



INTERNATIONAL TELECOMMUNICATION UNION

ITU POLICY ANALYSIS
Strengthening National Broadband Mapping
Systems in Côte d'Ivoire



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List of Acronyms and Abbreviations

AGEROUTE	Agence de Gestion des Routes (Road Infrastructure Agency)
AIGF	Agence Ivoirienne de Gestion des Fréquences (Ivorian Agency for the Management of Radio Frequencies)
ANCOM	National Authority for Management and Regulation in Communications (Romania)
ANSTAT	Agence Nationale de la Statistique (National Agency for Statistics)
ANSUT	Agence Nationale du Service Universel des Télécommunications-TIC (National Agency for the Universal Service of Telecommunications/ICT)
ARTCI	Autorité de Régulation des Télécommunications/TIC de Côte d'Ivoire (Telecommunications/ICT Regulatory Authority of Côte d'Ivoire)
BB-Maps	Broadband Maps
BDT	Telecommunication Development Bureau
BEREC	Body of European Regulators for Electronic Communications
BNETD	Bureau National d'Études Techniques et de Développement
CIE	Compagnie Ivoirienne d'Electricité
CI-ENERGIES	Côte d'Ivoire Energies (State utility for electricity)
CIGN	Centre d'Information Géographique et du Numérique (National Geographic Institute)
CNTIG	Comité National de Télédétection et d'Information Géographique
CTCI	Conseil des Télécommunications de Côte d'Ivoire (Côte d'Ivoire Telecommunications Council)
DESI	Digital Economy and Society Index

DNA	Digital Networks Act
DQI	Department of Service Quality and Infrastructure (ARTCI)
DRM	Department of Market Regulation (ARTCI)
EC	European Commission
ECOWAS	Economic Community of West African States
EECC	European Electronic Communications Code
EU	European Union
FTTB	Fibre to the Building
FTTH	Fibre to the Home
GDP	Gross Domestic Product
GIA	Gigabit Infrastructure Act
GIS	Geographic Information System
GSM	Global System for Mobile Communications (2G)
ICT	Information and Communication Technologies
IDI	ICT Development Index
ISP	Internet Service Provider
ITU	International Telecommunication Union
KPI	Key Performance Indicator
LTE	Long-Term Evolution (4G)
M&E	Monitoring and Evaluation
MCLU	Ministry of Construction, Housing and Urbanization
MENA	Ministry of Education
MNO	Mobile Network Operator

MTND	Ministry of Digital Transition and Digitalization
NRA	National Regulatory Authority
OCA	Other Competent Authorities
PCR-CI	Projet de Connectivité Inclusive et d'Infrastructures Rurales en Côte d'Ivoire (Inclusive Connectivity and Rural Infrastructure Project)
PND	Plan National de Développement (National Development Plan)
PPP	Purchasing Power Parity
PSNDEA	Projet de Solutions Numériques pour le Désenclavement des Zones Rurales et l'e-Agriculture (E-Agriculture Project)
QoS	Quality of Service
RNHD	Réseau National Haut Débit (National Data Transmission Backbone)
SNGD	Stratégie Nationale de la Gouvernance des Données (National Data Governance Strategy)
SNNCI	Stratégie Nationale de Développement du Numérique (National Digital Development Strategy)
SODECI	Société de Distribution d'Eau de la Côte d'Ivoire (Water Distribution Company)
SOP	Standard Operating Procedure
UMTS	Universal Mobile Telecommunications System (3G)
USO	Universal Service Obligation
UVICOCI	Union des Villes et Communes de Côte d'Ivoire (Union of Cities and Municipalities of Cote d'Ivoire)
VHCN	Very High Capacity Network
WAEMU	West African Economic and Monetary Union

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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, but the continent is experiencing the fastest internet growth in the world¹. Africa-BB-Maps is an 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, Cote 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, 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 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^[1].
- ii. *Support evidence-based policy* by providing reliable data to government policy makers and regulators to design targeted interventions for bridging the digital divide^[2].
- iii. *Facilitate resource allocation* by providing evidence-based data to guide more efficient investment decisions by showing where infrastructure is most needed^[3].
- iv. *Promote harmonization* by establishing standardized mapping systems across 11 African countries (Benin, Botswana, Burundi, Cote d'Ivoire, Ethiopia, Kenya, Malawi, Nigeria, Uganda, Zambia, and Zimbabwe)^[4].
- v. *Accelerate digital inclusion* by making broadband access more transparent, thus ensuring equitable connectivity for rural and urban populations^[5].
- vi. **Build local capacity** for data collection and analysis
- vii. **Promote interoperability and regional integration** of mapping tools

¹ International Telecommunication Union. (2024). *Measuring digital development: Facts and Figures 2024*. ITU. <https://www.itu.int/itu-d/reports/statistics/facts-figures-2024/>

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's Telecommunication Development Bureau (BDT), it reflects international collaboration for Africa's digital transformation^[6]. Furthermore, it will enable *data-driven planning* where governments can use the maps to prioritize infrastructure rollouts, especially in rural and low-income areas^[7]. 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

1.1.1 Problem Statement: The need for broadband mapping

Across Africa, broadband data remains fragmented, inconsistent, and often unavailable in standardised geospatial formats. Many countries lack clear mechanisms for data collection, validation, and publication, making it difficult to understand the true state of national coverage, infrastructure deployment, and service quality.

In Cote d'Ivoire, these challenges are explicitly reflected in the national questionnaire (Annex A), which confirms that the country:

- does operate a formal broadband infrastructure mapping system (cartodonnees.artci.ci);

^[1] 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>

^[2] 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/>

^[3] ibid

^[4] ibid

^[5] 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/>

^[6] ibid

^[7] ibid

- does collect coverage data from operators through data templates defined by ARTCI);
- relies primarily on self-reported data from operators without independent verification; and
- lacks any national cross-sector framework for data sharing or interoperability.

During the Cote d'Ivoire National Africa-BB-Maps Event (18–20 August 2025), attention was asked for the underground infrastructure and the many disruptions in telecom services because of damages occurred during public works. In the first half of 2025 more than 300 incidents have taken place of which three serious. The stakeholders emphasised that accurate mapping of telecom infrastructure is of the greatest importance.

1.1.2 Strategic value for Cote d'Ivoire

The Africa-BB-Maps initiative aligns directly with Cote d'Ivoire's national digital transformation priorities. As highlighted by government ministries, ARTCI, operators, and utilities during the national event, Cote d'Ivoire is expanding mobile broadband networks, extending fibre backhaul, and pursuing universal access.

However, these efforts require a coordinated, transparent, and data-driven framework. A national broadband mapping system will:

- support data-based investment planning, particularly for white zones and priority areas;
- enable ARTCI to enforce data standards, reporting obligations, and validation mechanisms;
- improve transparency and empower users, who will be able to verify actual coverage and quality;
- facilitate cross-sector coordination, reducing infrastructure duplication across telecom, energy, transport, and local government authorities;
- support national policy reforms and future data governance frameworks;

The national roadmap endorsed during the event—2025 (foundation), 2026 (system development), 2027 (operationalisation), 2028 (sustainability)—provides a clear, multi-year structured approach informed by international best practices.

1.1.3 Alignment with EU and ITU policy frameworks

The Africa-BB-Maps project is grounded in global and regional policy instruments that promote interoperability, transparency, quality assurance, and standardisation. These include:

- ITU Guidelines for Establishing National Broadband Mapping Systems (2022), which emphasise data governance, validation, interoperability, and public accessibility.
- ITU case studies from European and EaPeReg regions (2024), including Slovenia’s model of mandatory quarterly reporting, strict data validation, and regulator-led geoportal management.
- European Electronic Communications Code (Directive 2018/1972), promoting harmonised data and coordinated infrastructure deployment.
- Gigabit Infrastructure Act (2024), introducing measures to reduce deployment costs and standardise data formats for high-speed networks.
- EU Connectivity Toolbox (2023), which provides operational best practices for data-driven broadband rollout.

Aligning Cote d'Ivoire's national broadband mapping system with these frameworks ensures:

- compatibility with international standards,
- regulatory maturity and transparency,
- strong data governance structures (including data classification and sharing frameworks),
- the ability to benchmark progress with other African and European countries, and
- enhanced 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.

1.2.1 Expertise and experience brought by the project team

The ITU expert team applied knowledge and methodologies developed through previous broadband mapping projects, including:

- the design and implementation of the Romanian national broadband mapping system (ANCOM GIS),
- the development of legal frameworks for mandatory data reporting, validation procedures, and interoperability standards,
- advisory work in the EMERG and EaPeReg regions on mapping harmonisation,
- contributions to ITU guidelines, case studies, and regulatory toolkits related to broadband mapping and geospatial data governance.

This practical experience directly informed the analytical framework, stakeholder engagement strategy, and the identification of data, regulatory, and institutional requirements relevant for Cote d'Ivoire.

1.2.2 Literature Review

A comprehensive literature review was conducted with a primary focus on:

ITU publications and materials, including, but 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 Cote d'Ivoire's maturity, gaps, and opportunities.

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 data governance, reporting obligations, interoperability, and cross-sector coordination.

1.2.3 National Inputs and Stakeholder Engagement

Meetings with ARTCI

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

- project coordination sessions,
- discussions on legal mandates, existing data flows, infrastructure visibility,

- clarifications on ARTCI’s internal capacity, GIS capabilities, and institutional constraints,
- exchanges regarding data collection practices and operator reporting.

Cote d'Ivoire National Africa-BB-Maps Event (August 2025)

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

- high-level strategic orientation from ARTCI, 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.

