeronautics and Space Administration
NBS	-	Kenya National Bureau of Statistics
NCPD	-	National Council for Population and Development
NDA	-	Non-disclosure agreements
NDMA	-	National Drought Management Authority
NDP	-	National development plan 2002-2008
NRAs	-	National Regulatory Authorities

NWG	-	National Working Group
OCAs	-	Other Competent Authorities
ODBC	-	Open Database Connectivity
OECD	-	Organisation for Economic Co-operation and Development
OFDS	-	Open Fibre Data Standard
OGC	-	Open Geospatial Consortium
QoS	-	Quality of service
REST	-	Representational State Transfer
RSDI	-	Regional Spatial Data Infrastructure
SMEs	-	Small and Medium size Enterprises
SMP	-	Significant Market Power
SOA	-	Service-oriented Architecture
SOP	-	Standard Operating Procedure
SQL	-	Structured Query Language
TESPOK	-	Technology Service Providers of Kenya
UML	-	Unified Modelling Language
UNESCO	-	United Nations Educational, Scientific and Cultural Organization
USO	-	Universal service obligations
USO	-	Universal service obligations
VHCNs	-	Very High-Capacity Networks
WFS	-	Web Feature Service
WMS	-	Web Map Service
XML	-	eXtensible Markup Language
XSD	-	XML Schema Definition

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Executive Summary

1. Background

Global best practices demonstrate the value of broadband mapping as a strategic tool for digital transformation. The Africa Broadband Maps project is a four-year initiative led by the International Telecommunication Union (ITU) and funded by a € 15 million investment from the European Commission. It covers 11 Sub Saharan African countries: Benin, Botswana, Burundi, Cote d'Ivoire, Ethiopia, Kenya, Malawi, Nigeria, Uganda, Zimbabwe and Zambia. Officially launched in Cote d'Ivoire in March 2025, the project seeks to create national harmonized, validated and publicly accessible broadband mapping systems to guide evidence-based policy making, promote digital inclusion and attract investment in digital infrastructure.

Meanwhile, the European Union (EU) has set ambitious broadband targets under the Digital Decade Policy Programme 2030, monitored through the Digital Economy and Society Index (DESI). These include universal gigabit coverage by 2030, 5G for all urban areas, and 100 Mbps for all households by 2025. Specifically, broadband maps provided the evidence base that guided EU funding allocations in Slovenia, identified urban-rural connectivity gaps in Poland, and highlighted speed disparities in Italy, enabling each country to target fibre deployment and 5G expansion effectively in line with EU benchmarks. Consequently,

- Slovenia has achieved high rural fibre penetration through EU funding.
- Poland has bridged urban-rural divides by deploying fibre with EU structural funds.
- Italy, despite challenges with uneven speeds, accelerated fibre rollout and 5G deployment to meet EU benchmarks.

2. Current Status of Kenya Broadband Mapping

Kenya has recently secured a place in the Africa Broadband Mapping Systems (Africa-BB-Maps) project, backed by the ITU and European Union. With €15 million committed regionally, Kenya is among 11 countries benefiting from this initiative. The Kenya Africa-BB-Maps project was officially launched in Nairobi in August 2025 and aims to create a single, reliable status of connectivity gaps, infrastructure distribution, and affordability indicators. The ITU *Africa-BB-Maps Baseline Assessment & Maturity Matrix*[1] report ranks Kenya in the "advanced" cluster of African countries, reflecting its strong position in broadband policy, infrastructure expansion, and resilience. However, challenges remain around data accuracy, rural penetration, and affordability, underscoring the need for statutory clarity, geographic information system (GIS) infrastructure, and coordinated stakeholder engagement.

3. Objectives of Broadband Maps initiative for Kenya

The purpose and objectives are to establish a dynamic, authoritative broadband mapping system that integrates geospatial, socio-economic, and infrastructure data, guiding equitable investment, regulatory oversight, and inclusive digital transformation. Specifically, the project objectives are:

- To ensure *statutory alignment* of national broadband mandates against regional and global standards to ensure regulatory coherence.

[1] International Telecommunication Union. (2025). *Africa-BB-Maps Baseline Assessment & Maturity Matrix*. ITU Development Sector. Retrieved from https://www.itu.int/en/ITU-D/Projects/ITU-EU/Africa-BB-Maps

- To promote regional harmonisation by *aligning* Kenya's broadband mapping practices with continental and global benchmarks by fostering interoperability, standardisation, and coordinated policy frameworks across the eleven African countries of the project.
- To provide *geospatial insights* for evidence-based decision making through visualisation of broadband coverage, access gaps, and infrastructure distribution to inform policy and regulatory interventions, and facilitate equitable resource allocation.
- To establish harmonised key *performance indicators* (KPIs) for monitoring broadband penetration, affordability, and quality of service.
- To accelerate digital inclusion by making broadband access more transparent, thus ensuring equitable connectivity for rural and urban populations[5].
- To support *alignment of national policies* and frameworks governing broadband mapping, interoperability, and data governance with the Africa-BB-maps vision in the context of national broadband strategy.
- To *build local capacity* for data collection, analysis and reporting.
- To enhance collaboration between European and African national regulatory authorities (NRAs), promoting knowledge exchange, capacity building, best practices, and policy innovation.

4. Recommendations

a) *Policy and regulation of broadband mapping* – Establish clear statutory and regulatory provisions defining scope, standards, and accountability.

b) *Data governance and interoperability frameworks* – Develop robust governance structures for data collection, validation, and sharing.

c) *GIS technology infrastructure* – Deploy advanced GIS platforms, servers, and analytical tools for real-time geospatial mapping.

d) *Institutional capacity* – Build institutional capacity within CA, align national practices with continental/global benchmarks, and establish an empowered focal point for coordination.

e) *Stakeholder engagement and coordination* – Establish a National Broadband Mapping Working Group (NWG) to coordinate government, private sector, academia, and civil society.

f) *Accountability and measurable progress* - Embed a comprehensive set of performance indicators within its Monitoring and Evaluation system including Coverage expansion, Affordability, Quality of Service, Institutional Capacity, Stakeholder Engagement, Socio-economic indicators (education, health, public services,), and Policy Alignment which is the degree of harmonisation with continental frameworks (AU, ITU) and compliance with national strategies**.**

g) *Funding and resource mobilisation* – Implement a comprehensive resource mobilisation strategy to ensure that there are sufficient finds to implement all actions pertinent to the Africa-BB-Maps project, thus ensuring its sustainability.

h) *Regional harmonisation* - strengthen governance within national regulators, building their capacity, foster cross-border collaboration, develop shared policies, regulations and legal mechanisms, and establish a unified regional broadband data infrastructure and mapping platform**.**

5. Implementation Roadmap

Phase I – Foundation: Establish statutory anchors, governance structures, and stakeholder buy-in.

Phase II – Data Infrastructure: Deploy geospatial tools, standardise protocols, and initiate pilots.

Phase III – Institutional Integration: Build institutional capacity, align reporting, and embed documentation.

Phase IV – Regional Harmonisation: Scale across regions, integrate with continental initiatives, and align with global benchmarks.

Phase V – Monitoring and Evaluation: Implement dashboards, KPI tracking, and periodic reviews.

6. Risk Assessment

The successful implementation of the Africa-BB-Maps initiative requires proactive risk management. The following key risks (Table 01) are assessed in terms of *likelihood* (probability of occurrence) and *impact* (severity of consequences).

Table 0 1. Risk assessment

Risk	Description	Likelihood	Impact	Overall	Mitigation
Data Quality and Accuracy	Inconsistent or incomplete datasets may undermine credibility of broadband maps.	High	High	Very high	Establish strict validation protocols, metadata standards, and independent audits.
Infrastructure Gaps	Limited GIS capacity or unreliable connectivity in rural areas may slow implementation.	Medium	High	Very high	Phased deployment, targeted investment in underserved regions, and cloud-based GIS solutions.
Stakeholder Coordination Challenges	Divergent priorities among government, private sector, and civil society could delay consensus.	Medium-high	High	Very high	Empower the National Broadband Mapping Working Group (NWG) to lead inclusive dialogue and coordination.
Resource Constraints	Insufficient funding or technical expertise may hinder sustainability.	High	High	Very high	Mobilise resources through national budgets, regional development banks, and international partnerships.
Policy and Regulatory delays	Slow adoption of statutory provisions could stall progress.	Medium	High	High	Fast-track legislative processes and align with continental frameworks to accelerate adoption.
Institutional Capacity/ readiness	Weak institutional structures, limited technical expertise, or inadequate coordination mechanisms may reduce effectiveness of the Africa-BB-Maps project implementation.	Medium	High	High	Invest in structured capacity-building programmes, strengthen institutional governance, embed bilingual documentation, and align reporting with global benchmarks.

An elaboration of the risks, ownership, and time horizon are shown in Table 02.

Table 0 2. Risk elaboration, mitigation and ownership

Risk area	Likelihood	Severity/ impact	Overall risk	Mitigations	Owner	Time horizon
Policy	Medium–High	High	High	Harmonize broadband policy with National Digital Master Plan 2022-2032; Create interagency governance charter; Embed KPI review cadence.	MICDE/CA	Short–medium term
Legislation	Medium	High	High	Draft targeted statutory clauses for mandatory operator (or data owner) reporting, audit rights, and lawful geospatial use;	Parliament/ AG/ MICDE;	Medium term
Regulations	High	High	Very high	Publish unified reporting schema, SLAs, automated validation and penalties; define coverage/speed tiers and QoS reporting;	CA	Short-term
Technical and infrastructure	Medium–High	High	Very high	Adopt modular reference architecture (APIs, ETL, geospatial DB); enforce OGC/GeoJSON/OFDS standards; security, DR, and verification pipelines;	CA MCDAs MNOs ISPs	Short-term
Funding	Medium–High	High	Very high	Secure multi-year O&M lines; blended finance (exchequer, USF, donors/DFIs); in-kind operator contributions; KPI-linked disbursements;	Treasury/ MICDE/ Development partners	Short–medium term
Stakeholder coordination and engagement	High	Medium–High	Very high	Constitute empowered steering committee; thematic TWGs; county onboarding plan; public engagement and data dictionaries;	CA/MICDE; MCDAs	Short-term
Capacity building	High	Medium	High	Competency framework; accredited GIS/data courses; micro-credentials; SOPs and secondments;	CA/ITU/ Universities/ trainers	Short–medium term

7. Short-Term / Immediate Priorities for Kenya Africa-BB-Maps

a) Convene the National Broadband Mapping Working Group (NWG) to establish statutory provisions and coordination mechanisms.

b) Conduct baseline broadband mapping exercises to capture current coverage, access gaps, and affordability indicators.

c) Deploy pilot GIS infrastructure to test geospatial mapping capabilities.

d) Develop data templates for statutory extracts, dashboards, and Board submissions.

e) Engage key stakeholders in consultations to ensure inclusivity and legitimacy.

f) Secure technical partnerships with ITU, GSMA, UNESCO, and OECD to align with global benchmarks.

8. Next Steps

a) *Quick next steps* - Based on the risk analysis, the following are the recommended next quick actions:

- Present the framework and roadmap to authorities for endorsement and integration into national broadband strategies;
- Publish unified reporting scheme and form the Africa-BB-Maps steering committee (CA/MICDE lead) (**Immediate: 30–90 days);**
- Lock multi-year funding commitments; adopt OFDS and API specs; begin targeted legal drafting (**Short term: 3–9 months);**
- Deploy enterprise mapping stack, run validation audits, and roll out accredited capacity programs (**Medium term: 9–24 months).**

b) *Robust GIS Platform***:** Scale up deployment of a national GIS platform with cloud-based servers, analytical tools, and interoperability features to ensure accuracy and sustainability of broadband mapping (**6–12 months**). Initial deployment of cloud-based servers and analytical tools can begin within the first 6 months, with full national GIS platform scaling and interoperability features operational by 12 months.

c) *Capacity Building***:** Implement structured training programmes for government agencies, regulators, and institutions to strengthen technical expertise in geospatial analysis, data governance, and reporting (**3–18 months (ongoing thereafter**)). Early training programmes for government agencies and regulators should start within 3 months. Structured, phased training cycles continue over 18 months, with refresher and advanced modules embedded as ongoing institutional practice.

d) *Resource mobilisation:* Secure funding from national budgets, regional development banks, and international partners to sustain infrastructure, capacity building, and stakeholder engagement **(0–12 months (continuous thereafter)).** Immediate mobilisation efforts should begin at project inception (month 0), targeting national budget allocations and donor engagement. Regional development banks and international partners should be secured within the first year, with resource mobilisation continuing as a rolling activity.

e) *Initiate regional dialogues to harmonise Kenya's Africa-BB-Maps with continental initiatives* (**6–18 months)**. Preparatory consultations can begin by month 6, leading to formal regional dialogues and harmonisation workshops between months 12–18. This aligns Kenya's Africa-BB-Maps with continental initiatives under AU/ITU frameworks.

f) *Establish monitoring mechanisms to track progress against KPIs and statutory compliance* (**12–24 months).** KPI dashboards and statutory compliance tracking systems should be designed and piloted by month 12, with full institutional integration and periodic reporting cycles operational by 24 months.

9. Evidence-based policymaking, regional harmonisation, and digital equity

Kenya's Broadband Mapping initiative represents a decisive step towards evidence-based policymaking, regional harmonisation, and digital equity. Anchored in global best practices from the

ITU and European Union, and strengthened by clear statutory alignment, robust GIS infrastructure, and inclusive stakeholder coordination, the initiative provides a comprehensive roadmap for bridging connectivity gaps and advancing sustainable development. By prioritising immediate actions, mobilising resources, and investing in institutional readiness, Kenya positions itself as a continental leader in broadband mapping and digital transformation. The integration of capacity building, and risk management ensures that the initiative is also resilient, scalable, and aligned with global benchmarks. Ultimately, Kenya's broadband mapping initiative transforms broadband mapping from a technical exercise into a strategic instrument for national progress and regional integration.

1. Introduction

1.1 Purpose and Objectives of the Project

Africa's internet connectivity is significantly lower than the global average, with only 38% of the population online in 2024 compared to a 68% global rate though the continent is experiencing the fastest internet growth in the world[2]. Africa-BB-Maps is an International Telecommunication Union, ITU-led initiative supported by the European Commission (EC), designed to accelerate digital transformation across Africa. The project focuses on establishing national broadband mapping systems that provide data-driven insights, guide investment strategies, and identify connectivity gaps. By integrating broadband mapping into national digital policies, the initiative aims to enhance digital infrastructure, promote equitable access to connectivity, and drive socio-economic development.

The project benefits eleven Sub-Saharan African countries (Benin, Botswana, Burundi, Côte d'Ivoire, Ethiopia, Kenya, Malawi, Nigeria, Uganda, Zambia, and Zimbabwe), which will utilise broadband mapping to address challenges related to internet coverage, quality, and affordability. These systems will enable evidence-based policymaking and strategic investment planning, thus contributing to more inclusive and efficient digital ecosystems.

Africa-BB-Maps also serves as a platform for collaboration between European and African national regulatory authorities (NRAs), promoting knowledge exchange, capacity building, best practices, and policy innovation. It represents a key milestone in leveraging European expertise to support Africa's digital transformation agenda, fostering mutual learning and long-term partnerships across regions.

The following are the core objectives of the Africa-BB-Maps Project are to:

i. *Identify connectivity gaps* by mapping broadband infrastructure to pinpoint unserved and underserved areas in terms of coverage, quality, and affordability[3].
ii. *Support evidence-based policy* by providing reliable data to government policy makers and regulators to design targeted interventions for bridging the digital divide[4].
iii. *Facilitate resource allocation* by providing evidence-based data to guide more efficient investment decisions by showing where infrastructure is most needed[5].
iv. *Promote harmonization* by establishing standardized mapping systems across 11 African countries (Benin, Botswana, Burundi, Côte d'Ivoire, Ethiopia, Kenya, Malawi, Nigeria, Uganda, Zambia, and Zimbabwe)[6].
v. *Accelerate digital inclusion* by making broadband access more transparent, thus ensuring equitable connectivity for rural and urban populations[7].
vi. Build local capacity for data collection and analysis

[2] International Telecommunication Union. (2024). *Measuring digital development: Facts and Figures 2024*. ITU. https://www.itu.int/itu-d/reports/statistics/facts-figures-2024/

[3] Developing Telecoms. (2024, July 8). *ITU launches Africa Broadband Maps to identify connectivity gaps*. https://developingtelecoms.com/telecom-business/humanitarian-communications/16966-itu-launches-africa-broadband-maps-to-identify-connectivity-gaps.html

[4] International Telecommunication Union. (2025, March 26–27). *Implementing national broadband mapping systems in Africa*. ITU Digital Impact Unlocked. https://www.itu.int/itu-d/sites/digital-impact-unlocked/implementing-national-broadband-mapping-systems-in-africa/

[5] ibid

[6] ibid

[7] Kenya News Agency. (2025, August 25). *Kenya, EU and ITU launch broadband mapping project to bridge digital divide*. https://www.kenyanews.go.ke/kenya-eu-and-itu-launch-broadband-mapping-project-to-bridge-digital-divide/

vii. Promote interoperability and regional integration of mapping tools

A central component of this initiative is the policy and regulatory workstream which supports countries in aligning policies and frameworks governing broadband mapping, interoperability, and data governance.

The project is of strategic importance because, funded by the European Union and implemented by ITU it reflects international collaboration for Africa's digital transformation[8]. Furthermore, it will enable *data-driven planning* where governments can use the maps to prioritize infrastructure rollouts, especially in rural and low-income areas[9]. Additionally, it supports *regional integration* since harmonized systems will make it easier to compare progress across countries and align country-level initiatives with continental strategies such as the African Union's Digital Transformation Strategy.

This report covers policy analysis component across the three thematic areas of the project, namely:

- Policy and Regulation of Broadband Mapping
- Data Governance and Interoperability Frameworks
- Institutional Capacity and Regional Harmonisation

1.2 Methodology and Approach

The preparation of this policy and regulatory report followed a structured, multi-layered methodology combining international best practice, national inputs, and comparative regulatory analysis. The approach was designed to ensure robustness, accuracy, and contextual relevance, drawing on both qualitative and quantitative evidence. The methodological process consisted of five main components namely, application of expertise and experience of the project team, literature review and best practice benchmarking with European implementations of broadband mapping, review of the Africa Broadband Mapping launch report for Kenya, review of workshop presentations and videos, administration of an online questionnaire, stakeholder engagement and consultations, and internal reviews by the Communications Authority (CA). The following sub-sections outline the specific methods used in developing this policy report.

1.2.1 Expertise and experience brought by the project team

The ITU/Kenya expert team drew on extensive experience and proven methodologies from previous broadband mapping initiatives to inform the development of this policy report. This included expertise and experience from:

- The design and implementation of the EU compendium of case studies on national broadband mapping systems;
- The development of legal and regulatory frameworks for mandatory data reporting, data validation procedures, and interoperability standards;
- Advisory work supporting broadband development initiatives across the EAC and SADC regions; and
- Contributions to ITU guidelines, case studies, and regulatory toolkits on broadband mapping and geospatial data governance, ensuring alignment with global standards and ITU best practices.

[8] ibid
[9] ibid

This practical experience directly shaped the analytical framework, informed the stakeholder engagement and consultation approach, and supported the identification of data, regulatory, and institutional requirements relevant to the Kenyan context.

1.2.2 Literature review

The literature review drew on a wide range of published and unpublished materials from national, regional, and international sources. The review focused on existing documentation on broadband mapping systems in Kenya, with a particular emphasis on international best practices from the ITU and European Union's broadband mapping country policy reports.

From a national perspective, key documents pertinent to Kenya broadband mapping that were reviewed included the Africa Broadband Maps project workshop and launch reports, Kenya's National Broadband Strategy (NBS), National Digital Master Plan 2022-2032, Kenya Open Data Policy, Data Protection Act (2019), Kenya's Medium-Term Plans and Kenya Vision 2030, The Constitution of Kenya (2010), Academic literature and geospatial data governance reports among others. Furthermore, a comprehensive literature review was conducted with a primary focus on:

a) **ITU publications and materials**

The materials include, but were not limited to:

- *Guidelines to Establish or Strengthen National Broadband Mapping Systems (2022)*
- the *ITU Compendium of Case Studies on Broadband Mapping Systems* (2024)
- ITU Academy technical resources on broadband mapping
- materials and outputs from the Africa-BB-Maps regional workshop in Abidjan (March 2025)

These publications provided the conceptual and methodological backbone for evaluating Kenya's maturity, gaps, and opportunities.

b) **European frameworks**

The review also incorporated EU/BEREC documentation to enrich the regulatory dimension, particularly in relation to:

- the European Electronic Communications Code (EECC),
- the Gigabit Infrastructure Act (GIA),
- the EU Connectivity Toolbox,
- BEREC guidelines and reports on infrastructure mapping and data transparency.

These materials supported the development of recommendations for policy, data governance, reporting obligations, interoperability, and cross-sector coordination.

The synthesis was to examine existing broadband mapping systems and regulatory frameworks; identify current gaps, weaknesses, and challenges; assess Kenya's progress, milestones, and institutional arrangements; compare Kenya's ecosystem with international best practices; generate insights to inform new perspectives; and formulate practical recommendations for establishing/strengthening broadband mapping systems in Kenya. Through a triangulated synthesis of these materials, the review provided the contextual and theoretical foundation upon which the policy analysis and recommendations were developed.

1.2.3 National Inputs and Stakeholder Engagement

Stakeholder engagement activities included identifying and contacting relevant institutions, seeking consent for participation, communicating objectives, timelines, and expectations, and building consensus, and trust throughout the consultation process.

a) *Meetings with the Communications Authority of Kenya (CA)*

Multiple meetings were held with CA leadership and technical teams, including:

- project coordination sessions,
- discussions on legal mandates, existing data flows, infrastructure visibility,
- clarifications on CA's internal capacity, GIS capabilities, and institutional constraints,
- exchanges regarding data collection practices and operator reporting.

b) *Kenya National Africa-BB-Maps Event (August 2025)*

The national three-day event served as a major methodological component, providing:

- high-level strategic orientation from CA, Government, and ITU,
- detailed technical inputs from operators, utilities, and public agencies,
- insights into existing datasets, systems, bottlenecks, and expectations,
- discussions on governance, data sharing, interoperability, and critical infrastructure,
- co-creation sessions producing stakeholder roles, technical requirements, and roadmap elements.

The perspectives collected during the event constitute a core evidence base for the analysis in this report.

c) *Pre-event National Questionnaire (CA, 2025)*

A structured questionnaire—completed by CA prior to the national event—provided foundational information about CA's current broadband ecosystem, including:

- legal and regulatory frameworks,
- data collection mechanisms,
- operator compliance,
- availability of broadband coverage and infrastructure datasets,
- institutional capacity,
- national targets and rural connectivity conditions.

The foundational in formation from CA revealed that the Kenya Africa-BB-Maps were "advanced". The full questionnaire is included in the Annex 1. Its responses were used to determine Kenya's baseline broadband mapping maturity and to shape the analytical structure of this report.

d) *Stakeholder Invitations and Thematic Questionnaires (January 2026)*

Ahead of the January 2026 stakeholder coordination meetings, ITU and CA prepared and circulated targeted questionnaires (see Annex 1) tailored to:

- ICT regulator, CA

- Operators and infrastructure providers – the private sector- including Mobile Network Operators (MNOs) and ISPs
- Government and parastatal institutions, including Ministry of ICT and Digital Economy and Government agencies such as the ICT Authority
- Academia and Civil Society Organisations (CSOs)
- Development partners and regional organisations

The official target list provided by CA comprised institutions who participated in the Broadband maps launch workshop, some of who comprise the National Working Group which was formed during the Africa broadband Mapping Workshop. This list was expanded to include additional actors to ensure inclusivity and comprehensive representation.

The online questionnaire was administered via the KoboToolbox platform. The questionnaire adopted a qualitative, open-ended format designed to capture in-depth perspectives, explore emerging issues, and assess the broader status of broadband mapping in Kenya. The tool was designed to capture data on current practices, challenges, institutional arrangements, and technical capacities. It enabled a comparative and evidence-driven assessment of the status of broadband mapping in Kenya. Responses were systematically analysed. The input form this questionnaire will be used to update the draft report.

These instruments aimed to acquire more detailed and group-specific insights into data availability, technical standards, reporting capacity, legal concerns, and interoperability challenges. Responses will be integrated into later phases of the Africa-BB-Maps: Kenya workstream and referenced in subsequent versions of the policy analysis.

1.2.4 Consultations with Communication Authority on findings and draft policy report

Consultations were held with CA where the ITU team received invaluable input and incorporated them in the policy report. Furthermore, the ITU team made a presentation of Africa-BB-Maps project to the Kenya National Broad Strategy 2025-2030 steering committee of the Ministry of ICT and Digital Economy (Naivasha, December 8-9, 2025) and explained how it fits into the overall national broadband strategy. During this meeting, the steering committee was updated on the progress of the Africa-BB-Maps project and proposals made to be considered by the Committee for inclusion into the Kenya National Broadband Strategy to ensure that Africa-BB-Maps are effectively anchored in the strategy to ensure the success of the Africa-BB-Maps initiative. The Committee, of which CA is a member, provided comments which were incorporated into the policy report, including to strengthen the policy, legal, regulatory and coordination mechanisms for the success of the Africa-BB-Maps project.

1.2.5 Integrated Analytical Framework

All the described inputs were synthesised into a unified assessment organised along the three thematic areas of the Africa-BB-Maps initiative, namely:

1. Policy and Regulation of Broadband Mapping
2. Data Governance and Interoperability Frameworks
3. Institutional Capacity and Regional Harmonisation

The methodological approach ensured:

- triangulation of diverse data sources (literature, stakeholder input, questionnaire data, event discussions),
- consistency with ITU guidelines and international best practice,

- contextualisation to Kenya's national policies, infrastructure landscape, and institutional roles,
- alignment with the Africa-BB-Maps roadmap and upcoming technical development activities.

This report extensively draws on the Africa Broadband Mapping Launch Report prepared jointly by CA and ITU. This report provided critical insights into Kenya's challenges in broadband mapping; contributions by CA, Government agencies, private sector, civil society, and development partners; as well as progress achieved to date in establishing and operationalizing broadband mapping initiatives. The workshop's outputs included practical, actionable recommendations that informed key components of this policy analysis.

1.3 Structure of the Report

This report is organised into 11 section with annexes containing additional information. Chapter 1 presents an introduction to broadband maps, highlighting the purpose and objectives of the broadband mapping project as well as the methodology and approach that have been used to develop this report. In Chapter 2, the policy and strategic context of the project is presented from an international perspective to the Kenya national context highlighting best practices from Europe that can be leveraged locally. Chapter 3 provides a countrywide assessment and justification for broadband maps; it includes geographic and institutional overview, economic and telecom market of overview, broadband development to date, existing broadband mapping initiatives, stakeholder engagement and collaboration, as well an assessment of the impact of broadband mapping in Kenya.

While Chapter 4 covers policy and regulatory assessment for Kenya as well as gaps and challenges in relation to Africa-BB-Maps, Chapter 5 deals with data governance, institutional capacity and regional harmonisation aspects. Chapter 6 covers institutional capacity including their relevant stakeholders and institutional roles, human and technical capacity development, and institutional coordination mechanisms.

The seventh chapter is dedicated to proposals and recommendations to move the broadband maps initiative forward. It includes policy and strategic recommendations, implementation roadmap, and monitoring and evaluation framework. Furthermore, risk analysis and mitigation strategies pertinent to Kenya broadband maps initiative are represented in Chapter 8; the risks are analysed across policy, legal compliance, regulatory, technical and infrastructure, funding, stakeholder coordination, and capacity building dimensions of the initiatives.

Chapter 9 is dedicated to funding and resource mobilisation while Chapter 10 examines sustainability and long-term vision of the project. The last chapter (Chapter 11) is a conclusion of the report highlighting the purpose, methodology, as well the policy, legal and regulatory anchorage for broadband maps in Kenya. It underscores the centrality of institutional readiness as the cornerstone for the successful rollout of the broadband maps' initiatives in Kenya. It presents importance of the national working group, institutional clarity and alignment with the continental and global benchmarks. Additionally, long-term sustainability of the initiative rests on embedding broadband mapping as a statutory function within the Communication Authority of Kenya, securing multi stakeholder funding, fostering regional collaboration institutionalising robust GIS platforms, capacity building and standards.

2. Policy and Strategic Context

2.1 International Framework: ITU and EU Policy Directions

This chapter presents the current strategic and legislative framework, with an emphasis on mapping and its impact on mapping processes within the EU, which is regarded as one of the key global actors in this domain. The chapter helps to clarify the original context of the document. The second part of the Chapter comprises the Kenya National context of broadband mapping and best practice lessons from Slovenia.

2.1.1 Strategic framework

2.1.1.1 European Digital Decade

In its communication of 9 March 2021 entitled "2030 Digital Compass: The European way for the Digital Decade"[10] the Commission laid out its vision for 2030 to empower citizens and businesses through digital transformation (the "Digital Decade"). The Union's path to the digital transformation of the economy and society should encompass digital sovereignty in an open manner, respect for fundamental rights, the rule of law and democracy, inclusion, accessibility, equality, sustainability, resilience, security, improving quality of life, the availability of services and respect for citizens' rights and aspirations. It should contribute to a dynamic, resource-efficient, and fair economy and society in the Union. The European Digital Decade is therefore European Union's strategic vision for guiding the digital transformation of the EU between 2020 and 2030.

2.1.1.2 Digital Decade Policy Programme 2030

Digital Decade Policy Programme 2030[11] is part of the Europe's Digital Decade framework. In fact, the Digital Decade Policy Programme 2030 is the specific policy-programme that operationalises the vision of the European Digital Decade. It was formally established by Decision (EU) 2022/2481 of the European Parliament and of the Council, adopted on 14 December 2022 and published in the Official Journal of the EU on 19 December 2022. The Decision entered into force on 8 January 2023, officially launching the Digital Decade Policy Programme 2030. This programme builds upon earlier digital initiatives and provides the EU with a binding structure for achieving a digitally empowered, competitive, and sovereign Europe.

The purpose of the Digital Decade is to articulate a common vision for Europe's digital future, strengthen the EU's technological capacity, and ensure that digital transformation is human-centred, inclusive, and aligned with European values. It responds to global shifts in technology, competitiveness, and digital sovereignty, positioning the EU as a leading global actor in areas such as secure digital infrastructure, digital skills, and interoperable public services. The programme establishes a coordinated governance mechanism in which the European Commission and Member States work jointly to meet shared objectives through national Digital Decade strategic roadmaps and annual progress monitoring.

The governance framework is built around the "Path to the Digital Decade," which defines cooperation cycles based on annual progress reports, the Digital Economy and Society Index (DESI), and periodic assessments of Member State performance. This mechanism ensures transparency, comparability, and accountability. It also enables corrective action where necessary and promotes cross-border collaboration, particularly through multi-country projects. These projects are essential for developing Europe-wide digital infrastructure and capabilities—such as secure data processing, next-generation cloud-edge systems, high-performance computing, advanced semiconductors, cybersecurity capacities, and interoperable public administration platforms.

At its core, the Digital Decade sets four key pillars, each with specific quantitative targets for 2030:

[10] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0118

[11] https://eur-lex.europa.eu/eli/dec/2022/2481/oj/eng

a) Digital Skills

At least 80% of EU adults should possess basic digital skills, while the Union aims to reach 20 million employed ICT specialists. The goal is to reduce skill gaps and ensure that workers and citizens can participate fully in the digital society.

b) Secure and Sustainable Digital Infrastructure

Targets include gigabit connectivity for all households, universal 5G coverage for populated areas, doubling Europe's share of global semiconductor production, and deploying 10,000 climate-neutral edge nodes. These targets aim to strengthen Europe's digital sovereignty and resilience.

c) Digital Transformation of Businesses

By 2030, 75% of European businesses should adopt advanced digital technologies such as artificial intelligence, cloud computing, and big data. Additionally, more than 90% of SMEs should reach at least a basic level of digital intensity to remain competitive in a global market.

d) Digitalisation of Public Services

All key public services should be fully accessible online, allowing citizens and businesses to interact with public administrations efficiently and securely. A particularly important milestone is enabling all EU citizens to access digital health records across borders, supporting a more integrated and interoperable health ecosystem.

2.1.1.3 Global Gateway Strategy of the European Union

In 2021, the European Commission and the EU High Representative launched the Global Gateway[12], a new European strategy to boost smart, clean and secure links in digital, energy and transport sectors, while also strengthening health, education and research systems across the world. Since 2021, Team Europe has mobilised over €306 billion of investments that support sustainable and high-quality projects, addressing the needs of partner countries and ensuring lasting benefits for local communities. This has allowed EU's partners to (1) develop their societies and economies and (2) to create opportunities for the private sector in the EU to invest and remain competitive, whilst upholding the highest environmental and labour standards, as well as sound financial management. The Global Gateway is the EU's contribution to narrowing the global investment gap. It reflects the commitment of the G7 leaders in June 2021 to launch a values-driven, high-standard and transparent infrastructure partnership to meet global infrastructure development needs. The Global Gateway is also fully aligned with the UN's Agenda 2030 and its Sustainable Development Goals, as well as the Paris Agreement. A first milestone of the Global Gateway was the Africa-Europe Investment Package, with approximately €150 billion of investment dedicated to strengthening partnerships with Africa. Europe has also started implementing Global Gateway in Asia and the Pacific and in Latin America and the Caribbean. In 2023, ninety key projects were launched worldwide across the digital, energy and transport sectors, while also advancing health, education, and research systems globally.

Global Gateway partnerships are based on next six (6) principles: (1) Democratic values and high standards, (2) Good governance and transparency, (3) Equal partnerships, (4) Green and clean, (5) Security focused and (6) Catalysing private sector investment.

2.1.1.4 The European Green Deal

The European Green Deal[13] is transforming the EU into a modern, resource-efficient and competitive economy. Launched by President von der Leyen in 2019, it responds to citizens' urgent call—especially from young people—for climate action. It sets out a plan to transform Europe's economy, energy, transport, and industries for a more sustainable future. It aims to cut emissions by at least 50% by 2030, rising towards 55%, while legally binding the 2050 neutrality goal through the European Climate

[12] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021JC0030

[13] https://www.esdn.eu/fileadmin/ESDN_Reports/ESDN_Report_2_2020.pdf

Law. It pushes forward a clean transition that protects people and planet, is economically sound, and socially fair. The Green Deal invests in innovation, clean technology, and green infrastructure while ensuring a just transition for the communities most affected. As a result of the European Green Deal, Europeans enjoy cleaner air and more energy efficient products and homes. They are also drawing on more renewable energy sources to power their lives. The following policy priority promises of the Deal are also published[14]: (1) climate neutrality and emissions reduction; (2) financing through NextGenerationEU and REPowerEU; (3) just and fair transition; (4) carbon pricing and industrial reform; (5) clean and secure energy; (6) green industrial competitiveness; (7) circular economy; and (8) stakeholder engagement.

2.1.1.5 Competitiveness compass

In January 2025, the European Commission presented the competitiveness compass[15], a new roadmap to restore Europe's dynamism and boost our economic growth. The compass builds on the analysis of Mario Draghi's report on the future of European competitiveness[16], which identified three necessities for the EU to boost its competitiveness: (1) Closing the innovation gap, (2) Decarbonising our economy and (3) Reducing dependencies. The compass sets out an approach to translate these necessities into reality.

To close the innovation gap, it focuses on creating a friendly environment for young companies to start and expand, supported by a dedicated EU start-up and scale-up strategy; helping big companies adopt new technologies such as artificial intelligence (AI) and robotics through the Apply AI strategy; making it easier for companies to operate across the EU by simplifying rules and laws, including a proposal for a 28th legal regime that will guarantee one set of rules across the EU; and supporting the development of new technologies with action plans for quantum, advanced materials, biotech, robotics, and space technologies.

To decarbonise the economy, the Compass proposes putting forward the Clean Industrial Deal to help reduce carbon emissions, especially for energy-intensive companies, presenting tailor-made action plans for vulnerable sectors such as chemicals, steel, and metals, and developing an affordable energy action plan to help bring down energy prices and costs.

To reduce dependencies, it highlights the EU's existing network of trade agreements covering 76 countries and outlines measures to diversify and strengthen supply chains, including developing new clean trade and investment partnerships to secure raw materials, clean energy, sustainable transport fuels, and clean tech, as well as reviewing public procurement rules to introduce a European preference in critical sectors and technologies.

To complement these three pillars, the competitiveness compass introduces five horizontal enablers to increase competitiveness across all sectors. These are: (1) Cutting red tape, (2) Removing barriers in the single market, (3) Enabling more efficient financing, (4) Promoting skills and quality jobs and (5) Ensuring better coordination.

2.1.1.6 Strategic mapping relevance

The 2030 Digital Compass (European Digital Decade) identifies mapping as a key tool for monitoring, analysis, and strategic planning of digital projects, infrastructure, skills, and the digital transformation of businesses across the EU. Without precise mapping, it would be difficult to track progress towards the objectives of the Digital Decade. The Decision (EU) 2022/2481 establishes the Digital Decade Policy Programme 2030, providing a governance framework for the EU's digital transformation, which sets

[14] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
[15] https://european-research-area.ec.europa.eu/sites/default/files/documents/2025-01/COM%202025%2030%20-%20A%20Competitiveness%20Compass%20for%20the%20EU%20_%2029-1-2025.pdf
[16] https://commission.europa.eu/topics/competitiveness/draghi-report_en

clear objectives across four key areas: digital skills, infrastructure, business digitalisation, and public service digitalisation. Mapping as a central tool within this framework, enabling the Commission and Member States to monitor progress, identify gaps, and strategically plan initiatives. Tools such as national roadmaps and the Digital Economy and Society Index (DESI) allow for precise mapping of digital capabilities and the tracking of progress towards the 2030 targets. The European Green Deal sets out the Commission's vision for transforming the EU into a modern, resource-efficient and competitive economy. Within this framework, mapping functions as a vital tool to identify, monitor and optimise the deployment of sustainable infrastructure, clean energy systems, circular economy practices and digital innovations. By systematically mapping existing capabilities, resource use and transition pathways, the Union can track progress, close gaps and align investments with its sustainability objectives.

Additionally, a Competitiveness Compass for the EU, issued by the European Commission on 29 January 2025, sets out a forward-looking framework to enhance Europe's competitiveness by addressing innovation, decarbonisation and strategic dependencies. Within this framework, mapping plays a vital role in identifying barriers, monitoring structural weaknesses and aligning policies across Member States and sectors. Through precise mapping of digital, industrial and skills-related capabilities, the EU can strategically direct reforms, investments and cross-border collaboration to ensure the conditions for innovation-led productivity and resilience.

Legislative framework, specifically key electronic communications laws and guidelines related and with an emphasis on mapping will be presented in the sub-chapter that follows.

2.1.2 Legislative framework

2.1.2.1 European Electronic Communications Code

The European Commission published a draft Directive establishing the European Electronic Communications Code (EECC) on 14 September 2016[[17] as a first review of the EU regulatory framework for electronic communications since 2008. The EECC was part of the Digital Single Market strategy as the Commission's overarching strategy on digital issues for 2015–2020.

Directive (EU) 2018/1972 establishing the EECC[18] constitutes a comprehensive and modernised regulatory framework governing electronic communications networks, electronic communications services, associated facilities and associated services within the European Union. The Directive was adopted on 11 December 2018, published in the Official Journal on 17 December 2018, and entered into force on 20 December 2018. Member States were required to transpose its provisions into national law by 21 December 2020, with certain end-user protection provisions foreseen to be aligned by the end of 2021. The overarching purpose of the Directive is to ensure a harmonised regulatory approach across the Union, promoting connectivity, access to and take-up of very high-capacity networks (VHCN's), fostering sustainable competition, supporting innovation and the internal market, and strengthening the rights of end-users. The Code simultaneously places strong emphasis on the security, resilience and continuity of electronic communications networks and services, and on ensuring accessibility and equitable treatment for all categories of end-users, including vulnerable users and persons with disabilities.