Pre-event National Questionnaire (ARTCI, 2025)

A structured questionnaire—completed by ARTCI prior to the national event—provided foundational information about Cote d'Ivoire’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 full questionnaire is included in the Annex A. Its responses were used to determine ARTCI’s baseline broadband mapping maturity and to shape the analytical structure of this report.

Stakeholder Invitations and Thematic Questionnaires (December 2025)

Ahead of the stakeholder coordination meetings, ITU and ARTCI prepared and circulated targeted questionnaires tailored to:

- ARTCI specifically,
- operators and infrastructure providers,
- government and parastatal institutions.

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 Cote d'Ivoire workstream and referenced in subsequent versions of the policy analysis.

All questionnaires and invitations sent to stakeholders are included in the Annex B.

1.2.4 Desk Research and Comparative Analysis

A targeted desk research exercise was conducted for the selected stakeholders. This included:

- examining public versions of broadband mapping portals,
- reviewing available documentation from regulators (e.g., guidelines, maps, standards),
- analysing technical presentations, webinars, or regulatory reports shared following stakeholder interviews.

This comparative dimension provided useful insights into operational models, governance structures, and data validation practices applicable to Cote d'Ivoire.

1.2.5 Integrated Analytical Framework

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

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 Cote d'Ivoire's national policies, infrastructure landscape, and institutional roles,
- alignment with the Africa-BB-Maps roadmap and upcoming technical development activities.

1.3 Structure of the report

The structure of this report follows a logical progression that reflects the analytical process of the Africa-BB-Maps initiative. It begins with an overview of the project's purpose, objectives, and strategic relevance, followed by the methodology and approach used to gather and assess evidence. The core of the report is organised around the three thematic pillars of the ITU framework—policy and regulation, data governance and interoperability, and institutional capacity and regional harmonisation—each presenting the current situation in Cote d'Ivoire, key challenges, and detailed

recommendations. The document concludes with proposed policy actions, a roadmap for implementation, and considerations for long-term sustainability. Supporting materials, including the national questionnaire, stakeholder inputs, and reference documents, are provided in the annexes to ensure transparency and traceability of the analysis.

2. Policy and strategic context

2.1 International framework: ITU and EU policy directions

This chapter will present 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 will help clarify the original context of the document.

2.1.1 Strategic framework

European Digital Decade

In its communication of 9 March 2021 entitled “2030 Digital Compass: The European way for the Digital Decade”^[1] 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.

Digital Decade Policy Programme 2030

Digital Decade Policy Programme 2030^[2] 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:

(4) 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.

(4) 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.

(4) 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.

(4) 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.

Global Gateway Strategy EU

In 2021, the European Commission and the EU High Representative launched the Global Gateway^[3], 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 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.

The European Green Deal

The European Green Deal^[4] 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 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. Thanks to 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 promises kept are published^[5]: (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.

Competitiveness compass

In January 2025, the Commission presented the competitiveness compass^[6], 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^[7], 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 our 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.

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 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. 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 following.

2.1.2 Legislative framework

EECC

The European Commission published a draft Directive establishing the European Electronic Communications Code on 14 September 2016^[8] as a first review of the EU regulatory framework for electronic communications since 2008. The European Electronic Communications Code 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 European Electronic Communications Code (EECC)^[9] 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 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 BEREC. 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 significant market power (SMP)

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) 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.

State aid guidelines

The Guidelines on State Aid for Broadband Networks published by the European Commission on 31 January 2023^[10] 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.

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.

GIA

The Gigabit Infrastructure Act^[11] 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. Key features of the GIA 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.

BEREC

Under the EECC, BEREC 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.

[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 cover: (i) the Core Guidelines on conducting geographical surveys of network reach^[12]; (ii) Procedural Guidelines on the designation of areas, invitation of investment intentions and related processes^[13]; and (iii) Verification Guidelines on ensuring the accuracy and reliability of submitted data^[14]. 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 outlines 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^[15], 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.

VHCN

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—fixed or wireless—that can deliver a defined level of quality of service under normal peak-time conditions. 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)^[16] are to be updated at the end of 2025.

GIA guidelines

BEREC has published guidelines under the Gigabit Infrastructure Act to support national regulatory authorities in implementing key provisions of the regulation. The Guidelines on the Coordination of Civil Works (Article 5(6) GIA)^[17] 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)^[18] 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

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.

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 KPI to support monitoring of the Digital Decade connectivity targets and to improve the targeting of EU funding instruments and future State Aid 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.

The Omnibus package

On 19 November, the European Commission published legislation for an omnibus package designed to simplify, reduce bureaucracy, and harmonise various legal acts. The 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.

^[1] <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0118>

^[2] <https://eur-lex.europa.eu/eli/dec/2022/2481/oj>

^[3] <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021JC0030>

^[4] <https://op.europa.eu/en/publication-detail/-/publication/b828d165-1c22-11ea-8c1f-01aa75ed71a1?>

^[5] https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

^[6] <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>

^[7] https://commission.europa.eu/topics/competitiveness/draghi-report_en

^[8] <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2016:0590:FIN>

^[9] <https://eur-lex.europa.eu/eli/dir/2018/1972/oj/eng>

^[10] <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52023XC0131%2801%29>

^[11] <https://eur-lex.europa.eu/eli/reg/2024/1309/oj/eng>

^[12] https://www.berec.europa.eu/sites/default/files/files/document_register_store/2020/3/BoR_%2820%29_4_2_Guidelines_BBgeoSurveys.pdf

^[13] https://www.berec.europa.eu/sites/default/files/files/document_register_store/2021/3/BoR_%2821%29_3_2_BEREC_GL_Art22%282%2C3%2C4%29_clean.pdf

^[14] https://www.berec.europa.eu/sites/default/files/files/document_register_store/2021/6/BoR_%2821%29_8_2_BEREC_Guidelines_on_Verification_P2_2021_clean.pdf

2.2 National context: Romanian experience and best practices

The Romanian approach to broadband mapping serves as a model for ensuring accurate, standardized, and secure reporting. The primary objective is to create a reliable digital inventory of public electronic communications networks to facilitate national planning and cost-reduction strategies.

The policy enforces a strict annual timeline. Providers must declare network elements by September 1 and finalize data submissions by October 31. This scope covers a broad spectrum of infrastructure, including cellular mobile networks and fixed fiber systems that operate across significant geographical areas (defined as at least 25 localities in 5 counties).

Beyond simple reporting, the framework emphasizes high-fidelity data.

- **Completeness:** Submissions must cover both electronic components (e.g., switches, head-ends) and physical assets (e.g., shelters, poles).
- **Standardization:** To ensure seamless integration, data is submitted in XML for large networks or CSV for smaller entities, validated by qualified electronic signatures.
- **Geospatial Integration:** A key feature is the requirement for precise geographical coordinates. This allows the regulator, ANCOM, to maintain a high-accuracy national GIS inventory.

The integrity of the system is maintained through rigorous legal and technical safeguards. Data access is governed by strict confidentiality provisions, and adherence to the policy is mandatory, with sanctions for non-compliance established under Law no. 159/2016.

2.2.1 Sample Data Fields

Electronic Network Elements

- Element Code
- Owner/Concessionaire
- Type (Fiber, Coaxial, Ethernet)
- Number of Fibers (for fiber optic)

^[15] 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

^[16] https://www.berec.europa.eu/system/files/2023-10/BoR%20%2823%29%20164%20FNE%20WG_Draft%20BEREC%20Guidelines%20on%20VHCNs.pdf

^[17] 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

^[18] 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

- Installation Date (or best estimate)
- Status (Active / Under Construction)
- Geographical Coordinates (segment ends & vertices)
- Interconnection Partners (per interconnection point)
- Capacity (Gbps or E1 flows)

Physical Infrastructure Elements

- Element Code
- Type (Cabinet, Shelter, Terminal Box, Pipeline, Pole, Tower)
- Owner/Concessionaire
- Location Coordinates
- Dimensions (LxWxH, where applicable)
- Material (Concrete, Metal, Plastic, Composite)
- Condition (Active / Under Construction)
- Associated Cable Segments (codes & types)
- Number of Pipe Entrances/Outlets

Recommended Workflow

1. Collect Data from internal OSS/BSS and GIS platforms (align with Annex 2 definitions).
2. Validate Completeness against required fields; verify coordinates and segment vertices.
3. Format & Sign using XML/CSV and qualified extended electronic signature.
4. Transmit Securely via ANCOM's web application over a secure connection.
5. Update Annually during the reporting window (September 1 – October 31).

2.2.2 Methodology for Verification of Mobile Network Coverage

In order to verify the coverage declared by mobile network operators, ANCOM measured the received mobile signal strength by frequency band and radio access technology, as presented in the table below.

The signal level categories used for the analysis are based on:

- **ECC Report 256** (LTE coverage measurements), and
- **ETSI EN 300 910** (GSM/UMTS/LTE receiver sensitivity requirements).

Signal Level Classification

The classification of the measured signal levels (No signal, Sensitivity limit, Weak, Good, and Very good) is defined per technology and frequency band, taking into account both signal **level** (in dBm) and **quality** indicators, where applicable:

- **Ec/Io** for UMTS (3G), and
- **SINR** for LTE (4G).