Article 3 of the Directive sets out the general objectives that Member States, national regulatory authorities (NRAs), and other competent authorities must pursue when implementing the EECC. The foremost objective is to promote competition in the provision of electronic communications networks, electronic communications services and associated facilities, including effective and sustainable investment and innovation. This includes promoting the deployment and take-up of VHCN's and

[17] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2016:0590:FIN
[18] https://eur-lex.europa.eu/eli/dir/2018/1972/oj/eng

ensuring that regulation is proportionate, technology-neutral, predictable and aimed at supporting long-term investment incentives while securing efficient use of radio spectrum, numbering resources and other essential facilities.

A further key objective under Article 3 is to develop the internal market by removing remaining obstacles to the provision of electronic communications networks and services across the Union, encouraging harmonised regulatory approaches, interoperability and cross-border services, and ensuring consistent application of the regulatory framework in cooperation with Body of European Regulators for Electronic Communications (BEREC)[19]. The Directive also emphasises the need to promote the interests of end-users by ensuring widespread availability, affordability, high quality and security of electronic communications services; strengthening end-users' rights; and ensuring equivalent access and choice, including for end-users with disabilities. Moreover, NRAs and other competent authorities must contribute to ensuring a high level of security and resilience of networks and services, and to the efficient management of spectrum and numbering resources. Article 3 therefore establishes a balanced regulatory foundation combining competitive dynamics, investment incentives, end-user protection and strategic development of high-capacity connectivity across the Union.

Several provisions of the EECC directly establish or reinforce the regulatory framework for broadband mapping in the Union. These articles define obligations for information gathering, geographical surveys, the use of mapping results in market regulation and universal service, and cooperation between national authorities. Collectively, they confirm that accurate, consistent and up-to-date geographical information on electronic communications networks constitutes a core regulatory tool for ensuring effective competition, targeted public intervention, and evidence-based policy-making. These are:

- **Article 20 – Information requests to undertakings**

Article 20 introduces a strengthened and harmonised legal basis enabling Member States to ensure that providers of electronic communications networks and services supply all information necessary for competent authorities and BEREC to verify compliance with the EECC. This includes information on current network coverage, technical characteristics and financial plans related to future deployment. The provision obliges undertakings to respond to such requests in a timely manner and allows authorities to impose confidentiality requirements where appropriate. The article complements and reinforces the Broadband Cost Reduction Directive by formalising the information-gathering powers of NRAs and other competent authorities.

- **Article 22 – Geographical surveys of network deployments**

Article 22 establishes a mandatory obligation for national regulatory authorities and/or other competent authorities to conduct a geographical survey of broadband networks capable of delivering electronic communications by 21 December 2023, with updates required at least every three years thereafter. The provision clearly defines the objective of mapping the reach and performance of electronic communications networks across the Union. It requires BEREC to issue guidelines to ensure consistent application of survey methodologies. Article 22 thus creates an EU-wide legal obligation for broadband mapping, significantly strengthening earlier non-binding requirements such as those in the 2013 State aid guidelines. Member States may impose penalties on undertakings that submit misleading, erroneous or incomplete information (Article 29).

- **Articles 64–67 – Market analysis and c**

These articles govern the SMP framework and require NRAs to conduct market analyses based on objective criteria reflecting the state of competition in clearly defined markets. Where relevant, Article 64 explicitly states that geographical surveys must be taken into account when delineating markets and assessing competitive conditions. The results of mapping (geographical market definition)

[19] Established by **Regulation (EU) 2018/1971**, which sets out its objectives, functions, governance, and legal authority.

therefore serve as an input to identifying competitive and non-competitive areas, supporting proportionate and geographically targeted SMP obligations.

- **Article 73 – Cooperation with other competent authorities**

Article 73 requires NRAs to cooperate closely with other competent authorities, including authorities responsible for radio spectrum management, competition authorities and other bodies involved in the implementation of Union law. For broadband mapping, this cooperation is essential because it enables coordination of data requirements, verification of information submitted by undertakings and the integration of mapping results into other regulatory processes. The article strengthens institutional coordination and ensures consistency in the application of the Code, including in relation to geographical information and network deployment data.

- **Article 76 – Regulatory treatment of new very high-capacity network elements**

Article 76 sets out a specific regulatory framework for co-investment offers proposed by operators with significant market power for the deployment of new very high-capacity network elements. The article requires BEREC to publish guidelines to ensure NRAs apply the assessment criteria consistently. Although not exclusively about mapping, Article 76 directly relies on information on planned and existing network deployments, meaning that accurate geographical survey information supports the evaluation of co-investment commitments, eligibility conditions and the sustainability of competitive outcomes.

- **Articles 84–92 – Universal service obligations (USO)**

These provisions govern universal service obligations, including the requirement for Member States to ensure the availability at a fixed location of adequate broadband Internet access. Article 85 explicitly requires competent authorities to take account of the results of geographical surveys when assessing the availability of adequate broadband at end-user premises. As with SMP regulation, the use of mapping results extends the function of geographical surveys to support evidence-based application of USO rules, funding mechanisms and targeted interventions where market coverage is insufficient.

Under Article 122, the European Commission is required to conduct a review of the functioning of the Code and report to the European Parliament and the Council. This review includes an examination of whether the regulatory framework—such as that governing information gathering, geographical surveys, market regulation and universal service—is adequate to achieve the objectives of the Code.

2.1.2.2 State aid guidelines

The Guidelines on State Aid for Broadband Networks published by the European Commission on 31 January 2023[20] provide a modernised framework for the assessment and approval of public support measures to deploy and expand fixed and mobile broadband networks in the European Union. They reflect evolving market, policy and technological developments—especially the priorities of the EU Digital Decade and the transition to very high-capacity connectivity—and aim to ensure that Member States' broadband aid interventions are designed in a way that is compatible with the internal market and does not distort competition. The core purpose of the Guidelines is to guide Member States and national authorities in deploying public funds to support broadband infrastructure only where the market fails to deliver adequate connectivity, thereby addressing identified market failures, creating the necessary "step-change" in deployment and take-up of broadband services, and leveraging private investment rather than crowding it out. The Guidelines emphasise technology neutrality, transparency, proportionality and thorough mapping of coverage and performance (including the requirement for detailed mapping annexed to the Guidelines) to underpin public interventions.

[20] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52023XC0131%2801%29

Overall, these Guidelines serve to align public aid-based broadband deployment initiatives with the Union's strategic objectives of universal high-capacity connectivity, territorial cohesion, competition, innovation and investment efficiency.

2.1.2.3 Generalised Implementation Agreement - GIA

The Gigabit Infrastructure Act[21] establishes measures to reduce the cost of deploying gigabit electronic communications networks, and in doing so amends Regulation (EU) 2015/2120 and repeals Directive 2014/61/EU. The Regulation was adopted on 29 April 2024 and published in the Official Journal on 8 May 2024. It enters into force immediately, with most of its provisions applicable from 12 November 2025. The regulation applies directly in all Member States, without transposition, and sets minimum requirements that Member States may complement with national measures provided these comply with the Regulation. The overarching objective is to facilitate and accelerate the rollout of very-high-capacity networks (VHCNs) and to ensure the achievement of the Union's digital connectivity targets by reducing deployment costs, removing regulatory and administrative obstacles, promoting the reuse of existing physical infrastructure, and coordinating civil works.

The key features of the GIA[22] include: the extension of access obligations to physical infrastructure owned or controlled by utilities, public bodies, land-aggregators and other non-telecom undertakings; the obligation for competent authorities to establish a single-point electronic information system providing geo-referenced data on available infrastructure, permits and rights of way; and the introduction of tacit approval and streamlined permitting procedures to reduce administrative delay. In-building and new-building infrastructure obligations (including fibre-ready requirements) are also introduced to support fibre deployment and the transition to gigabit connectivity.

Overall, the GIA creates a harmonised framework across the Union aimed at enabling a faster, more cost-efficient deployment of gigabit networks, while fostering infrastructure sharing, enabling multi-operator access, ensuring transparency of physical infrastructure, and aligning regulatory requirements with the digital and sustainability policy goals of the Union.

2.1.2.4 Body of European Regulators for Electronic Communications

Under the EECC, BEREC[23] was explicitly tasked with supporting national regulatory authorities in the implementation of certain obligations related to broadband mapping and VHCN. In particular BEREC issued guidelines to assist national authorities in carrying out geographical surveys in a consistent and harmonised manner across the Union (Article 22), BEREC also plays a role in developing guidance related to the deployment of VHCNs, including best practices for access obligations and co-investment frameworks, as reflected in Articles 76 and 78.

(a) *Guidelines on conducting geographical surveys of network reach including procedural and verification guidelines*

Three sets of BEREC Guidelines are prepared to support National Regulatory Authorities (NRAs) and Other Competent Authorities (OCAs) in fulfilling their obligations under Article 22 of the EECC. These Guidelines cover: (i) the Core Guidelines on conducting geographical surveys of network reach[24]; (ii) Procedural Guidelines on the designation of areas, invitation of investment intentions and related

[21] https://eur-lex.europa.eu/eli/reg/2024/1309/oj/eng

[22] Generalised Implementation Agreement (GIA) is a formal instrument used within the European regulatory and standards environment

[23] BEREC is the EU's central coordination body for telecom regulators, ensuring harmonised rules, fair competition, and consumer protection across Europe. It plays a pivotal role in shaping broadband, 5G, and digital transformation policies.

[24] https://www.berec.europa.eu/sites/default/files/files/document_register_store/2020/3/BoR_%2820%29_42_Guidelines_BBgeoSurveys.pdf

processes[25]; and (iii) Verification Guidelines on ensuring the accuracy and reliability of submitted data[26]. Set of guidelines emphasises that geographical surveys are a key regulatory instrument to characterise the reach and performance of electronic communications networks capable of delivering broadband. They outline that surveys must collect data on current network capabilities and may include forecasts of network deployments, thereby supporting regulatory and policy decision-making, market definition, universal service obligations and public intervention.

Core guidelines provide detailed guidance on: definitions and data sources; spatial resolution of data (granularity); the elements of network connectivity and service performance to be collected for both fixed and mobile broadband; data collection frequency; Geographic Information System (GIS) requirements; forecast methodologies; data publication, confidentiality and aggregation. A significant element of guidelines is its treatment of the designation of "areas" where VHCNs are not planned or are unlikely, and the procedure by which competent authorities may invite undertakings and public bodies to declare their investment intentions in such areas.

Procedural Guidelines provides step-by-step flow diagrams and criteria for delimiting areas, publishing notices, collecting responses and disclosing outcomes — all in compliance with Article 22(2-4) of the EECC. In addition, the Verification Guidelines emphasise a four-step process for data accuracy: internal validation; third-party external checks; verification of declared service and infrastructure data; and decision-making on data correctness with publication of the methodology to enhance transparency and trust.

Overall, the set of guidelines promotes harmonisation across Member States in how geographical surveys are carried out, while recognising the need for proportionality and cost-effectiveness. By providing authoritative guidance on data specification, collection, verification and publication processes, it enables regulators to build robust broadband maps capable of supporting investment, regulatory intervention, market analyses and the achievement of the EU's connectivity and infrastructure policy objectives.

BEREC published an implementation report on the BEREC Guidelines on geographical surveys of network deployments[27], where concluded to update the Core Guidelines to take into account the implementation report findings and developments since 2020. The update is to be published in 2026.

The Core Guidelines have contributed to a substantial increase in the number of geographical surveys across the EU, as well as to improvements in their granularity, the quantity and breadth of information collected, and their comparability.

(**b**) Very High Capacity Networks

BEREC defines Very High Capacity Networks (VHCNs) in accordance with Article 82 of the European Electronic Communications Code (EECC) and issues guidelines to assist national regulatory authorities in determining when a network qualifies as a VHCN. A network is considered a VHCN if it meets at least one of several criteria, including: a fixed-line connection with fibre deployed to the building or premises (FTTB/FTTH), a wireless connection with fibre backhaul to the base station, or a network—

25 https://www.berec.europa.eu/sites/default/files/files/document_register_store/2021/3/BoR_%2821%29_32_BEREC_GL_Art22%282%2C3%2C4%29_clean.pdf

26 https://www.berec.europa.eu/sites/default/files/files/document_register_store/2021/6/BoR_%2821%29_82_BEREC_Guidelines_on_Verification_P2_2021_clean.pdf

27 https://www.berec.europa.eu/system/files/2024-10/BoR%20%2824%29%20146_Implementation%20report%20on%20the%20BEREC%20Guidelines%20on%20Geographical%20surveys%20of%20network%20deployments.pdf

fixed or wireless—that can deliver a defined level of quality of service under normal peak-time conditions. Furthermore, BEREC specifies performance thresholds for downlink and uplink speeds, latency, packet loss, and availability to ensure that VHCNs provide reliable, high-performance connectivity. The concept of VHCNs is central to the EECC regulatory framework, supporting long-term policy objectives by enabling resilient, high-capacity connectivity essential for innovation, economic development, and social cohesion across the Union. BEREC is mandated to update its VHCN Guidelines periodically to reflect technological developments and evolving network deployments. The BEREC Guidelines on Very High Capacity Networks (2023)[28] are to be updated at the end of 2025.

(c) *Gigabit Infrastructure Act (GIA) guidelines*

BEREC has published guidelines under the Gigabit Infrastructure Act (GIA) to support national regulatory authorities in implementing key provisions of the regulation. The Guidelines on the Coordination of Civil Works (Article 5(6) GIA)[29] provide guidance to ensure efficient planning and execution of civil works, minimise duplication of works, and reduce deployment costs for VHCNs. The Guidelines on Access to In-Building Infrastructure (Article 11(6) GIA)[30] set out practical principles for facilitating access to physical infrastructure within buildings, including technical, administrative, and procedural aspects, to enable faster and more cost-efficient VHCN deployment. In addition, BEREC is preparing guidance under Article 3 GIA, which governs access to existing physical infrastructure owned or controlled by network operators or public sector bodies.

2.1.3 Expected developments

2.1.3.1 Digital Networks Act (DNA) and the review of the EECC and BEREC's evaluation

The European Commission plans to adopt the Digital Networks Act (DNA) on 20 January 2026, alongside the outcome of the review of the EECC and BEREC's evaluation. The DNA aims to simplify and further harmonise the legal framework for electronic communications across the EU, with the objective of reinforcing competitiveness and promoting a more integrated single market. The Commission's proposal will be accompanied by an impact assessment, informed by the EECC evaluation, evidence collection, and stakeholder input, in line with Better Regulation guidelines. This assessment will also draw on the results of three dedicated studies commissioned by the Commission, covering access provisions and relevant markets, financing and regulatory implications, and regulatory enablers for cross-border networks.

2.1.3.2 Methodology on 5G Mobile and Fixed QoS Coverage Mapping

To support monitoring of the Digital Decade connectivity targets The European Commission plans to publish methodology for mapping the quality of service (QoS) of 5G networks across Europe, which holds high relevance for future connectivity mapping. The proposed methodology estimates theoretical QoS using a harmonised model applicable across all Member States and mobile operators, regardless of the 5G frequency band. It is designed to provide a more accurate representation of real network performance, particularly during peak-time usage, complementing existing indicators that currently do not capture such variations. The Commission is considering using this approach as the basis for a new key performance indicator (KPI) to support monitoring of the Digital Decade connectivity targets and to improve the targeting of EU funding instruments and future State Aid

[28] https://www.berec.europa.eu/system/files/2023-10/BoR%20%2823%29%20164%20FNE%20WG_Draft%20BEREC%20Guidelines%20on%20VHCNs.pdf

[29] https://www.berec.europa.eu/system/files/2025-10/BoR%20%2825%29%20140_BEREC%20Guidelines%20on%20the%20coordination%20of%20civil%20works%20according%20to%20Article%205%286%29%20of%20the%20Gigabit%20Infrastructure%20Act.pdf

[30] https://www.berec.europa.eu/system/files/2025-10/BoR%20%2825%29%20142_BEREC%20Guidelines%20on%20the%20access%20to%20in-building%20infrastructure%20according%20to%20Article%2011%286%29%20of%20the%20Gigabit%20Infrastructure%20Act.pdf

assessments. The draft was developed with input from academic experts, national regulators, BEREC, GSMA, and industry stakeholders, supported by pilot testing in several Member States.

2.1.3.4 The Omnibus Package

On 19 November 2025, the European Commission intends to publish draft legislation for an omnibus package designed to simplify, reduce bureaucracy, and harmonise various legal acts. The draft document identifies Geospatial data as one of the six thematic categories of High-Value Datasets listed in Annex I. These datasets must be made available by public sector bodies in open, machine-readable, standardised and reusable formats due to their significant societal and economic importance. Geospatial data are therefore recognised as a key category that enables a wide range of digital services, innovation, and analytical or mapping applications.

2.2 National Context: Slovenian Experience and Best practices

Kenya has emerged as one of the regional leaders in broadband mapping through its strategic participation in the Africa Broadband Mapping Systems (Africa-BB-Maps) project, jointly supported by the International Telecommunication Union (ITU) and the European Union (EU). This initiative aims to harmonize broadband data systems across 11 African countries, enabling evidence-based planning and investment in digital infrastructure[31]

Kenya has positioned itself at the forefront of this initiative, guided by its National Broadband Strategy (2018–2023) and the Communications Authority's mandate to expand broadband penetration to 100% by 2030. Consequently, Kenya is operationalising the project locally, including by assessing institutional and technical readiness, and aligning stakeholders on a roadmap for building a robust national broadband mapping system.

2.2.1 Broadband mapping experience and best practices

Kenya, through its Ministry of Information Communication and the Digital Economy (MICDE) has established various ICT policy and strategies to support the realization of its vision of becoming a digitally transformed nation. The established frameworks include the National ICT Policy, 2020, National Digital Master Plan 2022-2032 and the National Broadband Strategy 2018-2023.

Guided by the established ICT policies and strategies, the national ICT regulator, CA commenced the Broadband Infrastructure development and mapping efforts in 2004. This journey commenced with a study in 2004 that provided several recommendations, including the use of GIS to capture ICT infrastructure data. Since 2004, Kenya has made significant strides in the areas of ICT infrastructure roll-out and use of GIS. Subsequently, other studies have been conducted, including ICT Access Gap Studies in 2016 and 2021, that reported 3/4G coverage of 78% and later 96.3% respectively. The geographical 3/4G coverage was 17% in 2016, which significantly improved to 56.5% in 2021.

Through the Communications Authority of Kenya (CA), the country has developed a national platform aligned with its National Broadband Strategy 2023–2028.[32] The characteristics of the broadband mapping system are as follows:

a) *Institutional leadership and policy alignment.* Kenya's success is anchored in strong institutional coordination where:

- The Communications Authority of Kenya (CA) leads the technical deployment of the mapping platform.

[31] mygov.go.ke
[32] https://ict.go.ke/node/435

- The Africa-BB-Maps initiative aligns with Kenya's National Broadband Strategy 2023–2028, which emphasizes universal access, affordability, and digital inclusion[33].
- The Ministry of Information, Communications, and the Digital Economy provides policy oversight and ensures alignment with Vision 2030 and the Digital Superhighway agenda.

b) *Mapping System Features.* Kenya's broadband mapping platform features allow stakeholders to identify coverage gaps, prioritize infrastructure investments, and monitor progress toward national connectivity goals[34] [35]; they include:

- Geospatial visualization of broadband coverage by technology (fiber, 4G, satellite)
- Real-time data layers on schools, health centres, and underserved communities
- Interactive dashboards for policymakers, investors, and civil society
- Open data access to promote transparency and innovation

c) *Multi-Stakeholder collaboration and engagement*. The success of the broadband mapping projects depends on the participation and contribution of various stakeholders. The multi-stakeholder model emphasizes inclusive governance. It adopts a collaborative approach to ensure that the mapping system reflects ground realities and supports decentralized planning as follows:

- Public-private partnerships and collaboration with telecom operators to share infrastructure data
- Engagement with academia and civil society for validation and use of mapping outputs
- Capacity-building workshops for county governments and technical staff

d) *Regional Integration and Replicability.* Kenya's experience can inform regional best practices and be replicated due to the following aspects of its broadband mapping system:

- Technical templates and stakeholder engagement model are being adapted for use in Malawi, Nigeria, and Uganda.
- Leadership in promoting interoperable, standards-based mapping systems can be replicated in other countries whose broadband mapping is not as mature as that of Kenya.

2.2.2 Lessons from Slovenia

Slovenia's Broadband mapping ecosystem has four dimensions – infrastructure, investment, service and demand mapping dimensions as shown in Table 1.

Table 1: Slovenia Broadband Mapping Dimensions

Dimension	Description	Slovenia Context	Source
Infrastructure Mapping	Identifies physical broadband assets (fiber, mobile towers, backbone cables, data centres).	AKOS maintains national broadband coverage maps, especially for rural Alpine regions.	AKOS[36]

[33] ict.go.ke
[34] mygov.go.ke
[35] news.broadcastmediaafrica.com
[36] Agency for Communication Networks and Services of the Republic of Slovenia (AKOS). (2025). *Broadband coverage and service maps*. Ljubljana: AKOS. Retrieved from https://www.akos.si

Investment Mapping	Tracks public and private capital flows into broadband infrastructure.	Slovenia uses EU Cohesion Funds and national subsidies to finance rural broadband rollout.	Ministry of Digital Transformation Slovenia[37]; European Commission – CEF Digital[38]
Service Mapping	Maps availability and quality of broadband services (speed, latency, reliability).	AKOS publishes service availability maps showing fixed broadband, mobile 4G/5G, and satellite coverage.	AKOS; European Commission – Gigabit Society[39]
Demand Mapping	Captures user needs and adoption patterns (households, schools, SMEs, hospitals).	Slovenia's Digital Slovenia 2030 strategy links broadband demand to digital education, e-health, and smart tourism.	Government of Slovenia – Digital Slovenia[40] 2030[41]; OECD[42]; UNESCO Broadband Commission[43]

The following diagram (Figure 1) represents the relationship between the four broadband mapping dimensions of Slovenia.

Figure 1: Relationship between Slovenia Broadband mapping dimensions

[37] European Commission. (2025). *Connecting Europe Facility (CEF Digital)*. Brussels: European Union. Retrieved from https://digital-strategy.ec.europa.eu

[38] European Commission. (2025). *Connecting Europe Facility (CEF Digital)*. Brussels: European Union. Retrieved from https://digital-strategy.ec.europa.eu

[39] European Commission. (2016). *Gigabit Society targets*. Brussels: European Union. Retrieved from https://digital-strategy.ec.europa.eu

[40] Government of Slovenia. (2020). *Digital Slovenia 2030 Strategy*. Ljubljana: Ministry of Digital Transformation. Retrieved from https://www.gov.si

[41] Government of Slovenia. (2020). *Digital Slovenia 2030 Strategy*. Ljubljana: Ministry of Digital Transformation. Retrieved from https://www.gov.si

[42] Organisation for Economic Co-operation and Development (OECD). (2025). *Broadband statistics and digital economy indicators*. Paris: OECD. Retrieved from https://www.oecd.org

[43] UNESCO Broadband Commission. (2024). *Broadband for sustainable development: Linking connectivity to education and health*. Paris: UNESCO. Retrieved from https://www.broadbandcommission.org

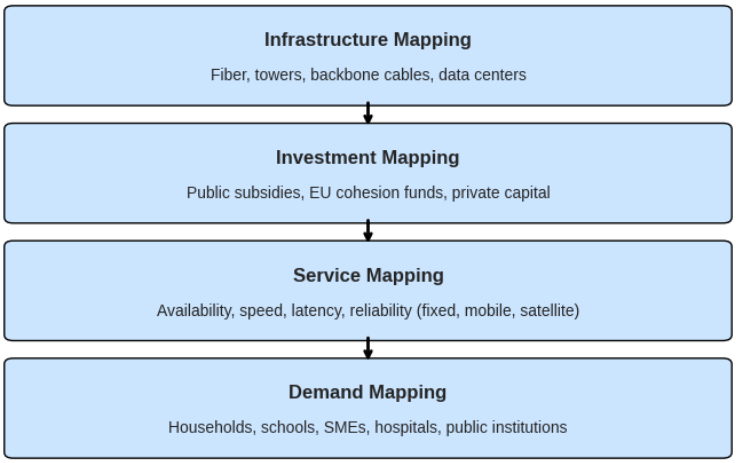


Figure 1 shows that broadband mapping is multi-dimensional**,** and Slovenia's approach integrates infrastructure, financing, service quality, and socio-economic demand into a cohesive system.

A further illustration of the Slovenia Africa-BB-Maps is as follows (Figure 2)

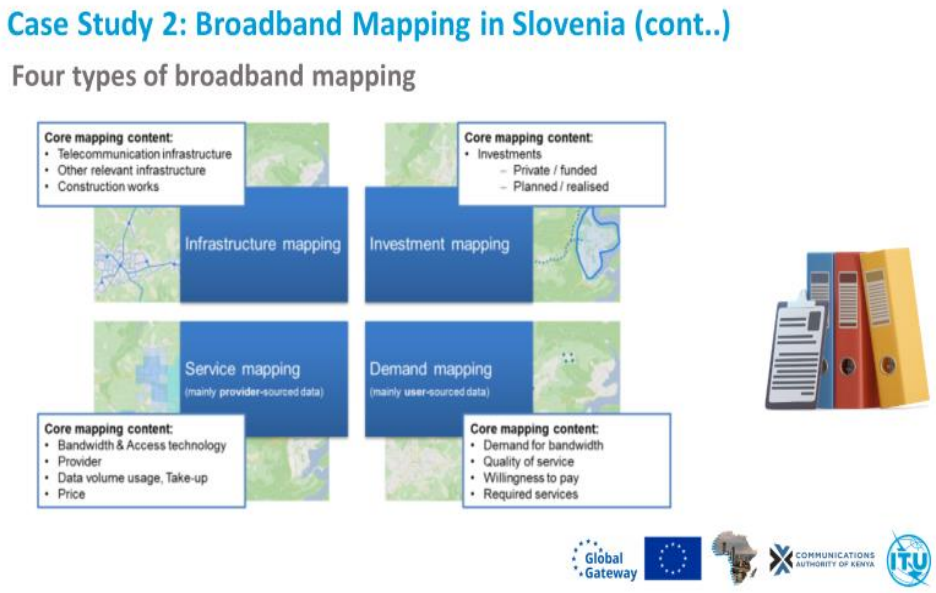


Figure 2. Broadband mapping in Slovenia

As seen from Figure 1 and Figure 2, Slovenia's broadband mapping system is multi-dimensional, integrating infrastructure rollout, financing mechanisms, service quality, and socio-economic demand into a cohesive framework. By leveraging EU structural funds and the Connecting Europe Broadband Fund, Slovenia has been able to identify underserved rural areas, prioritise fibre-to-the-home (FTTH) deployment, and align investment with socio-economic indicators. This mapping approach ensures

that broadband expansion is not only technically robust but also socially inclusive, enabling Slovenia to achieve high rural fibre penetration while maintaining affordability and quality of service[44].

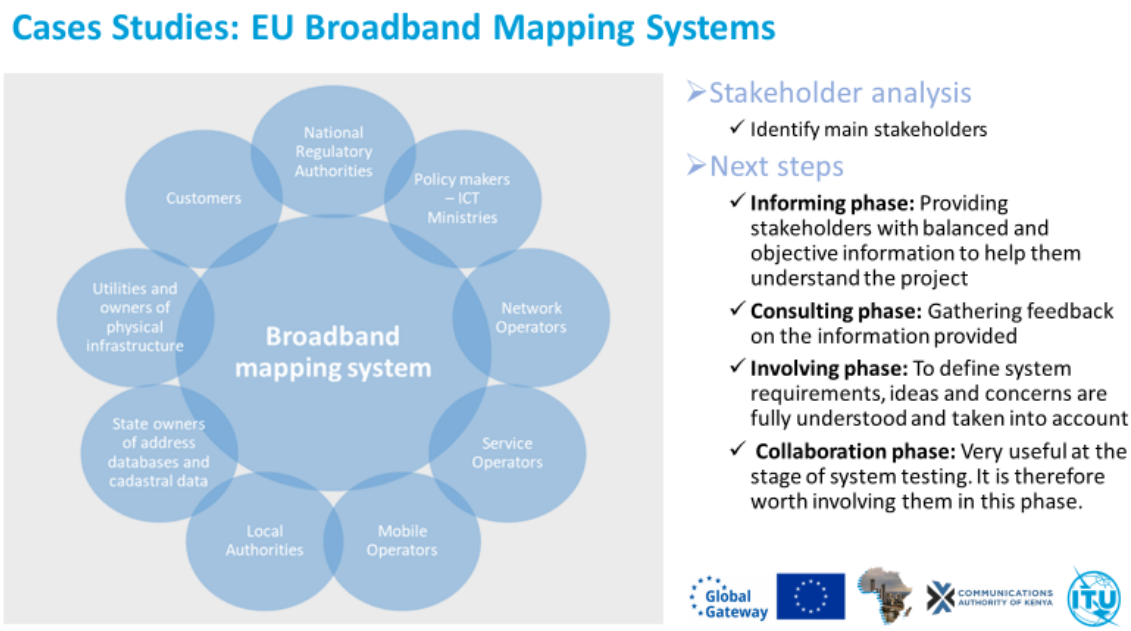


Figure 3. Broadband mapping system stakeholders

Figure 3 shows good practice Africa-BB-Maps stakeholders who must be engaged at every stage of Africa-BB-Maps development through a deliberate coordination mechanism lead by the ICT/ broadband regulator – CA in the case of Kenya.

2.2.3 Kenya Broadband maps versus selected good practices

The comparison of Kenya's Africa-BB-Maps and international practices is presented in Table 2

Table 2: Comparative Table: Kenya Broadband Mapping vs. International Practices

Action	Kenya's Status	International Best Practice	Source/s
Integrating AI and Satellite Data for Predictive Mapping	Africa-BB-Maps initiative (launched Nairobi, 2025) aims to strengthen data-driven broadband planning. Kenya can integrate AI + satellite	**Japan**: AI-operated satellites accelerate broadband deployment.	ITU[45]; NASA[46]; Mapflow.AI[47]; Africa-BB-Maps
		NASA (USA): AI-driven satellite data fills coverage gaps.	

[44] European Commission. (2019, May 29). *European Fund invests in Slovenian broadband network project to boost FTTH coverage*. Shaping Europe's Digital Future. https://digital-strategy.ec.europa.eu/en/news/european-fund-invests-slovenian-broadband-network-project-boost-ftth-coverage

[45] International Telecommunication Union (ITU). (2025). *Africa Broadband Mapping Systems (Africa-BB-Maps)*. Geneva: ITU. Retrieved from https://africabbmaps.itu.int

[46]National Aeronautics and Space Administration (NASA). (2025). *Earth observation assets for broadband and ICT planning*. Washington, DC: NASA. Retrieved from https://assets.science.nasa.gov

[47] Mapflow.AI. (2025). *AI-powered geospatial mapping solutions*. Retrieved from https://mapflow.ai

	imagery to predict underserved areas and optimize tower placement.	**Mapflow.AI** (Europe): AI extracts building footprints/population density for telecom expansion.	
Expanding Indicators to Include Affordability and Usage	Current Africa-BB-Maps focus on coverage. Adding affordability (price-to-income ratios) and usage (penetration, consumption) aligns with ITU affordability frameworks.	**ITU**: Uses affordability (% of GNI per capita) as a key indicator	ITU[48]
		World Bank: Tracks internet usage (% of population) and broadband subscriptions globally.	World Bank[49]
Linking Broadband Data to Education, Health and Economy	Kenya's National Digital Master Plan (2022–2032) emphasizes ICT integration in education, health, and economic growth. Broadband data is currently not adequately linked to these metrics. Thus, linking to these metrics will strengthens policy evidence.	**UNESCO Broadband Commission**: Broadband as "missing link" in education.	UNESCO[50]; OECD[51]; Kenya Digital Master Plan[52]
		OECD: Links broadband to access to public services, online health, and remote work.	

As seen from Table 2, Kenya's Africa-BB-Maps initiative is already aligned with global good practices thus adding AI and affordability indicators would elevate it further. Additionally, linking broadband to education, health, and economic indicators makes the mapping system a development tool, not just an infrastructure tracker.

- International examples (ITU, UNESCO, OECD, World Bank, Japan, and NASA) as well as good practices in EU, including Slovenia, provide tested models that Kenya can adapt for regional harmonization.

Comparing Kenya and international good practices benchmark, there is need to strengthen Kenya's Africa-BB-Maps. First, by implementing the complete scope of a best practice broadband mapping ecosystem similar to Slovenia and other similar ecosystems, and adopting emerging technologies in the ecosystem.

Though Kenya's policy and strategy documents on Broadband development, such as the Kenya's *National Digital Master Plan (2022–2032)* are aligned with international good practices, the there are gaps in implementation of the provisions of these policies/strategies. This implies the need to establish robust Africa-BB-Maps ecosystem by strengthening the existing (infrastructure and coverage) and providing additional systems to address the other dimensions of the ecosystem – service, investment and demand mapping.

2.2.4 Future Directions for Strengthening Kenya's Broadband Mapping

Strengthening Kenya's broadband mapping system requires expanding the scope of the mapping as well as integrating advanced technologies, including socio-economic indicators, and linking

[48] International Telecommunication Union (ITU). (2020). *Recommendation ITU-T L.1470: Greenhouse gas emissions trajectories for the ICT sector*. Geneva: ITU. Retrieved from https://www.itu.int

[49] World Bank. (2025). *World Bank Open Data: Kenya ICT and economic indicators*. Washington, DC: World Bank Group. Retrieved from https://data.worldbank.org

[50] UNESCO Broadband Commission. (2024). *Broadband for sustainable development: Linking connectivity to education and health*. Paris: UNESCO. Retrieved from https://www.broadbandcommission.org

[51] Organisation for Economic Co-operation and Development (OECD). (2025). *Broadband statistics and digital economy indicators*. Paris: OECD. Retrieved from https://www.oecd.org

[52] UNESCO Broadband Commission. (2024). *Broadband for sustainable development: Linking connectivity to education and health*. Paris: UNESCO. Retrieved from https://www.broadbandcommission.org

connectivity data to development outcomes. These actions will ensure alignment with global best practices.

a) Enhancing design and policy for broadband mapping system

Based on the experience from Slovenia, the following good practice design and policy are proposed to strengthen Kenya's Africa-BB-Maps ecosystem:

i. Four-dimension anchorage of the Africa-BB-Maps system

(a) Infrastructure mapping. This dimension maps fiber networks, mobile towers, backbone cables, and data centres form the physical foundation.
(b) Investment mapping. This dimension deals with funding mechanisms including public subsidies, EU cohesion funds, and private operator capital ensure financing and expansion.
(c) Service mapping. Service mapping tracks availability, speed, latency, and reliability across fixed, mobile, and satellite broadband
(d) Demand mapping. This dimension captures needs of households, schools, SMEs, hospitals, and public institutions to guide inclusive rollout.

ii. Policy and regulatory measures

In line with best-practice, the following policy measures can be taken to strengthen the broadband mapping:

(a) Update policy to provide for integrated infrastructure development and broadband data sharing
(b) Make regulations for broadband data sharing including by embedding comprehensive operators' data reporting obligations into licenses
(c) Establish effective data governance and multi-sectoral coordination including through a national data policy and
(d) Establish a common data scheme to serve as a template for reporting broadband maps data
(e) Harmonise legal and regulatory basis for broadband mapping data collection, reporting and sharing.

The Kenya Information and Communications Act (KICA 1998) (Cap. 411A), which establishes CA, mandates the regulator to develop the ICT sector including through regulations and license conditions which require submission of data to the regulator. As a consequence, the regulator makes regulations on various aspects of the sector including reporting of sector statistics/data and ensures compliance. Furthermore, while the KICA 1998 empowers the CA to require operators to submit broadband/geospatial data - coverage maps, site information, and fibre routes – to the Authority, The Geospatial Data Management Act, 2019 obligates custodians of geospatial data to collect, maintain, deposit, and share geospatial data with authorised agencies.

b) Leveraging emerging technologies and improving relevance of Africa-BB-Maps for socio-economic impact

The existing Africa-BB-Maps systems should be strengthened by

i. Integrating AI and satellite data for predictive mapping

The Africa-BB-Maps project (launched in Nairobi in 2025) already emphasizes data-driven planning for digital infrastructure[53]. Integrating AI with satellite imagery would allow predictive identification of underserved areas, anticipate demand growth, and optimize tower placement.

Globally, AI has been integrated in broadband mapping. For example, in Japan, AI-operated satellites are used to accelerate broadband deployment and inform land-use decisions[54] while in the USA, NASA uses AI-driven satellite data processing to fill coverage gaps and optimize observation timing.[55] Additionally, Mapflow.AI (Europe) AI platforms extract building footprints and population density from satellite imagery to guide telecom expansion.[56] These developments have important implication for Kenya since predictive mapping can reduce costs, improve rural coverage, and support climate-resilient infrastructure planning.

ii. Expanding indicators to include affordability and usage

The current mapping focuses on coverage and infrastructure. The addition of affordability (price-to-income ratios) and usage (internet penetration, data consumption) indicators will align the system with the ITU's affordability frameworks.[57]

The 'price' of telecom/ICT services is often cited as a barrier to using telecom services, but what really matters is the 'affordability' or ease of purchasing a service, relative to consumer income.[58] the ITU tracks affordability as a barrier to access and recommends monitoring of telecom prices relative to income.[59] To complement these efforts, the World Bank publishes indicators on internet usage (% of population) and broadband subscriptions.[60]

Therefore, the inclusion of affordability and usage (demand mapping) will ensure that the broadband mapping reveals digital divides not visible in coverage maps, thus ensuring that policy interventions target both supply and demand of ICT services.

iii. Linking Broadband Data to Education, Health, and Economic Metrics

In the Kenya's Context, broadband is invaluable to the National Digital Master Plan (2022–2032), which emphasizes ICT integration in education, health, and economic growth. Consequently, linking broadband data to these metrics will demonstrate tangible impacts of connectivity.

From a global perspective, Broadband is described by the Broadband Commission as the "missing link" in global education that should be provided to enable equitable access to learning resources[61]. Similarly, broadband statistics are associated with access to public services, online health, and remote work[62].

[53] https://www.kenyanews.go.ke/kenya-eu-and-itu-launch-broadband-mapping-project-to-bridge-digital-divide/
[54] https://www.nature.com/articles/d42473-023-00198-2
[55] https://assets.science.nasa.gov/content/dam/science/cds/science-enabling-technology/events/2025/accelerating-informatics/PM_6_Ahmad.pdf
[56] https://mapflow.ai/
[57] https://www.itu.int/en/mediacentre/backgrounders/Pages/affordability.aspx
[58] Affordability - backgrounder https://www.itu.int/en/mediacentre/backgrounders/Pages/affordability.aspx
[59] https://www.itu.int/en/mediacentre/backgrounders/Pages/affordability.aspx
[60] https://data.worldbank.org/indicator/IT.NET.USER.ZS
[61] UNESCO Broadband Commission.
[62] OECD

In this regard**,** m**a**pping broadband alongside school connectivity, telemedicine uptake, and SME digitalization outcomes will strengthen evidence for investment and policy harmonization, ensuring ICT contributes directly to Vision 2030 goals.

In summary, combination of these actions would transform Kenya's Broadband mapping system into a holistic digital inclusion tool, aligning with ITU, UNESCO, and World Bank best practices while supporting Kenya's Vision 2030 and Africa-BB-Maps initiative. Specifically,

- Integration of AI with satellite data enables predictive, cost-efficient, and climate-resilient broadband planning.
- Inclusion of affordability and usage indicators will reveal socio-economic barriers beyond coverage, ensuring inclusive access.
- Linking broadband mapping to development metrics will strengthen policy alignment by demonstrating broadband's role in education, health, and economic growth

3. Countrywide Assessment and Justification for Broadband Mapping

3.1 Geographic and Institutional Overview

Kenya has a geographical spatial coverage of 580,367 square kilometres with a population of 53.3 million people[63] (approximately 57.5 million[64] [65]). It is recognized regionally for its efforts in investing in digital development, making the country a front-runner on digital development within the region. Guided by its National ICT Policy 2020, the National Digital Master Plan 2022-2032 and the National Broadband Strategy 2023, the country aspires to increase broadband penetration to 80% by 2030, prioritizing unserved and underserved communities.

3.1.1 Ministry of ICT and the Digital Economy

Kenya's Information, Communications, and Digital Economy sector is a central pillar of national transformation. It overseen by the Ministry of Information, Communications and the Digital Economy (MICDE). The Ministry is mandated to formulate, administer, and manage ICT and broadcasting policy, while driving digital infrastructure, innovation, and entrepreneurship[66]. Through its State Department for ICT and Digital Economy, the government facilitates broadband expansion, e-government services, and digital skills development, ensuring that ICT remains a driver of socio-economic growth[67].

Strategic frameworks such as the *National Broadband Strategy 2023–2028* emphasize universal access, affordability, and cybersecurity, positioning broadband as a critical enabler of education, healthcare, and commerce[68]. Complementing this, the *Digital Economy Blueprint* outlines five pillars—digital government, digital business, infrastructure, innovation-driven entrepreneurship, and digital skills—anchoring Kenya's ambition to become a globally competitive, knowledge-based economy[69]. Furthermore, the Kenya's *National Digital Master Plan 2022–2032* is a ten-year strategy developed by the Ministry of ICT and the Digital Economy in collaboration with the Communications Authority of Kenya. The plan is structured around four pillars: digital infrastructure, digital government, digital business and society, and digital skills and innovation[70].

At the heart of the plan is broadband expansion**,** recognized as the backbone of digital transformation. The strategy emphasizes the use of GIS-based broadband maps **to** identify underserved areas, guide infrastructure investment, and ensure equitable access across both urban and rural communities (Digital Development, 2022). It also integrates cybersecurity, data protection, and affordability measures to build trust in digital services. Furthermore, the plan aligns with continental and global

[63] Stats Kenya. (2025, December 2). *Population of Kenya 2025 – Population by County*. https://statskenya.co.ke/public/at-stats-kenya/about/population-of-kenya-2025-population-by-county/110/
[64] Worldometer. (2025). *Kenya demographics 2025 (Population, age, sex, trends)*. https://www.worldometers.info/demographics/kenya-demographics/
[65] World Population Review. (2025). *Kenya population 2025*. https://worldpopulationreview.com/countries/kenya
[66] Ministry of ICT and the Digital Economy. (2025a). *About the Ministry*. https://ict.go.ke/
[67] Ministry of ICT and the Digital Economy. (2025b). *ICT and Digital Economy functions*. https://ict.go.ke/ict-and-digital-economy
[68] Ministry of ICT and the Digital Economy. (2024a). *National Broadband Strategy 2023–2028*. https://ict.go.ke/sites/default/files/2024-09/National-Broadband-Strategy-2023.pdf
[69] Government of Kenya. (2019). *Digital Economy Blueprint: Powering Kenya's transformation*. Ministry of ICT. https://ict.go.ke/sites/default/files/2024-09/Kenya-Digital-Economy-2019.pdf
[70] Communications Authority of Kenya. (2022). *Kenya National Digital Master Plan 2022–2032*. Nairobi: Communications Authority of Kenya. Retrieved from https://repository.ca.go.ke/items/721f1a1d-1a9d-4237-a2d5-265e44d247e9

frameworks, including the African Union's Digital Transformation Strategy and the UN Sustainable Development Goals, ensuring Kenya's digital agenda is harmonized with international commitments[71].

In essence, the *National Digital Master Plan 2022–2032* is not merely a technical document but a vision for inclusive prosperity, ensuring that no community is left behind in Kenya's journey toward a fully connected society. Through the ICT policy and strategic initiatives, Kenya is committed to bridging the digital divide, fostering youth empowerment, and integrating into the global digital economy. The sector's institutional mandate is to ensure that every citizen benefit from digital transformation, reinforcing Kenya's role as a continental digital leader. Currently, Kenya currently hosts six undersea cables, positioning the country as a hub for cloud computing, artificial intelligence, and fintech solutions[72].

Kenya is recognized as the "Silicon Savannah". It hosts major global tech investments and undersea cables, positioning itself as a regional hub for cloud, AI, and fintech. The sector emphasizes affordability, inclusivity, and cybersecurity, while fostering youth empowerment through ICT digital hubs and digital skills programs including the *Citizen Digital Skills Program* - a flagship initiative under Kenya's National Digital Master Plan 2022–2032 - designed to bridge the digital divide, enhance employability, and empower citizens to participate in the digital economy[73].

The National Broadband Mapping Systems initiative seeks to help address these gaps by developing standardized, interoperable mapping platforms that reveal broadband coverage, quality, and affordability of broadband in Kenya. It emphasizes the importance of ICT infrastructure in bridging the digital divide and supports the ICT regulator (Communications Authority's) Strategic Plan 2023–2027, particularly under the key result area on ICT Infrastructure and Services, which aims to expand coverage and enhance data-driven decision-making for ICT investments.

3.1.2 ICT Sector Regulator: Communications Authority of Kenya

The legal foundation for the ICT sector, and by extension the broadband mapping, is the Kenya Information and Communication Act (KICA, 1998), as amended. This Act created the Communications Authority (CA) which regulates the ICT Sector including the development of broadband in Kenya.

CA plays a pivotal role in regulating and promoting ICT services, with broadband development at the core of its mission. Guided by the *National Broadband Strategy* and its 2023–2027 Strategic Plan, the CA is tasked with expanding affordable, reliable, and high-quality broadband access across the country[74]. A key component of this mandate is the deployment of broadband maps**,** which provide real-time, GIS-based data on coverage, gaps, and underserved regions. These maps are designed to guide infrastructure investment, policy direction, and collaboration among stakeholders including operators, government, and civil society[75]. By integrating crowd-sourced data and independent audits, CA ensures transparency and accuracy in identifying areas lacking 3G, 4G, and 5G coverage. Ultimately, the Authority's broadband mandate supports Kenya's vision of becoming a globally competitive, knowledge-based society through inclusive digital transformation.

[71] Alpha Executive. (2022). *The Kenya National Digital Master Plan 2022–2032: An overview*. https://alphaexecutive.co.ke/the-kenya-national-digital-master-plan-2022-2032-an-overview/

[72] International Trade Administration. (2024, September 18). *Kenya - Digital economy*. U.S. Department of Commerce. https://www.trade.gov/country-commercial-guides/kenya-digital-economy

[73] ibid

[74] Communications Authority of Kenya. (2024a). *CA unveils its 5th Strategic Plan 2023–2027*. https://www.ca.go.ke/ca-unveils-its-5th-strategic-plan-2023-2027

[75] Communications Authority of Kenya. (2024b). *National Broadband Strategy*. https://ca.go.ke/national-broadband-strategy

3.2 Economic and Telecom Market Overview

Kenya's economy in 2025 remains resilient, driven by services and agriculture despite debt challenges, while its telecom market is expanding steadily, led by mobile data growth, fibre broadband rollout, and 4G/5G adoption. The following is an overview of the economic and telecom market in Kenya.

3.2.1 Economic Overview

According to the Kenya National Bureau of Statistics, Kenya's economy grew at a moderate pace in 2024–2025, with real GDP expanding by about 4%, down from 5.7% in 2023, reflecting global and domestic fiscal pressures[76]. The services sector contributed over 55% of GDP, followed by agriculture (22.5%) and industry (16.5%), underscoring the country's reliance on services and agribusiness. Employment creation remained strong, with more than 780,000 new jobs in 2024, 90% of which were in the informal sector. However, Kenya's public debt reached USD 81 billion by late 2024, with debt servicing consuming nearly 67% of government revenue, constraining fiscal space for development spending[77]. Despite these challenges, Kenya's economy is projected to remain stable in 2025, supported by a robust services sector, digital innovation, and creative industries.[78]

Kenya's Economic and Telecom Market Overview for Kenya (2025), compiled from official government and development organisations is presented in Table 3.

Table 3: Kenya Economic Overview (2025)

Indicator	**Value / Trend**	**Source**
Real GDP Growth (2025 projection)	4.80%	IMF[79]
Consumer Price Inflation (2025 projection)	4.00%	
Nominal GDP (2023–2024)	USD 111.5B (2023) → USD ~115B (2024 est.)	Kenya Economic Report IMF[80]
Public Debt (Dec 2024)	USD 81.0B; ~67.5% of government revenue allocated to debt servicing	
Employment (2024)	782,300 new jobs created; 90% in informal sector	
Population (2025)	~53.35 million	
Key Growth Drivers	Services sector (55.3% of GDP), agriculture (22.5%), industry (16.5%)	Kenya Economic Report[81]
Development Strategy	Anchored in Kenya Vision 2030 and supported by World Bank programs	World Bank[82]

3.2.2 Telecom and ICT Market Overview

Kenya's telecom market, valued at USD 3.79 billion in 2025, is on a steady growth trajectory with a projected CAGR of 2.24% through 2033[83]. The sector is dominated by Safaricom, Airtel Kenya, Telkom

[76] Kenya National Bureau of Statistics – *2025 Economic Survey.* Kenya National Bureau of Statistic
[77] Kenya National Bureau of Statistics Treasury – *Macroeconomic Outlook FY 2025/26* The National Treasury.
[78] Kenya National Bureau of Statistics.
[79] International Monetary Fund. (2025). *Kenya – Country Information*. Washington, DC: IMF. Retrieved November 25, 2025, from https://www.imf.org/en/countries/ken
[80] International Monetary Fund. (2025, November 6). *Kenya and the IMF – Country Information*. Washington, DC: IMF. Retrieved November 25, 2025, from https://www.imf.org/en/countries/ken
[81] Kenya National Bureau of Statistics. (2025, June). *Kenya Economic Report 2025*. Nairobi: KNBS. Retrieved November 25, 2025, from https://www.knbs.or.ke
[82] World Bank Group https://www.worldbank.org/en/country/kenya/overview
[83] Data Insights Market – *Kenya Telecom Market 2025–2033.* datainsightsmarket.com

Kenya, and Finserve, with Safaricom maintaining a leading market share[84]. Growth opportunities are driven by mobile data demand, affordable smartphones, and diverse data plans, alongside the expansion of fixed broadband services supported by fibre rollout[85]. The adoption of 4G and emerging 5G services is accelerating, with operators commercialising high-speed plans to meet rising consumer demand[86]. Regulatory oversight by the Communications Authority of Kenya (CA) continues to emphasise competition, consumer protection, and infrastructure investment, positioning the telecom sector as a key enabler of Kenya's digital economy[87] [88].

Table 4: Kenya Telecom and ICT Market Overview

Indicator	Value / Trend	Source
Mobile Subscriptions (Q1 2025)	76.16 million (+6.7% YoY)[89]	CA[90]
Mobile Penetration Rate	145.3% (multiple SIM ownership common)	CA[91]
Machine-to-Machine (M2M) Subscriptions	~2 million (+3.5% YoY)	
Telecom Market Value (2025)	USD 3.79 billion	Data Insights Market[92]
Projected CAGR (2025–2033)	2.24%	
Digital Economy Drivers	Mobile money, IoT, creative economy, broadband expansion	GSMA[93] [94]
Regulatory Developments (2025)	New environmental and carbon reduction rules for ICT sector	CA[95] Techweez[96]
Cybersecurity Concerns (2025)	Auditor-General reports persistent vulnerabilities in government ICT systems	Sharp Daily[97]

[84] Research and Markets – *Kenya Telecom Operators Intelligence Report 2025.* Yahoo Finance UK GlobeNewswire
[85] ibid
[86] GlobeNewswire
[87] Communications Authority of Kenya – *Sector Statistics Report Q1 2025/26.* Communications Authority of Kenya

[89] Communications Authority of Kenya. (2025). *Quarterly Sector Statistics Report, Q1 2025*. Nairobi: CAK. Retrieved from https://www.ca.go.ke
[90] Communications Authority of Kenya. (2025, October 15). *Mobile data and digital services rise, CA report shows*. Nairobi: CA. Retrieved from https://www.ca.go.ke/mobile-data-and-digital-services-rise-ca-report-shows
[91] Communications Authority of Kenya. (2025, October 15). *Mobile data and digital services rise, CA report shows*. Nairobi: CA. Retrieved from https://www.ca.go.ke/mobile-data-and-digital-services-rise-ca-report-shows
[92] Data Insights Market. (2025). *Comprehensive market research & forecast analysis*. Retrieved November 25, 2025, from https://www.datainsightsmarket.com/
[93] GSMA. (2025, March). *Mobile Money Evaluation: Kenya – Country Brief 2024*. London: GSMA. Retrieved from https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2025/03/Kenya.pdf
[94] GSMA. (2024, October). *Driving Digital Transformation of the Economy in Kenya: Opportunities, Policy Reforms and the Role of Mobile*. London: GSMA. Retrieved from https://www.gsma.com/about-us/regions/sub-saharan-africa/wp-content/uploads/2024/10/KENYA-DIGITAL-ECONOMY-REPORT-17TH-OCTOBER-V2.pdf
[95] Communications Authority of Kenya. (2025, September). *Framework for Reduction of Carbon Emissions in the ICT Sector 2025*. Nairobi: CA. Retrieved from https://www.ca.go.ke/sites/default/files/2025-09/Framework%20for%20CO2%20Reduction%20in%20the%20ICT%20Sector%202025.pdf
[96] Techweez. (2025, November 19). *CA releases new environmental rules for Kenya's ICT sector*. Nairobi: Techweez. Retrieved from https://techweez.com/2025/11/19/ca-environmental-rules-kenya-ict-sector/
[97] Sharp Daily. (2025). *Kenya's digital economy and ICT policy coverage*. Nairobi: Sharp Daily. Retrieved from https://sharpdaily.co.ke

Broadband and Connectivity	According to CA's Q3 2024/25 sector statistics, mobile subscriptions exceeded 66 million, with internet penetration surpassing 47% of households.	CA[98]
Mobile Operators	- Total mobile subscriptions: 76.16 million (Q1 2025)	CA (2025) [99]
	- Mobile penetration rate: 145.3%	
	- Machine-to-Machine (M2M) subscriptions: ~2 million (+3.5% YoY)	
Mobile Money	- Registered mobile money accounts: 87.01 million (Sept 2025)	Central Bank of Kenya (2025) [100]
	- Active agents: 456,742 (Sept 2025)	
	- Annual transaction value: KES 8.69 trillion (2024)	
	- Growth: +9.3% YoY	
	Mobile money penetration: ~95% of adults in Kenya use mobile money services.	GSMA (2025) [101].
Innovation and Start-ups	- Kenya Innovation Outlook 2024 launched by Kenya National Innovation Agency (KeNIA)	KeNIA[102]
	- Tracks progress under the 10-Year National Innovation Masterplan	
	- Local start-ups raised KSh 82.5 billion in 2024 (Sharp daily)	Sharp Daily[103]

Based on the existing statistics on the economy and telecom market (Table 3 and Table 4) it is noted that:

i. Kenya's economy remains service-driven, but debt servicing pressures constrain fiscal space this affecting economic resilience.
ii. Telecom growth is driven by mobile penetration which n exceeds 100%, showing multi-SIM usage and strong mobile money adoption.
iii. Digital transformation is expanding fast with IoT and broadband being among the drivers
iv. Both economic and telecom strategies are aligned with Vision 2030 and regional integration goals implying demonstrating policy alignment.

[98] Communications Authority of Kenya. (2025, June). *Sector Statistics Report Q3 2024–2025*. Nairobi: CA. Retrieved from https://www.ca.go.ke/sites/default/files/2025-06/Sector%20Statistics%20Report%20Q3%202024-2025.pdf
[99] Communications Authority of Kenya. (2025). *Quarterly Sector Statistics Report, Q1 2025*. Nairobi: CAK. Retrieved from https://www.ca.go.ke
[100] Central Bank of Kenya. (2025). *Mobile Payments Statistics – National Payments System*. Nairobi: CBK. Retrieved from https://www.centralbank.go.ke/national-payments-system/mobile-payments/
[101] GSMA. (2025). *The State of the Industry Report on Mobile Money 2025*. London: GSMA. Retrieved from https://www.gsma.com/sotir/wp-content/uploads/2025/04/The-State-of-the-Industry-Report-2025_English.pdf
[102] Kenya National Innovation Agency. (2024). *Kenya Innovation Outlook Report 2024*. Nairobi: KeNIA. Retrieved from https://innovationagency.go.ke
[103] ibid

3.3 Broadband Development to Date

Broadband development is underpinned by the Kenya's *National Digital Master Plan 2022–2032*[104] is a ten-year strategy developed by the Ministry of ICT and the Digital Economy in collaboration with the Communications Authority of Kenya as well as the national Broadband Strategy 2023, and CA strategic plan 2023-2027[105]. The Master plan provides a comprehensive roadmap for leveraging ICT to accelerate economic growth, enhance service delivery, and promote social inclusion. The plan is structured around four pillars: digital infrastructure, digital government, digital business and society, and digital skills and innovation**.** At the core of the Master plan is broadband expansion**,** recognized as the backbone of digital transformation. The strategy emphasizes the use of GIS-based broadband maps to identify underserved areas, guide infrastructure investment, and ensure equitable access across both urban and rural communities[106]. It also integrates cybersecurity, data protection, and affordability measures to build trust in digital services. It aligns with continental and global frameworks, including the African Union's Digital Transformation Strategy and the UN Sustainable Development Goals, ensuring Kenya's digital agenda is harmonized with international commitments[107]. Thus, the *National Digital Master Plan 2022–2032* is not merely a technical document but a vision for inclusive prosperity, through meaningful connectivity.

The communications Authority has made progress on broadband mapping as follows:

- Built a National ICT Coverage Geo-Portal (ArcGIS-based platform)
- Institutionalized Access-Gap Analysis (2016 ICT Study)
- Aligned mapping to National Broadband Strategy and Digital Master Plan
- Launched Africa-BB-Maps Project with ITU/EU support (2025)

3.4 Short Review of Existing National Broadband Mapping Initiatives

Based on existing information and consultation with stakeholders, Kenya's broadband mapping system moderately developed and requires strengthening to deliver the full benefits of such systems as is the case in some of the best-practice in EU countries such as Slovenia which has fully implemented as system with four dimensions – Infrastructure, Investment, service and demand mapping with each dimension representing a critical component of the broadband mapping ecosystem.

3.4.1 Status of Kenya's broadband mapping ecosystem and future direction

The Kenya's broadband mapping ecosystem and future direction is presented in Box 1.

Box 1. Kenya's broadband mapping outlook

[104] Communications Authority of Kenya. (2022). *Kenya National Digital Master Plan 2022–2032*. Nairobi: Communications Authority of Kenya. Retrieved from https://repository.ca.go.ke/items/721f1a1d-1a9d-4237-a2d5-265e44d247e9

[105] Communications Authority of Kenya. (2023). *Strategic Plan 2023–2027*. Nairobi: Communications Authority of Kenya. Retrieved from https://www.ca.go.ke/sites/default/files/CA/Strategic%20Plan/CA%20Strategic%20Plan%202023-2027%20Final.pdf

[106] Digital Development. (2022). *Kenya National Digital Master Plan 2022–2032*. https://www.digitaldevelopment.org/library/kenya-national-digital-master-plan/

[107] Alpha Executive. (2022). *The Kenya National Digital Master Plan 2022–2032: An overview*. https://alphaexecutive.co.ke/the-kenya-national-digital-master-plan-2022-2032-an-overview/

Status and outlook of Kenya's broadband mapping and future direction

1. **Communications Authority's (CA's) work in GIS and Broadband Mapping**
   - Built National ICT Coverage Geo-Portal (ArcGIS-based platform)
   - Institutionalized Access-Gap Analysis (2016 ICT Study)
   - Aligned mapping to National Broadband Strategy and Digital Master Plan
   - Launched Africa-BB-Maps Project with ITU/EU support (2025)

2. **Achievements and Challenges**

   a) *Achievements:*
      - Functioning national GIS portal with regular updates
      - Mapping outputs inform NBS execution and USF targeting
      - Geospatial monitoring of USF-funded projects
      - Alignment with Africa-BB-Maps continental framework

   b) *Challenges:*
      - Data completeness and refresh rates from operators
      - Lack of harmonized standards across datasets
      - Limited ground-truthing and QoS field validation
      - Sustaining toolchains, licenses and technical capacity
      - Prevalence of unauthorized installations and operators (illegal networks/WISPs)

3. **Next Steps for CA**
   - Develop and enforce National Broadband Data Standard
   - Automate provider data ingestion via secure APIs
   - Launch national drive-test and crowdsourced QoS program
   - Upgrade USF prioritization using socio-economic layers
   - Strengthen partnerships with counties for local GIS data
   - Strengthen collaboration and partnerships with all stakeholders on broadband mapping
   - Enhance coordination on broadband mapping

4. **Future Directions**

Policy directions are evolving toward:

- Real-time mapping using AI and satellite data
- Integration with 5G and fiber deployment plans
- Monitoring affordability and usage patterns
  Linking broadband data to education, health, and economic indicators

As noted from the foregoing future directions, there is a shift from static infrastructure maps to dynamic, policy-relevant data ecosystems to support timely decision making

Source: CA presentation August 25-27 2025, subsequent consultations and literature search

3.4.2 Broadband Maps and Universal Meaningful Connectivity

Broadband mapping should essentially support the realisation of Universal and Meaningful Connectivity (UMC). The International Telecommunication Union (ITU) defines *Universal and Meaningful Connectivity (UMC)* as the ability for *everyone* to access the Internet in optimal conditions, at an affordable cost, anytime and anywhere. Besides being online, UMC is about being online in a way that is safe, enriching, and empowering, including access to social and economic opportunities such as education, health, gainful employment, among others.

Table 5: ITU's Six Dimensions of Meaningful Connectivity

Dimension	Description
Quality	Fast and reliable connection
Availability	Ubiquitous and permanent access
Affordability	Internet access at a cost that doesn't exclude anyone
Devices	Access through appropriate and capable devices
Skills	Digital literacy and ability to use the Internet meaningfully
Security	Safe and secure online experience

Each dimension (Table 5) is essential and interdependent—strength in one cannot compensate for weakness in another.

The ITU tracks progress toward UMC through its Dashboard for Universal and Meaningful Connectivity, which helps countries benchmark their digital inclusion efforts. This framework is deliberately flexible and agnostic about specific interventions—recognizing that each country's path to digital equity will be unique. It is about empowering choice, not prescribing behaviour[108].

As observed from the existing broadband mapping system, some aspects of UMC are not current covered. In this regard, it is recommended that the enhanced system should capture the complete scope of the UMC including affordability and skills – as manifested in use of ICTs in social and economic sectors by the citizens.

3.5 Stakeholder Engagement and Collaboration

Kenya adopts a collaborative approach to ensure that the broadband mapping system reflects ground realities and supports decentralized planning. The model emphasizes inclusive governance:

- Public-private partnerships with telecom operators to share infrastructure data
- Engagement with academia and civil society for validation and use of mapping outputs
- Capacity-building workshops for county governments and technical staff

In particular, CA ensures stakeholder engagement and collaboration in broadband development and mapping by convening multi-stakeholder forums, partnering with county governments, operators, and civil society, and embedding consultation processes into Universal Service Fund (USF) projects. These engagements allow diverse actors—including regulators, service providers, academia, and advocacy groups—to contribute to policy design, infrastructure prioritisation, and geospatial data integration, thereby strengthening transparency and inclusivity in broadband mapping initiatives.[109]

3.5.1 Private sector roles

They stated that the contribution of the private sector to the initiative included: Establishing internal transparent, validated national broadband maps in compliance with the regulations; Sharing standardized datasets in agreed formats; Contributing in QoS field validation; Exploring use of open data; Establishing collaborations with the regulator, academia and innovators; and Sharing experiences/best practices based on their successes in deploying effective GIS platforms.

[108] International Telecommunication Union (ITU). (2025). *About the Universal and Meaningful Connectivity (UMC)*. Geneva: ITU. Retrieved from https://www.itu.int/itu-d/sites/projectumc/home/aboutumc/

[109] Okwisa, C. D., Gesimba, P. O., & Mbaya, J. M. (2025). Influence of stakeholder engagement on implementation of Universal Service Fund projects by the Communications Authority of Kenya. Strategic Journals, 12(4), 410–414. https://doi.org/10.61426/sjbcm.v12i4.3411

3.5.2 Governmental and public sector roles

As part of ensuring the delivery of an effective broadband mapping system in Kenya, governmental and public sector organisations can make the following contribution:

i. Provide infrastructure data e.g., data on electricity grid network, fiber optic network mapping, and electricity access data as baselines;
ii. Enable access to the various GIS platforms for integration to support real-time update of GIS overlaying data, and visualization;
iii. Collaborate in GIS database development and upgrades;
iv. Support the last mile delivery for broadband;
v. Adopt infrastructure sharing to minimize duplication and re-direct resources to priority infrastructure roll-out areas to reduce ultimate cost of services deployment and drive affordability; and
vi. Adopt harmonized data reporting standards and mechanisms to enhance accuracy

3.5.3 International partners

International partners paly and will continue to play a crucial role in the development of the broadband mapping ecosystem. To facilitate effective collaboration and engagement with international partners on the broadband project, some of the limitation that exist and which may negatively impact the success of the broadband mapping initiative should be addressed. Key among the mentioned challenges include; Inadequacies in data governance; Existence of gaps in the data management legal frameworks; Limited capacity development at the local level; and Fragmented policies within the ICT sector, and across sectors e.g., electricity, roads etc, that limit the much-desired harmonization.

3.6 Impact Assessment of Broadband Mapping

Kenya's broadband mapping development demonstrates how strategic leadership, technical innovation, and inclusive governance can transform digital infrastructure planning. Its experience offers a replicable model for other African countries seeking to close the digital divide[110] [111]. The key outcomes of the Broadband maps include:

a) Improved targeting of Universal Service Fund (USF) investments

b) Accelerated rollout of fiber and 4G in rural areas

c) Enhanced monitoring of school and health facility connectivity

To further develop its mapping system, and increase it impact on socio-economic development, Kenya plans to:

- Integrate AI and satellite data for predictive mapping;
- Expand mapping to include affordability and usage metrics; and
- Link broadband data to education, health, and economic indicators.

Furthermore, the cross-cutting aspects, including local capacity building, standards, enhance coordination among stakeholders, and strengthening the regulatory framework are necessary to increase the effectiveness of the maps and ultimate impact.

[110] Kenya News Agency. (2025, August 25). *Kenya unveils Africa broadband mapping project to bridge digital divide*. Nairobi: Government of Kenya. Retrieved from https://www.mygov.go.ke/kenya-unveils-africa-broadband-mapping-project-bridge-digital-divide

[111] International Telecommunication Union (ITU). (2025). *Africa-BB-Maps Project (2025–2028)*. Geneva: ITU. Retrieved from https://africabbmaps.itu.int

4. Policy and Regulatory Assessment: Kenya

4.1 Existing Legal and Regulatory Environment

4.1.1 Strategic significance of broadband mapping

Beyond connectivity, it integrates geospatial data such as population density, schools, hospitals, transport, and electricity access, thereby enabling evidence-based policymaking, digital inclusion, and strategic infrastructure investment.

The Africa-BB-Maps initiative is of strategic national importance because it establishes the analytical foundation necessary for Kenya to achieve its digital transformation agenda. By generating validated, interoperable, and publicly accessible broadband maps, the initiative equips the country with an evidence-based mechanism to guide policymaking, infrastructure planning, and investment prioritization. The project therefore contributes directly to the advancement of Kenya's socio-economic goals while also reinforcing the nation's leadership role in the regional digital ecosystem.

a) *Policy alignment*: The initiative is fully aligned with the National ICT Policy (2019), which emphasizes universal access to ICT services, infrastructure development, innovation, and digital inclusion. Broadband mapping advances these objectives by identifying unserved and underserved populations, enabling targeted investment in ICT infrastructure, and enhancing transparency and accountability through open and accessible data.
b) *Strategic alignment*: it directly supports the ambitions of the National Broadband Strategy (2023) to achieve 100% broadband penetration by 2030. The project is also aligned with Authority's Strategic Plan (2023–2027), which prioritizes regulatory efficiency, digital transformation, and consumer empowerment. The broadband mapping system will provide the Authority with a data-drive monitoring and compliance tool, enhance consumer protection by ensuring equitable access to services, and consolidate Kenya's reputation as a regional ICT hub.
c) *Universal service*: the project supports the objectives set forth in the Universal Service Fund (USF) Strategy (2023-2027). Africa-BB-Maps will allow for the precise targeting of resources to areas of greatest need, support evidence-based co-financing arrangements with operators and development partners and advance national objectives of equity and inclusivity in ICT access.
d) *Planning tool*: The initiative is also central to the implementation of the National Digital Master Plan (2022–2032), which is anchored on the four pillars of digital infrastructure, digital services, digital skills, and digital innovation. Broadband mapping contributes to these pillars by supporting systematic infrastructure planning, expanding the delivery of digital services in critical sectors such as health and education, building national capacity in data analytics and GIS, and fostering innovation by making broadband data available to researchers and entrepreneurs.
e) *Consistency with national policy and vision:* Beyond the national level, Africa-BB-Maps is consistent with broader policy frameworks. It advances the goals of Kenya Vision 2030 and the Bottom-Up Economic Transformation Agenda (BETA) by promoting inclusive growth and reducing the digital divide. It is also aligned with the Data Protection Act (2019), ensuring that mapping activities are conducted with due regard to data privacy and security. At the continental level, the initiative supports the African Union Digital Transformation Strategy (2020–2030), contributing to Africa's digital integration and competitiveness in the global economy.
f) *Digital transformation enabler:* The Africa-BB-Maps initiative is not a stand-alone project but a core enabler of Kenya's digital transformation and development priorities. It strengthens national capacity for infrastructure planning, regulatory oversight, and investment mobilization, while positioning Kenya as a regional leader in digital transformation and broadband innovation.

4.1.2 Legal framework

Kenya's legal framework for broadband mapping is anchored in national ICT laws, regulatory instruments, and strategic policy documents. It combines statutory authority, regulatory mandates, and strategic plans to guide how broadband infrastructure is mapped, monitored, and expanded. The Core Legal and Regulatory Framework is presented in Table 6.

Table 6: Core Policy, Legal and Regulatory Framework

	Legal /Strategic instrument	Description
1.	Kenya Information and Communications Act (KICA), 1998 (as amended)	• Establishes the Communications Authority of Kenya (CA) as the regulator
		• Provides the legal mandate for licensing, spectrum management, infrastructure rollout, and data collection.
		• Forms the statutory basis for CA's broadband mapping activities.
2.	Unified Licensing Framework (2017)	• Allows operators to deploy communication infrastructure nationwide using any technology.
		• Ensures that broadband mapping covers all licensed operators under a harmonized framework[112].
3.	Kenya ICT Regulations (2025, draft)	• A package of 15 regulations covering broadcasting, telecommunications, digital trust, consumer protection, fair competition, and universal service.
		• Provides regulatory impact assessment (RIA) frameworks to ensure broadband mapping supports universal service and avoids duplication[113]
4.	National ICT Policy (2019)	• Sets out government priorities for digital infrastructure, universal access, and ICT integration[114].
		• Broadband mapping is recognized as a tool for evidence-based planning and monitoring[115].
5.	National Broadband Strategies	• ***National Broadband Strategy 2013–2017 (NBS I):*** First attempt to set broadband targets.

[112] Policy Community Networks. (2017). *Kenya Country Profile – Unified Licensing Framework*. Retrieved from https://policy.communitynetworks.group/country-profiles/kenya

[113] KICTANet. (2025). *Kenya ICT Regulations 2025: Impact Assessment Review Explained*. Nairobi: KICTANet. Retrieved from https://www.kictanet.or.ke

[114] Ministry of ICT and the Digital Economy. (2019). *National ICT Policy*. Nairobi: Government of Kenya. Retrieved from https://ict.go.ke/policy-documents

[115] Ministry of ICT and the Digital Economy. (2019). *National ICT Policy*. Nairobi: Government of Kenya. Retrieved from https://ict.go.ke/policy-documents

	• ***National Broadband Strategy 2018–2023 (NBS II):*** Strengthened focus on infrastructure mapping, affordability, and uptake[116].
	• ***National Broadband Strategy 2023–2028 (NBS III,)***: Emphasizes GIS-based broadband mapping, integration with socio-economic indicators, and alignment with the ***National Digital Master Plan 2022–2032***[117].

Strategic linkages. To complement the legal and regulatory framework, there are strategic enablers/linkages for the broadband maps:

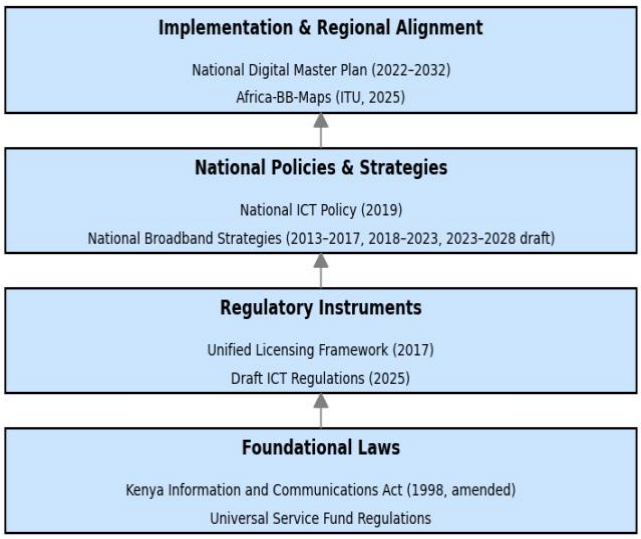
- National Digital Master Plan (2022–2032): Embeds broadband mapping into Kenya's long-term digital transformation agenda;
- Africa-BB-Maps (ITU, 2025): The continental initiative, aligning national mapping with regional harmonization;
- CA Strategic Plan (2023–2027) Africa-BB-Maps Project Framework (2025–2028).

The following is the mapping of the legal and strategic framework into a layered diagram (laws → regulations → strategies → implementation) (Figure 4).

[116] Communications Authority of Kenya. (2018). *National Broadband Strategy 2018–2023*. Nairobi: CA. Retrieved from https://repository.ca.go.ke

[117] Communications Authority of Kenya. (2023). *Draft National Broadband Strategy 2023–2028*. Nairobi: CA. Retrieved from https://www.itu.int/dms_pub/itu-d/oth/07/0d/D070D0000030001PDFE.pdf

Figure 4: Linkage between laws, regulations, strategies and implementation



As shown in Table 6 and Figure 4, Kenya's broadband mapping is underpinned by KICA (1998), the Unified Licensing Framework (2017), National ICT Policy (2019), successive National Broadband Strategies, and ICT Regulations (2025, draft). These instruments empower CA to collect, integrate, and publish broadband data, ensuring infrastructure planning and deployment supports universal service and digital transformation in the context of universal meaningful connectivity (see Table 3)

Table 3 shows full legal references for broadband mapping data reporting and submission. It includes an *Implication column* that links each clause directly to broadband mapping and reporting obligations for the Communications Authority of Kenya (CA). Table 7 includes Universal Service Fund (USF) regulations and Kenya National Bureau of Statistics (KNBS) obligations, alongside the Geospatial Data Management Act and KICA to give a complete evidence framework for broadband mapping submissions.

Table 7: Legal framework for Geospatial, Broadband and Population Data Reporting

Act / Regulation	Section / Clause	Provision	Implication for Broadband Mapping and CA Reporting	Source
Geospatial Data Management Act, No. 2 of 2019	Section 5(1)(c)	"…to establish and maintain a national geospatial data infrastructure and oversee the collection, management, sharing and dissemination of geospatial data by data custodians."	Creates a national obligation for custodians to share datasets; CA can access broadband coverage maps as part of the national infrastructure.	Kenya Law – Geospatial Data Management Act, 2019
	Section 7(1)	"The national mapping agency shall be the principal custodian of geospatial data and shall ensure that all public agencies deposit their geospatial datasets in the national repository."	Public agencies must deposit datasets; broadband data becomes part of the national repository accessible to CA.	Kenya Law – Geospatial Data Management Act, 2019
	Section 15	"Every data custodian shall collect, maintain and share geospatial data in accordance with prescribed standards and shall make such data available to authorised users."	Mandates standardised collection and sharing; CA qualifies as an authorised user, ensuring access to operator coverage maps and fibre routes.	Kenya Law – Geospatial Data Management Act, 2019

	Section 18	"…geospatial data deposited in the national repository shall be accessible to public agencies, regulators and authorised users subject to applicable laws."	Ensures legal access for CA as a regulator; broadband datasets must be shared with CA for planning and universal service monitoring.	Kenya Law – Geospatial Data Management Act, 2019
Kenya Information and Communications Act (Cap. 411A, 1998)	Section 5(1)(b)	"…to regulate the provision of telecommunications services in accordance with the Act."	Establishes CA's regulatory mandate, forming the legal basis for requiring broadband coverage and geospatial reporting.	Kenya Law – KICA
	Section 23	"The Authority may require any person licensed under this Act to furnish it…with such information as it may reasonably require for the performance of its functions."	Gives CA direct power to demand broadband coverage maps, GIS coordinates, and roll-out data from operators.	Kenya Law – KICA
	Section 84	"The Authority may require a licensee to produce records, documents and other information relating to its licensed services for inspection."	Authorises CA to inspect and verify broadband/geospatial data submitted by operators, ensuring compliance with coverage obligations.	Kenya Law – KICA
Universal Access and Service Regulations (Legal Notice No. 70 of 2010)	Regulation 3 & 4	Establishes the Universal Service Fund (USF) and empowers CA to collect data on ICT access and coverage gaps.	Requires operators to submit coverage and service data to CA for USF planning and disbursement.	Kenya Law – Universal Access and Service Regulations, 2010
	Regulation 10	"Licensees shall provide information on network coverage, penetration and service quality as may be required by the Authority."	Directly obligates operators to report broadband coverage and penetration data to CA.	Kenya Law – Universal Access and Service Regulations, 2010
Statistics Act, 2006 (KNBS)	Section 4 & 5	Establishes KNBS as the principal agency for collecting, analysing and disseminating official statistics.	KNBS population and demographic data must be integrated into broadband planning frameworks; CA uses KNBS datasets for universal service gap analysis.	KNBS – Statistics Act, 2006
	Section 7	"Every public agency shall provide to the Bureau such statistical information as the Bureau may require."	Ensures demographic and population data flows into KNBS, which informs CA's broadband mapping and universal service targets.	KNBS – Statistics Act, 2006

From the information in Table 7, the existing legal instruments to support broadband maps for Kenya are as follows:

- *Geospatial Data Management Act, 2019:* Custodians must collect, deposit, and share geospatial datasets.
- *KICA (Cap. 411A):* CA empowered to demand broadband/geospatial data from operators.

- *Universal Access & Service Regulations, 2010:* Operators must report coverage, penetration, and service quality data for USF planning.
- *Statistics Act, 2006 (KNBS):* KNBS population/demographic data is mandatory and feeds into broadband planning and CA's universal service analysis.

4.1.3 Regulatory framework

The Communications Authority of Kenya (CA), is the ICT sector regulator in Kenya, and the lead agency for the national broadband mapping initiative**.** It derives its mandate directly from the *Kenya Information and Communications Act, No. 2 of 1998* (KICA), as amended. This Act establishes the Authority, defines its scope, and empowers it to regulate telecommunications, broadcasting, postal/courier services, frequency spectrum, consumer protection, and universal access. Its broadband mapping is "advanced"[118] alongside Nigeria, Benin, and Côte d'Ivoire, due to strong broadband policy frameworks, infrastructure rollout, and resilience. This implies the need to further strengthen its capacity to deliver a robust broadband mapping ecosystem in collaboration with multiple stakeholders. This maturity level signals readiness of Kenya's ecosystem to integrate global standards (ITU, GSMA, UNESCO) into local frameworks.

Currently, CA is working with its stakeholders and aims to deepen these collaborations to ensure best practice broadband mapping ecosystem that can deliver universal and meaningful connectivity to all. CA expects to establish national ownership and sustainability of this project. However, there are mapping challenges that need mitigation and CA requests ITU to assist it to implement and achieve objectives of broadband mapping in Kenya.

To support the achievement of the targeted broadband coverage of 100% by 2030, Kenya has continued to create an enabling environment to support the roll-out of ICT infrastructure and services. Such initiatives updating ICT policy and regulation to reflect the current realities, use of Universal Service Fund (USF) to bridge the digital gaps, establishing partnerships and collaboration between various stakeholders including, government, private sector, academia, advocacy bodies and others; and providing incentives within the ICT sector to allow for ease of doing business for ICT infrastructure providers.