	GSM	UMTS900	UMTS2100	LTE700	LTE800	LTE900	LTE1800	LTE2100	LTE2600	
	dBm	dBm/dB	dBm/dB	dBm/dB	dBm/dB	dBm/dB	dBm/dB	dBm/dB	dBm/dB	
No signal	< -102	< -114	< -117	< -123.5	< -122	< -122	< -122	< -125	< -123	
Signal at sensitivity limit	-102	-114	-117	-123.5	-122	-122	-122	-125	-123	
Weak signal	Level	-92	-104	-107	-113.5	-112	-112	-112	-115	-113
	Quality	-	-12	-12	-5	-5	-5	-5	-5	-5

		GSM	UMTS900	UMTS2100	LTE700	LTE800	LTE900	LTE1800	LTE2100	LTE2600
		dBm	dBm/dB	dBm/dB	dBm/dB	dBm/dB	dBm/dB	dBm/dB	dBm/dB	dBm/dB
Good signal (urban)	Level	-80	-92	-91	-101.5	-100	-100	-96	-99	-97
	Quality	-	-12	-12	-5	-5	-5	-5	-5	-5
Good signal (rural, N and R)	Level	-86	-98	-99	-107.5	-106	-106	-104	-107	-105
	Quality	-	-12	-12	-5	-5	-5	-5	-5	-5
Very good signal	Level	≥ -70	≥ -70	≥ -70	≥ -85	≥ -85	≥ -85	≥ -85	≥ -85	≥ -85
	Quality	-	-12	-12	-5	-5	-5	-5	-5	-5

Table 1. Signal strength thresholds

The corresponding thresholds are summarized in the table above.

Note: For GSM (2G), only received signal level (RSSI) is considered, as signal quality metrics comparable to E_c/I_o or SINR are not defined for coverage assessment purposes.

Coverage Thresholds and Margins

For each measured technology (2G / GSM, 3G / UMTS, and 4G / LTE), a minimum threshold level was defined as follows:

1. **Receiver sensitivity level**, according to the applicable reference standards (ETSI and ECC);
2. **An additional margin of 10 dB** to ensure robust service availability; and
3. **An indoor propagation attenuation correction factor**, as specified in **Annex 3 of the operators' licenses**, applied depending on the coverage scenario:
 - **+6 dB** for coverage in rural areas and along national roads;
 - **+12 dB** for coverage in urban areas.

These adjustments ensure that measured coverage reflects realistic user conditions, including indoor reception environments.

Signal Quality Requirements

In addition to received signal level, compliance with minimum signal quality requirements was verified during the assessment:

- **UMTS (3G):**
 - $E_c/I_o \geq -12$ dB
- **LTE (4G):**
 - $SINR \geq -5$ dB

Only measurements meeting both the signal level and the signal quality criteria were considered compliant for coverage verification purposes.

Measurement Chain Considerations

When computing the effective received signal level, the following factors in the reception and measurement chain were taken into account:

- Cable attenuation losses;
- Connector losses;
- Measurement receiver accuracy and uncertainty;
- Other relevant system losses affecting the measured signal level.

These corrections ensure that the reported results accurately represent the actual radio signal conditions at the measurement point.

3. Countrywide assessment and justification for broadband mapping

3.1 Geographic and institutional overview

3.1.1 Geographic overview

Cote d'Ivoire, is a West African nation that stretches along the Gulf of Guinea, occupying a strategic position between the humid coastal belt and the drier savanna interior. Covering an area of about 322,000 square kilometers, the country shares borders with Liberia and Guinea to the west, Mali and Burkina Faso to the north, and Ghana to the east, while its southern edge opens to the Atlantic Ocean. This coastal access has historically shaped its economy and culture, making Abidjan one of the most important ports in the region.

The landscape of Cote d'Ivoire is remarkably diverse. The southern fringe is dominated by lagoons and sandy beaches, giving way to dense tropical rainforests that once covered much of the country. Moving northward, the terrain gradually rises into a plateau, interspersed with rolling hills and savanna grasslands. In the far west, near the borders with Guinea and Liberia, the relief becomes more rugged, culminating in the Mont Nimba range, where Mount Richard-Molard reaches 1,752 meters—the highest point in the country. These variations in elevation and vegetation create distinct ecological zones, each with its own climate and biodiversity.

Cote d'Ivoire enjoys a tropical climate, but it is not uniform across the country. The southern regions experience an equatorial climate with high humidity and two rainy seasons, typically from May to July and again in October and November. In contrast, the northern savanna has a single rainy season from May to October, followed by a long dry period that can stretch into March. Average temperatures hover between 25 and 30 degrees Celsius, though the northern interior can see cooler nights and occasional heat spikes during the dry season. Rainfall is abundant along the coast, often exceeding 2,000 millimeters annually, while the northern plains receive less, around 1,200 millimeters.

The country's hydrography is dominated by four major rivers flowing southward into the Gulf of Guinea: the Cavally, Sassandra, Bandama, and Comoé. Among these, the Bandama is the longest, running nearly 800 kilometers and feeding Lake Kossou, the largest artificial reservoir in Cote d'Ivoire. These waterways are vital for agriculture, transportation, and hydroelectric power, supporting both rural livelihoods and urban development.

Cote d'Ivoire is home to a network of national parks and reserves that protect its rich biodiversity and unique landscapes. Among the most notable is Tai National Park, a UNESCO World Heritage Site that preserves one of the last remnants of primary rainforest in West Africa. This park shelters rare species such as pygmy hippos, forest elephants, and chimpanzees, making it a vital conservation area. In the northeast, Comoé National Park stands out as one of the largest protected areas in Africa, encompassing savanna, gallery forests, and wetlands that support diverse wildlife, including lions and antelopes. Other important reserves include Banco National Park near Abidjan, which safeguards

urban forest ecosystems, and Mount Nimba Strict Nature Reserve, shared with Guinea and Liberia, known for its exceptional flora and fauna. Despite these efforts, many of these areas face challenges from deforestation, poaching, and agricultural encroachment, highlighting the need for stronger environmental protection measures.

Cote d'Ivoire has a multi-tiered administrative structure designed to decentralize governance and improve local administration. The system was significantly reorganized in 2011 and currently consists of five main levels, each with distinct roles and responsibilities.

At the first level, the country is divided into 14 districts, which are the highest administrative units. Two of these—Abidjan and Yamoussoukro—are autonomous districts, reflecting their importance as the economic and political capitals, respectively. The remaining twelve districts cover the rest of the national territory and serve as major administrative and development zones.

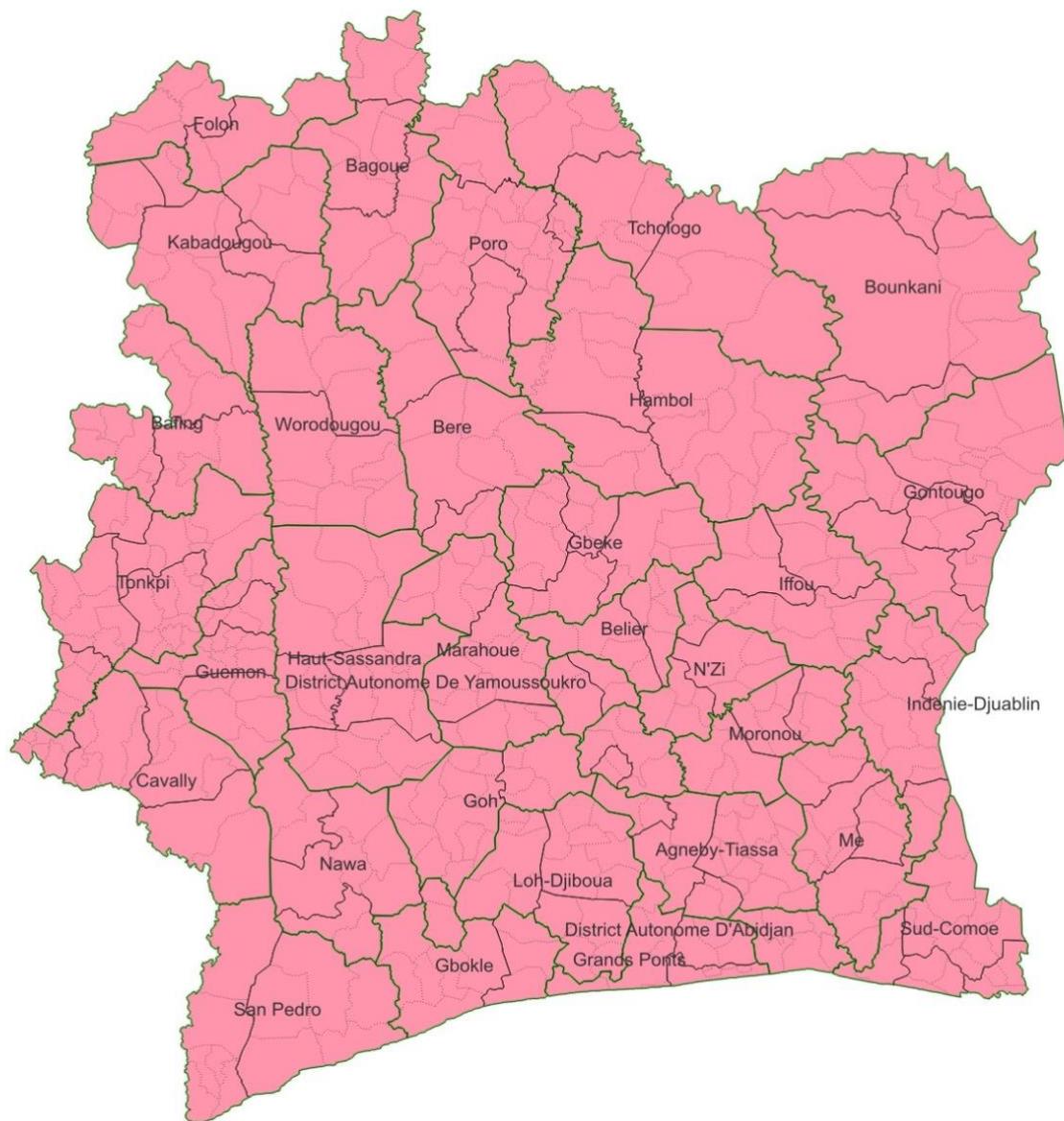


Figure 1. Districts and subdistricts of Ivory Coast

The second level comprises 31 regions, which are subdivisions of the districts (except for the autonomous districts, which do not contain regions). Regions act as intermediate authorities, coordinating development projects and public services across multiple departments. Each region is overseen by a prefect appointed by the national government.