Currently, CA has an operational GIS platform, albeit with noted limitations which include limited numbers of licences, access restriction both internally and by the public, insufficient data on broadband and limited capacity/skills for effective use of the system. Other CA efforts that complement the broadband mapping initiative include adoption of a technology neutral licensing to allow for deployment of ICT infrastructure, and establishment of a Compliance and Enforcement framework required to ensure that licensed ICT operators provide accurate and timely fiber infrastructure data to operationalize an effective GIS. Additionally, CA has a Spectrum Management framework that ensures the planning and allocation of spectrum resources for ICT services deployment, including broadband services. The CA responsibilities are broad and strategic as presented in Table 8.

Table 8: Regulatory mandate of the Communications Authority of Kenya

Mandate Area	**Key Responsibilities**	**Legal Basis (KICA, 1998)[119]**
	- Licensing and oversight of telecom operators	

[118] https://www.itu.int/itu-d/sites/digital-impact-unlocked/implementing-national-broadband-mapping-systems-in-africa/
[119] Kenya Information and Communications Act, 1998 (Revised Edition 2020) – CA Official Site

Telecommunications Regulation	- Ensuring fair competition and compliance with standards	**Sections 23–29** (Licensing of telecommunications services)
Broadcasting Services	- Licensing radio and TV broadcasters - Regulating content standards and promoting diversity in media	**Sections 46A–46I** (Broadcasting services regulation)
Postal and Courier Services	- Licensing and monitoring postal/courier operators - Ensuring affordable and reliable delivery services nationwide	**Sections 65–73** (Postal/courier services licensing and regulation)
Frequency Spectrum Management	- Allocating and managing radio frequencies - Preventing interference and optimizing spectrum use for innovation	**Sections 30–34** (Radio communications and frequency spectrum management)
Consumer Protection	- Safeguarding user rights in ICT services - Handling complaints and enforcing service quality standards	**Sections 84–102** (Fair competition, consumer rights, enforcement powers)
Cybersecurity Oversight	- Securing Kenya's digital environment - Coordinating national cyber incident response and resilience	**Sections 83C–83E** (Cybersecurity and electronic transactions provisions)
Universal Access and ICT Development	- Promoting equitable access to ICT across rural and underserved areas - Implementing universal service projects to bridge the digital divide	**Section 84J** (Universal Service Fund and access obligations)
E-commerce Regulation	- Overseeing digital transactions and online platforms - Supporting trust and innovation in Kenya's digital economy	**Sections 83A–83F** (Electronic transactions and e-commerce regulation)

4.1.4 Kenyan Geospatial data legal anchors and Regional harmonization

There are various geospatial data institutions establishing laws in Kenya. Table 9 represents these institutions and reference/linkage to the regional/EAC–AU harmonization frameworks that govern geospatial/data.

Table 9: Kenyan Geospatial data Legal Anchors and Regional Harmonization

Kenya Institution	**Establishing Law**	**Geospatial/Data Sharing Provisions**	**Regional/EAC–AU Harmonization**
Directorate of Surveys (Survey of Kenya)	Survey Act (Cap. 299, Laws of Kenya)	Licensed surveyors must submit data to Director of Surveys; governed by Data Protection Act, 2019	EAC Spatial Data Infrastructure (SDI); AU African Geodetic Reference Frame (AFREF)
Kenya Space Agency (KSA)	Kenya Space Agency Order, Legal Notice No. 22 of 2017; draft Kenya Space Bill, 2024	Mandates secure sharing of satellite/Earth observation data	AU Space Policy and Strategy (2016); EAC Space Science and Technology Roadmap

National Addressing System of Kenya (NASK)[120] under CA	National Addressing Bill, 2025[2][121]	Establishes National Address Information Database; standardized geospatial attributes	EAC ICT Policy Framework; AU Digital Transformation Strategy (2020–2030)
National Council for Population and Development (NCPD)	Legal Notice No. 120 of 2004; draft NCPD Bill, 2023	Population/demographic data sharing under Sessional Paper No. 01 of 2023 and Data Protection Act, 2019	AU Demographic Dividend Roadmap (2017); EAC Population & Development Policy Framework
Ministry of Lands, Public Works, Housing and Urban Development	Physical and Land Use Planning Act, 2019; Building Regulations, 2021	Land use/housing data sharing under National Spatial Data Infrastructure (NSDI)	EAC Urban Development Strategy; AU Agenda 2063 Goal 1 (Infrastructure and Housing)
Kenya Meteorological Department (KMD → Kenya Meteorological Authority)	Meteorology Bill, 2023 (Senate Bill No. 45)	Mandates integration of climate data with NDMA[122]; governed by Data Protection Act, 2019	IGAD Climate Prediction and Applications Centre (ICPAC); AU Climate Change Strategy (2022–2032)

From an integration perspective, the mapping (Table 9) shows how Kenya's agencies can contribute to regional digital transformation through mapping. Harmonisation is crucial to achieve the following two objectives:

a) *National → Regional → Continental alignment:* This is crucial because each Kenyan institution is not only grounded in domestic law but also linked to EAC harmonization and AU continental strategies.
b) *Geospatial data sharing***:** Kenya's Data Protection Act, 2019 is the overarching safeguard, however, sectoral laws (Survey Act, Space Bill, Meteorology Bill, Addressing Bill) add domain-specific rules.

4.1.5 Kenya's national address system

The Kenya's national address system is officially called the *National Addressing System of Kenya (NASK)*.[123] It is managed and regulated by the Communications Authority of Kenya (CA). the Bill to establish the system is *The Kenya National Addressing Bill, 2025*. The Bill seeks to give effect to paragraphs 18(i) and 21 of Part 1 and paragraphs 8(b) and (c) of Part 2 of the Fourth Schedule to the Constitution of Kenya and provides a legal framework for the development and regulation of the National Addressing System**.**

The purpose of this addressing system is to provide a framework for street naming, property numbering, and parcel identification, and support e-commerce, postal/courier services, and emergency response by enabling precise location referencing.

The legal anchorage of the system is the Kenya Information and Communications (Numbering) Regulations, 2010, which mandates CA to establish a National Communications and Addressing Plan (NCAP). The legal framework is strengthened by the National Addressing Bill, 2025, which proposes

[120] https://www.ca.go.ke/national-addressing-system-kenya
[121] https://new.kenyalaw.org/akn/ke/bill/na/2025-06-24/the-national-addressing-bill-2025
[122] National Drought Management Authority (NDMA) is the state corporation mandated to coordinate all matters related to drought risk management and resilience building
[123] Communications Authority of Kenya. *National Addressing System for Kenya*. Published May 2, 2023. Available at: https://www.ca.go.ke/national-addressing-system-kenya

the creation of a National Addressing Council and County Addressing Committees to standardize implementation[124]. The following are the roles of the NASK which make it a backbone for geospatial and postal modernization:

a) *Digital Transformation:* NASK is a critical enabler of Kenya's digital economy, aligning with the AU Digital Transformation Strategy (2020–2030).
b) *Geospatial integration*: It ties into Kenya's National Spatial Data Infrastructure (NSDI), ensuring interoperability with other geospatial datasets (land, housing, population, climate).
c) *Regional harmonization:* Supports EAC ICT Policy Framework, making Kenya's addressing system compatible with regional trade and logistics systems.

4.2 Gaps and Challenges

Based on stakeholder engagement feedback, various challenges that need mitigation and support to addressed to achieve objectives of effective Broadband Mapping in Kenya; they include:

- Low accuracy of available broadband coverage maps;
- Limited enterprise integration between the various existing ICT infrastructure systems that are critical to feeding into GIS;
- Inefficient coordination in cross-border broadband coverage;
- Limited capacity of existing GIS systems; and
- Limited compatibility and integration between the existing inter-sectoral GIS systems that hold data critical to making GIS output meaningful and useful for regulatory oversight of the ICT sector, and investment decision for investors.

[124] Kenya National Assembly. *The National Addressing Bill, 2025*. Kenya Law, 24 June 2025. Available at: https://new.kenyalaw.org/akn/ke/bill/na/2025-06-24/the-national-addressing-bill-2025

The various gaps and challenges identified by various categories of stakeholders are presented in Box 2.

Box 2: Broadband mapping challenges

Broadband Maps Challenges

1. Government institutions

The following factors limit he effective contribution of other government institutions to the broadband mapping in Kenya; they include:

a) Lack of harmonized approach to data collection and reporting across the institutions
b) Limited or no integration between the various GIS platforms owned by stakeholders
c) Limited budgetary resources to support acquisition of appropriate mapping systems including the GIS platforms
d) Inadequacies in staff technical skills to utilize advanced technological application and GIS related software for mapping
e) Lack of supporting policies and regulations that facilitate strategies such access to and sharing of data.

2. Private sector challenges

Various challenges may hinder private sector institutions' support of the Broadband mapping Project, they include:

a) Continued production and use of inconsistent operator data formats;
b) Overstated coverage reporting caused by lack of accountability mechanism;
c) Limited GIS capacity to support big-data;
d) Limited harmonization between private sector actors leading to missed opportunities to save on investment cost, both at the technical mapping level and service cost thus contributing to meaningful connectivity; and
e) Lack of supporting policies and regulations that facilitate strategies such access to and sharing of data.

3. International partners perspective

From an international partners perspective, there still exist limitations that may negatively impact the success of the broadband mapping initiative unless they are comprehensively addressed; key among the them are:

a) Inadequacies in data governance;
b) Existence of gaps in the data management legal frameworks;
c) Limited capacity development at the local level; and
d) Fragmented policies within the ICT sector, and across sectors than impact Broadband, e.g., electricity, roads etc, that limit the desired harmonization of mapping

Source: "Kenya's National Broadband Mapping Systems". Report of Workshop 25-27 August 2025 Villa Rosa Kempinski hotel Nairobi – Kenya

4.2.1 Gaps in existing broadband mapping systems

Furthermore, there are various factors and challenges associated with the key aspects of Africa-BB-Maps system Architecture, Standards, Tools and Data Ecosystem that could hinder the realization of a sustain able broadband mapping. These include:

- Duplication in investments in rolling out of infrastructure;
- Lack of complete record of nation-wide fiber infrastructure rolled out, including dark fiber and lit fibre;
- Inadequate stakeholder mapping and engagement for mapping ecosystem;
- Limited data availability and accessibility;

- Data quality and standardization limitation arising from inconsistent or total lack of adherence to open standards, and/or incomplete reporting;
- Technical and infrastructure limitations that limit integration with legacy systems; lead to incomplete infrastructure maps; and exhibit limited processing capacity; and;
- Fragmented mandates requiring regulatory and institutional coordination.

5. Data Governance and Interoperability Frameworks

5.1 Data Governance

5.1.1 Overview of broadband data governance in Kenya

The CA, as the national coordinator, operates a dedicated broadband mapping platform built on the ESRI ArcGIS GIS environment. Despite significant efficiency challenges, the Authority has managed to collect broadband data from various agencies on a quarterly basis through manual Excel (CSV) template. This mode of data collection is not reliable due to its rigidity and lacks flexibility. The template is fixed with pre-determined outcomes, it does not take into consideration data standards and specifications. Other challenges experienced by CA in collecting and managing broadband data include a limited number of ArcGIS licenses, restricted system access both internally and for the public, insufficient data availability, and inadequate technical capacity and skills within CA and partner institutions to effectively utilize the system.

In response to these challenges, CA has implemented several complementary measures to strengthen broadband mapping. These include the adoption of a technology-neutral licensing framework to encourage broad deployment of ICT infrastructure, and the establishment of a Compliance and Enforcement Framework that requires licensed operators to submit accurate and timely fibre infrastructure data necessary for effective GIS-based broadband mapping. Additionally, the Authority has instituted a Spectrum Management Framework to facilitate efficient planning and allocation of spectrum resources for ICT service deployment, including broadband mapping.

For effective coordination and data governance, alignment with modern telecommunications data governance principles is essential. Central to these principles is inclusive stakeholder participation to ensure that data coordination frameworks are both technically robust and socially balanced. The involvement of Kenya's diverse stakeholders, including the regulator, private operators and service providers, civil society organizations, professional associations, and academia, enriches the coordination process by integrating multiple perspectives, preventing regulatory capture, and aligning broadband planning with national development goals.

Such collaboration fosters transparency, adaptability, and resilience, enabling the governance ecosystem to evolve alongside technological advancements. Inclusive stakeholder participation thus transforms regulation from a top-down approach into a collaborative data-governance model, ensuring that broadband mapping data delivers maximum value for the entire country

5.1.1.1 Interventions by Government agencies and public sector

There is an established collaboration between the CA and key Government agencies involved in the rollout of backbone broadband infrastructure, particularly KPLC, KeTRACO, and KeNHA. These agencies play a crucial role in facilitating last-mile broadband connectivity, which is subsequently leased to Internet Service Providers (ISPs). Their support includes providing essential infrastructure datasets such as electricity grid networks, fiber-optic route maps, and electricity access baselines along with access to GIS platforms that enable real-time integration, updates, overlays, and visualization. They also contribute to last-mile broadband delivery, promote infrastructure sharing to reduce duplication and optimize resource allocation to priority areas, lower the overall cost of broadband services, and uphold harmonized data reporting standards to improve accuracy.

The Survey of Kenya (SoK) supports CA in broadband mapping by providing: updated, accurate, and authoritative geospatial datasets; facilitate data integration and interoperability with CA and other partners through Kenya National Spatial Data Infrastructure (KNSDI); support capacity building on the use of GIS for broadband mapping; promote use of open standards while protecting sensitive national datasets; and ensure spatial accuracy and reliability of broadband maps. Similarly, the Kenya National Bureau of Statistics (KNBS) collaborates with CA through an established framework that enables the nationwide collection of ICT data. Each year, KNBS gathers broadband usage statistics that help track progress in bridging digital gaps across the country.

While these collaborative efforts between the CA and various Government agencies are yielding positive results, there remains a need to establish additional partnerships with other key institutions that play a critical role in broadband development and mapping. Notably, collaboration is yet to be initiated in several core sectors that heavily rely on broadband, such as utility services, lands and housing, postal services, health facilities, educational institutions, County Governments, and municipalities. These entities serve as major catchment points for broadband demand and are integral to accurate broadband mapping, targeted infrastructure rollout, and the overall expansion of broadband coverage across the country.

5.1.1.2 The role of industry and private sector

Collaboration between the CA and industry infrastructure providers is essential to effective broadband mapping. In Kenya, there is strong cooperation between the regulator and private-sector operators, who serve as the primary providers of broadband data. These industry players gather extensive datasets on network coverage, fiber footprints and links, traffic and usage patterns, customer complaints, drive testing results, GIS-based radio planning (using tools such as ArcGIS and QGIS), satellite imagery, and predictive analytics.

Private mobile network operators (MNOs) and Internet Service Providers (ISPs) have made significant investments in ICT infrastructure, particularly in nationwide fiber networks, and have developed sophisticated GIS platforms that host up-to-date infrastructure data. Their advanced GIS methodologies allow seamless data overlays that support smart, evidence-based planning for broadband coverage. These private-sector investments offer several benefits to the CA, including improved regulatory alignment and streamlined reporting, reduced infrastructure duplication and associated cost savings, and better data-driven investment planning. Nonetheless, there remains a need to ensure seamless harmonization of datasets and integration across systems and GIS platforms to fully realize the goals of broadband mapping.

As key stakeholders, private sector agencies in Kenya are committed to contributing to the success of the broadband mapping initiative. Their contributions include establishing transparent and validated internal broadband maps aligned with regulatory requirements; sharing standardized datasets in agreed-upon formats; participating in Quality of Service (QoS) field validation; exploring the use of open data; fostering collaborations with the regulator, academia, and innovators; and sharing best practices based on their experiences in deploying advanced GIS platforms.

By strengthening data sharing practices, the private sector and CA can minimize duplication costs, accelerate network expansion, and enhance Quality of Service. This collaborative model is consistent with international best practices observed in developed economies, where coordinated participation among national regulators, governments, private operators, civil society, and academia ensures that broadband planning frameworks are technically robust, socially inclusive, and economically sustainable.

5.1.1.3 Efforts by other stakeholders

In addition to government and private sector actors, several other organizations play a pivotal role in supporting broadband development in Kenya and the wider Eastern Africa region (EAC-RECS). These

include academic institutions, civil society organizations (CSOs), and advocacy bodies such as the Kenya ICT Action Network (KICTANet)[125], Internet Society Kenya (ISOK)[126], and the Technology Service Providers of Kenya (TESPOK)[127]. Regional agencies such as the East African Communications Organization (EACO)[128] and international development partners including the European Union (EU) and the World Bank also contribute significantly to the broadband ecosystem.

ISOK provides targeted support to Kenya's Community Networks (CN) segment and leads community-level coverage mapping initiatives using open-source tools such as OpenStreetMap, ensuring that local communities are represented on global digital maps. EACO, mandated to harmonize ICT practices across the East African region, advocates for aligned digital development and regulatory approaches. Its key achievements include cross-border frequency coordination, which has significantly reduced interference; harmonization of Universal Service Fund (USF) frameworks to strengthen broadband financing models; collection of regional ICT statistics; and development of a regional broadband strategy.

The World Bank, through its digital development programs, is actively promoting broadband fiber mapping and developing an Open Fiber Data Standard (OFDS) to capture backbone typologies and advance open ICT infrastructure data as a public good. It is also supporting the Digital Super Highway broadband connectivity initiative under the Kenya Digital Acceleration Program, which focuses on fiber rollout and mapping to identify unserved and underserved areas across the country.

The European Union (EU), through its Global Gateway initiative, is funding multiple digital development projects in Kenya. A key program is UNICEF GIGA, jointly implemented with the International Telecommunication Union (ITU), aimed at connecting marginalized schools to the internet. The EU is also supporting national-level digital transformation efforts, including the review of Kenya's Data Protection Policy and the development of the national broadband strategy.

5.1.2 Current status and challenges of broadband data governance in Kenya

5.1.2.1 Status of data governance

CA currently collects data from service providers using a standardized reporting template in Excel (CSV) format, primarily to support the production of quarterly sector statistics reports. The data sharing and access architecture is as shown in Figure 5. However, this approach presents several challenges.

[125] Multistakeholder ICT policy think tank in Kenya, central to digital rights and governance dialogues. https://www.kictanet.or.ke kictanet.or.ke

[126] Kenya chapter of the Internet Society, focused on community networks, standards, and digital inclusion. https://www.isoc.or.ke isoc.or.ke

[127] Industry association managing the Kenya Internet Exchange Point (KIXP), representing ICT service providers. https://www.tespok.co.ke LinkedIn Kenya

[128] Regional body headquartered in Kigali, harmonising ICT policy and regulation across East Africa. http://www.eaco.int LinkedIn

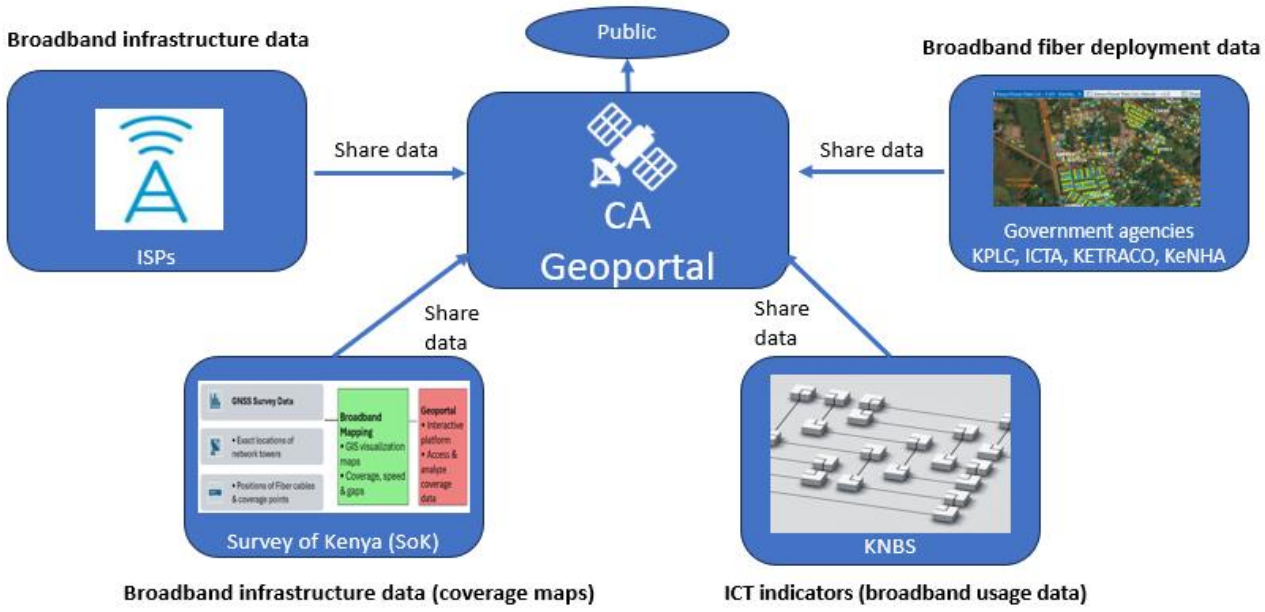


Figure 5. Data sharing and access architecture

5.1.2.2 Data governance challenges

These include incomplete submissions, duplication arising from the absence of a coordinated and standardized reporting framework, limited data availability and accessibility, poor data quality, and the lack of commonly agreed-upon standards. Additional challenges include insufficient mapping and visualization tools, inadequate metadata, low precision and low accuracy of datasets, heterogeneous system architectures and data schemas across providers, limited reporting indicators, and fragmented institutional mandates that require stronger regulatory and inter-agency coordination. Capacity and resource constraints among stakeholders further compound these issues.

Collectively, these challenges hinder CA, private-sector institutions, and other stakeholders from establishing a consistent and sustainable national framework for broadband mapping. Key issues that must be addressed to ensure the success of the broadband mapping initiative include: persistent inconsistencies in operator data formats; overstated coverage reporting due to weak accountability mechanisms; limited GIS capacity within agencies and data providers; insufficient harmonization among stakeholders to prevent duplication and unlock potential cost savings in infrastructure deployment; and gaps in policies and regulations that should enable data sharing, access, and coordinated mapping efforts. Addressing these constraints is essential for improving data reliability, enhancing investment efficiency, and achieving meaningful broadband connectivity.

5.1.2.3 Progress on data governance

Positive progress is already underway. The ICT Authority (ICTA), mandated to set and enforce ICT standards across government, established a standards committee in 2021 to identify relevant standard domains and oversee their development using the Kenya Bureau of Standards (KEBS) procedures. Through this process, ICTA developed the Fiber-Optic Backbone, Metro and Last Mile Infrastructure Standard, which forms part of the broader Government Enterprise Architecture (GEA) and is aligned with international best practices, including ISO standards.

These standards cover crucial elements such as fiber cable categorization, design considerations, labelling and colour coding, installation, placement, splicing and termination, infrastructure sharing, maintenance, quality assurance, and interoperability. They provide a critical foundation for regulatory oversight and enable the CA to monitor network deployment nationwide in line with established benchmarks. Importantly, these indicators can be incorporated into fiber GIS attribute geodatabases

and the OFDS schema, informing identifiers, vocabularies, code lists, metadata, definitions, lexicons, and rules. Collectively, this forms a robust data ecosystem to support monitoring, evaluation, compliance, and enforcement by the regulator.

5.1.2.4 Proposals to address data governance challenges

To effectively address these challenges and provide a sustainable enabling environment for standardized broadband infrastructure and data, the CA should take the lead in developing a comprehensive data standardization mechanism. This should be supported by a robust data governance policy, an interoperability framework, an updated regulatory framework, and clear data management guidelines that collectively ensure effective execution, ownership, and long-term sustainability. Achieving this vision will require strong collaboration and support from all stakeholders.

Key recommendations include aligning operator datasets with CA's regulatory requirements; providing granular, standardized GIS layers for national broadband mapping—covering dimensions such as coverage, capacity, and affordability; and promoting harmonized, evidence-based platforms and systems to minimize duplication of infrastructure data. Additional measures include developing policies and guidelines on data management; establishing transparent and validated national broadband maps; ensuring the sharing of standardized datasets in agreed formats; improving standardized Quality of Service (QoS) field validation procedures; and advancing the development of Open Fiber Data Standards (OFDS) alongside open data collaborations to enhance transparency and accountability.

5.1.3 Importance of broadband data standards and technical specifications in Data Governance

Data standards are technical specifications that define how broadband data should be structured, stored, and exchanged. They promote consistency by setting requirements for all common elements across datasets—such as formats, terminology, schemas, and metadata standards. Developing effective data standards involves establishing a shared language and framework that enables organizations to collaborate seamlessly and supports the successful implementation of standardized data practices.

Consistent data standards make it possible to manage data efficiently and integrate information from multiple sources for large-scale analysis and visualization. This consistency is achieved through standardized file structures, database architectures, feature class names, metadata conventions, schemas, and attribute fields. By relying on a common data-standard framework, agencies can integrate datasets into unified platforms and exchange information freely without compatibility challenges.

Given that developing new data standards is often resource-intensive and time-consuming, adopting existing international standards can streamline the process of improving data management practices. Open standards—publicly available and developed through consensus—are designed to foster consistency and interoperability, particularly in environments where diverse stakeholders contribute data to address shared information gaps. A widely used example is the Open Geospatial Consortium[129] (OGC) Web Map Service[130] (WMS) standard, which supports geospatial data exchange.

Beyond open standards, countries and national institutions can also adopt paid global standards, such as those developed by the International Organization for Standardization (ISO), which offer comprehensive and internationally recognized frameworks for data governance and interoperability.

[129]The Open Geospatial Consortium (OGC) is an international voluntary organization, leader in the development and promotion of open standards for geospatial content and services.

[130]Web Map Services (WMS) are a standard protocol for georeferenced map images over the internet, allowing users to request them. The OGC's Web Map Service (WMS) standard defines a set of rules that compliant servers must implement.

5.1.3.1 Open fiber data standards

The *Open Fiber Data Standard (OFDS)* is a globally recognised data standard designed to support the publication, structuring, and sharing of open fibre-optic network data. It defines what fibre-infrastructure data should be published and how that data should be formatted to meet diverse technical, regulatory, and analytical use cases. By providing a consistent data model, OFDS reduces ambiguity and enables seamless interpretation and reuse of fibre-related datasets across different organisations and systems.

OFDS provides three core components, namely:

> ***a) A common structured data model****:* This includes a well-defined schema, codelists, terminology, and rules governing how fibre data should be described and represented. The model ensures consistency across different publishers and enhances data interoperability.
>
> ***b) Publication formats tailored to different use cases***: OFDS supports multiple data formats, allowing publishers and users to choose structures that best meet their analytical, operational, or regulatory needs.
>
> ***c) Guidance and tooling for publication and use***: The standard is accompanied by documentation, validation tools, and implementation guidance to support data publishers and users in generating, interpreting, and integrating fibre-infrastructure datasets.

In terms of scope**,** OFDS covers:

- Geographic location of fibre infrastructure (e.g., routes, nodes, spans)
- Technical attributes (e.g., fibre type, capacity, connectivity, operational characteristics)
- Administrative attributes (e.g., ownership, operatorship, maintenance responsibilities)

By clearly defining the structure and semantic meaning of data elements, OFDS resolves common ambiguities that arise when fibre infrastructure data is published using inconsistent or ad-hoc formats. Standardisation simplifies analysis, promotes reuse, and enables the development of tools that work across multiple datasets without requiring dataset-specific customisation. Without such standards, data users, including regulators, network operators, planners, and researchers, must expend considerable effort interpreting disparate datasets, reconciling inconsistencies, and building one-off methodologies. With OFDS, users can rely on a shared framework that supports scalable, comparable, and automated analysis.

To meet the needs of a wide range of data users, OFDS supports three main publication formats:

a) ***CSV*****:** OFDS CSV data is organised into multiple relational tables that reflect the hierarchical and nested nature of fibre infrastructure data (e.g., separate tables for nodes, spans, attributes, ownership records). This format is ideal for tabular analysis and integration with database systems.

b) ***JSON*****:** OFDS JSON data represents fibre infrastructure using a structured, text-based format. JSON is suitable for systems that require hierarchical data with flexible structures and is commonly used for web-based applications and API integration.

c) ***GeoJSON*****:** OFDS GeoJSON data contains separate files for nodes and spans, enabling direct spatial representation of fibre network components. This format is widely used for mapping, GIS analysis, and visualization tools.

5.1.3.2 Geospatial data standards

Geospatial data standards are formalized rules and specifications that guide the creation,

management, exchange, and use of geospatial datasets. They ensure that geospatial information is consistent, accurate, interoperable, and usable across different institutions, systems, and applications. For the development of Fundamental Datasets (FDS) and other national geospatial datasets, it is essential to establish clear standards and specifications to guarantee uniformity and alignment with national and international best practices.

(a) ***Data requirements:*** These specify the technical and structural parameters that each dataset must meet before submission to CA or other custodians. Typical specifications include:

- *Accepted data formats:* e.g., Shapefile (.shp), File Geodatabase (.gdb), CSV, KML, GML, GeoJSON, Web Map Service (WMS), Web Feature Service (WFS), etc.
- *Geographic and temporal scope:* e.g., County, municipality, sub-county, ward, city/town boundaries, and time period of data relevance.
- *Coordinate reference system (CRS):* e.g., WGS84 (EPSG:4326) or any nationally adopted CRS.
- *File naming conventions:* Standardised naming to avoid ambiguity and ensure traceability.
- *Positional and attribute accuracy thresholds:* Minimum acceptable levels for spatial accuracy and data correctness.
- *Update and maintenance frequency:* Clear expectations for how often datasets must be updated (e.g., quarterly, annually).

(b) ***Third-party data requirements:*** This describes the obligations of external data providers—such as telecommunications operators, government ministries, county governments, utilities, and private sector stakeholders—when supplying data. Requirements typically include:

- *Permitted data formats:* e.g., Shapefiles, GeoJSON, CSV, APIs, JSON feeds.
- *Metadata standards:* Including: data source and ownership, collection or update date, spatial accuracy, processing history, coordinate system, usage constraints (e.g., licensing).
- *Quality assurance and validation protocols:* Requirements for: data completeness checks, consistency and topology validation, alignment with local or international standards (e.g., ISO 19115 metadata, OGC standards).
- *Submission guidelines:* Ensuring data is delivered securely, on time, and in compliant formats.

(c) ***Data creation methods:*** These provide detailed guidance on how geospatial data should be collected, processed, and compiled. This ensures consistency and comparability across datasets created by different organisations. Specifications may include:

- *Methodologies for data collection:* e.g., field surveys, GPS[131]/GNSS[132] methods, remote sensing, photogrammetry, Light Detection and Ranging, LiDAR[133], or crowdsourcing.
- *Minimum precision and accuracy requirements:* Such as GNSS receiver classes, allowable error margins, or remote-sensing resolution standards.
- *Equipment and tools used:* e.g., required GNSS accuracy levels, software tools, mapping platforms, sensors or drones.

[131] GPS is the U.S. satellite-based navigation system

[132] Global Navigation Satellite System is the broader umbrella term that includes GPS, Europe's Galileo, Russia's GLONASS, and China's BeiDou.

[133] LiDAR uses laser pulses to measure distances and generate high-resolution 3D maps of terrain and infrastructure.

- *Data processing workflows:* Including cleaning, georeferencing, digitization, and QA/QC procedures.
- *Documentation requirements:* All data creation must be accompanied by process documentation to ensure transparency and reproducibility.

Then integration of GPS. GNSS and LiDAR in broadband mapping is presented in Box 3.

Box 3. Integration of GPS, GNSS, and LiDAR in Broadband Mapping

Integration of GPS, GNSS, and LiDAR in Broadband Mapping

- **GPS (Global Positioning System):**
  Used in drive-tests and crowd-sourced QoS programs to capture precise geolocation of signal strength, coverage gaps, and user experience. This ensures broadband maps reflect real-world connectivity conditions at household and community levels (Bangotra et al., 2023; RF Wireless World, 2023).
- **GNSS (Global Navigation Satellite System):**
  Extends GPS by incorporating multiple satellite constellations (Galileo, GLONASS, BeiDou), improving accuracy and reliability of geospatial data. GNSS enables cross-border harmonisation of broadband maps, ensuring Kenya's datasets align with regional and continental standards (Ogaja, 2024; Royal Institution of Chartered Surveyors [RICS], 2023).
- **LiDAR (Light Detection and Ranging):**
  Provides high-resolution 3D terrain and infrastructure mapping, critical for planning fibre routes, tower placement, and rural connectivity. LiDAR overlays allow broadband maps to integrate physical geography with socio-economic demand layers, reducing duplication and optimising investment (Meegle, 2025; Edwards, 2025).

The combination of GPS, GNSS, and LiDAR create a multi-dimensional geospatial backbone for broadband mapping. They enable:

- Evidence-based infrastructure planning (where to deploy fibre/towers).
- Accurate socio-economic overlays (linking coverage to affordability and demand).
- Regional harmonisation (aligning Kenya's maps with AU and ITU standards).
- Transparency and validation (crowd-sourced QoS data matched with satellite precision).

Sources: https://ijisrt.com/assets/upload/files/IJISRT23JUL2292.pdf; https://www.rfwireless-world.com/terminology/rf-drive-test-measurements-tools; https://link.springer.com/chapter/10.1007/978-3-031-74494-5_5; https://www.rics.org/content/dam/ricsglobal/documents/standards/Use%20of%20GNSS%20in%20land%20surveying%20and%20mapping_3rd%20edition.pdf; https://www.meegle.com/en_us/topics/lidar/lidar-in-urban-infrastructure-planning; https://www.surveymaximus.com/utilizing-lidar-surveying-infrastructure-planning

5.1.3.3 Metadata standard

Metadata is another critical component of data standard as it captures essential attributes about datasets such as the origin, theme, format, and publisher, among others. Properly documented metadata enables a shared understanding and management practices, thus ensuring that datasets can be effectively shared, reused, and integrated across different systems and stakeholders.

To enhance metadata practices, it is recommended to adopt recognized standards that define clear requirements for metadata elements, such as ISO 19115-1:2014 and the Federal Geographic Data Committee's (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM). Best practices include maintaining metadata alongside datasets, ensuring accuracy and completeness, using controlled vocabularies, and updating metadata whenever datasets are modified. Adherence to these

practices promotes interoperability, provenance tracking, and efficient lifecycle management of geospatial datasets.

5.1.3.4 Fundamental components of geospatial data standards

The components of a data standard are the building blocks that define its structure and function. Developing a data standard requires first identifying and outlining these key components, ensuring they are clearly defined to establish a shared understanding. This helps ensure consistent use of terminology and concepts for all stakeholders' data. Below is an outline of the key components essential to any data standard:

1. *Data Type:* A data type defines the nature or kind of information that a data element can hold. It is one of the foundational principles of data representation. Common data types include:

- *Boolean*: Represents true or false values (e.g., whether a parcel is for residential/commercial use: true/false).
- *Integer*: Represents whole numbers (e.g., population count of a broadband catchment: 42).
- *String*: Represents sequences of characters or text (e.g., street names: "Koinange Street").
- *Date*: Represents calendar dates, often in standardized formats (e.g., project completion date: "2025-12-04").

2. *Identifiers:* An identifier is a unique reference assigned to a specific unit of data or an entry in a classification scheme. Identifiers help to distinguish individual records within local contexts. Examples:

- *UUIDs (Universally Unique Identifiers):* Randomly generated identifiers that are globally unique.
- *Code lists and classification schemes*: Predefined sets of codes for standardized reference. For instance, "KEN" represents Kenya in the context of ISO 3166-1.

3. *Vocabulary:* A vocabulary is a standardized set of terms with consistent semantic definitions, usually scoped to a specific domain or namespace. It often includes terms as machine-readable labels with definitions provided in a data dictionary. Example:

- The *Dublin Core Metadata Initiative* defines terms for metadata elements like "publisher" to ensure the term is used consistently.

4. *Schema:* A schema outlines the structure and relationships within a dataset or database. It serves as a blueprint for organizing and validating data. The main types of schemas are:

- *Database schemas:* Define how data is organized in a database, often using SQL (Structured Query Language) to specify tables, columns, and relationships. For example, a land parcel database may include tables for owner information, boundaries, and zoning classifications, with relationships defined between them.
- *Data models:* Represent the logical structure of data and its relationships, typically visualized using diagrams like UML (Unified Modelling Language).
- *Serialization schemas*: Specify rules for formatting data for storage or transmission, using formats like JSON Schema or XSD (XML Schema Definition).

5. *Format:* A data format refers to the syntax, encoding, and file type used to store or transmit data. Examples:

- *JSON (JavaScript Object Notation)* is a lightweight, text-based data format used for structuring and exchanging data, typically consisting of key-value pairs and arrays.
- *CSV (Comma-Separated Value)* consists of a simple text format for tabular data.
- *XML (eXtensible Markup Language)* is a flexible, text-based format used for structuring,

storing, and transporting data using custom tags to define elements and their hierarchy.

6. *API (Application Programming Interface):* An API is a set of rules and protocols for accessing or manipulating data across systems. The main types of APIs are:

- *Database APIs:* Provide a way for applications to interact with databases, using interfaces like ODBC (Open Database Connectivity) for accessing various databases and SQL (Structured Query Language) for querying and managing data.
- *Web APIs:* Allow applications to interact with web services, typically using protocols like REST (Representational State Transfer), which rely on standard HTTP methods for data exchange between clients and servers.

Additionally, to ensure clear communication and consistent application of data standards, it is essential to document each component. The documentation should include definitions for each data type, identifier, and schema, with examples, guidelines for implementing these standards in various software platforms, and version control information to track changes in data standards over time.

5.1.3.5 Adoption of data standards

The successful adoption of a data standard depends on its effective implementation and broad acceptance among stakeholders. Demonstrating the standard's value, particularly its ability to facilitate data exchange and interoperability across agencies, is a critical factor in encouraging uptake. Adoption can be supported through targeted strategies, including: providing training to familiarize users with the standard and its applications; establishing dedicated support channels, such as help desks and FAQs, to address stakeholder challenges; and conducting pilot projects to evaluate and refine the standard in practical settings before full-scale implementation. Communication efforts led by the regulator (CA) are essential for building awareness and acceptance. CA should actively promote the benefits of the standards, publish clear and accessible guidance, and maintain transparency in its development process to foster stakeholder confidence and buy-in.

5.2 Interoperability Frameworks

Interoperability frameworks are structured sets of rules, standards, and guidelines that enable diverse datasets, systems, organizations, and individuals to connect and exchange information seamlessly. These frameworks operate across multiple layers—regulatory, organizational, semantic, and technical—to ensure that data can be shared, understood, and effectively utilized. By facilitating consistent and efficient data exchange, interoperability frameworks contribute to improved service delivery, operational efficiency, and overall development. The key components and functions of interoperability frameworks are explained below.

5.2.1 Data Interoperability

Data interoperability refers to the ability of different systems to exchange, interpret, and effectively use data. It enables systems to work together seamlessly, facilitating automation in data mining, discovery, retrieval, and sharing. Without interoperability, valuable data can become isolated or difficult to integrate, reducing its overall utility.

Below are key strategies to improve data interoperability:

- ***Field-type definitions*:** This ensures accurate data querying, display, and analysis by assigning the proper data field types to all spatial and non-spatial datasets and other data management systems. Field types include text, numbers, and dates, and set acceptable ranges for numerical data to avoid errors.
- ***Data dictionaries*:** This provides a shared framework for understanding and managing data. To implement, develop, and share data dictionaries that standardize definitions, field types, and business rules, and use these dictionaries to document metadata and ensure clarity in data

mapping. Data dictionaries enhance interoperability by ensuring that all staff managing broadband data work with consistent definitions across teams, departments and agencies. This shared framework simplifies the use of data created by other broadband data providers, as it reduces the need for clarifications about concepts and definitions.

- ***Valid values*:** Defining valid values for data fields helps maintain consistency and quality by restricting acceptable inputs. Examples include fiber cable span/nodes or geographic projections for broadband networks. Valid values can be stored in lists or tables for reference.
- ***Drop-down lists for data entry*:** This will foster consistency by limiting broadband data providers input to the predefined valid values. To implement, incorporate drop-down lists in spreadsheets and field collection tools to standardize datasets.
- ***Standard naming conventions for data files*:** This enhances the organization and retrieval of data by establishing logical file naming structures. For example, begin file names with broad categories, like County or project name, and narrow down to specifics, such Ward locations.
- ***Version control*:** This prevents confusion from multiple versions of data and ensures access to the most up-to-date information. To implement, and maintain one final, authoritative version of datasets while archiving interim versions with clear documentation of creation and archival dates. For example, a dataset used in the analysis should include a version history to track updates.

5.2.2 Data quality and assurance

Maintaining high-quality data standards is essential for ensuring their usability, reliability, and relevance of broadband data. A structured framework approach to meaningful data quality assurance (DQA) framework should address key aspects such as data validation processes. These processes include: plausible check (assess data for consistency, credibility, and correctness) and manual checks and reviews (conduct thorough inspections of datasets to identify anomalies or errors); additional user feedback and cross-referencing (Incorporate feedback from stakeholders and verify field data against mapped datasets to enhance accuracy); Periodic Data Audits (regular audits should be conducted to verify compliance with data quality and assurance standards.

In this regard, CA should establish a structured framework to ensure that all elements of broadband data meet established criteria); and Policy and Monitoring (a formal broadband data quality policy to institutionalize these measures, including conducting quality checks before publishing new datasets or standards. Continuous monitoring of data standard operations is crucial, as it helps identify challenges early and informs improvements for future data management practices). These processes are already embedded by CA on the Kenya broadband geoportal.

Periodic data audits should be conducted to verify that datasets comply with data quality and assurance standards. A sound framework should be established by CA to ensure these data standards elements meet established criteria. A broadband data quality policy should be established to formalize these measures, including conducting quality checks before publishing new standards. Continuous monitoring of data standard operations is equally important, as it identifies potential challenges and informs improvements in future.

5.2.3 Data sharing protocol

A data-sharing protocol is a Standard Operating Procedure (SOP) that governs the exchange of data by establishing common rules, procedures, and responsibilities. It defines the purpose of data sharing, specifies steps for handling datasets, and clarifies the roles of all stakeholders involved in broadband mapping. Ensuring that broadband data providers comply with established protocols fosters effective cooperation and coordination.

A robust data-sharing protocol enhances workflows, supports decision-making systems (DSS), and promotes long-term benefits by increasing interoperability among agencies and improving collaborative operations. Data sharing goes beyond providing access; it enables timely and informed decision-making across the broadband ecosystem.

To fully harness the potential of broadband data, CA must ensure data accessibility to all relevant agencies. Currently, some data is limited to basic broadband information. A comprehensive data repository, containing complete, accurate, and up-to-date information, is essential. This repository should operate within an ecosystem supported by the necessary systems, institutional policies, and operational procedures.

A clear data-sharing framework should guide the operationalization of this model, defining roles, procedures, and responsibilities within agencies. Key roles include GIS experts, data stewards, data custodians, coordinators, and administrators, among others, to ensure seamless, secure, and efficient data sharing.

5.2.4 Data access and inventory

A data inventory is a critical component of broadband data management, serving as a comprehensive record of all datasets held by an agency. A broadband data inventory includes details such as the type of data, its location, accuracy, source, and other relevant information. Maintaining a comprehensive inventory is essential for the effective management, utilization, and governance of broadband data.

A centralized broadband data inventory streamlines the discovery, management, and use of both spatial and non-spatial datasets. Key advantages include:

a) Improved data finding and retrieval by organising datasets thematically or by logical filters, which in turn reduces unnecessary collection efforts as data creators possess accurate knowledge of data needs and the existing datasets.
b) Improved gap assessment, helps identify missing or gaps that need to be addressed to support the broadband mapping system.
c) Ensures quality control by accurately tracking of data sources, formats, and metadata for quality control, ensuring stakeholders can access reliable and complete information. A data inventory enhances data interoperability, accuracy and completeness.
d) It supports data sharing and integration across agencies. A well-maintained inventory supports seamless sharing and integration of data across agencies, improving coordination and decision-making.

5.2.5 Technical interoperability

In Kenya, the operationalization of CA's data governance mechanisms faces several technical challenges, as highlighted by stakeholder feedback. Key issues include:

- ***Low data quality*****:** Data received from various providers often varies in quality due to differing collection systems.
- ***Spatial accuracy concerns:*** Inconsistent spatial precision limits the utility of datasets for mapping and analysis.
- ***Lack of integration:*** Many private organizations and government entities, such as the Survey of Kenya (SoK), do not integrate their datasets—including fundamental datasets (FDS) like the land cadaster database—with broadband

These challenges result in limited compatibility and integration between inter-sectoral GIS systems, which are critical for meaningful broadband mapping and the establishment of a national broadband mapping system. To address their challenges, the following actions are recommended:

a) ***Advanced systems integration:*** Develop integrated systems that facilitate interoperability across agencies and institutions contributing to broadband mapping.

b) ***Common architectures and specifications:*** Establish standardized, symbiotic architectures, schemas, and system specifications with a focus on broadband data management.

c) ***Deep integration of technologies:*** Design architectures that combine geospatial data (shapefiles, satellite imagery), APIs, IoT, AI, and automation for efficient data handling.

d) ***Integrated deployment:*** Utilize virtual and physical systems through integrated enterprise geoportals, cloud web services (e.g., AWS), ArcGIS servers, and other platforms.

e) ***System synergy:*** Ensure system reliability and seamless data collection, management, sharing, and transfer across agencies while adhering to common data standards.

By addressing these areas, technical interoperability can be enhanced, enabling the creation of a robust, integrated broadband mapping ecosystem.

5.3 Technical Requirements for Broadband Mapping in Kenya

Kenya has made significant strides over the past decade to create an enabling environment for ICT infrastructure roll-out. Key initiatives include: Policy and regulatory updates by modernizing regulations to reflect current ICT developments in the Country; Utilization of Universal Service Fund (USF) to bridging the digital divide by supporting infrastructure deployment in underserved areas; stakeholder collaboration through establishment of partnerships between government, private sector, academia, advocacy bodies, and other stakeholders; and finally providing incentives for ICT service providers by facilitating ease of doing business for infrastructure deployment.

Despite these achievements, broadband infrastructure mapping in Kenya still faces operational and technical challenges. Over the last few years, infrastructure information has been collected and shared with CA on a quarterly basis via manual Excel spreadsheets. However, the manual format presents limitations it that data comes from multiple agencies with varying precision, quality, and accuracy, manual data collection increases the risk of errors and inconsistencies, current access to this dataset is restricted, limiting opportunities for analysis and decision-making.

Although CA's ArcGIS platform provides a foundation for geospatial analysis, there is a need for a more efficient, integrated, and open system for data collection, analysis, storage, and dissemination. To achieve this, the following are recommended:

a) ***Centralized data repository:*** A secure, centralized platform to store all broadband data.

b) ***Automated data collection and submission:*** Standardized tools for collecting, validating, and submitting data from multiple providers.

c) ***Data harmonization and quality assurance:*** Mechanisms to reconcile varying data precision, accuracy, and formats to ensure consistency.

d) ***Integration with existing geospatial systems:*** Connect broadband datasets with other government and private sector geospatial data, such as Survey of Kenya FDS.

e) ***Robust access and sharing policy:*** Facilitate controlled yet open access to relevant stakeholders for analysis and decision-making.

f) ***Advanced GIS and analytics capabilities:*** Utilize tools like ArcGIS, cloud services, and enterprise geoportals to support visualization, mapping, and spatial analysis.

g) ***Interoperability standards:*** Ensure that systems, formats, and data structures are compatible across agencies and platforms.

h) ***Capacity building:*** Upskill personnel in advanced GIS operations, data management, and technical analysis.

i) ***Continuous monitoring, evaluation and updates:*** Implement systems to regularly update datasets, track changes, and maintain an authoritative version of infrastructure data.

Implementing these technical requirements will strengthen Kenya's broadband mapping ecosystem, enhance data-driven decision-making, and support more efficient planning, monitoring, and management of ICT infrastructure.

5.3.1 Data quality

Broadband mapping in Kenya remains largely manual. Internet Service Providers (ISPs) submit data via Excel spreadsheets containing coordinates and basic geographic information. However, there are no established guidelines for data quality, standards, or metadata, which results in inconsistent and incomplete datasets. Key challenges on data quality range from incomplete data submissions from ISPs, errors in precision and geometric accuracy, inconsistent coordinate systems, incomplete geodatabases and varying data formats, poor integration with other critical datasets such as cadaster, roads, buildings, and utilities to lack of a metadata catalog for inventory and management. These challenges compromise the usability, interoperability, and reliability of broadband data.

To improve data quality and in order to mitigate these challenges, it is advisable to:

- ***Establish the Open Fiber Data Standard (OFDS):*** Develop a national framework to guide data sourcing, submission, and dissemination. Include common indicators, schemas, workflows, data life cycles, supply chains, and standardized data definitions. Mandate CA to implement this standard.
- ***Develop a metadata catalog*****:** Maintain a centralized repository of all broadband datasets to facilitate inventory, management, and quality monitoring.
- ***Establish a Data Quality Protocol (DQP):*** Implement standard checks, quality control, and assurance (QA/QC). Harmonize geodetic controls and reference systems. Ensure consistent cartographic representation.
- ***Encourage automation and modernization:*** Replace manual Excel templates with automated data submission using APIs and mobile applications. Directly link ISP data to CA servers using a robust telecom register of all data providers.

Implementing these data quality measures will enhance the accuracy, completeness, and interoperability of broadband datasets, laying the foundation for a reliable and unified national broadband mapping system.

5.3.2 Data confidentiality

Broadband data contains critical information that requires strict confidentiality. In Kenya, much of this data is generated by private sector Internet Service Providers (ISPs). ISPs are required, through CA, to collect and submit data for purposes such as mapping, reporting on broadband service quality, and regulatory oversight. The confidential data in this case are the IP addresses, connection location, internet traffic, and data usage metrics.

In Kenya, it is noted that there is laxity of agencies to share their data with third parties or public. The limited nature data sharing among agencies is due to competition and market segmentation. Agencies often operate in silos, restricting access to critical datasets. This is due to insufficient regulatory frameworks governing data confidentiality and secure sharing.

While, it is important to advance the protection of personal information and online activities from being accessed, shared, or misused by unauthorized parties, there is need for regulatory framework wit rules and guidelines to protect sensitive broadband data, including personal information and operational metrics. It is crucial for the data collection systems to provide a secure reporting environment that ensures data collection platforms implement access controls, user identification, and cybersecurity measures. Data sharing policies that enable controlled, secure sharing of data where permissible, balancing confidentiality with interoperability and analytical needs.

Even though Kenya does not yet have a specific Open Data law, the country already possesses a strong national and sub-national regulatory framework that supports open data initiatives and their confidentiality. They include:

- ***National Development Plan 2002-2008 (2002***): The national development plan (NDP) 2002-2008, implemented an initiative for establishing an NSDI in the country
- ***E-Government Strategy (2004):*** The strategy seeks to achieve efficient delivery of Government information to the citizens and encourage participation of citizens in Government
- ***The Constitution of Kenya (2010):*** It guarantees privacy as a fundamental right (Article 31) and mandates the State to publish essential information (Article 35) that affects the nation.
- ***Open Data Initiative (2011):*** The Kenya Open Data Initiative, seeks to make key government data freely available to the public through a single online portal
- ***Data Protection Act (2019):*** This act regulates the processing of personal data, protecting individual privacy, and establishing legal mechanisms for safeguarding personal data

At the sub-national level, existing regulations provide a foundation for Kenyan authorities to build upon and unlock the potential for a robust Open Data Framework. They are:

- ***National Development Plan 2002-2008 (2002):*** During the NDP 2002- 2008, the Government of Kenya requested a study for the establishment of an SDI framework for the City of Nairobi
- ***Urban Areas and Cities Act (2011):*** The Act requires municipal boards to maintain a comprehensive database and ensure public access
- ***County Governments Act (2012):*** The Act assigns the country responsibility for, collecting, storing, and updating data for the planning process, and establishing a GIS-based database system

The Kenyan Government is at the forefront in strengthening data protection laws and policies like the Data Protection Act 2019, Data Protection (General) Regulations 2021 enforced by the Office of the Data Protection Commissioner (ODPC), governs how ISPs and other organizations handle personal data. The ODPC Guidance Note and the National Broadband Strategy (NBS) provide guidance on data protection principles like data minimization and accuracy[134]. The new Kenya Information Communication Amendment Bill 2025 is a new proposed legislation that is still in Parliament, aims to create more specific regulations for data collection by providers, including the potential for government access to usage data.

On the other hand, the national broadband strategy[135], envisages the following on broadband data privacy and data protection;

- ***Individual participation:*** Emphasizing that consumers must provide informed consent before their data is collected or processed. Consent should be specific, freely given, and based on clear understanding of data usage.
- ***Increasing transparency in data collection and processing****:* The public should receive sufficient information to make informed choices regarding their personal data. Transparency can be

[134]https://www.odpc.go.ke/wp-content/uploads/2024/02/ODPC-Guidance-Note-for-the-Communication-Sector.pdf
[135]https://ict.go.ke/sites/default/files/2024-09/National-Broadband-Strategy-2023.pdf

promoted through **standard privacy notices**, plain-language explanations, and **data breach notifications**.

- ***Responsibility of data controllers:*** Data Collectors (DCs) are mandated incorporate substantive privacy protections into their practices, including data security measures, data minimization practices, sound retention and deletion practices and policies, and data accuracy as a right for consumers including maintaining comprehensive data management procedures throughout the life cycle of their products and services
- ***Raising awareness among users:*** Educate users of the data, on the privacy implications of broadband and emerging technologies.
- ***International cooperation:*** I Strengthen cross-border collaboration for enforcement of privacy laws and data protection standards.
- ***Encryption:*** Building capacity on Encryption methods. Advocate for Policies Requiring messaging and communication channels to use Encryption. Ensure IoT and other internet-enabled devices support encryption by default to safeguard data.

Implementing these measures ensures that broadband data collection and use align with privacy and data protection best practices, fostering public trust and compliance with national and international standards.

5.3.2 Data sources

As indicated above, broadband data in Kenya is primarily sourced from private network operators and ISPs, who collect and submit information to CA on a quarterly basis. This data is generally collected in the field by the ISPs themselves, who bear the associated costs and capital expenditures. While these sources of data are trustable and reliable, most of these data are collected and stored in difference formats. These varying methodologies warrants the challenges related to accuracy, precision, varying level of details, timelines, capacity and interoperability challenges and lack of unified standards of data collection. In order for broadband mapping to succeed, there is need to harmonize data collection methods, standards and specifications especially on methodologies, systems of data collection and workflows.

Furthermore, these data come with confidentiality clauses and non-disclosure agreements (NDA), and accompanied with strict access both by other agencies and public. The lack of open data policies in Kenya and the laxity of agencies to open datasets for public good leads to redundancies. It is advisable to use publicly available data as much as possible. However, this requires a sound regulatory environment and coordination from the regulator, in this case CA.

5.3.4 Reporting types

In Kenya, broadband reporting is currently conducted on a quarterly basis, where agencies submit information to CA using a manual template. This data is primarily used for regulatory purposes and for the publication of quarterly sector statistics reports. Key metrics include subscription growth rates, market share by operator, and geographical reach. The challenge of this is that the existing template does not accommodate the four critical types of broadband reporting: infrastructure mapping (nodes, spans, and network layouts), demand mapping (Consumer usage patterns and demand metrics), supply mapping (Service availability and coverage levels) and investment mapping (Infrastructure investments and funding sources). Each of these requires a collection of different types of data with varying degrees of detail and coming from various sources. At present, there is inefficient processing of collected data to be able to present it in a clear format. Excel files contain minimal GIS data, limited databases, metadata, catalogs, or schemas. Inconsistent formats and absence of integrated geospatial tools hinder interoperability and data analysis.

There is need to leverage emerging geospatial technologies and enterprise geodatabases for seamless data collection, storage, and harmonization. Develop reporting templates and workflows that

incorporate all four reporting types, with standardized metadata, schemas, and GIS integration. Automate data submission where possible to reduce errors and improve timeliness. Implementing these measures will enhance the quality, usability, and interoperability of broadband reporting.

5.3.5 Regulation

Despite significant progress in Kenya's legal and regulatory framework for data sharing, there is currently insufficient regulation specifically addressing broadband data collection and management. Clear definitions are needed to determine what data must be collected to successfully support the broadband mapping process. Currently, public data is partially accessible but Critical private data collected by ISPs and backbone infrastructure providers, such as KPLC, KETRACO and KeNHA, is not openly available.

To mitigate these challenges, state-level regulation is the most effective way to obtain such data, however, with building trust between governing bodies and private sectors, some additional, non-compulsory data may be obtained. With this in mind, the national regulator (CA) should clearly state, what data, to what detail and with what frequency has to be provided by the operators. The regulator should design regulation for data reporting, that consider such data aspects as:

a) type of data to be collected

b) level of detail of data (i.e., to the household level)

c) frequency of data collection (once a year, twice a year, quarterly, on a rolling basis)

d) list of legal entities that are obliged to provide data (ISPs and providers such as private operators, and county governments)

International best practices recommend the constitution of a Dispute Settlement Body (DSB) in order to maximize the benefits of broadband mapping systems, not only should a single information point be established, but also a DSB. The role of the DSB, and if assigned to, and adopted by CA, would be critical in ensuring that all parties involved would abide by the rules and legal framework under which the broadband mapping systems would operate, both by setting general references when rules and procedures may raise questions and by playing an active role as the mechanisms that would ensure the resolution of any litigation.

5.3.6 Stakeholder costs

Stakeholder costs associated with broadband data collection, primarily involve compliance burdens for ISP and administrative overhead for the regulator. ISPs bear the most direct costs (CAPEX/OPEX) related to data collection and reporting. This is due to the mandatory nature where service providers must gather granular data on where they do offer service, including specific detailed information, and submit quarterly to CA. These activities require investment in expensive data management systems and labour. ISPs may also incur costs responding to bulk challenges to their reported data filed to CA, which requires additional data validation and submission. They often invest resources in validating this data and conducting their own bulk challenges, requiring staff time, technical expertise, and potentially GIS tools.

Since ISPs in Kenya vary in terms of size, coverage (local/national) and capital expenditure, varying size of broadband providers poses the following challenges:

a) Varying level of detail of data available within ISPs

b) Level of automation of data management within ISPs

c) Varying formats of data storage within ISPs

d) Varying skillset for data management within ISPs

The above-mentioned challenges have to be taken into account when designing the data reporting platform, which should accept various data format loads [i.e., csv, xls, pdf, GIS (nodes/spans), GeoJSON, XML via API etc.]. It should also accommodate automatic, semi-automatic and manual reporting. Due to varying sizes of reporting bodies, it might be considered what data is compulsory for all entities to report and what data should only be reported by the largest operators. The benefits of addressing stakeholder costs minimizes compliance burden on smaller operators, ensures inclusivity and fairness in reporting, and improves data consistency, quality, and interoperability across providers

5.4 Institutional Governance Models

Successful broadband mapping in Kenya requires robust institutional governance models that clearly define roles, responsibilities, and operational processes. Examples of Governance models include: stakeholder involvement, clear definition of mapping types, internal sponsorship and financial support, reporting support, investment in reporting tools, change management and talent management.

In terms of long-term sustainability, Governance models must incorporate mechanisms for continuous monitoring, updating standards, and adapting to technological and sectoral changes. Long-term planning ensures that broadband mapping aligns with national development goals and provides reliable, actionable data. Effective Governance models have benefits such as enhances coordination and collaboration across stakeholders, ensures compliance with data standards and regulatory requirements, supports sustainable and scalable broadband mapping, and improves trust, transparency, and the quality of data available for policy and investment decisions.

The regulator (CA) needs to be empowered with both financial and human resources in order to achieve a sustainable broadband mapping system in Kenya. The long-term sustainability model requires long term attention in order to meet the long-term goals of broadband mapping. Below are examples of models that can be adopted in Kenya.

5.4.1 Stakeholder involvement

Successful broadband mapping in Kenya requires strong multi-stakeholder collaboration, bringing together partners from public, private, academic, civil society, professional, and international development sectors. Key areas include:

- ***Government leadership*:** Strong leadership from Communications Authority of Kenya (CA) and the parent Ministry of Information, Communications and the Digital Economy (MICDE) is essential for steering the project and providing a clear national vision, such as the one outlined in the National Broadband Strategy (NBS). CA should take the lead as the regulator to provide clear communication about why the data is collected, disclosing gathered data on request, given the confidentiality clauses. Also providing tools, platforms and information that may be then used and applied by telecommunication operators in their private businesses is likely to stimulate their involvement.
- ***Private sector involvement:*** ISPs and other private entities must be involved in data collection, submission and infrastructure deployment. This can be achieved by encouraging transparent system that can attract investment in broadband mapping. Private sector stakeholders can also lead in producing reports and publicly available maps to demonstrate the value of collected data.
- ***Other stakeholder engagements*:** This encompasses bringing in other stakeholders such as civil society and academia through participatory approaches in order to be part of the wider broadband mapping initiative. Civil society and academia are crucial in providing education, capacity building skills, broadband mapping systems curriculum development, citizen engagement and Promoting awareness of the goals, benefits, and opportunities created by

broadband mapping initiatives that will be achieved by implementing broadband mapping in Kenya.

Multi-stakeholder collaboration has immense benefits, in that it encourages trust and cooperation among diverse stakeholders, promotes data transparency and sharing while respecting confidentiality, strengthens the sustainability and effectiveness of the broadband mapping system, and enhances capacity development and knowledge transfer across sectors.

5.4.2 Clear definition on types of mapping

For successful broadband mapping in Kenya, it is essential to clearly define the four main types of mapping. Clear definitions provide guidance for stakeholders on the fundamental datasets (FDS) to be collected, reducing ambiguity in data reporting, processing, and compilation from multiple sources.

The four main types of broadband mapping include:

a) Infrastructure – i.e., telecommunication infrastructure, other relevant infrastructure (e.g., energy network), construction works

b) Investment – i.e., private, funded, planned, completed

c) Service – i.e., bandwidth and access technologies, provider, data volume usage

d) Demand – i.e., demand for bandwidth, quality of service, willingness to pay

While ISPs have ISPs have primarily focused on infrastructure mapping, investment, service, and demand mapping remain limited or inconsistent. Due to this shortcoming, it is advisable for the regulator and the Government to promote and provide a conducive environment for ISPs to thrive, through sound policies, ease of doing business and through tax incentives and other support mechanisms. CA should encourage comprehensive mapping across all four types ensures a holistic broadband ecosystem, improving planning, investment, and service delivery.

5.4.3 Internal sponsorship and financial support

CA, as the coordinator and convener of broadband stakeholders, requires institutional strengthening and financial support to effectively carry out its mandate as the national broadband data collection and management agency. As broadband mapping involves multiple stakeholders, including inter-governmental bodies, private sector operators, academia, and civil society, CA requires both institutional authority and sponsorship to coordinate these actors effectively and ensure compliance with data standards and reporting protocols.

Furthermore, the support needed should be able to leverage on integrating broadband mapping in planning and financial sustainability e.g. the linking of broadband mapping to broader socio-economic goals, such as Vision 2030, Kenya's Digital Economy Blueprint, the National Digital Masterplan[136] (2022-2032) underscores the importance of institutional planning, the policy scaffolding: targets for universal broadband, digital hubs deployment, public-service digitization, and inclusive-access standards and guidelines for local implementation. Newer bills (e.g., the Digital Literacy Opportunities Bill) formalise community digital hubs and set quality/accessibility standards. By establishing structured policy direction, they create predictability for both public and private stakeholders and ensure that empowerment efforts are coherent rather than fragmented.

[136]https://cms.icta.go.ke/sites/default/files/2022-04/Kenya%20Digital%20Masterplan%202022-2032%20Online%20Version.pdf

Further, there is need for synergies with other intergovernmental bodies such as MICDE, Kenya Power and Lighting Company (KPLC)[137], Kenya Electricity Transmission Company **(**KETRACO)[138], Kenya National Highways Authority (KeNHA)[139], Survey of Kenya, Kenya National Bureau of Statistics (KNBS)[140] etc to leverage on joint funding/programming models across Government agencies. Integrated approaches help reduce redundancies and enhance efficiency in data collection and management.

Apart from Government funding, there is also need to leverage funding from donors and international agencies by utilizing funds such as the Universal Service Fund (USF) and securing international partnerships such as ITU, UNICEF Giga project[141], World Bank digital acceleration program and open data initiative, Africa Development Bank's last mile connectivity project, open data initiatives and other international development programs.

5.6 Recommendations for Data Governance and Interoperability

To achieve a sustainable and effective data governance model for broadband mapping systems in Kenya, it is essential to strengthen institutional frameworks, enhance interoperability, and align national practices with regional and international standards. The following recommendations are proposed:

a) Development of data standards and guidelines

The development of data standards requires a comprehensive understanding of existing datasets, current data management practices within CA, and practices adopted by other data-providing organizations. Key considerations include defining and enforcing OFDS and metadata requirements, establishing minimum compliance thresholds such as mandatory metadata fields for all broadband datasets, and designing fiber data standards with interoperability as a central principle. This process also involves developing relevant guidelines and standard operating procedures for data submission, processing, and validation. Importantly, the successful adoption of standards requires consensus building and joint endorsement by both CA and all stakeholders.

b) Establishing clear data sharing procedures and protocols

Clear and well-defined data-sharing procedures are vital to ensure efficient information flow between CA and data providers. Regardless of the adopted sharing model, several critical considerations must be addressed:

- ***Data security and sensitivity*****:** Implement encryption, access controls, and protocols for handling sensitive datasets to prevent unauthorized access and breaches.
- ***Standardized data request formats*****:** Establish a clear, uniform structure for data requests to streamline communication and minimize delays.
- ***Designation of a data custodian or steward*****:** Assign a dedicated individual or team to manage data requests, ensure timely communication, and maintain accountability.

[137] Kenya's national utility, responsible for electricity distribution and retail supply. https://www.kplc.co.ke Kenya Power
[138] State-owned operator of high-voltage transmission lines and regional. https://www.ketraco.co.ke Kenya Electricity Transmission Co. Ltd
[139] Statutory body managing trunk roads (Class S, A, B) under the Kenya Roads Act. https://www.kenha.co.ke Kenya National Highways Authority
[140] Kenya's principal government agency mandated to collect, analyze, and disseminate statistical data. https://www.knbs.or.ke
[141] A UNICEF–ITU initiative launched in 2019 to connect every school worldwide to the internet, supporting digital inclusion and education. https://giga.global Giga

- ***Training and public awareness:*** CA should provide targeted training to data providers and internal users, clarifying data-sharing procedures, available datasets, and access rights.

Data-sharing procedures can be further strengthened through the creation of a centralized data catalog, managed by CA, which serves as a unified repository of available datasets. This catalog reduces duplication, improves discoverability, and ensures consistent access to datasets across institutions. It may be integrated directly into the CA ArcGIS platform to support streamlined data collection and access.

c) Setting up data collection, integration, and inventory tools and templates

A data inventory is a dynamic resource that informs CA's understanding of current data coverage, future data requirements, and supports broadband mapping and planning. Developing a data inventory involves systematically cataloging existing datasets, identifying gaps, and formulating strategies to address them.

A well-designed data inventory template should clarify: What data assets will be included; Who is responsible for maintaining each dataset; What metadata attributes are required; How updates and quality will be ensured; and which standards will govern metadata attributes (e.g., controlled vocabularies, numeric formats). Defining these elements during the design phase ensures consistent development and ongoing maintenance of the inventory. To accomplish this step effectively, CA may need to assess existing data collection practices and current metadata registration processes.

d) Harnessing system interoperability and developing unified architectures and schemas

Interoperability is fundamental to enabling systems from different agencies to exchange and utilize data. Achieving it requires harmonization across technical, semantic, data, and legal domains. Without interoperability, datasets remain isolated, undermining their usefulness.

CA and stakeholders should work toward harmonizing existing broadband mapping systems by adopting: Common data standards and naming conventions; Unified technical architectures and schemas; Cloud-native and service-based platforms; Shared dashboards, geoportals, and visualization tools; Version control processes; and scalable storage and data discovery mechanisms.

These efforts will automate data retrieval, promote seamless data exchange, and ensure compatibility across agencies.

e) Development of data governance policies and guidelines

The long-term success of broadband mapping depends on strong policy frameworks and clear implementation guidelines. CA should develop a Data Governance Policy (DGP) to improve data quality, integrity, security, and transparency. This policy should also clarify data ownership, outline security measures, and ensure compliance with relevant legislation.

Additionally, CA should develop an Open Data Policy (ODP) aimed at: Establishing internal procedures for data classification; Protecting sensitive information; Enhancing accessibility for internal and external stakeholders; and supporting responsible public data release.

The DGP and ODP are mutually reinforcing: the open data policy supports the governance policy by enabling structured data sharing in compliance with privacy and security laws such as the Data Protection Act (2019). The open data framework may be adopted as a standalone policy or integrated into the broader governance policy. Other key policies include a data-sharing policy, a Data Quality Assurance (DQA) framework, and detailed technical guidelines.

f) Human resource management, training, and capacity building

Despite progress made by CA and select ISPs, broadband geospatial data management in Kenya remains at an early stage. Sustained broadband mapping requires targeted capacity building to strengthen the technical skills needed for producing, maintaining, and sharing accurate broadband information. Priority capacity areas include ICT systems, programming, server and database management, and geospatial data technologies.

Capacity enhancement can be achieved through: Industry-based training programs such as ESRI Telecommunications GIS modules; Virtual training through ITU's academy for NRA member countries; Tailor-made university academic curricula for geospatial programs to incorporate broadband mapping technologies; Peer-to-peer learning with EU agencies (e.g., BEREC) through workshops, webinars, seminars, and exchange programs.

Such interventions will help address technical capability gaps and ensure sustainable broadband mapping practices in Kenya.

g) Operationalizing and aligning data protection laws and regulations

Because broadband datasets may contain microdata and sensitive personal information, it is imperative to embed data protection principles within all data governance frameworks. This requires aligning CA's governance, open data, and data-sharing policies with Kenya's existing data protection legislation.

The Kenya Data Protection Act (2019) plays a central role by outlining rules for personal data collection, processing, storage, and use that is consistent with Article 31 of the Constitution. It establishes responsibilities for data controllers and processors and protects individuals from unauthorized data sharing. Given that data in Kenya is often shared widely without clear consent or oversight, effective safeguards are essential to uphold privacy rights and ensure responsible use of data across stakeholders.

h) Developing a Monitoring and Evaluation framework and communication strategies

A comprehensive M&E framework is essential for tracking the progress, effectiveness, and impact of broadband data governance initiatives. It enables CA to monitor activities, measure outcomes, identify challenges, address gaps, and ensure alignment with strategic objectives.

A strong M&E framework should: Include SMART-aligned Key Performance Indicators (KPIs); Track data quality, metadata compliance, and interoperability progress; Provide regular progress updates; Integrate stakeholder engagement through feedback mechanisms such as surveys and reporting templates; and Guide adjustments to tools, timelines, and standards.

Effective communication strategies will also ensure that stakeholders remain informed, aligned, and actively engaged in ongoing broadband data governance improvements.

5.7 Regional Harmonisation Initiative

In Kenya, the launch of the Kenya Open Data Initiative (KODI) in 2011 marked an important milestone toward enhancing transparency, public participation, and evidence-based decision-making. However, more than a decade later, significant challenges persist in accessing, managing, and sharing data at both national and regional levels. Despite the existence of substantial datasets—produced by government agencies, parastatals, private sector entities, and development partners—the government does not consistently publish open, officially sanctioned, and publicly accessible data. As a result, Kenya continues to face several systemic challenges that hinder effective data governance and regional harmonisation efforts.

The major challenges to regional harmonisation include:

• ***Lack of data access****:* Kenya currently lacks a centralized, publicly accessible repository for official government datasets. The Kenya Open Data Portal, initially established in 2011 as a flagship initiative to promote openness and transparency, is no longer operational. This limits the ability of users—including policymakers, researchers, and regional bodies—to access reliable, up-to-date, and official datasets.

• ***Data sharing and compatibility challenges****:* Data sharing practices across national institutions remain weak and inconsistent. Many public agencies still operate in silos, with limited coordination and incompatible data formats. This fragmented approach results in data duplication, inefficient use of resources, and significant challenges in integrating datasets to support national and regional decision-making.

• ***Interoperability shortcomings****:* Although various datasets are available online from different organizations, many do not comply with established interoperability standards. As a result, they cannot be easily integrated, analysed, or shared across platforms, limiting their usefulness for comprehensive, multi-sectoral, or cross-border applications.

• ***Limited regulatory and policy frameworks****:* Kenya lacks a robust and enforceable regulatory framework governing data sharing among national regulatory agencies (NRAs), especially across borders. This gap makes it difficult to participate effectively in regional harmonisation efforts or to align national practices with continental initiatives such as those led by AU, UNECA, SADC, ECOWAS, and IGAD.

These challenges highlight the urgent need for strengthened national data governance mechanisms, improved institutional coordination, and harmonized data-sharing standards. Addressing these gaps will be crucial not only for advancing Kenya's own spatial data infrastructure but also for enabling meaningful participation in wider regional SDI and broadband mapping harmonisation initiatives across Africa.

5.7.1 Status of national spatial data infrastructure in Kenya

The concept and development of the Kenya National Spatial Data Infrastructure (KNSDI) began in 2001[142] with the objective of enhancing the production, sharing, and use of spatial data to support sustainable development and strengthen evidence-based decision-making. Between 2001 and 2009, the initiative received significant financial and technical support from the Japan International Cooperation Agency (JICA), which enabled Kenya to take its initial steps toward establishing a national SDI.

Early progress included the development of a national clearinghouse in 2003 and, subsequently, an NSDI clearinghouse in 2008[143]. However, these platforms are currently non-operational. During this foundational period, several key institutions actively contributed to KNSDI development, including the Survey of Kenya (SOK), the Nairobi City Council (NCC), the Ministry of Lands (MoL), and the Institution of Surveyors of Kenya (ISK).

One of the major achievements of this early phase was the establishment of the *Kenya Profile for Geographic Information Standards (KPGIS)* [144]. This framework strengthened Kenya's technical competencies in key areas such as map digitization, data-sharing protocols, capacity building, training, and the development of an organizational and governance structure for geospatial information management.

[142]https://www.researchgate.net/publication/324586447_Relaunching_the_Kenya_National_Spatial_Data_Infrastructure
[143]https://www.researchgate.net/publication/233985742_World_Status_of_National_Spatial_Data_Clearinghouses
[144]https://www.scirp.org/reference/referencespapers?referenceid=3991381

A draft KNSDI policy was also developed with the intention of establishing a national framework for geospatial information collection, integration, distribution, and sharing across the public sector, private sector, and civil society. The draft policy aimed to:

a) Eliminate resource wastage and duplication in geospatial data production
b) Establish standards for data production, management, and distribution
c) Provide mechanisms for easy discovery, access, and use of geospatial data
d) Promote and coordinate Kenya's participation in international SDI initiatives

Despite being listed as a flagship program in Kenya's Vision 2030 Third Medium Term Plan (MTP III, 2018–2022) [145], the draft KNSDI policy[146] has not been ratified, and its formulation stalled in 2016. As a result, the initiative has lacked a formal enabling framework necessary for sustained implementation and institutional anchoring.

The progress of the KNSDI has been slowed by several factors, including:

- Uncertainty regarding the institution mandated to host and manage the KNSDI
- Fragmented and ad hoc development efforts across ministries and agencies
- Lack of sustainable funding mechanisms
- Weak institutional frameworks and unclear governance arrangements
- Limited promotion of custodianship and data stewardship responsibilities
- Concerns over long-term sustainability due to the project's initial design and execution

Kenya has numerous public and private organizations involved in spatial data production, use, and dissemination. However, due to the stalled momentum of the KNSDI, these efforts remain largely fragmented, uncoordinated, and agency-specific. When compared with other African countries, Kenya's NSDI maturity level can be considered average—neither among the continent's most advanced nor among the least developed.

Notable achievements, however, include:

- Strong technical capacity in map digitization and digital geospatial workflows
- Development of geospatial data-sharing guidelines
- Investments in training and capacity building
- Establishment of an initial organizational structure for SDI governance
- Preparation of the KNSDI policy, which—once approved—would create a formal legal and institutional framework
- Development of a prototype clearinghouse portal (currently inaccessible)

Overall, while Kenya laid important foundational elements for its NSDI, the absence of a ratified policy, fragmented institutional roles, and resource constraints have prevented the KNSDI from maturing into a fully functional national infrastructure[147]. Renewed political commitment, legal backing, and sustainable institutional arrangements will be essential to revitalize the initiative and align it with continental and regional geospatial frameworks.

5.7.2 National spatial data infrastructure development in Africa and regional efforts

The development and implementation of Spatial Data Infrastructures (SDIs) on the African continent involve a broad and diverse range of stakeholders drawn from governmental agencies, regional bodies, development partners, and technical institutions. Each of these actors brings distinct

[145]https://www.sajg.org.za/index.php/sajg/article/view/156
[146] Kenya Vision 2030 Delivery Secretariat. (n.d.). *Kenya National Spatial Data Infrastructure (KNSDI).* Government of Kenya. Retrieved January 31, 2026, from https://vision2030.go.ke
[147]https://www.researchgate.net/publication/272088434_SPATIAL_DATA_INFRASTRUCTURE_AND_VOLUNTARY_GEOGRAPHIC_INFORMATION

mandates, capacities, and perspectives, contributing to the complexity—and importance—of SDI maturation across Africa.

At the continental level, the *United Nations Economic Commission for Africa (UNECA)* has played a central leadership role in advocating for and guiding the establishment of National Spatial Data Infrastructures (NSDIs). UNECA's efforts have focused on promoting geospatial policy development, strengthening institutional frameworks, and supporting the adoption of international standards that enable effective spatial data sharing and interoperability.

At the sub-regional level, the momentum for SDI development has been reinforced by Africa's Regional Economic Communities (RECs). Political and economic blocs—such as the *Economic Community of West African States (ECOWAS)*, the *Southern African Development Community (SADC)*, the *Intergovernmental Authority on Development (IGAD)*, *the New Partnership for Africa's Development (NEPAD)*, and the *Common Market for Eastern and Southern Africa (COMESA)*—have each advanced SDI initiatives aligned to regional priorities. Their contributions often include harmonizing geospatial policies, coordinating cross-border spatial data initiatives, and supporting capacity building among member states.

These regional and continental initiatives are complemented by the collaborative efforts of national mapping organizations, land agencies, and statistical offices, which serve as technical stewards of geospatial data. Together, these partnerships form a multi-layered governance ecosystem that underpins Africa's drive toward fully functional NSDIs and a coherent Regional or Continental Spatial Data Infrastructure (RSDI/CSDI).

5.7.2.1 IGAD NSDI Regional Spatial Data Infrastructure (NSDI) Initiative

The IGAD NSDI initiative focuses on regional geospatial data sharing and enhancing the capabilities of data-sharing nodes within member states. Its primary goal is to harmonize geospatial data across the eight IGAD member countries to support regional integration, infrastructure planning, and sustainable development.

Key objectives and activities include:

- ***Data harmonization efforts****:* Promote consistency and compatibility of geospatial and statistical datasets across all member states, and facilitate the standardization of spatial data to support cross-border planning and infrastructure development.
- ***Regional data ecosystem development:*** Strengthen regional data infrastructures to ensure interoperability among national SDIs (NSDIs) and the regional SDI (RSDI/ARSDI); and harmonize geospatial data for critical sectors including land governance, water resource management, and regional infrastructure planning.
- ***Geospatial data utilization:*** Encourage the use of GIS and spatial data in regional projects, such as the IGAD Regional Infrastructure Master Plan (IRIMP), and use geospatial data to map existing and planned infrastructure, inform policy decisions, and support strategic investment.
- ***Regional cooperation and standards:*** Develop harmonized policies and common technical standards among member states, and ensure that both national (NSDI) and regional (RSDI/ARSDI) spatial data infrastructures are aligned and interoperable.

The IGAD NSDI[148] initiative illustrates a regional approach to geospatial data harmonization in East Africa, highlighting the importance of coordination, standardized practices, and data interoperability for infrastructure planning and regional integration.

[148] **I**ntergovernmental Authority on Development (IGAD). (n.d.). *IGAD Spatial Web Portal: National Spatial Data Infrastructure (NSDI).* Djibouti: IGAD Secretariat. Retrieved January 31, 2026, from https://geonode.igad.int

5.7.2.2 ECOWAS Regional Spatial Data Infrastructure (SDI) Project

The ECOWAS SDI Project is a strategic initiative aimed at harmonizing, centralizing, and standardizing geospatial data across the 15 West African Member States. The primary objective is to leverage geospatial data to improve decision-making, governance, crisis response, and development planning, supporting the broader vision for a resilient, innovative, and inclusive digital future for West Africa.