At the third level, Cote d'Ivoire has 111 departments. These departments are the backbone of local administration, handling day-to-day governance, civil registration, and local infrastructure. Departments are further divided into 510 sub-prefectures, which form the fourth level of administration. Sub-prefectures manage smaller clusters of communities and villages, ensuring that government services reach rural areas.

Local municipalities in Cote d'Ivoire currently have only a minor role in broadband deployment planning and execution, according to ARTCI. This limited involvement presents a significant policy gap, as municipalities are critical for accurate geospatial data collection, validation of underserved areas, and facilitating community-level infrastructure projects. Strengthening their participation in broadband mapping—through formal coordination frameworks, capacity-building programs, and integration into national data workflows—would enhance planning accuracy, accelerate universal service initiatives, and ensure equitable digital inclusion across urban, suburban, and rural geotypes.

Geotypes are a critical factor in broadband development because they directly influence deployment costs per potential customer. In essence, geotypes classify areas based on population density, settlement patterns, and terrain, which helps operators estimate infrastructure investment and prioritize rollout strategies.

For example:

Urban geotypes (dense cities like Abidjan) have high population density, meaning the cost per customer is relatively low because fiber or fixed wireless can serve many households within a small area.

Suburban geotypes have moderate density, requiring more network length per user, which increases costs slightly.

Rural geotypes (villages and dispersed settlements in the north or west) have very low density, so the cost per customer can be several times higher due to longer backhaul links and fewer subscribers per kilometer of network.

Remote geotypes (mountainous or forested areas like Montagnes or Tai region) face additional challenges such as difficult terrain, which raises civil works and maintenance costs.

Operators often use these geotype classifications to build cost models and decide where fiber, fixed wireless, or satellite solutions make sense. In Cote d'Ivoire, the contrast between dense southern coastal cities and sparsely populated northern savannas makes geotype analysis essential for planning universal broadband coverage and broadband mapping.

253,850 km² inhabited out of the total 322,463 km² ⁴

⁴ (<https://hub.worldpop.org/geodata/summary?id=77791>).

gid	km ²	share of km ²	population	share of population	label	population/km ²
0	99,858	39.34%	166,258	0.51%	Low Rural	0-5
1	140,389	55.30%	6,535,839	20.22%	Rural	5-300
2	6,703	2.64%	3,186,222	9.86%	High Rural	300-750
3	2,970	1.17%	3,005,268	9.30%	Low Suburban	750-1,400
4	1,522	0.60%	2,741,760	8.48%	High Suburban	1,400-2,350
5	986	0.39%	2,982,307	9.23%	Low Suburban	2,350-4,000
6	805	0.32%	4,553,081	14.09%	High Urban	4,000-8,000
7	492	0.19%	5,542,401	17.15%	Low Urban	8,000-20,000
8	125	0.05%	3,607,359	11.16%	High Urban	20,000-45,500
253,850		100%	32,320,495	100.00%		

Table 2. Geotypes

For Population Spatial Distribution 1km² grid and 100m grid in Cote d'Ivoire data⁵

⁵ <https://hub.worldpop.org/geodata/summary?id=77791> and <https://hub.worldpop.org/geodata/summary?id=73919>.

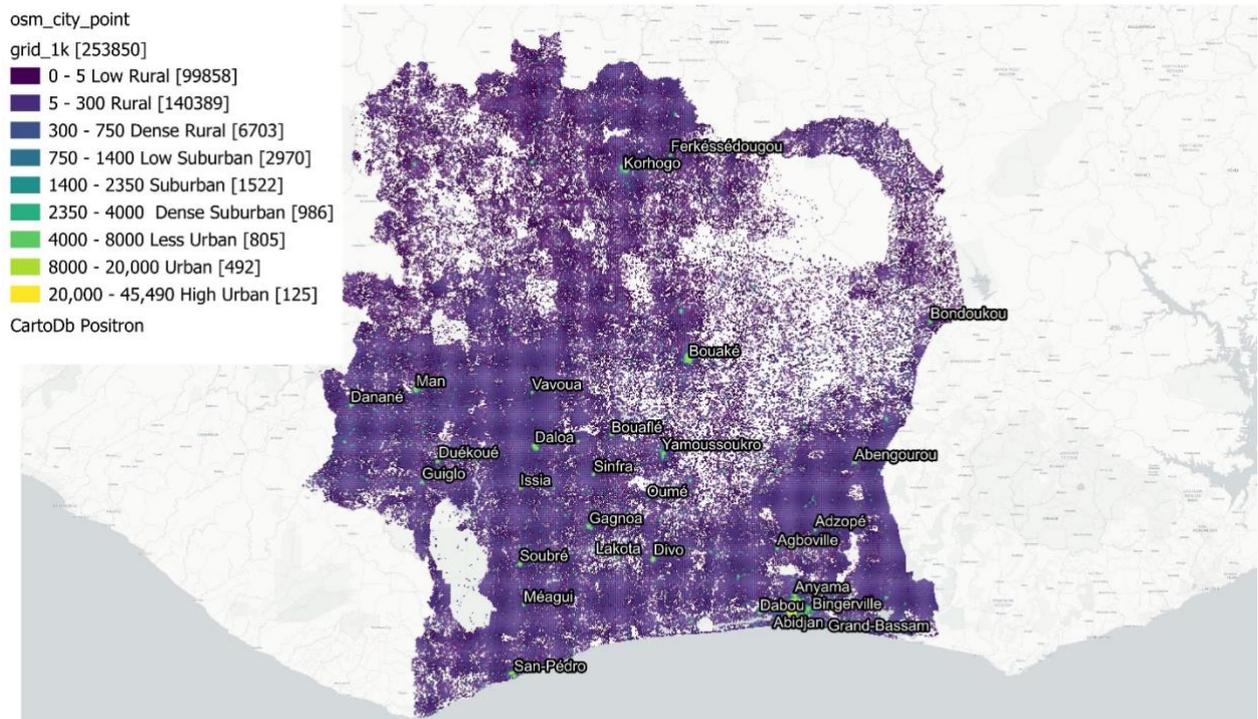


Figure 2. Population distribution.

At present, there is no clear legal definition of rural areas (*Law No. 2019-868 from 14 October 2019 on rural land - defines the legal regime of rural land and the mechanisms for awarding rural property certificates, but refers only to rural land Ordinance No. 2025-85 of February 12, 2025 establishing the Rural Land Information System of Côte d'Ivoire SIFOR, its responsibilities, organization and operation <https://afor.ci/textes-juridiques/lois>*). Rural areas are defined simply as regions outside urban municipalities with limited infrastructure, and there are no detailed analyses of population distribution per square kilometer. This approach creates a significant policy gap, as accurate spatial data is essential for equitable broadband planning. Incorporating broadband mapping as a core tool—supported by high-resolution geospatial datasets and local validation—would enable more precise identification of underserved areas, optimize resource allocation, and accelerate universal service initiatives. Strengthening this process through collaboration with municipalities and integration into national data workflows is critical for achieving inclusive digital connectivity.

3.1.2 Institutional Framework

Executive and Ministerial Oversight

At the highest level, the **State/Government** defines the overarching policies and legislation. It represents the nation internationally and guarantees the independence of the regulatory authority, ARTCI. Specifically for broadband, the State defines the national policy and ensures strategic oversight to guarantee a minimum level of ICT for public services and educational institutions.

The **Ministry of Digital Economy, Telecommunications and Innovation** translates this high-level vision into sectoral strategy. Its primary responsibilities include:

- **Licensing:** Granting individual licenses to operators.
- **Universal Service:** Approving universal service programs to ensure broad access.
- **Mapping Implementation:** Implementing the national broadband strategy and coordinating mapping initiatives to ensure they align with government policy.

Regulatory and Technical Management

ARTCI (Regulatory Authority) serves as the central body for technical regulation and data management. It manages essential resources such as frequencies, numbering, domain names, and IP addresses. Regarding broadband mapping, ARTCI is responsible for:

- **Data Collection:** Conducting regular mapping of infrastructures, networks, and services by collecting data directly from operators.
- **Compliance:** Monitoring deployment commitments and enforcing obligations.
- **Gap Identification:** Identifying underserved areas and publishing the updated **National Broadband Map**.

Complementing this is the **Frequency Management Agency**, which handles the planning and allocation of radio frequencies. It supports mapping efforts by updating spectrum usage maps and sharing data with ARTCI to ensure integrated mapping and compatibility with broadband deployment.

Implementation and Universal Service

ANSUT (Universal Service Agency) is the operational arm focused on digital inclusion. It manages the funding and implementation of universal service programs. In the mapping workflow, ANSUT uses the data generated by ARTCI to:

- **Project Design:** Design and prioritize projects specifically targeting "white areas" (underserved regions).
- **Collaboration:** Work closely with ARTCI to ensure mapping accuracy for effective project execution.