Key features and objectives include:

- ***Harmonization and standardization:*** Establish uniform standards for geospatial data across all 15 member countries, and to ensure seamless data sharing and integration to support cross-border planning and decision-making.
- ***Collaboration:*** Foster cooperation among national geospatial agencies, technical experts, and regional and international partners. Partners include the African Regional Institute for Geospatial Information Science and Technology (AFRIGIST) and the World Bank, notably through programs like the Western Africa Regional Digital Integration Program (WARDIP).
- ***Policy framework:*** Develop a robust policy and institutional framework to ensure the long-term sustainability of the SDI infrastructure; Provide guidance for governance, data management, and regulatory compliance across the region.

The ECOWAS SDI Project demonstrates a regional approach to geospatial data management, emphasizing standardization, interoperability, and cross-border collaboration, which can serve as a model for broader African regional initiatives in geospatial and broadband data harmonization.

5.7.2.3 SADC NSDI initiative

The Southern African Development Community (SADC) recognizes NSDIs as critical enablers for regional integration and sustainable development within the Southern Africa region. While the region has made progress in general geospatial infrastructure development, the establishment of fully operational NSDIs across all member states remains at an early stage.

SADC's approach focuses primarily on creating an enabling environment for geospatial data sharing and building the capacity of member states rather than implementing a single centralized infrastructure.

Key initiatives and progress include:

- ***Policy and coordination:*** SADC encourage its Member states to develop national policies and legal frameworks for geospatial data management. These efforts aim to promote data sharing, avoid duplication, and strengthen national NSDI governance. This approach aligns with the broader African Action Plan on Global Geospatial Information Management (AAP-GGIM), which emphasizes policy, governance, and common frameworks for spatial data.
- ***Regional Remote Sensing Unit (RRSU):*** The SADC-RRSU plays a central role in supporting spatial data initiatives. It collects and manages metadata for spatial datasets, supports national metadata working groups, and enhances regional capacity for remote sensing imagery and geospatial data analysis.
- ***Regional Infrastructure Development Master Plan (RIDMP):*** The RIDMP (2012–2027) identifies infrastructure as a key enabler for industrialization and regional integration. It spans sectors including transport, energy, ICT, and water, with spatial data serving as a foundational element to support planning, monitoring, and decision-making.

Despite progress, NSDI development in the SADC region faces several constraints, these challenges include: Limited political will to prioritize geospatial infrastructure at national and regional levels;

Insufficient funding from governments and international donors; Personnel skills and capacity shortages in geospatial data management and analysis; Diverse national regulatory frameworks, creating barriers to standardization and interoperability; limited private sector participation, which reduces investment and innovation in NSDI development.

5.7.2.4 AU and UNECA Initiatives on Geospatial Information and NSDI Development in Africa

The African Union (AU), primarily through the United Nations Economic Commission for Africa (UNECA), promotes the use of geospatial information systems (GIS) to support continental development goals, including Agenda 2063 and the Sustainable Development Goals (SDGs). A cornerstone initiative in this regard is the African Action Plan on Global Geospatial Information Management (AAP-GGIM), officially branded as Geospatial Information for Sustainable Development in Africa (GI4SD), covering the period 2016–2030 and beyond. The initiative aims to advance sustainable development through the management and production of evidence-based geospatial data.

Key aspects of the Initiative include:

1. ***Policy and guidelines for implementation****:* The United Nations Economic Commission for Africa (UNECA)[149] has developed policies and guidelines to assist Member States (MS) in establishing National Spatial Data Infrastructures (NSDIs), strengthening national capacity to develop geospatial information services. These guidelines should be should be adapted to the specific country circumstances of individual African countries.

2. ***Capacity building, training, and knowledge transfer****:* The AU and UNECA organize training programs, workshops, and awareness campaigns to support the implementation of the Integrated Geospatial Information Framework (IGIF), helping MS develop their geospatial strategies and capabilities.

3. ***Common continental frameworks and tools****:* NSDIs are aligned with broader continental strategies, including the African Space Policy and Strategy and programs such as GMES Africa, funded by the EU, which leverage Earth Observation data to inform policy-making and decision support.

4. ***Integration of geospatial information and statistics****:* The AU and UNECA work to mainstream geospatial information into national development programs, enhancing evidence-based decision-making at both national and continental levels.

5. ***Promotion of collaboration and cooperation****:* Coordination is fostered between Member States, RECs, specialized institutions (e.g., SADC, IGAD, COMESA, NEPAD), and international partners to implement ICT and space-related activities that rely on robust geospatial infrastructures.

5.7.2.5 Progress in implementing NSDIs in African Countries

Despite the concept of NSDI being developed in Africa, a couple of African countries have either developed or are on their way towards developing a sustainable NSDI. These countries include South Africa, Nigeria, Egypt, Algeria, Morocco, Tunisia, Kenya, Botswana, Zimbabwe, Namibia, Zambia, Uganda, Ethiopia, Lesotho and Swaziland[150]. Lately, progress has been made by some countries in Africa to implement NSDIs, indicating the willingness of several nations to participate and take

[149] United Nations Economic Commission for Africa. (2019**).** *Guidelines for the implementation of national spatial data infrastructure in African countries.* Addis Ababa: UNECA. Retrieved January 31, 2026, from https://www.uneca.org/sites/default/files/ACS/un-ggim-2022/policy-guideline-on-the-implementation-of-nsdi-in-africa_english.pdf

[150]Longley, P.A. Michael F. Goodchild, David J. Maguire, & David W. Rhind. (2009). Geographic Information Systems and Science. London: McGraw Hill

ownership of NSDI initiatives. For example, Rwanda has established a functional national geoportal, while others are still in the process of drafting policies and building foundational infrastructure. The increasing number of the national clearinghouse is the best indicators for the development of SDI.

According to UNECA policy-guideline on the-implementation of NSDI in Africa[151], successful implementation of national spatial data infrastructure requires the proper functioning of all five components of NSDI. Namely:

a) Policies and institutional frameworks (governance, data-sharing, funding)
b) Data (framework/fundamental data, metadata)
c) Standards (framework/fundamental data, metadata, services)
d) Access network (technology – hardware, software, ICT networks)
e) People (knowledge and skills of available human resources, capacity development, geospatial awareness).

Most of the African countries apply a methodology similar to the EU INSPIRE in the development of their NSDI. Nonetheless, the development of African NSDIs is still at infancy as it can be epitomised by only few countries with reasonable funding, with consistent data collection, reasonable political support, clear national policies and legal frameworks. Key challenges include:

- ***Slow progress***: NSDIs are developing more slowly in Africa compared to other regions such as European Union INSPIRE
- ***Key obstacles***: The primary factors hindering development are financial limitations, lack of efficient ICT infrastructure, and a shortage of skilled human resources in African countries
- ***Policy, regulatory framework and vision gaps***: Many African countries lack comprehensive policies and a clear, integrated vision for their NSDI, leading to independent data collection for specific projects rather than a unified approach
- ***Data quality issues***: Incomplete, outdated, and incompatible datasets are common problems that impede effective use of spatial data in the region
- ***Other barriers***: Cultural and linguistic differences also present challenges to data sharing and interoperability. The diversity of national official languages and RECs dynamics pose coordination challenges

However, there is a promising Africa continental outlook as indicated by the ongoing initiatives spearheaded by the regional economic agencies and the established AU continental efforts, such as:

- ***Regional and national efforts***: Organizations like the AU/UNECA providing guidelines for national implementation of NSDIs
- ***Technological support***: Advancements in information and communication technology (ICT), including web GIS and online portals, are continuously making spatial data more accessible
- ***Standardization:*** Efforts to adopt international standards from organizations like the ISO and the Open Geospatial Consortium (OGC) Web Map Services (WMS), GGDC and W3C are crucial for interoperability across the region
- ***Continental internet exchange:*** The launch of the Continental Internet Exchange (CIX) in September 2025 could help improve the foundational digital infrastructure for data sharing across the continent.

[151]https://www.uneca.org/sites/default/files/ACS/un-ggim-2022/policy-guideline-on-the-implementation-of-nsdi-in-africa_english.pdf

5.7.3 International best practices and EU directives on broadband mapping and regional harmonisation

The EU successfully implemented the broadband mapping regional harmonization initiative which aims to create comparable, unified data on broadband coverage across Europe by developing common methodologies for broadband data collection and analysis. The goal was to enable better policy-making, ensure public funding is used effectively, and facilitate regional coordination for infrastructure deployment. This was achieved by creating a single, interoperable mapping platform that uses standardized data sets for fixed and mobile services.

5.7.3.1 Infrastructure for Spatial Information in Europe (INSPIRE) directive

The European Union (EU) established the INSPIRE Directive in 2007 as a legally binding framework mandating the development of a unified Infrastructure for Spatial Information to support environmental policy across the region. Unlike Africa, where coordinated spatial data infrastructures remain limited, INSPIRE provides a harmonized system for cross-border geospatial data sharing, ensuring interoperability among Member States. The Directive focuses on 34 spatial data themes essential for environmental applications and obligates EU countries to make their spatial datasets and services compatible, discoverable, and accessible.

INSPIRE is built upon key principles designed to guarantee seamless integration and use of spatial information. These include harmonized data collection, standardized metadata, interoperability of systems and services, and public accessibility of geospatial information. The overarching objective is to provide accurate, harmonized, and high-quality geographic data to support policy development, implementation, monitoring, and evaluation in environmental domains.

Member States are required to establish national spatial data infrastructures aligned with common Implementing Rules (IRs) that define technical specifications for metadata, data standards, network services, data sharing, and monitoring/reporting. These IRs are legally binding and adopted through Commission Decisions or Regulations. To facilitate access, Member States must also make their data available through a centralized community geo-portal operated by the European Commission, in addition to any national or regional portals they may maintain.

The Directive's regulatory framework ensures that stakeholders—governments, businesses, researchers, civil society, and citizens—use a consistent terminology, standardized models, and interoperable technologies. This harmonization enables effective cross-border environmental management and provides a model of coordinated spatial data governance that could guide similar initiatives in Africa and other regions.

5.7.3.2 The EU SMART project

The Mapping of Fixed and Mobile Broadband Services in Europe (SMART)[152] project is directly related to mapping. The project was initiated in January 2016 with the objective to develop the first EU-wide integrated monitoring platform on the internet connectivity. The project focused on expanding high-speed internet access to support a smart digital economy and society. The project is driven by the EU's digital connectivity goals, such as ensuring gigabit (100 Mbps) connectivity for all households by 2030, upgradable to 1 Gbps, and 1 Gbps for all schools and major public service providers, and connecting all populated areas covered by 5G.

The project builds on existing mapping initiatives. The data is provided on a voluntary basis by Member States' public authorities as well as from operators of private mapping initiatives and operators of crowdsourcing applications and could present a good approach to benefit from. Methodologies and focuses of QoS mapping initiatives vary across Europe that is why the comparability is assessed by means of comparing descriptive metadata.

[152] marketplace.ec.europa.eu/action-clusters-and-initiatives/EU-initatives/smart-cities-marketplace

In terms of output, the EC has developed an online platform in order to monitor the progress made in the deployment of high-capacity networks. The information is derived via theoretical calculations and measurements. The project has developed three data categories for Quality of Service (QoS)n namely: calculated availability of Service (QoS-1), measured provision of service (QoS-2), and measured experience of service (QoS-3).

Together, these components enable highly granular, harmonized, and reliable broadband mapping across Europe, offering a strong model for Africa, including Kenya, seeking to establish standardized and interoperable broadband data systems.

5.7.3.3 EU Electronic Communication Code

The European Electronic Communications Code (EECC), established under Directive (EU) 2018/1972, is a comprehensive set of rules governing electronic across the EU. Its purpose is to

promote high-quality connectivity, ensure fair competition, encourage investment in modern digital infrastructure, and safeguard consumer rights. The EECC updates and consolidates earlier telecommunications directives to create a unified and future-oriented regulatory framework for Europe's digital economy.

The Code regulates electronic communication networks, services, and associated facilities, and sets out the responsibilities of national regulatory authorities (NRAs) and other relevant bodies. It also defines procedures that ensure harmonized implementation of regulatory rules across all EU Member States. The overarching objective is to stimulate competition and drive investment in very high-capacity networks (VHCNs)—such as fibre—to ensure universal access to high-quality digital services.

The EECC modernizes Europe's regulatory landscape by expanding its scope to cover emerging technologies and internet-based services, strengthening consumer protection, and adapting rules to the needs of the contemporary digital environment. Its core objectives and provisions include:

Key objectives and provisions include:

(d) ***Promote high-quality connectivity:*** The EECC aims to accelerate the deployment of very high-capacity networks, particularly fibre-based infrastructure, to meet the increasing demand for reliable, high-speed connectivity.
(e) ***Expand the regulatory scope:*** The Code updates telecom rules to include internet-based and "over-the-top" (OTT) services—such as messaging and VoIP applications—that were previously outside traditional telecom regulation.
(f) ***Ensure fair and effective competition:*** *It establishes rules on wholesale access, co-investment, and market regulation to foster a competitive environment while promoting sustainable investment in digital infrastructure.*
(g) ***Enhance security and public safety:*** *The Code incorporates provisions to tackle cybersecurity threats and improve public safety, including requirements for public warning systems during emergencies.*
(h) ***Promote social inclusion and universal access:*** *The EECC mandates that people with disabilities, elderly persons, and vulnerable communities have equivalent access to essential communication services. It also strengthens universal service obligations.*

In terms of implementation, The EECC entered into force in December 2018, with EU Member States given two years to transpose its provisions into national legislation. By 2022, most Member States had implemented the Code, supported by the European Commission's monitoring and guidance. The Body of European Regulators for Electronic Communications (BEREC) has developed a series of guidelines to facilitate consistent and effective implementation across the EU.

5.7.3.4 Lessons learned from European Union

The European Union's experience demonstrates that effective regional harmonisation relies on strong

institutional governance, coordinated policy frameworks, and enforceable regulatory instruments. Key lessons include:

a) ***Legally mandated institutional structures:*** The EU established legally backed agencies and directives, such as INSPIRE, the SMART project, and the EECC, supported by binding Implementing Rules (IRs). These bodies have a clearly defined mandate to lead regional initiatives, ensuring consistency, accountability, and compliance across Member States.

b) ***Regional collaboration and coordination:*** Harmonisation is strengthened through collective regional approaches, where agencies like BEREC facilitate coordination among national regulators, standardising practices and enabling cross-border interoperability. The legal and institutional framework ensures all actors operate within a unified system rather than fragmented national silos.

c) ***Policy and regulatory alignment:*** EU directives and regulations are harmonised across multiple layers, national, regional, and sectoral, ensuring that all Member States follow consistent standards for data management, network deployment, and service monitoring.

d) ***Enforceable Implementing Rules (IRs):*** Tangible IRs provide clarity on responsibilities, technical standards, and compliance obligations, making harmonisation actionable rather than aspirational. They allow interoperability, shared data platforms, and unified monitoring practices to be implemented effectively.

e) ***Legal and institutional backing:*** The EU approach benefits from strong legislative support, including EU treaties, directives, and subsidiary regulations. This legal foundation provides legitimacy and ensures that regional initiatives are enforceable and sustainable over time.

For Africa-wide regional harmonisation to succeed, it is essential to replicate the EU's model: establish legally mandated continental structures, implement enforceable directives and technical rules, coordinate national regulators under a central authority, and build institutional frameworks supported by law. A unified, legally supported approach will address the current fragmentation in African broadband governance and enable cross-border interoperability, data sharing, and regional digital integration.

5.7.4 The need for an Africa regional broadband harmonization initiative

The European Union's experience demonstrates that effective institutional governance, robust policy and regulatory frameworks, and clearly defined Implementing Rules (IRs)—supported by a coordinated regional approach—are the key drivers of successful regional harmonisation in the digital and broadband sectors. The presence of strong, legally mandated regional structures such as the INSPIRE Directive, the SMART broadband mapping initiative, the European Electronic Communications Code (EECC), and regulatory bodies like BEREC has ensured consistency, interoperability, and accountability across all Member States. These bodies operate under an EU-wide legislative mandate, ensuring that rules are uniformly applied, standards are enforceable, and cross-border coordination is institutionalized rather than voluntary.

In contrast, Africa's regional harmonisation efforts often face challenges stemming from fragmented institutional arrangements, overlapping mandates, and reliance on non-binding coordination. Unlike the EU, where institutions such as INSPIRE are legally designated as the central authorities responsible for spatial data infrastructure, Africa lacks continent-wide agencies with equivalent legal authority and enforcement power.

To achieve meaningful and lasting regional harmonisation, Africa would benefit from adopting elements of the EU model. This includes establishing continentally mandated structures with legal authority, developing binding implementing rules, and operationalising a unified governance framework for digital infrastructure, data sharing, and broadband development. Following this

pathway would strengthen coordination, reduce duplication, promote interoperability, and ultimately accelerate the continent's digital integration.

5.7.4.1 Why harmonization of broadband mapping is needed in Africa

Regional harmonisation is essential for establishing a unified and effective approach to broadband mapping across Africa. Unlike the European Union—where harmonised regulations, institutions, and technical standards guide all Member States, most African countries face several systemic challenges:

• ***Inconsistent methodologies:*** Countries operate in isolation, using nationally developed mapping techniques, data models, and assessment frameworks. These approaches are shaped by domestic laws, institutional capacities, and market conditions, resulting in significant variation and incompatibility across the continent.

• ***Lack of comparable data:*** Because broadband data is collected and structured according to national procedures rather than regional or international standards, it is difficult to compare coverage, performance, and quality of service between countries. This lack of interoperability undermines continent-wide planning, investment prioritisation, and the ability to attract funding for cross-border digital infrastructure.

• ***Policy and planning limitations:*** In the absence of regional regulatory frameworks, African countries rely solely on national policies and standards. This creates disparities in how data is collected, validated, and shared, making it challenging for policymakers to develop broadband strategies that align with regional integration goals or global benchmarks.

Addressing these challenges is crucial to establishing a continent-wide, harmonised broadband mapping system. Achieving this requires a dedicated regional initiative, similar in ambition and structure to the EU's model, that provides legal authority, technical guidance, and institutional coordination to ensure consistency, interoperability, and shared standards across Africa.

5.7.4.2 How harmonization can be achieved Africa

Building on the challenges identified above, regional harmonisation in Africa can be effectively advanced through the following measures:

• ***Develop a common methodology:*** The African Union, in collaboration with regional stakeholders such as ITU and UNECA, should commission and support studies to establish a unified methodology for broadband mapping. This should include standardised indicators for coverage, quality of service (QoS), infrastructure availability, and digital inclusion. The common methodology would ensure that all countries apply consistent criteria and produce comparable datasets.

• ***Create a continent-wide mapping platform:*** An Africa-wide broadband mapping platform should be developed to consolidate, visualise, and benchmark data from national regulatory authorities (NRAs), operators, and crowdsourcing initiatives. A single portal, similar to the EU's SMART platform, would enable continent-level monitoring of broadband development, support investment decisions, and improve transparency.

• ***Standardise datasets:*** NRAs should upgrade or adapt their national platforms to collect and report broadband data using harmonised data models and formats. Standardisation will ensure that all submitted datasets are compatible, comparable, and interoperable across countries and regional economic communities (RECs).

• ***Promote interoperability:*** To ensure seamless data exchange across borders, Africa should adopt and promote open geospatial and broadband-related standards such as the Open Fibre Data Standard (OFDS), Web Map Service (WMS), and Web Feature Service (WFS). These standards would enable automatic, scalable data sharing between national and regional systems, enhancing the accuracy and usability of broadband maps for policymakers, investors, and service providers.

5.7.4.3 What is needed to achieve regional broadband data harmonization in Africa

Achieving regional broadband data harmonization across Africa requires a coordinated, legally supported, and technically standardized approach similar to the European Union's INSPIRE framework. To ensure that broadband data infrastructures of African Member States (MS) are compatible, interoperable, and usable in a transboundary context, the African Union (AU) should establish a continental directive supported by common Implementing Rules (IRs) and non-binding Technical Guidelines. These instruments would guide National Regulatory Authorities (NRAs) in adopting harmonized standards for data creation, sharing, and use.

Central to this effort is the establishment of a model Africa Spatial Data Infrastructure (Africa SDI), an overarching continental platform enabling standardized broadband data sharing across countries. The Africa SDI, supported by an AU broadband mapping directive, would create the legal and technical foundation for harmonized datasets, interoperable systems, and consistent reporting.

To achieve this vision, the following components are essential:

- ***Unified data ecosystems:*** African countries should adopt a holistic data ecosystem encompassing regulatory data frameworks, fundamental datasets (FDS), and comprehensive metadata. Key actions include: Establishing AU-level regulations for data frameworks and metadata standards; Creating and maintaining metadata for all broadband-related spatial datasets and services; Developing Implementing Rules at a high (abstract and generic) level, supported by detailed Technical Guidelines explaining how legal obligations should be operationalized. This ensures uniformity, transparency, and traceability of broadband datasets across the continent.

- ***Data specifications and technical guidelines:*** Harmonization requires common data models and interoperability specifications. This involves: Developing IRs focused on interoperability of spatial datasets and services; Creating detailed Data Specifications (Technical Guidelines) defining common data models, schemas, code lists, geospatial layers, and extended metadata; Ensuring interoperability through either: Harmonizing and storing datasets in a common structure, or transforming existing datasets through interoperability services. A clear implementation roadmap should define milestones for availability of metadata, datasets, and network services.

- ***Access network services (technology: hardware, software, and ICT networks):*** A regional SDI directive should define standard web-based services enabling access to broadband spatial resources across countries. Actions include: Building sustainable, regionally aligned legacy and next-generation systems; Defining network services (discovery, view, download, transformation, and invoke) based on global standards (W3C, ISO, OGC); Integrating Service-Oriented Architecture (SOA) principles for scalable and interoperable online services; and reinforcing the use of standards such as CSW (catalogue services), WMS (web mapping), and WFS (web feature services).

- ***Data service sharing:*** Efficient broadband policy-making by MS requires seamless access to and use of broadband spatial datasets. A regional directive should establish: Rights and obligations for data sharing between countries; IRs governing provision of access to datasets and services from MS to NRAs and the AU; and Complementary Technical Guidelines, including non-binding templates such as model contracts, framework agreements, and best-practice examples, to support operational implementation. This ensures transparent, consistent, and predictable cross-country data sharing arrangements.

- ***Spatial data services, standards, and harmonization:*** To enable cross-border broadband service interoperability, the following are key requirements: Spatial data services must include enhanced metadata: Harmonization should extend beyond datasets to include service behaviour, semantics, and protocols; Standardization should ensure that services can communicate, integrate, and exchange data seamlessly across national systems.

• ***Monitoring and reporting:*** NRAs should monitor and report the status of broadband spatial information infrastructures annually. Key requirements include: Developing monitoring indicators using metadata of datasets and published services; Making monitoring results publicly accessible online; and Publishing updated summary reports as needed. This enables transparency, benchmarking, and evidence-based decision-making at national and regional levels.

• ***Maintenance and implementation:*** To ensure continuity and evolution, there is need to: Establish a continental expert working group composed of NRA National Contact Points and technical representatives; Coordinate joint activities, support implementation of the Africa broadband data directive, and oversee periodic revisions of Implementing Rules and Technical Guidelines.

5.7.5 Recommendations for regional harmonisation

To realise a functional, sustainable, and interoperable broadband data-sharing ecosystem across African countries, the following policy recommendations are proposed:

a) Strengthening governance and institutional arrangements within National Regulatory Authorities

NRAs should establish robust governance structures that enable coordinated and consistent broadband data sharing. Key actions include:

- Designating a National Broadband Mapping Focal Point (champion/steward/controller) responsible for leading national participation in regional mapping initiatives.
- Ensuring that the focal point has the authority and institutional backing to advocate for policy adoption, administrative alignment, and resource mobilisation.
- Securing government-level buy-in to provide financial resources, policy direction, and a clear national mandate for broadband mapping activities.
- Exploring the establishment of a regional communication and coordination body, similar to the EU's BEREC, representing all NRAs and fostering harmonised regulatory practices across the continent. The EACO is the closest effort in this direction, however, it needs to be formally recognised as an EAC organ responsible for implementation of regional ICT and broadband directives.

b) Facilitating cross-border synergies, coordination, and collaboration

A resilient coordination mechanism is essential for synchronising NRA actions and ensuring regional alignment. This requires:

- Creation of a regional coordination platform that harmonizes data supply chains, cross-border infrastructure deployment, and interoperability standards.
- Allowing flexibility for each country to determine whether coordination is led by the NRA focal point or a designated national authority.
- Embedding principles of transparency, legitimacy, and openness in all regional processes to build trust between regulators, stakeholders, and the public.
- Promoting inclusive collaboration so regulators can adapt rapidly to technological change and maintain future-proof policies that serve long-term regional interests.

c) Capacity building for National Regulatory Authorities

A structured and sustained capacity-building programme is necessary to enhance technical and institutional competencies. This should:

- Develop skills in data collection, verification, quality assurance, geospatial analysis, data storage, and secure data exchange.
- Include training on both hardware tools (e.g., GPS equipment, field survey devices) and software tools (e.g., GIS platforms, mapping systems).
- Establish a Training-of-Trainers (ToT) competency framework, ensuring long-term continuity and decentralised institutional knowledge.
- Facilitate peer-to-peer learning and regional knowledge exchanges, working groups, and community of practice forums.
- Provide opportunities for international certification aligned with global geospatial and telecom standards.

d) Developing regional regulations, policies, standards, systems, and legal mechanisms for data sharing

Africa should aim to leapfrog fragmented national frameworks by developing regionally harmonised regulations inspired by best global practices, including the EU model. This entails:

- Developing continental-level regulations and directives through the African Union and legislating them through the Pan-African Parliament.
- Establishing clear, enforceable rules that mandate data interoperability, data governance, and cross-border accessibility.
- Creating a predictable regulatory environment that aligns with countries' connectivity ambitions while simplifying compliance across Member States.
- Compensating for the limited technical capacity of some RECs by adopting an Africa-wide harmonisation pathway, under AU leadership, as the most viable and impactful approach.

e) Establishing a regional broadband data infrastructure and mapping platform

A continental broadband spatial data infrastructure, Africa SDI for Broadband, is critical for enabling seamless, cross-border broadband data sharing. Key features include:

- A unified continental mapping platform that aggregates broadband data from all NRAs.
- Technical mechanisms that ensure interoperability of data structures, semantics, standards, and system components across countries.
- Adoption of a compatible suite of geospatial and broadband standards inspired by frameworks such as INSPIRE, and built on ISO, ITU, OGC, and W3C standards.
- Establishment of a regional agency with legal authority to drive the development, enforcement, and maintenance of the Africa SDI, an equivalent to EU INSPIRE governance.
- Creation of a regional body analogous to EU BEREC, bringing together African NRAs to coordinate regulatory alignment.
- Development of a Pan-African Electronic Communications Code (similar to the EU EECC) to provide legal, institutional, and operational backing for harmonised broadband governance.

6. Institutional Capacity

6.1 Institutional Arrangements for Broadband Mapping

The Communication Authority (CA) of Kenya is the agency mandated to coordinate broadband data collection in the country. CA has been at the forefront of creating an enabling environment for the integration and management of broadband infrastructure data. Its current efforts include updating data collection procedures, establishing a National Working Group (NWG) comprising key industry stakeholders, and strengthening collaboration across relevant institutions.

These collaborators include Government agencies mandated to develop policy such as the National Communication Secretariat under the Ministry of ICT and the Digital Economy (MICDE), backbone infrastructure providers such as Kenya Power and Lighting Company (KPLC), Kenya Electricity Transmission Company (KETRACO), and Kenya National Highways Authority (KeNHA), as well as line agencies including the Survey of Kenya (SoK) and the Kenya National Bureau of Statistics (KNBS).

CA has also engaged private-sector mobile operators/ Internet Service Providers (ISPs) such as Safaricom, Liquid Telecom, Airtel Kenya, Telkom Kenya, and Jamii Telecom on the Africa-BB-Maps initiative. Additionally, it has included academia, civil society, and advocacy groups such as the Kenya ICT Action Network (KICTANet), the Internet Society Kenya Chapter (ISOK), and the Technology Service Providers of Kenya (TESPOK). The NWG further collaborates with the East African Communications Organization (EACO) and development partners including the ITU, EU and the World Bank.

However, it is important to note that not all stakeholders are represented in the NWG hence the need to provide a structured mechanism through which many small ISPs and County Governments can effectively participate in the initiative to ensure more inclusive participation. This should be ensured, including through effective coordination and engagement of these stakeholders to ensure that all sector players are adequately involved. The categories of stakeholders that form the NWG are presented in Figure 6

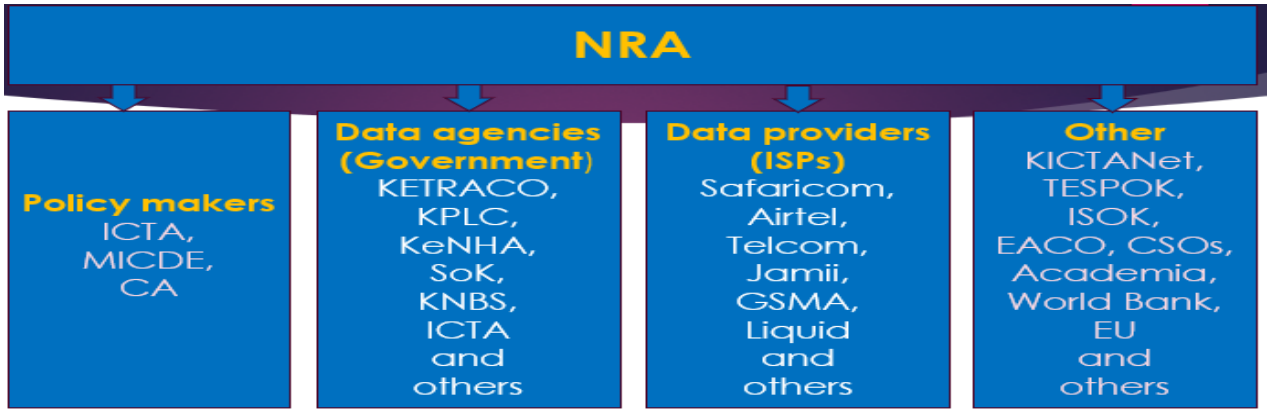


Figure 6. Categories of stakeholders (NWG)

6.2 Relevant Stakeholders and Institutional Roles

As seen from Figure 6, Kenya's broadband maps initiative requires a multi-stakeholder approach that integrates government, regulators, private sector, civil society, academia and the general public who use broadband services. The *Ministry of Information, Communications and the Digital Economy* provides overarching policy direction, ensuring alignment with national digital transformation strategies. The *Communications Authority of Kenya (CA)* plays a central role in regulatory oversight,

spectrum management, and data validation, while the Kenya National Bureau of Statistics (KNBS) contributes geospatial and socio-economic datasets to enrich mapping outputs. Furthermore, *County governments* are critical for localized data collection and contextualization, ensuring rural and underserved areas are accurately represented. Additionally, the *private sector actors*—including mobile network operators, internet service providers, and infrastructure companies—supply technical data on coverage, capacity, and investment priorities. *Civil society* organizations and consumer associations provide insights into affordability, accessibility, and equity concerns, ensuring inclusivity in mapping outcomes. *Academic and research institutions* contribute methodological rigor, capacity building, and innovation in geospatial analytics. *Development partners* such as the ITU, EU and the World Bank offer technical assistance, funding, and global best practices. Together, these stakeholders form a collaborative ecosystem where institutional roles are clearly defined, ensuring that broadband maps serve as authoritative tools for policy, investment, and monitoring of Kenya's digital inclusion agenda.

6.3 Human and Technical Capacity Development

The sustainability of Kenya's broadband maps initiative depends on robust human and technical capacity development. Skilled personnel are required to manage geospatial data, conduct advanced analytics, and interpret broadband coverage trends for policy and investment decisions. *Capacity building* should target government agencies such as the CA, KNBS, and county ICT departments, equipping staff with competencies in GIS, big data management, and digital policy analysis. Training programs, developed in collaboration with universities and technical institutes, can foster a pipeline of professionals competent in broadband mapping methodologies. On the *technical side*, investment in modern infrastructure—including cloud-based data repositories, secure servers, and interoperable mapping platforms—is essential to ensure reliability and scalability. Partnerships with private sector firms can accelerate technology transfer, while regional collaborations with African institutions can enhance knowledge exchange. Continuous professional development, supported by development partners, should be implemented to ensure that staff remain updated on evolving standards such as ITU broadband indicators and GSMA methodologies. Importantly, capacity development must be bilingual (English and Kiswahili) to ensure accessibility across institutional levels. By strengthening both human expertise and technical systems, Kenya can institutionalize broadband mapping as a core capability, enabling evidence-based decision-making and fostering equitable digital transformation.

6.4 Institutional Coordination Mechanisms

Effective institutional coordination is vital to the success of Kenya's broadband maps initiative. Fragmentation of roles across ministries, regulators, counties, and private actors can undermine data integrity and policy coherence. To address this, a national coordination framework should be established under the MICDE, with the CA serving as technical lead. This framework would define clear mandates, reporting lines, and data-sharing protocols among stakeholders. A multi-stakeholder steering committee, comprising government agencies, operators, civil society, and academia, can provide oversight, ensure inclusivity, and resolve conflicts. County governments should be integrated through decentralized coordination units, enabling localized data collection and validation while feeding into national repositories. Memoranda of Understanding (MoUs) and statutory instruments can formalize collaboration, ensuring compliance with data standards and confidentiality requirements. Digital platforms, such as interoperable dashboards, should facilitate real-time data exchange and transparency. Development partners can support coordination by aligning donor-funded projects with national priorities, avoiding duplication. Regular stakeholder forums and policy dialogues will sustain momentum, while monitoring and evaluation mechanisms will track progress against national broadband targets. Through structured coordination, Kenya can harmonize institutional efforts, enhance accountability, and deliver broadband maps that are authoritative, inclusive, and actionable.

7. Proposals and Recommendations

The following are the proposed priority actions towards achieving effective and sustainable Broadband mapping

a) Adoption of Open Fiber Data Standard to anchor the components of sharing of agreed data sets publicly, harmonizing data set, and enhancing data accuracy.
b) Revision of regulation and policy to support open data.
c) Undertaking a deep dive in the scope and span of stakeholders required for effective collaboration and partnership to ensure data accuracy and harmony.
d) Investing in capacity building
e) Adoption of sustainable and scalable GIS solution

7.1 Policy and Strategic Recommendations

The success of the BB initiative will depend on effective policy and strategic actions which result in alignment, enhanced institutional capacity, data quality, innovation and linkage of the maps with priority socio-economic indicators. The following is a set of policy and strategic recommendations.

7.1.1 Recommendations towards Execution, National Ownership and Sustainability: Policy Recommendations to CA

Ensure successful execution, national ownership and sustainability of the project, the following policy recommendations are pertinent to the regulator (Table 10).

Table 10: Thematic Grouping of Recommendations

Thematic Area	Recommendations	Focus
Institutional capacity and Systems integration	a) Invest in advanced institutional GIS systems that integrate with other internal systems.	Strengthening institutional GIS capacity and interoperability across stakeholders.
	b) Advocate for integration of CA's GIS systems with other public and private institutions.	
	c) Harness partnerships and collaboration for data, capacity building, system integration, and resourcing.	
	d) Share standardized datasets in agreed formats.	
Policy alignment and Strategic frameworks	a) Work with stakeholders to redefine broadband to support Universal Meaningful Connectivity.	Ensuring GIS mapping aligns with national strategies, regulatory frameworks, and policy goals.
	b) Leverage the new National Broadband Strategy to inform infrastructure gap mapping.	
	c) Support policy development and universal service initiatives.	
	d) Align operator data with CA regulatory framework.	
Data quality, Mapping and Evidence-based planning	a) Provide granular GIS layers for national mapping (coverage, capacity, affordability)	Enhancing accuracy, granularity, and transparency of broadband mapping data.
	b) Enable data-driven planning to avoid duplication of infrastructure.	
	c) Establish transparent, validated national broadband maps.	

	d) Contribute to QoS field validation.	
Innovation, Demand and Socio-Economic Linkages	a) Couple mapping initiatives with strategies such as investing in content creation to achieve meaningful connectivity.	Linking broadband mapping to innovation ecosystems, demand-side strategies, and socio-economic transformation.
	b) Explore open data collaborations with academia and innovation.	

As shown in Table 10, the four thematic recommendations will lead to the following outcomes:

- Institutional capacity ensures GIS systems are robust and interoperable.
- Policy alignment links mapping to Kenya's National Broadband Strategy and regulatory frameworks.
- Data quality guarantees evidence-based planning and transparency.
- Innovation and demand link mapping to broader digital transformation goals like education, content creation, and research.

7.1.2 Recommendations on the Contributions of the Private Institutions to the Broadband Mapping Initiative

Private sector institutions will various crucial role in the development of broadband mapping; in particular, they will:

a) Leverage the new National Broadband Strategy under development, to ensure the mapping of broadband infrastructure inform the gap areas, end to end;
b) Invest in leveraging emerging technologies such as Artificial Intelligence for mapping;
c) Explore the option of having a common portal serving the GIS platforms owned by all the private and public institution that can support broadband infrastructure;
d) Enhance investment for capacity building, especially for government institutions;
e) Seek funding support to ensure that all relevant government institution can support fiber mapping in various ways and acquire the GIS platforms for this purpose.

7.1.3 Recommendations for Stakeholder Coordination: Cross-Sector Synergies, Data Sharing and Protection

Effective coordination of all Africa-BB-Maps initiatives will ensure the success of the project. To achieve the needed cross-sector synergies, data sharing and protection, the regulator in collaboration with other actors will:

a) Encourage cross sector co-deployment and sharing project, supported by government policy;
b) Encourage public policy that advances cross-sector infrastructure co-deployment and sharing;
c) Maintain a geospatial inventory of infrastructure for sharing with stakeholders;
d) Ensure cross-industry coordination and regional cross border coordination;
e) Harmonize relevant sector regulations;
f) Encourage competition and address service coverage in low-revenue areas.

7.2 Implementation Roadmap

7.2.1 Short-term 2026

Objective 1: *Strengthening institutional GIS capacity and interoperability across stakeholders.*

(a) Develop and enforce National Broadband Data Standard
(b) Automate provider data ingestion via secure APIs

(c) Launch national drive-test and crowd-sourced QoS program
(d) Upgrade USF prioritization using socio-economic layers
(e) Strengthen partnerships with the 47 Counties for local GIS data
(f) Include quality of service and affordability data in the Africa-BB-Maps
(g) Develop capacity – both human and institutional - at the local level;
(h) Work with stakeholders to redefine broadband to support meaningful connectivity and clarify roles
(i) Harness partnerships and collaboration for data, capacity building, system integration, and resourcing.
(j) Share standardized datasets in agreed formats.

7.2.2 Medium term 2027-2028

***Objective 2**: Ensuring GIS mapping aligns with national strategies, regulatory frameworks, and policy goals.*

(a) Harmonise data policies within the ICT sector, and across sectors that impact Broadband, e.g., electricity, roads etc to achieve the desired harmonization of mapping
(b) Enhance data governance through data policy;
(c) Enhance data management regulatory frameworks through regulations that are relevant to geospatial data, and other data to align with BB mapping requirements;
(d) Implement robust – interoperable, standards-based and resilient - technology infrastructure to support BB mapping
(e) Leverage the new National Broadband Strategy to inform infrastructure gap mapping.
(f) Support policy development and universal service initiatives.
(g) Align operator data format with CA regulatory framework.
(h) Advocate for integration of CA's GIS systems with other public and private institutions.

7.2.3 Long-term 2029-2030

***Objective 3**: Enhancing accuracy, granularity, and transparency of broadband mapping data.*

(a) Invest in advanced institutional GIS systems that integrate with other internal systems.
(b) Implement robust standards, interoperable BB mapping ecosystem
(c) Integrate AI and satellite/geospatial into the Africa-BB-Maps
(d) Couple mapping initiatives with strategies such as investing in content creation to achieve meaningful connectivity.)
(e) Explore and implement open data collaborations with academia and innovation.
(f) Provide granular GIS layers for national mapping (coverage, capacity, affordability)
(g) Enable data-driven planning to avoid duplication of infrastructure.
(h) Establish transparent, validated national broadband maps.

Objective 4: Linking broadband mapping to innovation ecosystems, demand-side strategies, and socio-economic transformation.

(a) Couple mapping initiatives with strategies such as investing in content creation to achieve meaningful connectivity.

7.3 Monitoring and Evaluation Framework

7.3.1 Objectives, Activities, KPIs, and responsibility

The following (Table 11) is the proposed M&E Framework for Kenya Africa-BB-Maps for the period 2026-2030). It comprises short-Term, Medium-Term and Long-Term activities.

Table 11: Objectives, activities, KPIs and target and responsibility

7.3.1 Short-Term (2026)			
Objective 1: Strengthening institutional GIS capacity and interoperability across stakeholders			
Activity	**KPIs**	**Budget (Indicative)**	**Responsibility**
Develop and enforce National Broadband Data Standard	Standard published and adopted by 80% of operators by end-2026	KES 40M	MICDE, CA
Automate provider data ingestion via secure APIs	% of operators submitting data via APIs (**target: 70% by 2026**)	KES 60M	CA
Launch national drive-test and crowd-sourced QoS program	Drive-test coverage in all 47 counties; **50,000** crowd-sourced samples	KES 100M	CA, Universities
Upgrade USF prioritization using socio-economic layers	USF allocation reports integrating socio-economic data	KES 30M	Universal Service Fund Secretariat
Strengthen partnerships with 47 Counties for local GIS data	MoUs signed with all counties; % of counties submitting GIS data (**target: 80%)**	KES 50M	MICDE, Council of Governors
Include QoS and affordability data in Africa-BB-Maps	QoS & affordability indicators integrated into national maps	KES 25M	CA
Develop local capacity (human and institutional)	200 county officials trained in GIS/data governance	KES 80M	ICT Authority, Universities
Work with stakeholders to redefine broadband & clarify roles	Consensus framework adopted; % of stakeholders aligned (**target: 70%**)	KES 20M	National Working Group
Harness partnerships for data, capacity, resourcing	Number of partnerships formalised (**target: 10 by 2026**)	KES 15M	MICDE, CA
Share standardized datasets in agreed formats	% of datasets shared in standard formats (**target: 90%)**	KES 10M	CA

7.3.2 Medium-Term (2027–2028)			
Objective 2: Ensuring GIS mapping aligns with national strategies, regulatory frameworks, and policy goals			
Activity	**KPIs**	**Budget (Indicative)**	**Responsibility**
Harmonise data policies across ICT and related sectors	Cross-sector policy harmonisation framework adopted	KES 70M	MICDE, Ministry of Energy, Ministry of Transport
Enhance data governance through policy	National Data Governance Policy enacted	KES 40M	MICDE, CA
Enhance regulatory frameworks for geospatial data	New regulations gazetted and enforced	KES 30M	CA, Parliament
Implement resilient, standards-based infrastructure	% of systems interoperable (**target: 80% by 2028**)	KES 150M	ICT Authority
Leverage National Broadband Strategy for gap mapping	Gap mapping reports published annually	KES 20M	MICDE
Support policy development & universal service initiatives	Number of universal service projects funded (**target: 10 by 2028)**	KES 50M	USF Secretariat
Align operator data format with CA framework	% of operators compliant (**target: 90%)**	KES 15M	CA
Advocate for integration of CA GIS with other institutions	Number of integrations achieved (**target: 5 by 2028**)	KES 25M	CA

7.3.3 Long-Term (2029–2030)			
Objective 3: Enhancing accuracy, granularity, and transparency of broadband mapping data			
Objective 4: Linking broadband mapping to innovation ecosystems, demand-side strategies, and socio-economic transformation			
Activity	**KPIs**	**Budget (Indicative)**	**Responsibility**
Invest in advanced institutional GIS systems	Advanced GIS platform operational by 2030	KES 200M	CA
Implement robust, interoperable BB mapping ecosystem	% of systems interoperable (**target: 95%)**	KES 100M	MICDE
Integrate AI & satellite/geospatial into Africa-BB-Maps	AI/satellite layers integrated by 2030	KES 150M	CA, Universities
Couple mapping with content creation strategies	% of maps linked to content demand indicators	KES 50M	MICDE, Private Sector
Explore open data collaborations with academia	Number of collaborations (**target: 10 by 2030**)	KES 30M	Universities, CA
Provide granular GIS layers (coverage, affordability)	GIS layers updated annually	KES 40M	CA
Enable data-driven planning to avoid duplication	% reduction in duplicated infrastructure (**target: 20%)**	KES 25M	MICDE, Operators

Establish transparent, validated national broadband maps	Annual validated maps published	KES 20M	CA,
Link mapping to innovation ecosystems	Number of innovation projects supported (**target: 15 by 2030)**	KES 50M	MICDE, Innovation Hubs

Notes

1. Budget figures are indicative and should be refined during detailed planning.
2. Responsibilities are distributed across MICDE, CA, ICT Authority, USF Secretariat, Counties, Universities, and private sector partners.
3. M&E cycle: Quarterly tracking, annual reporting, mid-term review (2028), final evaluation (2030).

7.3.2 Performance Indicators

To ensure accountability and measurable progress, Kenya's Africa-BB-Maps framework should embed a comprehensive set of performance indicators within its Monitoring & Evaluation (M&E) system. These indicators should track:

- *Coverage expansion:* Percentage of households, schools, and health facilities connected to broadband.
- *Affordability***:** Average cost per Mbps relative to income levels, with targets for reducing the digital divide.
- *Quality of Service:* Latency, reliability, and average speeds across rural and urban areas.
- *Institutional capacity:* Number of trained officials, interoperable datasets shared, and adoption of bilingual reporting templates.
- *Stakeholder engagement:* Frequency of multi-stakeholder consultations and number of partnerships formalised.
- *Policy alignment:* Degree of harmonisation with continental frameworks (AU, ITU) and compliance with national strategies.

Embedding these indicators into quarterly tracking, annual reporting, and mid-term/final evaluations will ensure that Kenya's Africa-BB-Maps initiative remains transparent, evidence-based, and resilient, while providing Council with clear benchmarks for success.

8. Risk Analysis and Mitigation Strategies

The analysis of risks and mitigation strategies across seven dimensions - Policy, Legislation, Regulations, Technical and infrastructure, Funding, Stakeholder coordination and engagement, and Capacity building – for the BB mapping reveals that there is a high likelihood and severity of the seven risk areas

8.1 Kenya broadband mapping risk assessment overview

The following (Table 12) is a prioritized view of key risk areas for Kenya's broadband (BB) mapping, with likelihood and impact ratings, followed by targeted mitigation measures.

Table 12: Comparative risk ranking across seven risk dimensions/ areas

Risk area	Likelihood	Severity/ impact	Overall risk	Time horizon	Primary owner
Policy	Medium–High	High	High	Near–mid term	MICDE/CA
Legislation	Medium	High	High	Mid term	Parliament/ AG/ MICDE
Regulations	High	High	Very high	Near term	CA/MICDE
Technical and infrastructure	Medium–High	High	Very high	Near term	CA/MCDAs/ISPs
Funding	Medium–High	High	Very high	Near–mid term	Treasury/ MICDE/ Donors
Stakeholder coordination and engagement	High	Medium–High	Very high	Near term	MICDE/CA/ County govts
Capacity building	High	Medium	High	Near–mid term	MICDE/TVET/ Universities

Sources: Expert synthesis and contextual analysis for Kenya's broadband mapping ecosystem.

As shown in Table 12, the greatest risk is regulations followed by Technical and infrastructure; Funding; and Stakeholder coordination and engagement which are ranked the same. However, the likelihood of regulation, and Stakeholder coordination and engagement risks occurring is the same.

8.1.1 Policy risks

Policy fragmentation across MCDAs and inadequate data policies as well as misalignment with key national plans such as the National Digital Master Plan (20222-2032)/ National Broadband Strategy (2025-2030 – under development) can pose serious risk to the success of the Africa-BB-Maps initiative. This category of risks has been identified, assessed and mitigation measures proposed as presented in Table 13.

Table 13: Policy risks

Item	Description
Key risks	Fragmented policy directives across MCDAs; misalignment with National Digital Master Plan/National Broadband Strategy; policy shifts with leadership changes; insufficient data-governance clarity for geospatial assets.
Likelihood: **Medium–High** Impact: **High**	Policy misalignment quickly cascades into inconsistent data collection, access permissions, and prioritization.
Mitigation measures:	
1. *Policy harmonization*	Establish a national BB mapping policy note that references the master plan, defines scope (coverage, quality, affordability), and codifies data-sharing principles.
2. *Governance charter*	Create an interagency charter with decision rights, SLAs, and escalation paths; and embed county government roles.
3. *Regular policy updates*	Quarterly policy reviews linked to KPIs (data completeness, publication cadence, stakeholder satisfaction).
4. *Data governance*	Define national data model and stewardship roles, with open-data tiers and privacy-by-design.

8.1.2 Legal and compliance risk

The Africa-BB-Maps initiative is not without legal and compliance risks which should be mitigated to ensure successful and sustainable implementation in Kenya. The risks are shown in Table 14.

Table 14: Legal and compliance risks

Item	Description
Key risks	Gaps in statutory authority for mandatory data submission by operators; unclear legal basis for geospatial data use/reuse; misalignment with addressing/national identifiers; procurement constraints for mapping platforms.
Likelihood**: Medium** Impact**: High**	Legal ambiguities stall compliance and limit enforceability.
Mitigation measures:	
1. *Targeted amendments*	Introduce enabling clauses for operator data submission, audit rights, and sanctions for non-compliance.
2. *Data-use provisions*	Clarify lawful bases for processing and publishing aggregated geospatial telecom data; define anonymization standards
3. *Alignment with national systems*	Cross-reference National Addressing System and unique identifiers, ensuring interoperability and privacy safeguards.
4. *Model contracts*	Standardize procurement templates with IP, security, and escrow clauses for mapping tools.

8.1.3 Regulatory risk

An identification of key regulatory risks, their assessment and proposed mitigation strategies are presented in Table 15.

Table 15: Regulatory risks

Item	**Description**
Key risks	Inconsistent or outdated reporting templates; weak enforcement for data quality and timeliness; unclear definitions (coverage vs. service availability; speed tiers); lack of QoS/QoE integration.
Likelihood **(High), Impact (High)**	Directly impairs dataset reliability and comparability
Mitigation measures:	
1. *Unified reporting schema*	Mandate a national broadband mapping schema (GIS layers, cell IDs, technology types, speed tiers, latency, backhaul).
2. *Submission cadence and SLAs*	Monthly/quarterly reporting with automated validation, penalties for delays, and incentives for exemplary compliance
3. *Quality rules*	Define acceptance thresholds (spatial accuracy, completeness, time stamps); run independent validation audits.
4. *QoS integration*	Require crowdsourced and regulator-measured QoS/QoE data ingestion to balance operator-reported datasets.

8.1.4 Technical and infrastructure risk

Various infrastructure risks are anticipated and mitigation measures proposed as shown in Table 16.

Table 16: Technical and infrastructure risks

Item	**Description**
Key risks	Heterogeneous data formats; limited GIS capacity; platform scalability and cybersecurity; incomplete rural and backbone data; absence of APIs for automated ingestion.
Likelihood: (Medium-High), Impact: (High)	Technical bottlenecks degrade performance and trust in outputs.
Mitigation measures:	
1. *Reference architecture*	Deploy a modular BB mapping stack (data ingestion APIs, ETL, geospatial DB, analytics, visualization) with cloud/on-prem hybrid resilience.
2. *Interoperability standards*	Adopt open standards (OGC, GeoJSON, CSW) and common identifiers for sites/backhaul.
3. *Data pipelines*	Automate ingestion from operators, crowdsourcing apps, regulator probes, and government fiber projects; implement CI/CD for schema updates.
4. *Security and resilience*	Zero-trust access, role-based controls, audit logging, encryption; disaster recovery and backup strategy.

5. Coverage verification	Use satellite/remote sensing and drive tests for rural validation; integrate crowdsourced samples where feasible.

8.1.5 Funding risk

Since sufficient funding and the associated resource mobilisation strategy are crucial to the implementation of the Bb initiative, various risks have been assessed and possible mitigation measures proffered as shown in Table 17.

Table 17: Funding risks

Key risks	Underfunded operations and maintenance; donor dependency; fragmented budget lines across agencies; limited multi-year commitments.
Likelihood: *Medium-High Impact: High*	Funding gaps halt data collection and platform continuity.
Mitigation measures:	
1. Multi-year financing	Program-based budgeting with ring-fenced O&M lines; link disbursements to KPI milestones.
2. Blended finance	Combine exchequer funds, universal service funds, and donor/DFI support for capital and capacity components.
3. Cost sharing	Negotiate in-kind contributions (operator data, infrastructure metadata, measurement probes).
4. Value articulation	Publish annual impact brief (investment planning, inclusion outcomes) to sustain stakeholder buy-in.

8.1.6 Stakeholder coordination and engagement risk

The success of Africa-BB-Maps project depends on the contribution of various stakeholders in government, private sector, academia, civil society, local communities and development partners among others. The se stakeholders play various roles without which the initiative cannot succeed. Table 18 shows the risks associated with stakeholder coordination and engagement and how they can be mitigated.

Table 18: Stakeholder coordination and engagement risk

Key risks	Siloed MDAs and counties; operator resistance; weak citizen engagement; unclear roles for academia and civil society; uneven regional participation.
Likelihood: *(High), Impact (Medium-High)*	Coordination failures slow adoption and reduce data richness.
Mitigation measures:	
1. Steering committee	Formal, empowered

8.1.7 Capacity building risk

Capacity building is a high-likelihood risk with high impact (Table 19) that constrains data quality, platform sustainability, and cross-agency use; targeted training, accredited pipelines, and retention incentives are the fastest, highest-leverage mitigations. The capacity building risks, their assessment,

mitigation, ownership and the time horizon within which they should be mitigated is shown in table 19.

Table 19: Capacity building — risks, likelihood/impact, and mitigations

Risk	Likelihood	Impact	Mitigations	Owner	Horizon
Insufficient GIS and data engineering skills	High	High	Establish accredited training pipeline (university/TVET + vendor micro-credentials); on-the-job apprenticeships and vendor-led bootcamps;	CA / Universities / TVETs	3–12 months
Weak data stewardship and quality assurance (QA) practices	High	Medium–High	Create SOPs, playbooks, and QA checklists; embed data stewards in each agency with clear KPIs and handover docs;	CA / MDAs	1–6 months
High staff turnover and knowledge loss	High	Medium	Retention incentives, career pathways, and secondments; maintain living knowledge base and recorded trainings;	CA / MICDE	6–18 months
Limited regulator analytics and policy translation skills	Medium–High	Medium–High	Targeted analytics fellowships (regulator ↔ academia); short courses on policy-grade analytics and visualization;	CA / MICDE / Universities	3–9 months
Uneven county-level capacity	High	Medium–High	County onboarding program with standardized curricula, remote mentoring, and shared toolkits; regional hubs for hands-on labs;	MICDE / County govts	6–18 months
Vendor/tool dependence without local skills	Medium	Medium	Vendor-neutral curricula; open-source tool adoption; vendor training tied to knowledge transfer clauses in contracts;	Procurement / CA	Contract cycle

Sources: Kenya News Agency Communications Authority of Kenya africabbmaps.itu.int ict.go.ke skillsforafrica.org Esri Eastern Africa.

The rationale and prioritized actions on capacity building are as follows:

i. National and donor programs (e.g., Africa-BB-Maps initiative launch) emphasize country ownership and capacity transfer; without local skills the mapping platform risks becoming unsustainable or vendor-locked[153] [154]
ii. CA reports and access-gap studies document the need for stronger capacity at national and county levels to collect, validate, and publish reliable broadband layers[155]
iii. The National Broadband Strategy calls for institutional capacity strengthening and multi-stakeholder training to operationalize mapping and planning functions[156]
iv. Market providers and regional trainers (Skills for Africa; Esri Eastern Africa) already offer telecom-focused GIS and RF courses that can be adapted into accredited pipelines

8.2 Risk Assessment Summary

Top risks for the Africa-BB-Maps initiative in Kenya are regulatory clarity, stakeholder coordination, technical interoperability, and sustainable funding; each requires immediate governance, standards, and multi-year financing to reduce likelihood and impact. The ranking of risks is presented in Table 20.

[153] Kenya News Agency
[154] africabbmaps.itu.int
[155] Communications Authority of Kenya
[156] ict.go.ke.

Table 20: Ranked risks table

Risk area	Likelihood	Severity/ impact	Overall risk	Mitigations	Owner	Time horizon
Policy	Medium–High	High	High	Harmonize BB policy with National Digital Master Plan 2022-2032; Create interagency governance charter; Embed KPI review cadence;	MICDE/CA	Short–medium term
Legislation	Medium	High	High	Draft targeted statutory clauses for mandatory operator (or data owner) reporting, audit rights, and lawful geospatial use;	Parliament/ AG/ MICDE;	Medium term
Regulations	High	High	Very high	Publish unified reporting schema, SLAs, automated validation and penalties; define coverage/speed tiers and QoS reporting;	CA	Short-term
Technical and infrastructure	Medium–High	High	Very high	Adopt modular reference architecture (APIs, ETL, geospatial DB); enforce OGC/GeoJSON/OFDS standards; security, DR, and verification pipelines;	CA/MCDAs/ ISPs	Short-term
Funding	Medium–High	High	Very high	Secure multi-year O&M lines; blended finance (exchequer, USF, donors/DFIs); in-kind operator contributions; KPI-linked disbursements;	Treasury/ MICDE/ Donors	Short–medium term
Stakeholder coordination and engagement	High	Medium–High	Very high	Constitute empowered steering committee; thematic TWGs; county onboarding plan; public engagement and data dictionaries;	CA/MICDE	Short-term
Capacity building	High	Medium	High	Competency framework; accredited GIS/data courses; micro-credentials; SOPs and secondments;	CA/ITU/ Universities/ trainers	Short–medium term

Sources: OFFICE OF THE DATA PROTECTION COMMISSIONER KENYA standard.ofds.info The World Bank Communications Authority of Kenya africabbmaps.itu.int ict.go.ke.

8.2.1 Evidence and rationale

The evidence and rationale of the identified risks as well as the references are presented in Table 21.

Table 21: Evidence and rationale for identified risks

Evidence	Rationale	Source
Legal and privacy framework	Kenya's Data Protection Act and attendant regulations set obligations and limits on processing personal and geospatial	OFFICE OF THE DATA PROTECTION

	data, so mapping programs must embed privacy-by-design and data classification to avoid legal risk[157]	COMMISSIONER KENYA
Standards for fibre data	The Open Fibre Data Standard (OFDS) provides an interoperable schema for fibre network sharing and is a recommended baseline to reduce heterogeneity and improve data exchange[158]	standard.ofds.info
Financing and national programs	The World Bank–backed Kenya Digital Economy Acceleration Project (KDEAP) and related investments support large-scale fiber rollout and can be leveraged for blended financing of mapping and O&M of the infrastructure[159]	The World Bank
Regulatory practice and portals	CA already operates a GIS geo-portal and publishes mobile broadband coverage layers, demonstrating both capability and the need to improve data completeness, cadence, and validation[160]	Communications Authority of Kenya
Regional program context	Kenya is a beneficiary of the ITU/EU Africa-BB-Maps initiative (2025–2028), which frames the project's pillars (policy, technology, capacity) and provides a timeline for readiness, deployment, and sustainability[161]	africabbmaps.itu.int
National strategy alignment	The National Broadband Strategy emphasizes harmonized governance, cross-sector coordination, and demand-side measures—points that must be reflected in policy, regulation, and stakeholder engagement plans[162]	ict.go.ke

8.2.2 Quick next steps (recommended)

Based on the risk analysis, the following are the recommended next quick actions:

i. Publish unified reporting schema and form the steering committee (CA/MICDE lead) ***(Immediate: 30–90 days)***.
ii. Lock multi-year funding commitments; adopt OFDS and API specs; begin targeted legal drafting ***(Short term: 3–9 months)***
iii. Deploy enterprise mapping stack, run validation audits, and roll out accredited capacity programs ***(Medium term: 9–24 months)***

[157] OFFICE OF THE DATA PROTECTION COMMISSIONER KENYA
[158] standard.ofds.info
[159] The World Bank
[160] https://www.ca.go.ke/ict-services-coverage-geo-portal
[161] https://africabbmaps.itu.int/ke-kickoff/
[162] ict.go.ke

9. Funding and Resource Mobilization

Building and maintaining a best-practice broadband mapping system requires robust and diversified.

9.1 Objectives of Funding and Resource Mobilization

The purpose of funding and resource mobilization for broadband mapping in Kenya is to ensure stable and sustainable financing for:

- Development, legal anchoring, and enforcement of binding SOPs;
- Deployment and operation of standardized operator data submission and validation systems;
- Regular data quality verification and field measurement campaigns;
- Capacity building and institutional strengthening within CA;
- Progressive transition to nationally funded, long-term operations.

Funding is structured to support Kenya's progression from medium to advanced maturity under the ITU Africa-BB-Maps framework.

9.2 Securing multiple sources of funding

Effective resource mobilization ensures that the CA can continuously collect, update, and validate geospatial data on broadband coverage, as well as on affordability and socio-economic broadband demand side indicators – health, education, e-government services among others. Public funding provides foundational support, but private sector investment and international development financing are equally critical. By blending resources, Kenya can secure the technical infrastructure, skilled personnel, and advanced analytical tools necessary for accurate mapping. Transparent allocation of funds fosters accountability and builds trust among stakeholders, while partnerships with mobile operators, research institutions, and global organizations such as GSMA, UNESCO, and OECD can unlock additional expertise and financial support[163] [164] [165]. Resource mobilization should also prioritize capacity building, ensuring that local teams are trained to manage and interpret broadband data effectively. Thus, it is recommended that blended financing be adopted as best practice for funding and resource mobilisation for the broadband maps for Kenya.

9.3 Recommendations for Kenya

In view of the resource requirements for Africa-BB-Maps the following recommendations are pertinent

a) Establish a dedicated broadband mapping fund within CA, supported by Universal Service Fund contributions[166]
b) Pursue blended financing by combining government allocations, operator levies, and donor support[167].

[163] GSMA. (2023). *Mobile connectivity index and policy recommendations*. London: GSM Association.
[164] OECD. (2021). *Broadband policies for Africa: Accelerating digital transformation*. Paris: Organisation for Economic Co-operation and Development.
[165] UNESCO. (2021). *Digital inclusion frameworks for education and broadband*. Paris: United Nations Educational, Scientific and Cultural Organization.
[166] Communications Authority of Kenya. (2023). *Universal Service Fund Strategy 2023–2027*. Nairobi: CA.
[167] International Telecommunication Union (ITU). (2022). *Africa-BB-Maps project: Broadband mapping for Sub-Saharan Africa*. Geneva: ITU.

c) Formalize partnerships with KNBS, universities, and international agencies to share costs and expertise.
d) Introduce transparent reporting mechanisms to track resource use and outcomes.

9.4 Role of ITU Africa-BB-Maps in Funding

The strategic positioning of the ITU Africa-BB-Maps Programme (funded by the European Union and implemented by the ITU Telecommunication Development Bureau) constitutes a core external funding pillar for the initial and intermediate phases of broadband mapping implementation in Kenya.

ITU Africa-BB-Maps funding is designed to:

- Support system establishment or strengthening;
- Transfer technical know-how and standards;
- Finance non-recurrent investments (platform design, SOP development, training);
- Enable a structured transition to national ownership.

9.5 Funding Needs by Cost Category and Source

This project comprises various activities each with funding needs. The sources of funds and funding rational are presented in Table 22.

Table 22: Funding Needs by Cost Category and Source

Activity	Funding needs	Funding sources	Funding rationale
SOP Development and Regulatory Framework	• Drafting and formalization of SOPs (data collection, validation, publication); • Legal anchoring of SOPs in decrees and licence obligations; • Inter-institutional coordination instruments (MoUs).	**ITU Africa-BB-Maps:** • Technical assistance for SOP design aligned with ITU Guidelines; • Expert support for data governance and regulatory harmonization. **National budget (CA / National Treasury):** • Legal processes, gazetting, and long-term enforcement	SOP development is a one-time enabling investment, well-suited for ITU project funding.
Operator Data Submission and Validation Platform	• Secure SFTP / API ingestion mechanisms; • Automated schema-validation and QA tools; • Core GIS infrastructure for controlled access.	**ITU Africa-BB-Maps:** • Initial platform architecture and configuration; • Integration of ITU reference data models and templates **European Union (via Africa-BB-Maps):** • Capital expenditure for platform establishment. • National budget (medium term): • Hosting, maintenance, and upgrades.	Platform establishment is capital-intensive and fits the Africa-BB-Maps system-building mandate.

Capacity Building and Skills Transfer	• Training CA staff on SOP execution and data validation; • Certification in GIS, geospatial QA, and data governance; • Knowledge transfer from ITU experts.	**ITU Africa-BB-Maps**: • ITU Academy courses and certifications; • On-the-job coaching and regional workshops. • National budget: Staff costs and skills retention.	Capacity building is a pillar of Africa-BB-Maps and a prerequisite for sustainability.
Field Verification and Measurements	• Biannual measurement campaigns (QoS verification); • Data processing and discrepancy resolution.	**Mixed model:** • ITU Africa-BB-Maps (initial methodology and tools); • CA operational budget (routine campaigns).	Africa-BB-Maps supports methodological setup, while recurrent measurements must be nationally funded.
Governance, Monitoring, and Evaluation	SOP reviews and updates; Operator compliance monitoring; Annual evaluation and maturity assessment.	**ITU Africa-BB-Maps**: • Initial maturity assessments; • Performance monitoring templates. **National budget:** • Permanent governance and reporting structures.	

9.6 Consolidated Funding Sources Matrix

Based on the scope of the project, the consolidated funding sources is presented in Table 23.

Table 23: Consolidated Funding Sources Matrix

Cost Area	ITU Africa-BB-Maps	National Budget
SOP development and harmonization	✅ Core funder	✅ Legal enforcement
Platform establishment	✅ Core funder	✅ O&M after handover
Operator schema standardization	✅ Technical support	✅ Enforcement
Staff training and certification	✅ Core funder	✅ Retention
Field verification setup	✅ Initial support	✅ Recurrent
Routine operations	❌	✅ Primary

9.7 Phased Resource Mobilization Strategy

Resources for the project will be mobilised in phases to align with activities in each phase as shown in Table 24.

Table 24: Phased resource mobilisation

Resource mobilisation phase	Primary funding
Phase 1 – Establishment (0–6 months)	ITU Africa-BB-Maps
○ SOP drafting and approval	
○ Operator schema finalization	
○ Platform architecture and onboarding	
Phase 2 – Scaling (6–18 months)	ITU Africa-BB-Maps + National Budget
○ Automated validation	
○ First mandatory data cycles	
○ Capacity building and verification	
Phase 3 – Sustainability (18+ months)	National Budget
○ Routine operations	

○ SOP updates ○ Long-term regulatory use	

9.8 Sustainability and Exit Strategy from Donor Funding

To avoid dependency on external financing:

- Africa-BB-Maps funding is time-bound and non-recurrent;
- SOPs institutionalize processes beyond project closure;
- Platform costs are absorbed into CA's core mandate budget;
- Skills acquired through ITU support are retained internally;
- Mapping outputs are reused for multiple regulatory functions (licensing, QoS, universal access, infrastructure coordination).

9.9 Key Funding Risks and Mitigation

There are potential funding and resource mobilization risks associated with the Africa-BB-Maps project. The identified key funding risks and mitigation measures are presented in Table 25.

Table 25: Funding Risks and Mitigation

Risk	**Mitigation**
Over-reliance on ITU funding	Clear national handover plan
Fragmented donor support	Africa-BB-Maps used as single-entry point
Sustainability gap post-project	Early national budget integration
Platform cost escalation	Modular, SOP-driven automation

10. Sustainability and Long-Term Vision

The sustainability of the broadband maps initiative for Kenya is conceived of at two levels: strategic and operational levels with the overall vision being to guarantee universal, affordable, and high-quality broadband access, positioning the country as a regional leader in digital inclusion, knowledge economies, and sustainable development across Africa.

10.1 Long Term Sustainability: Strategic Level

Sustainability in broadband mapping requires institutional ownership, standardized methodologies, and a clear long-term vision. A best-practice system is not a one-off project but a continuous process of updating, integrating, and aligning data with national digital transformation strategies. Sustainability means embedding broadband mapping into Kenya's regulatory framework, ensuring that CA has the authority and resources to demand regular data submissions from operators[168]. Furthermore, the long-term vision is to anticipate demographic, economic, and technological changes, such as population growth, urbanization, and the rollout of 5G and fibre networks. By integrating KNBS demographic data, geospatial standards, and international benchmarks, Kenya can build a resilient system that supports universal service planning, investment prioritization, and regional harmonisation[169] [170]. Sustainability also requires interoperability, so that broadband maps can be linked with education, health, and economic datasets for holistic policy planning. In this regard, the following are strategic recommendations to sustain broadband mapping:

a) Institutionalize broadband mapping as a statutory function of CA, with clear reporting obligations for operators, and MCDAs that possess data that is needed for Africa-BB-Maps;
b) Adopt open geospatial standards to ensure interoperability and long-term usability[171]
c) Align mapping updates with KNBS census cycles and national ICT strategies;
d) Develop a 5 to10-year roadmap that integrates broadband mapping into Kenya's Vision 2030 and regional digital integration frameworks.
e) Include socio-economic indicates in the Africa-BB-Maps
f) Implement a robust data national GIS technical infrastructure with interfaces to all stakeholders that are required to provide data needed for effective Africa-BB-Maps
g) Conduct capacity building
h) Harmonise the Africa-BB-Maps with regional and international frameworks
i) Enhance collaboration and coordination with all stakeholder including international partners MCDAs, MNOs, ISPs, academia, CSOs, among other stakeholders
j) Enhance resources mobilisation for the initiative including from development private sector, partners and government.

In addition to the foregoing strategic recommendations, the following three recommendation categories are crucial for the long-term sustainability of the project.

[168] ibid
[169] UNESCO. (2021). *Digital inclusion frameworks for education and broadband*. Paris: United Nations Educational, Scientific and Cultural Organization.
[170] OECD. (2021). *Broadband policies for Africa: Accelerating digital transformation*. Paris: Organisation for Economic Co-operation and Development.
[171] International Telecommunication Union (ITU). (2022). *Africa-BB-Maps project: Broadband mapping for Sub-Saharan Africa*. Geneva: ITU.

10.1.1 Choice of platform

Broadband mapping platforms can either be built on open-source solutions or proprietary platforms. The cost implications of both options are under the discretion of the implementing agency. Currently, CA currently operates a proprietary ESRI ArcGIS system, which provides robust functionality but comes with challenges related to cost, sustainability, and licensing restrictions. The choice of platform is not mandatory, but long-term sustainability, low maintenance costs, and availability of technical expertise should guide the decision.

Proprietary platforms come with the cost of acquisition of the software, annual subscriptions and maintenance costs, limited licensing, not open to scalability and dependence on vendor for maintenance and upgrades. On the other hand, open-source solutions are free access and have lower operational costs, customizable to meet specific national broadband mapping needs, integration with other systems for dynamic visualization and tool development, supports long-term sustainability through community-driven enhancements. The only challenge of open-source systems is that it requires in-house technical expertise to maintain and customize.

It is recommended that the NRA should select a platform that balances cost, sustainability, and technical capability, while supporting the long-term objectives of Kenya's broadband mapping system. Consider open-source solutions where feasible, especially for scalability, customization, and long-term operational sustainability, while proprietary systems may be used for specialized functionalities if needed. Open source ensures sustainable and adaptable broadband mapping, reduces long-term operational costs, enhances flexibility and integration capabilities with other national datasets, and strengthens capacity building and local technical expertise

10.1.2 Change management

To ensure the long-term sustainability of Kenya's broadband mapping system, the regulator (CA), in consultation with stakeholders, should develop a comprehensive change management strategy. The change management strategy should account for the evolving broadband market dynamics (2G, 3G, 4G, 5G), adapt to changing datasets over time, such as increasing internet speeds and emerging service types, and incorporate new technology requirements and upgrades in reporting, data processing, and visualization tools, changing regulatory frameworks and policies in Kenya.

The change management strategy should consider short-term, medium-term and long-term milestones. Implementation of any adjustments and updates to the change management process will always involve an array of stakeholders, therefore it has to be planned carefully and with an appropriate amount of time for every party to adjust.

10.1.3 Talent management

The advanced technological requirements of broadband mapping necessitate highly skilled technical personnel within CA. Proper talent management is essential for the successful development, implementation, and maintenance of Kenya's broadband mapping system. As indicated from the survey, CA is understaffed and with less training on GIS, systems development and data management. For the success of the broadband mapping system development and maintenance in Kenya, professional and well-trained staff are an asset. CA is therefore mandated to provide sufficient training and capacity building modules on GIS, data, IT, AI, IoT, ML and systems development / programming, among others.

Consequently, key areas of capacity pertinent to talent management include:

(a) ***Capacity Building and Training:*** Ensure training covers both practical tool usage and broader analytical and planning skills. CA must invest in training and capacity building for staff on key areas, including:

- GIS and spatial data management
- IT systems and infrastructure
- Artificial Intelligence (AI), Internet of Things (IoT), Machine Learning (ML) applications
- Systems development and programming

(b) ***Competencies and Skills Development:*** Tailored training should address both general and advanced technical competencies needed for evolving broadband technologies. Internal team members at CA should acquire:
- Deep knowledge of telecommunications markets
- Understanding of legal and regulatory frameworks in the telecom sector
- IT skills relevant to the broadband mapping tools
- Analytical abilities and data management skills for quality assurance, interoperability, and visualization

(c) ***Leveraging External Expertise:*** This include:

- Partner with ITU and other specialized institutions for training, capacity building, and technical support.
- Utilize available free and paid modules from ITU's Virtual Academy and other recognized programs.
- Develop ad hoc or customized training modules to address specific skill gaps or emerging needs.

(d) ***Staff Retention and Professional Development:*** Mainly to:

- Promote career growth opportunities, continuous learning, and certifications to retain skilled personnel.
- Encourage knowledge sharing within CA and among stakeholders to build a cohesive and competent workforce.

Competencies and skills that should be covered by the internal team members should include deep and thorough knowledge of telecommunication markets, legal regulations relating to the telecommunication market, IT skills related to specific tools used in the broadband mapping process, analytical abilities and data management skills. It is recommended that ITU, as the premier agency in telecommunication training and capacity building could provide this training and technical support. Some free and paid modules already exist at the ITU virtual academy that can be capitalised by the agency and its staff. Ad hoc and tailored training modules could also be provided on request.

10.2 Long Term Sustainability: Operational Level

At an operational level, the development and management of a national broadband mapping system in Kenya require careful consideration of long-term sustainability to ensure continuous effectiveness and relevance. These include investment in an efficient reporting tool, flexible adaptability, versatile visualisation capabilities, change management and talent management amongst others.

Addressing long-term sustainability ensures the broadband mapping system remains relevant, reliable, and up-to-date, supports evidence-based decision-making for policy, investment, and planning, encourages continuous stakeholder engagement and trust in the system, and reduces risks of system obsolescence, inefficiency, and data fragmentation.

10.2.1 Efficient reporting tool

A standardized, efficient reporting tool is critical for effective broadband mapping in Kenya. This tool

should accommodate multiple data formats, support streamlined reporting processes, and enable seamless integration across diverse stakeholders. To ensure the most efficient data reporting within the broadband mapping process, the CA should have an elaborate and designated platform for reporting. Considering that CA has to obtain data from multiple stakeholders/data providers, it is vital to use an efficient standard reporting tool. There is need for CA to invest in a compliant tool that is efficient and reliable for reporting. In designing the reporting tool, CA should consider and take into account the following aspects i.e. ability to report data in automatic manner, guarantees possibility to load data in numerous formats (csv, pdf, via API etc.) and allow for data quality check mechanisms within it.

The platform should be able to fulfil rigid safety and security criteria for reporting, but also balance the user experience to facilitate compliance by data providers. During the national workshop launch of the Africa Africa-BB-Maps project in Kenya, the stakeholders recommended the migration from the manual excel sheet data collection template to an online automated tool for reporting. There are three options for this:

- ***Option 1: Browser-Based Reporting****:* The option should allow reporting data via a browser. Allows direct online input via a web interface. It would be dedicated to entities that have a small amount of data to report and to those, whose data changes only a little between reporting periods.
- ***Option 2: Automated File Submission****:* The option is an automated method which allows transferring data by entities via pre-prepared files. These files should have an appropriate structure, which has to be determined in advance. These data files could be for example CSV or XML files, or both, based on their inventory systems. The reporting format is predetermined based on the provider's inventory system.
- ***Option 3: Automated and Semi-Automated Transfers****:* The option is the platform should enable to transfer data automated and semi-automated way. On the data provider's validation aspect, it is recommended that one basic method is using a logging-in system, which may be significantly strengthened by a separate procedure of obtaining usernames and passwords by the data providers. Importantly, only logged in users should be able to report data. Simultaneously, the reporting system should give the possibility to log in only to entities that report data. The platform should allow access to view data, as well as to edit them and update for reporting entities.

10.2.2 Reporting support

To ensure efficient and accurate broadband data reporting, CA should provide comprehensive technical support and backstopping for all data reporting agencies. Given the diversity of data providers and the challenges of navigating the complexities of choosing and utilizing broadband data reporting tools, there is need for technical support, backstopping and training of data providers on the tools and their use cases. There should additional recognised channels of reporting support, that may include:

- ***User manuals and guidelines:*** Provide openly accessible documentation to guide data providers through reporting procedures.
- ***Standard Operating Procedures (SOPs*)**: Establish clear workflows and step-by-step instructions for reporting.
- ***Helpdesk Services:*** Operate a phone helpdesk and a dedicated online ticketing system, such as an Open-Source Ticket Request System (OTRS), to respond to queries and resolve issues.
- ***Video Tutorials:*** Offer video-based instructions for common reporting tasks.

- ***Online assistance and AI support:*** Utilize chatbots or AI applications to provide instant guidance and troubleshooting.

Other solutions might include video instruction manuals, training provided by CA or online assistance using AI applications and Chat Bots. By providing robust reporting support, CA can ensure that all stakeholders are equipped to navigate reporting tools effectively, ultimately improving the quality and utility of Kenya's broadband mapping system.

10.2.3 Investment in reporting tools

Continuous investment in reporting tools is essential for CA to ensure effective broadband mapping now and in the future. Given the rapidly evolving nature of IT tools and applications, CA must maintain operational efficiency while adapting to emerging technologies.

The development and investment in reporting tools should be driven by the following:

- ***Importance of accurate data*****:** Develop versatile, interoperable, and reliable reporting systems to guarantee high-quality and accurate data. Invest in robust data collection methods that minimize errors and enhance usability.
- ***Value of stakeholder collaboration*****:** Foster sustainable partnerships with ISPs, government agencies, and other stakeholders. Collaboration ensures the creation of accurate maps and supports successful broadband mapping initiatives.
- ***Need for continuous improvement*****:** Broadband mapping is a dynamic and ongoing process, requiring adaptability to new technologies and reporting standards. Regular updates to tools and systems are necessary to keep pace with telecommunications sector innovations.

CA currently utilizes the ESRI ArcGIS platform for reporting. While effective, continuous enhancements are needed to adapt to the changing telecom landscape. Emerging open-source solutions provide scalable, agile, and versatile alternatives that could complement or enhance existing systems. Investments should cover: technological innovations in reporting and data management; technical capacity building for CA staff; earmarked financial resources to support technology acquisition and staff training

10.2.4 Collection tool adaptability and development

As mentioned above, the broadband data collection tool must be developed and adapted continuously to meet evolving reporting requirements and sectoral needs. When investing in a collection tool, there is need to consider compatibility and adaptability aspects where the tools could provide scenarios and life cycles such as past, present and future forecasts, trends analysis, market segment insights, monitoring and evaluation. Some of key areas include:

- ***Compatibility with Past Versions:*** The tool should maintain backward compatibility to ensure seamless use of historical data. When developing a new version, transcription or migration of legacy data into the new format must be possible to preserve continuity and data integrity.
- ***Forecasting and Trend Analysis:*** The tool should support data life cycle analysis, including past, present, and future trends. Enable functionalities for market segment insights, monitoring, evaluation, and scenario planning.
- ***Scalability:*** Design the tool to be scalable, accommodating increasing volumes of data and additional stakeholders. Ensure alignment with both current broadband mapping needs and future growth of the national broadband ecosystem.
- ***Regular Updates and Enhancements:*** Continuously improve the tool to integrate new technologies, reporting requirements, and analytical capabilities. Maintain a structured development roadmap to guide updates, upgrades, and new feature implementation.