Operator Obligations

The effectiveness of this framework relies on the legal obligations of **Operators**. Under Articles 44 and 75-79 from Law no 2024-352, operators must:

- **Infrastructure Sharing:** Comply with infrastructure sharing and mapping obligations.
- **Data Submission:** Provide yearly data including coverage, quality of service, and network investment maps.
- **Service Standards:** Adhere to neutrality, non-discrimination, and data protection standards.

Broadband Mapping Workflow

The workflow of the broadband mapping can be presented in the following broadband mapping workflow diagram.

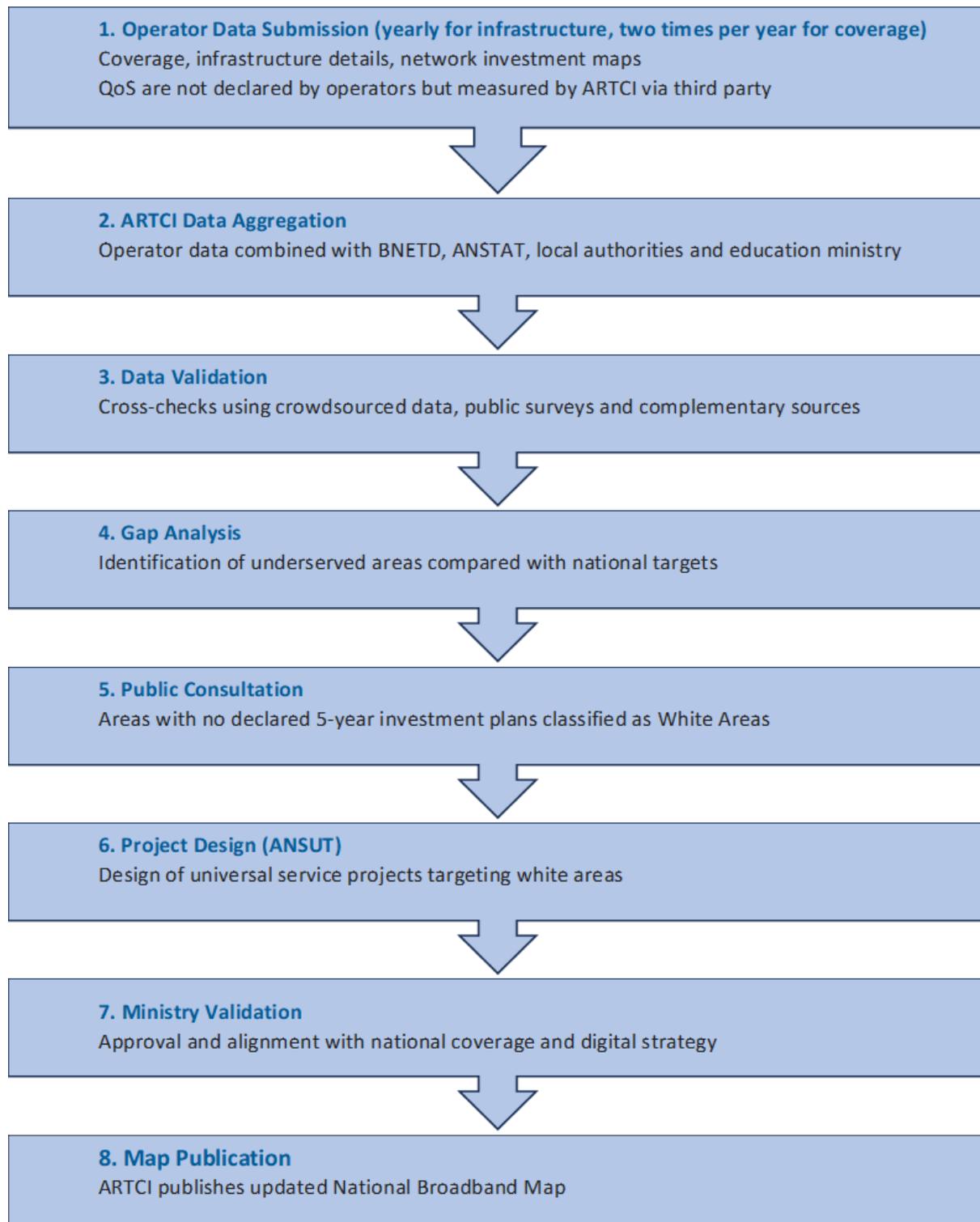


Figure 3. Broadband mapping workflow

3.2 Economic and telecom market overview.

Cote d'Ivoire stands today as one of the fastest-growing economies in Sub-Saharan Africa, with a nominal GDP projected at \$95.46 billion in 2025 and a purchasing power parity GDP of \$264.99 billion. Growth has remained robust, reaching 6.5% in 2023 and expected to sustain at 6.4% in 2025, placing the country among the region's leaders. This expansion translates into a GDP per capita of \$2,900 in nominal terms and \$8,060 in PPP, underscoring both the progress achieved and the challenges that remain.

The economy is broadly diversified, with agriculture contributing around 20% of GDP, industry accounting for 26.6%, and services dominating at 53.3%. Agriculture remains a cornerstone, as Cote d'Ivoire is the world's top cocoa producer, while cashew and rubber exports continue to grow⁶.

Industry is driven by manufacturing, mining, and oil refining, while services thrive on trade, transport, telecommunications, and finance. Infrastructure and energy investments—spanning roads, ports, and power generation—are reshaping the country's productive landscape. Meanwhile, the Baleine oil and gas field, with reserves of 2.5 billion barrels of oil and 3,300 cubic feet of gas, is expected to significantly bolster future growth.⁷

Fiscal consolidation has also been underway. The budget deficit, which stood at 6.8% of GDP in 2022, is projected to narrow to 3% by 2025, while public debt, estimated at 56.8% of GDP in 2023, is expected to decline. Yet social indicators highlight persistent challenges: poverty remains at about 37.5% (2021), though slowly declining, and youth unemployment, at 4.9% in 2023, continues to demand attention.

Against this backdrop, Cote d'Ivoire has positioned itself as a regional hub within the West African Economic and Monetary Union (WAEMU), attracting foreign direct investment in agribusiness, energy, and digital sectors. The National Development Plan (2021–2025) places strong emphasis on the digital economy, industrial parks, and renewable energy, signalling the government's commitment to structural transformation.

The telecom sector exemplifies this transformation. Valued at \$2.44 billion in 2025, the mobile network operator market is projected to reach \$3.03 billion by 2030, growing at a CAGR of 4.45%. Overall telecom and pay-TV revenues are expected to expand at 3.7% annually between 2024 and 2029. Orange Cote d'Ivoire leads the market with revenues of nearly 580.2 billion FCFA in 2023, followed by MTN Cote d'Ivoire at 333.4 billion FCFA and Moov Africa at 217.3 billion FCFA. Together, these three operators control 92.6% of sector revenues⁸.

Technological penetration is striking: 4G coverage reached 96% in 2024, and the launch of 5G is anticipated in 2026. Fiber optic infrastructure has expanded rapidly, with 30,303 kilometers deployed, covering nearly 95% of localities. Fixed internet penetration overall was 38.4% in 2024 and is forecast to rise to 46.5% by 2025 (<https://datareportal.com/reports/digital-2024-cote-divoire>).

⁶ https://en.wikipedia.org/wiki/Economy_of_Ivory_Coast

⁷ <https://www.nsenergybusiness.com/projects/baleine-oil-and-gas>

⁸ <https://www.economie-ivoirienne.ci/en/actualites/dynamic-and-growth-telecom-market-cote-divoire.html>

Data service affordability improved to **1.54% of** gross national income in 2023 (below ITU/World Bank’s 2% threshold). Prices dropped significantly between 2019–2024:

- Voice: **–50.1%** (12.57 → 6.26 FCFA/min)
- SMS: **–37.7%** (1.46 → 0.91 FCFA/SMS)
- Mobile Internet: **–57%** (0.93 → 0.40 FCFA/MB)

ARTCI conducts an annual Information Society Measure (MSI) survey, aligned with ITU standards, to assess and report on the country’s digital maturity.

	2019	2020	2021	2022	2023	2024	2025-Sept
Mobile Phone Subscriptions							
Total	37,376,603	40,095,246	44,561,505	49,006,419	53,601,479	58,719,380	60,449,222
Orange	15,488,694	16,048,870	19,338,715	21,519,743	26,072,930	30,414,339	30309987
MTN	12,913,408	13,996,388	14,733,529	16,643,003	17,268,756	16,358,456	17387848
MooV	8,974,501	10,049,988	10,489,261	10,843,673	10,259,793	11,946,585	12751387

Table 3. Mobile phone subscriptions per operator (2019-sept. 2025)

Category	Global Total	Urban Total	Urban Male	Urban Female	Rural Total	Rural Male	Rural Female
Total target population (5+ yrs)	26,932,474	15,421,910	7,392,610	8,029,300	11,510,565	5,559,361	5,951,204
Number of people using the computer	5,343,097	4,228,744	2,468,076	1,760,668	1,114,353	761,612	352,742
Number of people using mobile phones	18,681,687	11,424,494	5,539,814	5,884,680	7,257,193	3,775,571	3,481,622
Number of people who own a mobile phone	17,899,012	11,083,663	5,373,868	5,709,795	6,815,349	3,561,650	3,253,699
Number of people who own a smartphone	10,703,787	7,915,072	4,075,721	3,839,351	2,788,715	1,779,682	1,009,033
Number of people using the Internet	10,948,818	8,121,991	4,200,417	3,921,574	2,826,827	1,810,136	1,016,691
Number of people shopping online	2,220,814	1,919,628	777,083	1,142,545	301,186	58,620	242,567
Number of people with a mobile money account	12,532,532	8,413,990	4,398,354	4,015,636	4,118,542	2,525,387	1,593,155

Table 4. Mobile connectivity parameters

International Rankings (IDI – ICT Development Index, 2023)

Global: 131st (score 59.0)

Africa: 11th (between São Tomé and Ghana; Mauritius leads)

ECOWAS: 4th (after Nigeria, before Ghana)

Revenue growth is driven primarily by mobile data, which is expected to grow at a CAGR of 9.6% through 2029, while fixed broadband revenues are projected to expand even faster, at 11.1% between 2023 and 2028 (<https://www.globaldata.com/store/report/ivory-coast-telecom-operators-market-analysis/>) Investments are substantial: in 2024 alone, ICT investments reached \$446 million, part of a broader \$3.3 billion digital strategy spanning 2021–2025. Key focus areas include fiber expansion, 5G deployment, cloud data centers, fintech, IoT, and rural coverage(<https://www.economie-ivoirienne.ci/actualites/cote-divoire-plus-de-446-millions-usd-investis-dans-le-numerique-en-2024-moteur-de>).

Taken together, Cote d'Ivoire's economic trajectory and telecom evolution reveal a nation at the forefront of Africa's growth story. Agriculture, infrastructure, and energy continue to anchor the economy, while telecommunications and digital transformation are emerging as powerful engines of future prosperity. With strong ICT investments and a clear strategy for modernization, the country is poised not only to sustain high growth but also to redefine its role as a digital and economic hub in West Africa.

In Cote d'Ivoire, broadband is defined as internet speeds exceeding 512 Kbps.

Taken together, Cote d'Ivoire's economic trajectory and telecom evolution reveal a nation at the forefront of Africa's growth story. Agriculture, infrastructure, and energy continue to anchor the economy, while telecommunications and digital transformation are emerging as powerful engines of future prosperity. With strong ICT investments and a clear strategy for modernization, the country is poised not only to sustain high growth but also to redefine its role as a digital and economic hub in West Africa.

3.3 Broadband mapping developments in Cote d'Ivoire to date.

The national mapping platform available via the link <https://cartodonnees.artci.ci>, has several features:

- Dynamic access to network coverage history.
- Dynamic access to the history of network Quality of Service (QoS) campaigns.
- Integration of infrastructures (fiber optics, radio stations, etc.).
- Enhanced accessibility for people with disabilities (voice requests, adapted views).
- A user reporting tab, allowing you to locate and correct service problems.
- A 360° dashboard for informed coverage and QoS decision-making.
- Open data in open data mode.
- The objectives of the platform are to increase transparency, improve planning and optimize regulation of the sector.

Current coverage data is reported at the locality level—over 8,000 localities—which does not provide an accurate view of the population that is actually served by mobile networks.

We suggest:

1. **Move from Locality-Level to Fine-Grained Mapping**

- Current reporting at the locality level (8,518 localities) is too coarse and does not reflect actual service coverage.
 - Adopt **address-point geocoding** or **regular grids (100×100 m)** to capture population distribution and service availability with high precision.
2. **Integrate High-Resolution Population and Infrastructure Data**
 - Use datasets like **WorldPop 100 m grids** and national address repositories (PADA/PAVI projects) for accurate population density mapping.
 - Overlay telecom infrastructure (fiber routes, towers, POPs) on these grids for precise coverage analysis.
 3. **Standardize GIS Protocols**
 - Implement **WGS84 for global interoperability** but align with national projected systems for compliance.
 - Define mandatory GIS formats (example: GeoJSON, ShapeFile, etc.) for operator submissions to ensure consistency.
 4. **Dynamic, Multi-Layer Platform**
 - Enhance or replace the existing platform (cartodonnees.artci.ci) with:
 - ♣ **Grid-based coverage visualization (100×100 m cells).**
 - ♣ **Population served per cell metrics.**
 - ♣ **QoS heatmaps integrated with coverage layers.**
 - ♣ **Extend existing accessibility features for inclusive design.**
 - ♣ **Automatization of data pipeline**
 5. **Data Validation Framework**
 - Introduce **crowdsourced feedback**, **field audits**, and **cross-agency verification** to ensure accuracy.
 - Automate anomaly detection (e.g., mismatched coverage vs. population density).
 6. **Policy and Governance**
 - Mandate existing **biannual operator submissions** with finer granularity to grid/address level.
 - Establish **inter-agency coordination** (ARTCI, ANSUT, BNETD, municipalities) for data sharing and validation.
 7. **Open Data & Transparency**
 - Publish anonymized grid-level maps for public access to foster transparency and enable third-party innovation.

3.4 Short review of existing national broadband mapping initiatives

As mentioned in the previous chapter, Cote d'Ivoire has made initial strides in broadband mapping through regulatory requirements and public platforms. The national regulatory authority **ARTCI** mandates that licensed operators submit biannual reports detailing coverage. The quality of service (QoS) evaluation for mobile operators' networks is done by ARTCI through a third-party company. These reports feed into a national mapping system that visualizes network availability across districts and communes. An interactive map, accessible via <https://cartodonnees.artci.ci/>, currently displays

coverage layers and QoS evaluations. While this initiative provides a foundational dataset, its scope remains limited in granularity and interoperability, highlighting the need for enhanced methodologies and integration with socio-economic indicators.

A core component of this initiative is the mandatory reporting framework for telecommunications operators. **Mobile Network Operators (MNOs)**—specifically **Orange**, **MTN**, and **Moov**—are required to submit detailed coverage and network performance data to ARTCI. This reporting cycle occurs twice a year, ensuring that the regulator possesses relatively up-to-date information regarding network expansion and potential degradation of service. This allows ARTCI to track progress against license obligations and universal service goals.

Public Visualization Platform

To foster transparency and consumer awareness, ARTCI maintains a public-facing geographic information system, accessible at cartodonnees.artci.ci. This platform currently serves two main functions:

- **Coverage display:** It visualizes the geographical reach of mobile networks, distinguishing between different technologies (2G, 3G, 4G) to help users understand service availability in their specific localities. Also, fiber optic lines are displayed on the map, categorized by operator and the total length of the networks. Statistical calculations of coverage of localities and population is provided.
- **QoS evaluation:** The map integrates data on Quality of Service (QoS), displaying metrics derived from ARTCI's audit campaigns. This allows stakeholders to view not just where the signal is present, but the reliability of voice and data services in those areas.

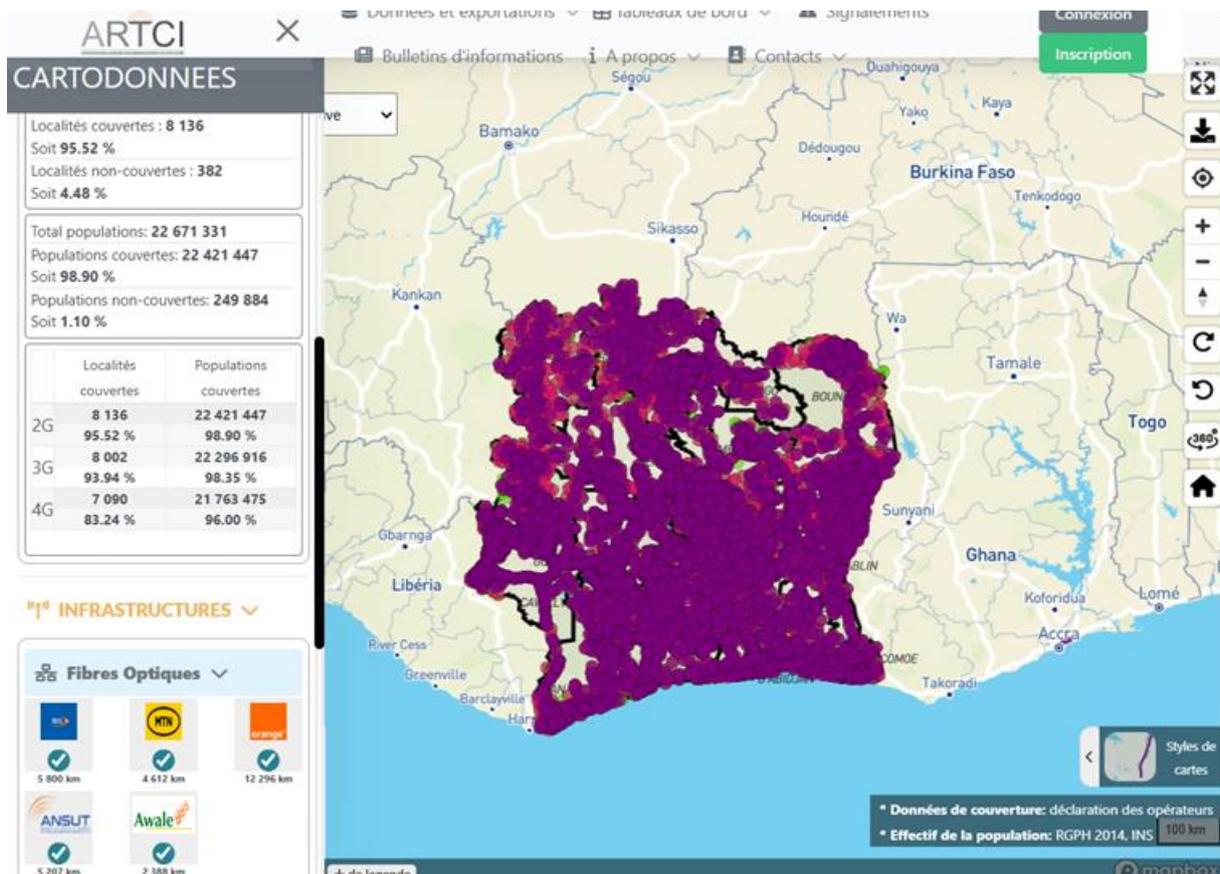


Figure 4. Coverage. source: cartodonnees.artci.ci

3.4.1 Advanced GIS Strengthening Coverage Planning Through Deep Geospatial Intelligence

Applying advanced geospatial analysis to national development challenges, particularly in the expansion of digital and telecommunications services. The availability public geographic datasets—such as those published by ARTCI—can enable sophisticated evaluations of population distribution, accessibility, infrastructure proximity, and service coverage. Two practical examples illustrate how such tools help reveal hidden patterns and support smarter decision-making.