10.2.5 Developing robust and versatile visualisation tools

For a sustainable and effective broadband mapping system, it is critical to develop robust and versatile visualization tools that transform complex broadband datasets into actionable insights for policymakers, network operators, consumers, and the general public. Developing robust and versatile broadband visualization tools involves leveraging key technologies like GIS, interactive maps, online platforms, dashboards and geoportals, and adhering to best practices for data accuracy, interactivity, and scalability, and using powerful software and libraries. The goal is to transform complex broadband data into actionable insights for policymakers, network operators, consumers and the general public.

Developing robust and versatile visualization tools requires a focus on core principles of clarity, simplicity, interactivity, scalability, and accessibility, while leveraging appropriate frameworks and an iterative design process. It was noted during the stakeholder engagements that Kenya lacks a robust visualization tool for broadband maps and data, mainly on visualization outputs, instructiveness, overlays of various datasets, export to other formats such as map layouts, print PDF etc. Due to these challenges, it is incumbent upon CA to make a choice on what type of platforms to use, and make appropriate budgetary and technical provisions for the development/acquisition of the tool, in this case both proprietary and open-source solutions are available.

In order to achieve better results, key features/components of robust and versatile tools that could be considered by CA in making a decision on the type of the tool in order to realise effective broadband visualization include:

- ***Geospatial analysis and mapping*****:** Using GIS to map broadband infrastructure, coverage, demand, availability, speeds, allowing for the identification of underserved areas and optimal infrastructure placement.
- ***Real-time progress monitoring*****:** Integrating with mobile-enabled devices (routers, network probes) to collect and display live data on key performance indicators (KPIs) in a simple dashboard, while data analysts would need more detailed, granular views.
- ***Interactivity and customization*****:** Enabling users to filter data, zoom into specific areas, drill down into details, provide tooltips and customize dashboards to explore data from multiple perspectives and do comparisons e.g. with satellite imagery etc. This enables users to explore data dynamically and uncover insights on their own, transforming static visuals into a user-driven experience.
- ***Data integration capabilities*****:** The tool should seamlessly connect with diverse data sources, including land cadasters and parcels, households, schools, hospitals, road networks, power and other utility networks and other existing stakeholder/government databases to ensure a comprehensive and verified dataset.
- ***Scalability and performance:*** There is a need to design tools that can able to handle varying data volumes and complexities without performance degradation and provide fast results, using techniques like data reduction and parallel processing to avoid performance bottlenecks.
- ***Predictive analytics:*** The tools should be able to use historical data to model and forecast potential developments in infrastructure planning, service degradations, identify future network issues, and prioritize planning efforts proactively.
- ***User-friendly graphic user interface (GUI)****:* The tool could have clear design principles, appropriate chart types (heatmaps, line graphs, bar charts, etc.), and user assistance (e.g., user guides, tooltips, modules) and providing guidance on selecting the most appropriate one for the data relationship being displayed (e.g., line charts for trends over time, bar charts for

category comparisons etc) to ensure accessibility for both technical and non-technical audiences.

10.2.6 Development of sustainable tools

The development of sustainable broadband tools requires a holistic approach that integrates strategic planning, policy frameworks, and technical solutions to ensure economic viability, social inclusion, and environmental balance. The tool should be developed in an integrated approach using various methodologies and technologies to accommodate a diversity of stakeholders such as private entities and agencies, individuals, governments, civil society and advocacy organisations etc. There is need to develop a marketing strategy, training seminars and workshops, and promotion campaigns to ensure that the tool is well understood and is sustainably embedded in a Country's development for societal good and benefits.

Investment in sustainable tools would be able to help stakeholders to be able to be continuously informed of the status of broadband in Kenya, by being appraised on broadband opportunities sustainability roadmap to identify needs and potential for broadband development in the country, gauge the status of digital infrastructure, impact and market assessment that utilizes economic impact models to estimate potential growth from increased broadband use, among other insights. There should be a sound sustainability policy and regulatory framework that allows CA as the regulator to create frameworks and policies to foster a sustainable and competitive market. Other sustainability opportunities include public private partnerships for longevity, universal service obligations that ensure service providers extend connectivity to unserved or underserved, often rural, areas, measurement and monitoring tools and metrics that are crucial for assessing progress and ensuring activities align with sustainability principles, and sustainability dashboards that monitor long-term sustainability indicators.

10.2.7 Data application

Broadband mapping involves collecting data from multiple public and private sources. To transform this data into actionable information, a data application tool is essential. Such a tool should support planning, verification of available services, reporting of service demand, and serve as a single broadband information one-stop-shop. When designing a data application tool, the following key elements should be put into consideration.

a) Creation of a platform to plan investments, for example platform presenting and visualizing existing network, services provided, e.g. allowing simple calculation of potential investment in a chosen area

b) Creation of a tool for verification of services available e.g. a tool presenting services available at the level of household, combining data obtained from all reporting operators. Enable verification of network coverage, service quality, and accessibility.

c) Creation of a tool for reporting services demand e.g. a tool with the functionality available to individual consumers to easily report demand for a service at an address. Capture user-reported demand data to inform network expansion and planning decisions.

d) Creation of a platform acting as a single telecommunication information point e.g. platform presenting information on the formal and legal side of the investment, Serve as a central repository for comprehensive broadband information

10.3 Long Term Vision for Kenya's Broadband Maps Project

Kenya's broadband maps project envisions a dynamic, authoritative platform that continuously integrates geospatial, socio-economic, and infrastructure data to guide inclusive digital transformation. Over the next 5 to 10 years, the maps will evolve into a national reference system,

enabling evidence-based policymaking, equitable investment, and transparent monitoring of connectivity progress. By harmonizing its Africa-BB-Maps national realities with global standards[172] [173] such as ITU's *Africa-BB-Maps*[174], GSMA's operator-verified coverage datasets[175] and OECD broadband indicators[176], the Africa-BB-Maps initiative will institutionalize broadband mapping as a statutory tool through an ecosystem underpinned by strong GIS technology, enhanced institutional and human capacity, and effective multi-stakeholder collaboration, and engagement. This vision emphasizes inclusivity, ensuring underserved Counties are represented in co-creation of the maps and served with broadband, while fostering accountability, resilience, and innovation. Ultimately, Kenya seeks to guarantee universal, affordable, and high-quality broadband access, positioning itself as a regional leader in digital inclusion, knowledge economies, and sustainable development across Africa.

To realise this vision Kenya will embed the Africa-BB-Maps initiative as a strategic objective in its National Broadband Strategy 2025-2030 to ensure that it is institutionalised and successfully implemented. Furthermore, the socio-economic relevance of the maps will be ensured by expanding the scope to include socio-economic indicators such as affordability, demographics and direct customer feedbacks.

[172] Kenya News Agency. (2025, August 25). *Kenya, EU and ITU launch broadband mapping project to bridge digital divide*. Retrieved from https://www.kenyanews.go.ke

[173] TechTrendsKE. (2025, August 26). *Kenya Broadband Mapping Project to Bridge Digital Divide*. Retrieved from https://techtrendske.co.ke

[174] International Telecommunication Union. (2025). *Africa-BB-Maps project (2025–2028)*. Retrieved from https://africabbmaps.itu.int

[175] GSMA Intelligence. (2025). *Network coverage maps*. Retrieved from https://www.gsma.com/coverage

[176] Organisation for Economic Co-operation and Development. (2009). *Indicators of broadband coverage*. OECD Digital Economy Papers. Retrieved from https://www.oecd.org/en/publications/indicators-of-broadband-coverage_5kml8rfg777l-en.html

11. Conclusion

Kenya's broadband maps initiative represents a strategic commitment to bridging the digital divide and institutionalizing evidence-based policymaking. The purpose and objectives are to establish a dynamic, authoritative mapping system that integrates geospatial, socio-economic, and infrastructure data, guiding equitable investment, regulatory oversight, and inclusive digital transformation.

The proposed methodology for broadband maps for Kenya blends international best practices—ITU's *Africa-BB-Maps*, GSMA's operator-verified coverage datasets, and OECD broadband indicators—with localized inputs from KNBS, county governments, and operators. This ensures global benchmarking while reflecting Kenya's realities.

The policy, legal, and regulatory framework provides the backbone for implementation. Anchored in Kenya's National ICT Policy, Digital Master plan 2022-2032, National Broadband Strategy 2025-2030 (under development), and Data Protection Act, the Communications Authority will enforce statutory mandates on data sharing and infrastructure reporting, while KNBS integrates socio-economic datasets under the Statistics Act and shares the data with CA including through and an MoU. MoUs and statutory regulations ensure confidentiality, interoperability, and accountability. Consequently, the key recommendations for Africa-BB-Maps emphasize:

- Deployment of a robust standards-based GIS platform to integrate infrastructure, coverage, and socio-economic layers into interoperable dashboards.
- Continuous capacity building for government, CA, rother regulators, Counties, and academic staff, ensuring training in GIS, big data, and indicator methodologies.
- Adoption of best-practice standards aligned with ITU, GSMA, and OECD frameworks to guarantee comparability, transparency, and long-term sustainability, and technical GIS and related systems standards that will ensure interoperability and seamless sharing of Africa-BB-Maps data.
- Integration of emerging technologies in the BB mapping.

The road map prioritizes phased implementation: governance protocols, GIS platform deployment, integration of operator and socio-economic datasets, and dashboards for transparency. Thus, a strong monitoring and evaluation (M&E) framework—anchored in annual reviews against OECD-aligned indicators, validation of operator coverage through GSMA datasets, and continuous ITU infrastructure updates—ensures accountability and adaptability.

Furthermore, institutional readiness is the cornerstone for the successful rollout of Africa-BB-Maps initiative. While Kenya has demonstrated advanced progress through its participation in the ITU Africa-BB-Maps initiative, the sustainability of these gains depends on the ability of institutions to adopt, operationalise, and scale the project. This requires not only technical capacity in GIS and data governance, but also structured coordination through the NWG, statutory clarity, and alignment with continental and global benchmarks. By investing in institutional capacity-building, embedding monitoring and evaluation systems, and mobilising resources for long-term implementation, Kenya can ensure that its institutions are fully prepared to deliver accurate, inclusive, and harmonised broadband mapping outputs. Institutional readiness thus transforms the Africa-BB-Maps initiative from a policy vision into a practical, instrument that advances digital equity and regional integration.

Additionally, long-term sustainability rests on embedding broadband mapping as a statutory function within CA, securing multi-stakeholder funding, and fostering regional collaboration. By institutionalizing robust GIS platforms, capacity building, and standards, Kenya positions itself as a

continental leader in digital inclusion, resilient infrastructure planning, and harmonized broadband governance.

Annexes

Annex 1: Data Sources and Methodological Notes

Data Collection Tool

KENYA BROADBAND MAPS PROJECT

Request for Information Questionnaire

The Kenya Broadband Maps Project is part of the African Continental broadband maps project being implemented across 11 selected countries. Following the launch of the project in August 2025, you are invited and requested to participate in the project by providing information through this questionnaire that will inform the next phases of the design and implementation of a robust broadband maps ecosystem in Kenya to support the development of the digital economy in a line with the Kenya National Digital Master Plan 2022- 2032 and position Kenya as a continental digital innovation hub. This national project for Kenya is supported by the International Telecommunication Union and coordinated by the Communications Authority of Kenya on behalf of the Government of Kenya.

Please complete the questionnaire and submit it online. We will contact you we will need further clarification once we receive your response and update you on the outcome of the analysis of the data that will be obtained through this survey.

We thank you for your time and invaluable information to enable the success of this important national project. The broadband maps project once implemented will enhance broadband meaningful connectivity and services, inform investment decisions in ICTs/broadband infrastructure/ services and in the digital sector and improve the quality digital services that are required to drive digital transformation and create a Kenya digital society.

Consent

I Consent to participate in the Survey	Y/N

Basic Information

Name of the organisation/agency:	
Sector:	
Name (point of contact):	
Role / Designation:	
Email Address:	

Section 1: Enabling Broadband Data Infrastructure

1. Data Infrastructure (Cloud Infrastructure and Services)
(CA, ICTA, MICDE, KPLC, KETRACO, KeNHA)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Does the country have access to **Cloud Infrastructure**?		

b) If YES, does the accessibility include **international** (Commercial) data centers (e.g., Microsoft, Amazon, etc.)?		
c) If YES, does the accessibility include **government data centers**?		
d) If YES, does the accessibility include **commercial data centers**?		
e) If NO, is there a plan to build a local data center, a virtual network operations center (NOC)? What is the expected launch date?		
f) Does your agency (Government) use **Cloud services**?		
g) If YES, what share of your agency / government broadband data are stored on the cloud?		
h) If YES, are **broadband data stored on the cloud** easily accessible across departments and different levels of government (national/county) for analysis?		
i) What **share** of cloud services are provided by international (commercial) versus national government vs. national commercial providers?		
j) What services are most used on **cloud services**? (e.g., AI- enabled applications such as chatbots and machine learning analytics tools; data storage; online services; …etc.)		
k) If NO, is the Government planning for **Cloud migration**?		

2. National Broadband Data Infrastructure Security
(CA, ICTA, MICDE)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Does the Government have a National **Critical Infrastructure** Plan?		
b) If YES, does the plan include National **cloud broadband infrastructure**, platforms, and services?		
c) Does the plan refer to **Data Center Security** (physical practices and virtual technologies used to protect data centers from cyber threats and attacks)?		
d) Are existing data centers built with **advanced security** measures including redundant and dual-powered servers, storage, network links and other IT components (i.e., Tier 3; Tier 4)?		
e) Are international security **standards** (e.g., ISO 27000) adopted and practices?		
f) Does your agency / Government **collaborate** with domestic and international organizations to mitigate cyber risks?		

3. Broadband Infrastructure Mapping Systems
(CA, ICTA, KPLC, KETRACO, KeNHA, ISPs, GSMA)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Does your agency/Kenya have a **national broadband mapping system**?		
b) If YES, who manages the system?		
c) Does your broadband mapping system **systematically integrate user- reported issues** and **network complaints**?		
d) Have you implemented the following **broadband mapping systems**? If YES, which ones?		

○ Infrastructure mapping ○ Service mapping ○ Investment mapping ○ Demand mapping ○ Quality and affordable mapping		
e) Is broadband infrastructure mapping **integrated** with other national infrastructure **planning systems**?		
f) Which **infrastructure or coverage data** are included in broadband mapping initiatives/efforts? (*select all that apply*) ○ Backbone networks and fibre backhaul; ○ Mobile broadband towers (3G, 4G, 5G); ○ Satellite broadband coverage areas; ○ Fixed broadband access networks (DSL, FTTH, Cable); ○ Power and energy infrastructure related to broadband; ○ None of the above – no infrastructure data is mapped		

4. Architecture, Interoperability Standards and Framework

(CA, ICTA, MICDE, KPLC, KETRACO, KeNHA, Survey of Kenya)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Does your agency have an established **Broadband Enterprise Architecture** (s) for data related? ○ Schema (*please share*) ○ Workflow		
b) Is there knowledge and expertise around the **concept of Data Architecture**?		
c) Does your organisation have an **e-Government Interoperability** Framework with **mandatory standards** for each agency's systems?		
d) Is there an agency-wide / government operated **broadband data interoperability/data sharing platform?**		
e) What are the **features of the interoperability platform?** ○ Based on an **open-source** solution (e.g. OSGeo, OGC, WMS) ○ Based on a **proprietary solution** (e.g. ArcGIS Enterprise) ○ All government agencies are connected to the platform ○ The platform is accessible to/by private sector entities		
f) Is there a body responsible for setting (or reviewing) **technical standards** that government entities abide by to make their systems interoperable?		
g) Is your agency or government entities mandated to use **common technical standards** that enable the interoperability of systems, databases and registries?		
h) Does your agency (government) have **established standards** for Application Programming Interfaces (APIs) to develop applications or online services?		
i) Has the Government defined, digitized and shared a set of basic **data registers**?		
j) If YES (see, item i), please identify what data registers (*select all that apply*): ○ National *population* and *demographic* statistics database; ○ National *land* and *cadaster* database;		

○ National *business* registration and *financial* database; ○ National *address* database; etc		
k) For each basic register, has the government defined **institutional responsibilities** for the operation, update, and sharing of the **broadband register's data**?		
l) Are all government agencies legally required to use basic registers rather than collect and hold their own data?		
m) Is there a government **data classification** policy/directive?		
n) Does the policy or directive prescribe the **categories of common data classification**?		

5. Physical Infrastructure and Network

(CA, ICTA, MICDE, KETRACO, KPLC, KeNHA)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Are there established secure **physical network** (s) (LAN/WAN) for the sharing of data and services among agencies?		
b) If YES, are government agencies and other agencies also connected?		
c) If NO, what is the **government plan** to ensure interconnectivity across government agencies?		
d) Are there **data servers** in your organisation?		
e) If YES, what data do they store, how are they accessed, how many are they?		
f) Through which standards is the data accessed?		

Section 2: Broadband Data Collection, Access and Management

6. Data Collection Mechanisms, Verification, and Accuracy

(CA, KPLC, ICTA, KETRACO, KeNHA, GSMA, ISPs (Safaricom, Airtel, Liquid, Jamii, Telkom Kenya etc)

Questions	Y / N	Response / Comments Add Links / Attachments
a) What **methods** are used to collect broadband coverage data? (*multiple options*) ○ Licensed service providers/ISP reports (*please share the quarterly reporting template)* ○ Crowd-sourced data ○ Automated real-time data validation tools ○ Independent field surveys ○ Government-led audits ○ Other/s (please specify		
b) (i) Are broadband coverage maps/ data sets updated and verified?		
(ii) How **frequently** (**timelines**) are broadband coverage maps or datasets updated and verified?		
c) If YES (see b(i), ii)), what is the **procedure** of updating and verifying the datasets?		
d) Is there a **data catalogue or a data map** that documents your data assets?		
e) Is the **data lifecycle** mapped or documented for systems and services?		

f) In your view, is there a **harmonized data collection and harmonization approach**?		
g) If NO, how can the data collection be harmonised?		

7. Data Supply, Quality, Validation and Management

(CA, ICTA, KPLC, KETRACO, KeNHA, GSMA, Survey of Kenya, ISPs (Safaricom, Airtel, Liquid, Jamii, Telkom etc)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Do you have a **defined process** for broadband data collection, storage, processing, and usage?		
b) What format is/are the data source/s? (*indicate all that apply*) ○ GIS (georeferenced vector/raster imagery) ○ Excel-CSV (*please share the template*) ○ JSON/GeoJSON ○ XML ○ KML/GML etc		
c) Are there a **data quality protocols/processes** for broadband data? ○ Plausible checks (consistency, credibility, and correctness) ○ Manual checks? ○ Additional user feedback?		
d) Is there a consistent understanding of **data definitions, data usage, and data ownership** within the organization?		
e) Do you maintain a centralized broadband **metadata repository**?		
f) If YES, Is the metadata accurate, complete, and regularly updated?		
g) Are all data assets consistently **classified and tagged**?		
h) If there is NO **broadband metadata**, what metadata will you need to generate so that others in your field will be able to find, understand, and make use of your data?		
i) Who is responsible for ensuring metadata standards are followed?		
j) Is there a **data retention policy** in place?		
k) Are there documented processes and procedures in place for the **operation/storage and archival** of broadband data?		

8. Data Access

(CA, KPLC, ICTA, MICDE, KETRACO, KeNHA, GSMA, Survey of Kenya, ISPs (Safaricom, Airtel, Liquid, Jamii, Telkom Kenya, etc)

Questions	Y / N	Response / Comments Add Links / Attachments
a) How do the stakeholders currently **access** your broadband data? ○ Internal access? ○ Limited access? ○ Public access?		
b) What challenges do you face when finding or trusting data?		
c) What **methods** are used for sharing data both within and outside of the organisation (HTTPS, APIs, Batch File Transfer, Secure File Transfer Protocol (SFTP), email, etc.)?		

d) Do you have access to **AI-assisted tools** for data search, discovery, or analysis?		
e) Is data, where appropriate, made publicly available as **Open Data**?		
f) Do you have a broadband **data geoportal**? *If YES, please share the link.*		
g) How is the data (GIS) **published**? (*select all that apply*) ○ Interactive maps published in a dynamic web application; ○ Interactive address search published in a dynamic web application; ○ Application Programming Interfaces (APIs) for accessing data; ○ Datasets in open and generalized formats such as CSV; ○ Statistical reports, including tables and analyses.		
h) Are there technical and **non-technical policies and procedures** in place to provide **access to data** (and govern such access)?		

9. Goals and Objectives of Data Management

(CA, KPLC, ICTA, MICDE, KETRACO, KeNHA, ISPs (Safaricom, Airtel, Liquid, Jamii, Telkom Kenya etc)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Do you have a broadband **data governance framework**?		
b) Do you have a clearly defined **goals and objectives** for implementing a broadband **data governance framework**?		
c) Do your objectives align with overall agency strategy and objectives?		
d) Which primary driver applies to you? (Regulatory compliance / AI readiness / Data quality / Other)		

10. Data Governance, Coordination, Ownership and Stewardship

(CA, ICTA, MICDE)

Questions	Y / N	Response / Comments Add Links / Attachments
a) (i) Which **institutions and stakeholders** do you work with and what are their roles? (*List those who constitute the National Working Group (NWG)*)		
b) Have you identified key stakeholders who will be involved in the broadband **data governance** program?		
c) How is your relationship and **coordination role** with other stakeholders such as operators, county and local administration etc?		
d) Are all stakeholders represented in governance decisions?		
e) Is there a **coordination structure** between your agency and stakeholders?		
f) Have you assessed your **broadband data governance maturity level** using a standard model?		
g) Does it measure our maturity in terms of data quality management processes, data lineage, metadata infrastructure, automation and AI, and compliance readiness?		
h) Are there known blind spots in data lineage, quality, policy enforcement, or metadata coverage?		

i) Have you identified potential **risks and challenges** in implementing a **broadband data governance program**?		
j) Does your agency/Government entities and Businesses adopt **data governance principles**?		
k) Are you aware of the gaps and areas that need improvement in our current data governance practice?		
l) Does your organisation have an organization-wide, formal **data governance policy** or structure in place?		

11. Data Standards

(CA, KPLC, ICTA, MICDE&DE, KETRACO, KeNHA, ISPs (Safaricom, Airtel, Liquid, Jamii, Telkom Kenya etc)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Do you have up-to-date **data policies and standards**? e.g. Open Fiber Data Standards (**OFDS**) *If YES, please share.*		
b) Is there an enterprise-wide **data catalog**? *If YES, please share*		
c) Do you maintain current **lineage diagrams for critical datasets**? *If YES, please share.*		
d) Have you documented your current data **quality management practices**?		

12. Data Sharing Framework

(CA, KPLC, ICTA, MICDE&DE, KETRACO, KeNHA, GSMA, ISPs (Safaricom, Airtel, Liquid, Jamii, Telkom Kenya etc)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Has your agency adopted **international data standards** (including metadata standards)?		
b) (i) Does your agency promote **mainstreaming of APIs**?		
(ii) If YES, For what kind of data are APIs enabled?		
b(i) Is there a platform for sharing data via APIs?		
(ii)If YES, does it facilitate 2G, 3G, and/or 5G?		
c) Does your agency (or Government) have common **Data Sharing Agreements** or **Data Exchange Protocols** with any third party		

13. Open Datasets

(CA, ICTA, MICDE)

Questions	Y / N	Comments Add Links / Attachments
a) Has your agency (or government) adopted an **Open Data policy** or an Open Data Act (if any) applicable across the public sector?		
b) If YES, at what level of government is this policy applicable (*select all that apply*) ○ Entire public sector; ○ National Government; ○ County Governments		

c) (i) If YES, is the government proactively **releasing open data sets** and encouraging the use of these data sets?		
c(ii) Which datasets are open?		
d) Is your agency's (government) data available and **used by policy makers** and **service providers**?		
e) (i) Are your agency (government) datasets accessible by **private sector** and **academic** institutions?		
(ii) Are these open datasets designated/clearly identified as (e.g., for public good; for development, commercial services; ... etc.)?		
f) Has your agency (government) adopted an **open licensing regime** (such as a Creative Common License by Attribution) to enable the reuse of public sector data?		
g) Does the **Open License** apply to all government data?		

14. ***Data Access Barriers and Regulatory Limitations***

(CA, ICTA, MICDE&DE)

Questions	**Y / N**	**Response / Comments** Add Links / Attachments
a) Has **Right /Access** to data/information legislation been passed that grants individuals the right to request government records or data?		
b) Does the law provide for **limitations or exceptions** to this right of requesting access to government records or data? E.g. sensitive information, personal data, privileged information, public investigations and audits and other		
c) Does the law provide for the creation of a **centralized unit** to process broadband data requests?		
d) Does the law include a provision requiring the collection of data on **broadband data requests**?		
e) Is this information published and publicly available on a citizen-facing agency/government website?		

Section 3: Institutional Capacity, Strengthening and Limitations

15. Data Stewardship

(CA, ICTA, MICDE)

Questions	Y / N	**Response / Comments** Add Links / Attachments
a) Is there a formal **agency policy** on data stewardship / ownership and licensing of broadband data?		
b) If YES, what are the **obligations** / **rights** that are set for various actors/ stakeholders: (*please provide a copy of the policy*) ○ Government ○ Individuals/ Public ○ Businesses		

16. Personnel Skills and Talent

(CA, ICTA, KPLC, KETRACO, KeNHA, ISPs (Safaricom, Airtel, Liquid, Jamii, Telkom Kenya etc), GSMA)

Questions	**Y / N**	**Response / Comments** Add Links / Attachments

a) How many personnel are able to **operate and maintain the geospatial servers** in your agency? (*also provide the number*)		
b) (i) Do you have **in-house developers**?		
(ii) If yes, what are their skills (software, database, scripting)? (*also provide the number*)		
c) What are the **data-related positions** in the agency? *This could be exclusively databases or just personnel that use GIS data and software in their everyday work.* (*also provide the number*)		
d) Describe the level of **GIS skills and experience** possessed by your personnel in general (basic/intermediate/advanced).		
e) (i) Does the agency **hire external contractors** to perform internal geospatial or data analysis tasks?		
(ii) If yes, what tasks are they typically hired to do?		
f) Are there any **capacity building initiatives** for data and/or GIS analysis in the agency?		
g) Please identify any **additional skills** that agency personnel may require to aid in broadband data management.		

Section 4: Data Laws, Regulations and Legal Systems

17. Data Protection / Cybercrime Legislation, Regional and International Treaties

(CA, ICTA, MICDE)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Were any of the below **international/regional models or guidelines** used as the basis for developing the data protection legislation? Please mark all as appropriate ○ East African Community (EAC-RECs) ○ Commonwealth model law on privacy ○ AU Convention on Cybersecurity and Personal Data Protection ○ European Electronic Communications Code 11 (EECC) ○ EU General Data Protection Regulation (EU GDPR) ○ Other (*please specify*)		
b) Is the government a party to any of the below data-related **international conventions and agreements**? If YES, what is the date of accession or ratification?		
○ International Covenant on Civil and Political Rights, 1966 (Article 17 on the right to privacy) ○ Council of Europe Convention for the Protection of Individuals regarding Automatic Processing of Personal Data, 1980; revised 2016 (open to all countries) ○ Convention on Cybercrime (Budapest Convention), 2001		
c) If NO, has the government indicated an intent to join any of the above?		
d) If YES, please specify which one		
e) What is the status of the recently enacted **Computer Misuse and Cybercrime Act** law in relation to data protection and security?		
f) Have the relevant implementing regulations been implemented?		

Section 5: Regional Harmonization Initiatives

18. Cross-Border Data Transfers and Coordination

(CA, ICTA, MICDE, EACO, TESPOK, KCINet, GSMA)

Questions	Y / N	Response / Comments Add Links/Attachments
a) Is there a **national or regional framework** to coordinate cross-border data collection and broadband mapping standards?		
b) Do any laws, regulations or policies restrict **the transfer of broadband** (personal/non-personal) data outside Kenya?		
c) Do any laws, regulations or policies require broadband data to be stored, processed, managed and analyzed within Kenya? (**data localization**)		
d) What are the **conditions or restrictions** on broadband data processing abroad (personal/non-personal data)?		
e) Does the country have **arrangements with foreign countries** or multinational entities or schemes, including decisions of domestic and foreign bodies or agencies, to require, permit or limit transfers of broadband data between countries?		
f) If the regime requires an "adequacy" or similar mechanism, what circumstances constitute an "adequate level of protection" when transferring data regionally (Africa) or internationally?		
g) Is there a regional "One Stop Shop" Agency (e.g. Africa Data Protection Bureau equivalent in the case of personal data protection) to harmonize processing of decisions and regulatory enforcement?		
h) Is there a **regional Spatial Data Infrastructure** (Africa SDI) e.g. EU-INSPIRE /EuroSDI for sharing spatial data in place?		
i) If YES, are you a party to it? What is the current arrangement for sharing broadband data across the region (EAC-RECs/Africa)?		
j) Is your organisation deploying the **Seven ITU transmission indicators**?		
k) If YES, do you think it is appropriate for an Africa-wide regional harmonization of broadband datasets?		
l) Are there **other monitoring indicators** you have deployed? *If YES, please share*		

Section 6: Training and Capacity Building

19. National Capabilities (Technical Capacity and Training)

(CA, ICTA, KPLC, KETRACO, KeNHA)

Questions	Y / N	Response / Comments Add Links / Attachments
a) Does the agency have a national **Capacity Development** Plan?		
b) If YES, what are the **targets** among the personnel, training needs and how often?		
c) Does your agency Plan include specific training to develop intermediate and advanced digital **skills related to Data** (data management, data security, data sharing, data structure, data privacy and protection, Machine Learning, GIS etc.)?		
d) If YES, Is this training provided directly by your agency / Government or in partnership with existing training providers (e.g. universities)?		

e) Is there a national Talent Development Plan to address the supply and demand of **data-driven job opportunities** within private sector? What are the KPIs for this plan?		

Section 7: Broadband Policy and Regulatory Framework

20. Policy Regulatory Framework
(CA, ICTA, MICDE)

Questions	Y / N	Response / Comments Add Links / Attachments
a) What is your **mandate** in broadband mapping (broadband plans, ICT strategies etc)?		
b) What is your **role in legislative framework** on broadband? Especially in the following areas: ○ Infrastructure sharing (infrastructure mapping) ○ Allocation of public funding (service mapping) ○ Objective of the map ○ Obligation of the authority/organisation to deliver the map ○ Obligations of the stakeholders to provide information ○ Other/s		
c) Do you have **enough budgetary resources** to deliver on your mandate especially on broadband mapping?		
d) Do you have **sufficient human resources** in order to deliver on your mandate especially on broadband mapping?		
e) What are the **technical methodologies and definitions** you require in order to carry our broadband mapping and establish a broadband mapping system?		
f) Do you have **established monitoring and evaluation systems** (M&E) for broadband mapping? *If YES please share the M&E Framework.*		

Annex 2: Stakeholder List

No	Organization in attendance
1	World Bank
2	ITU
3	International Telecommunication Union (ITU)
4	Sinat
5	Easri East Africa
6	Strathmore University
7	Kenya Power & Lightning Company
8	Konza Technopolis
9	KBC Tv
10	Tech IT Media
11	Liquid Technology
12	Internet Society of Kenya
13	Telkom Kenya
14	Survey of Kenya
15	Safaricom
16	Cellular Expert
17	Radio47.cape media
18	NEMA
19	Kenya News Agency
20	Information and Communication Technology Authority.
21	Kenya National Bureau of Statistics.
22	European Investment Bank
23	Royal Media Services
24	Huawei
25	University of Nairobi
26	Airtel Networks
27	KETRACO
28	AFRALTI
29	Master Space
30	GSMA
31	QGIS
32	EACO
33	Jomo Kenyatta University of Agriculture and Technology.
34	Mawingu
35	Jamii Telecommunications Limited.
36	Kenya Metrological Department
37	State department for Lands
38	National Construction Authority (NCA)
39	Office of the Data Protection Commissioner (ODPC)
40	State Department for Lands and Physical Planning
41	Technical University of Kenya (TUK)
42	Aegir Consult

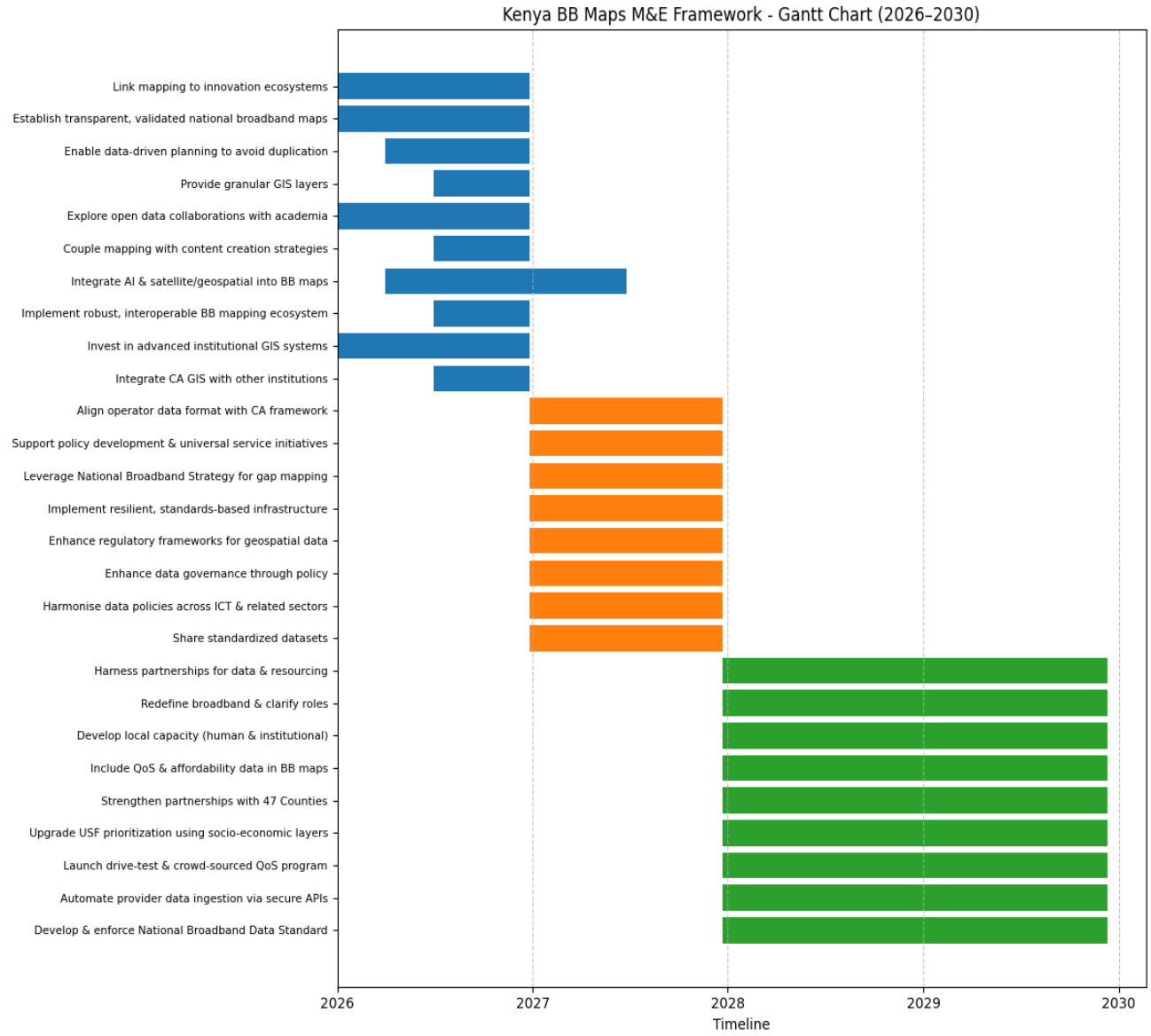
Annex 3: Additional Tables or Figures

Table 3A. Monitoring and Evaluation (M&E) Matrix for Kenya Africa-BB-Maps

Timeline	Objective	Activity	KPIs	Responsibility	Risk Linkage
2026 (Short -Term)	Strengthening institutional GIS capacity & interoperability	Develop and enforce National Broadband Data Standard	Standard adopted by 80% of operators	MICDE, CA	Mitigates data quality & policy delays
		Automate provider data ingestion via secure APIs	70% of operators submitting via APIs	CA	Addresses data accuracy & institutional readiness
		Launch drive-test and crowd-sourced QoS program	Coverage in 47 counties; 50,000 samples	CA, Universities	Reduces data quality risk
		Upgrade USF prioritization using socio-economic layers	USF allocation reports integrating socio-economic data	USF Secretariat	Mitigates resource allocation gaps
		Strengthen partnerships with 47 Counties	MoUs signed; 80% counties submitting GIS data	MICDE, CA Council of Governors	Addresses stakeholder coordination & institutional readiness
		Include QoS & affordability data in Africa-BB-Maps	Indicators integrated into maps	CA	Mitigates data quality & affordability gaps
		Develop local capacity (human & institutional)	200 county officials trained	CA, ICT Authority, Universities	Addresses institutional readiness
		Redefine broadband & clarify roles	Consensus framework adopted	National Working Group	Mitigates policy delays & coordination challenges
		Harness partnerships for data & resourcing	10 partnerships formalised	MICDE, CA	Addresses resource constraints
		Share standardized datasets	90% datasets shared in agreed formats	CA	Mitigates data quality & interoperability gaps
2027–2028 (Medium -Term)	Align GIS mapping with national strategies & regulatory frameworks	Harmonise data policies across ICT & related sectors	Cross-sector policy harmonisation framework adopted	MICDE, CA, Energy, Transport	Addresses policy delays & coordination challenges
		Enhance data governance through policy	National Data Governance Policy enacted	MICDE, CA	Mitigates data quality & policy delays
		Enhance regulatory frameworks for geospatial data	New regulations gazetted & enforced	CA, Parliament	Addresses policy delays

		Implement resilient, standards-based infrastructure	80% systems interoperable	CA	Mitigates infrastructure gaps
		Leverage National Broadband Strategy for gap mapping	Annual gap mapping reports published	MICDE	Addresses data accuracy
		Support policy development & universal service initiatives	10 projects funded by 2028	USF Secretariat	Mitigates resource constraints
		Align operator data format with CA framework	90% operator compliance	CA	Addresses data quality
		Integrate CA GIS with other institutions	5 integrations achieved	CA,	Mitigates institutional readiness & coordination challenges
2029–2030 (Long-Term)	Enhance accuracy, granularity & transparency of broadband mapping data	Invest in advanced institutional GIS systems	Advanced GIS platform operational	CA	Addresses infrastructure gaps & institutional readiness
		Implement robust, interoperable BB mapping ecosystem	95% systems interoperable	MICDE	Mitigates data quality & interoperability risks
		Integrate AI & satellite/geospatial into Africa-BB-Maps	AI/satellite layers integrated	CA, Universities	Addresses data accuracy
		Couple mapping with content creation strategies	Maps linked to content demand indicators	MICDE, Private Sector	Mitigates coordination challenges
		Explore open data collaborations with academia	10 collaborations formalised	Universities, CA	Addresses institutional readiness
		Provide granular GIS layers	Annual updates published	CA	Mitigates data quality
		Enable data-driven planning to avoid duplication	20% reduction in duplicated infrastructure	MICDE, Operators	Addresses resource constraints
		Establish transparent, validated national broadband maps	Annual validated maps published	CA	Mitigates data quality & transparency risks
2029–2030 (Long-Term)	Link broadband mapping to innovation ecosystems & socio-economic transformation	Couple mapping with content creation strategies	15 innovation projects supported	MICDE, Innovation Hubs	Addresses institutional readiness & coordination challenges

Annex 4: Kenya Africa-BB-Maps M&E Framework – Gantt Chart (2026-2030)



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