Example1: Identifying Underserved Localities Near Major Roads

One powerful use of geospatial analysis is identifying localities with no mobile coverage “white zones” that are located close to major roads such as motorways, trunk routes, and primary national roads.

By mapping every locality and measuring its distance from these key transport corridors, it becomes possible to pinpoint areas where extending service would be both strategically important and cost-effective. Many localities lie just a few hundred meters from well-developed roads, which means that improving connectivity in these locations would:

- Provide immediate benefits to thousands of residents
- Support regional mobility and commerce

- Leverage existing transport infrastructure to reduce deployment costs
- Accelerate national objectives for digital access

For example, localities such as **Wongué**, **Ouandaramana Bambarasso**, and **Ziriglo** are situated extremely close to primary roads yet remain underserved. Highlighting and ranking these places by population gives ARTCI and ANSUT a clear, high-impact list of targets for rapid service expansion.

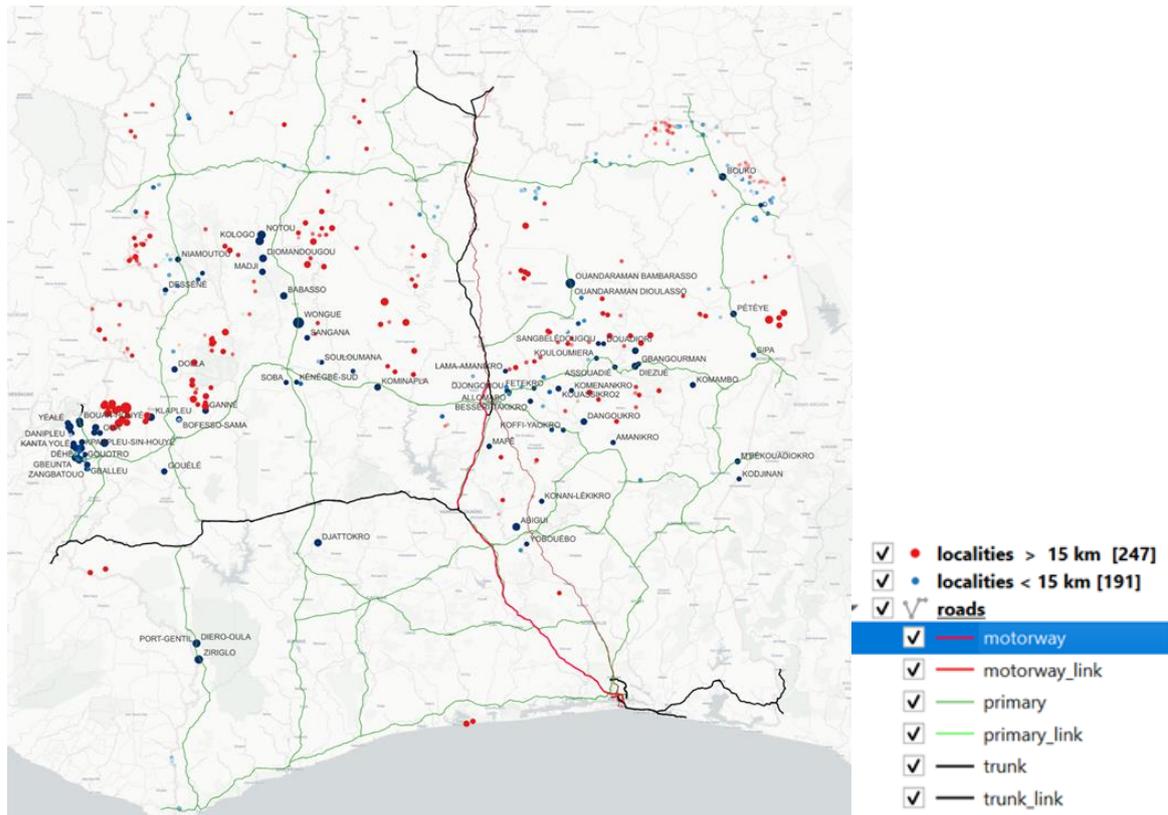


Figure 5. Underserved localities near major roads.

Top 10 Localities “white zones” by population within 15 km from a major road

id	adm4_fr	population	Distance Km	Road type	ref
7797	WONGUE	4902	0.10	primary	A5
6101	OUANDARAMAN BAMBARASSO	3479	0.10	primary	B313
4138	KOLOGO	2611	11.50	primary	A5
5972	NOTOU	2587	11.70	primary	A5
8191	ZIRIGLO	2587	1.00	primary	A7
1778	DANIPLEU	2447	9.90	primary	A8
7702	TROKOLIMPLEU	2398	9.70	primary	A8
1994	DIERO-OULA	2256	0.10	primary	A7
23	ABIGUI	2149	8.10	primary	A4

2866	GBEUNTA	2108	0.20	primary	TAH7
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Table 5. Top 10 white zone localities near major roads

Example2: Revealing Clusters of Underserved Localities

Beyond examining localities individually, more sophisticated spatial analysis makes it possible to identify groups of nearby settlements (5 km) that together could form high-priority zones for infrastructure investment. These clusters often represent pockets of population that, while individually small, collectively amount to tens of thousands of people still lacking adequate coverage.

By grouping localities that lie within a short distance of each other, analysts can uncover:

- Natural population centers hidden in rural or remote areas
- Regions where service extension would benefit multiple communities at once
- Areas where shared investment (such as a single strategic tower) could serve many localities
- Opportunities for coordinated rural coverage planning

This Côte d'Ivoire examples demonstrate this power clearly. Some clusters include 10 to 20 localities, together amounting to populations of 8,000–16,000 people who remain outside the reach of modern digital services. These population totals dramatically strengthen the case for targeted infrastructure development.

Once clusters are identified, a further layer of analysis helps determine how far each underserved area lies from the nearest point of existing 4G service. This insight allows planners to:

- Evaluate how easily coverage could be extended
- Identify anchor localities that already have infrastructure
- Estimate expected improvement in regional connectivity
- Prioritize zones where extension would have immediate impact

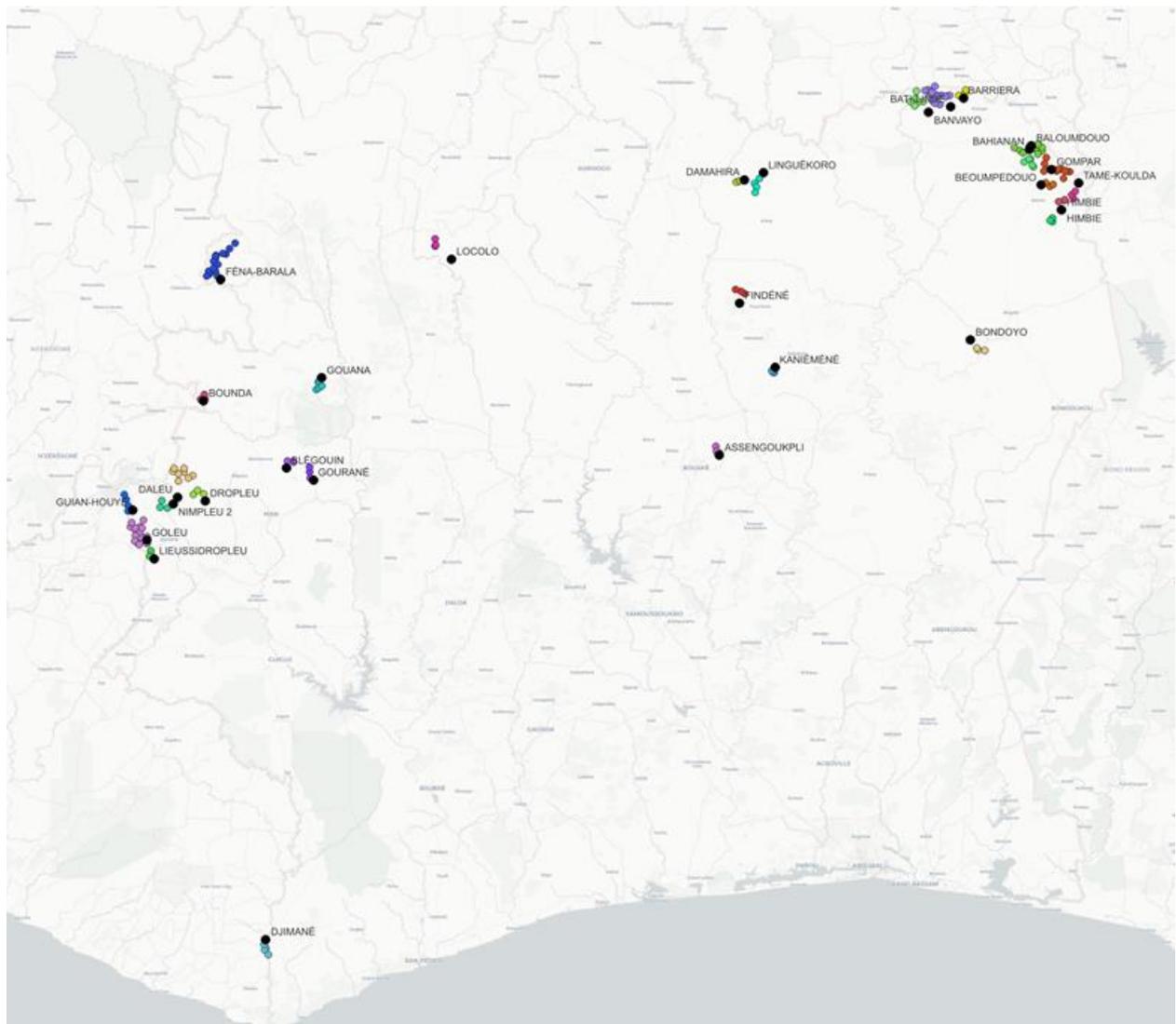


Figure 6. Clusters of underserved localities



id	cluster_id	adm4_fr	population	cluster_total_pop	locality covered_4g	distanceto_4g km
7866	146	YANGUILEU	1431	16636	DALEU	19.1
3787	146	KATA	2877	16636	DALEU	10.7
3441	146	GUIZREU	2208	16636	DALEU	17.2
2798	146	GBANLEU	2327	16636	DALEU	14.5
2291	146	DOUANGOPLEU	2137	16636	DALEU	17.3
1976	146	DIEMPLEU	2860	16636	DALEU	19.3
1783	146	DANTOGOUINÉ	876	16636	DALEU	15.4
8257	146	ZOUPLEU	1920	16636	DALEU	17.1
2811	87	GBATA	428	14288	GOLEU	6.7
2778	87	GBANGATOOUO	195	14288	GOLEU	2.5
2651	87	GAHAPLEU	411	14288	GOLEU	6.5
2575	87	FLAMPLEU 2	1077	14288	GOLEU	13.1

2287	87	DOUALEU	503	14288	GOLEU	13.7
2227	87	DOHOUBA	463	14288	GOLEU	9.8
1997	87	DIETTA	972	14288	GOLEU	4.3
1836	87	DÉHÉ	508	14288	GOLEU	10.2
1176	87	BIEUPLEU 2	80	14288	GOLEU	3.5
6531	87	SALLEU	1404	14288	GOLEU	5.9
6179	87	OUMPLEU	685	14288	GOLEU	2
4676	87	KPANPLEU-SIN-HOUYÉ	1687	14288	GOLEU	8.1
3718	87	KANTA YOLÉ	1108	14288	GOLEU	15.1
3255	87	GOUOTRO	820	14288	GOLEU	2.4
2952	87	GLAN-HOUYÉ	1580	14288	GOLEU	10.8
2866	87	GBEUNTA	2108	14288	GOLEU	8.1
2822	87	GBÉADAPLEU	259	14288	GOLEU	8.1
8142	138	ZÉRÉGOUINÉ	2640	8277	DROPLEU	8.9
7913	138	YASSÉGOUINÉ	3468	8277	DROPLEU	9.2
1265	138	BLITA	2169	8277	DROPLEU	4.8

Table 6. Top 3 clusters by cluster total population

For instance:

- **Cluster 146**, with a total population of more than **16,000 residents**, lies roughly **10–19 km** from the nearest covered locality (Daleu).
- **Cluster 87**, home to over **14,000 residents**, is located **2–15 km** from the nearest covered locality (Goleu).

These distances suggest realistic opportunities for extending existing coverage, and they help ARTCI and ANSUT to allocate resources where they will achieve the most inclusive outcomes.

Côte d’Ivoire’s fast-growing population, expanding infrastructure, and strong digital ambitions make geospatial analysis a powerful decision tool. With these examples we want to show how geospatial tools such as we are proposing can help revealing underserved communities, highlight which areas should be prioritized, and show where new digital investments will have the greatest impact. By clearly identifying coverage gaps and understanding how they affect real populations, planners can design more effective national programs. Whether improving telecom services, strengthening transport links, or guiding rural development, geospatial insights give leaders a clear view of where action is needed and how it will benefit citizens.

These examples serve as initial demonstrations, and the final analyses or models can be enhanced, refined, or fully customized based on the specific datasets available to the teams using them.

Other mapping initiatives are performed by these stakeholders:

- **ANSTAT – National Agency for Statistics** Maintains a comprehensive georeferenced database of localities, administrative boundaries, socio-economic infrastructure, and road networks.

Supports data exploitation through a Geomatics Laboratory, Map Library, and Geoportal for public and institutional use.

- **BNETD (CIGN)**

Serves as the **National Geographic Institute**, managing the national map library and supervising large-scale cartography ($\leq 1:5,000$). Centralizes geodetic and photogrammetric data and contributes to major projects like RNHD and eGOUV, including updated network topology for infrastructure optimization.

- **CNTIG (Comité National de Télédétection et d'Information Géographique)**

Serves as Côte d'Ivoire's national hub for GIS, remote sensing, and digital cartography, supporting government and local authorities with geospatial solutions for planning, governance, and public-sector digitalization. CNTIG produces and maintains national GIS datasets, thematic maps, drone imagery, and decision-support tools, and leads key initiatives such as *e-Commune* and *e-Région* to modernize municipal management across the country

- **ANSUT**

Uses field surveys, satellite imagery, and telecom data processed with GIS tools (ArcGIS, QGIS) to identify underserved areas and optimize fiber/mobile deployment. Future plans include an **interactive public map portal**, AI integration, and regional cooperation.

- **MCLU (Ministry of Construction, Housing and Urbanization)** employs mapping for urban development plans, land management, and geodetic reference systems. Data sources include aerial photos (5 cm), Lidar, and ground point clouds. Produces orthophoto plans and urban databases organized by seven thematic layers. Challenges include periodic updates and lack of sharing tools; prospects involve a **data-sharing platform** and inter-agency agreements.

- **AGEROUTE**

Integrates GIS for road network management (mapping intercity roads, highways, bridges, road equipment, traffic lights, roadworks in Abidjan, etc.) using ESRI, QGIS, and Global Mapper. Additionally, technical information is measured and collected about the current state of the road, surface degradation data, geotechnical survey data, and traffic data. Data collection relies on Logiroad-equipped vehicles (logiroad.fr), differential GPS, and drones with RTK for 3D mapping.

- **SODECI – Water Distribution** Operates a mapping department for managing and disseminating geospatial data related to water networks, supporting operational efficiency and planning.

- **CI-ENERGIES – State utility for electricity** Manages over 74,000 km of electrical networks using GIS tools and drones. Current focus is on visualization and asset management; outlook includes **AI-driven predictive maintenance**, digital twins, and augmented reality for modernization.

- **AUICI / UVICOCI – Union of Municipalities** advocates for public accessibility to mapping tools, simplified features (e.g., voice commands), and training initiatives, especially in rural areas. Promotes collaboration among stakeholders for better data updates.

Another initiative that has broadband mapping in its scope is **E-Agriculture Project (Projet de Solutions Numériques pour le Désenclavement des Zones Rurales et l'e-Agriculture – PSNDEA)** funded by the World Bank that systematically integrates mapping and infrastructure geolocalization into its broader digital development and agricultural transformation, along with complementary support for the **National Digital Development Strategy 2025**. These initiatives utilize mapping data to identify connectivity gaps ("white zones") and target investment for rural inclusion.

Key Components & Objectives

- **Identification of digital "White Zones"**: One of the operational objectives of broadband mapping initiatives in Cote d'Ivoire is to map underserved rural areas where commercial operators have not deployed infrastructure. This mapping facilitates the allocation of public funds, where the government has data and calculations for making optimal decisions where to subsidize private operators to build towers and fiber in these specific, mapped locations.
- **Support for regulatory capacity (ARTCI)**: The projects provide technical assistance to the Telecommunications Regulatory Authority (**ARTCI**) to enhance its data collection and monitoring capabilities. This ensures that the national broadband map—used to monitor Quality of Service (QoS) and coverage obligations—remains accurate and up-to-date.
- **Synergy with civil infrastructure**: Through the **Inclusive Connectivity and Rural Infrastructure Project (Projet de Connectivité Inclusive et d'Infrastructures Rurales en Côte d'Ivoire (PCR-CI))**, the mapping of civil works (rural roads) alongside digital assets like broadband infrastructure is promoted. This "dig once" approach encourages the laying of fiber optic ducts during road construction, requiring precise geospatial coordination between utility and transport sectors.

(<https://www.prici.ci/pcrci.html>)

It is also worth noting that Cote d'Ivoire is a key beneficiary of the Africa-BB-Maps project, an initiative funded by the EU and implemented by the ITU. This project aims to strengthen national broadband mapping systems in Sub-Saharan Africa, and focuses specifically on standardizing the national mapping systems and visualization platforms at a regulatory level

3.5 Stakeholder Engagement and Collaboration

The success of a countrywide broadband assessment relies on a cooperative ecosystem of stakeholders, each playing a distinct role in the data value chain. Broadband mapping in Cote d'Ivoire requires coordinated efforts among diverse stakeholders to ensure accuracy, transparency, and actionable insights. **Government agencies** (ANSTAT, BNETD, ANSUT, MCLU, AGEROUTE, CI-ENERGIES,

SODECI) highlighted the strategic role of GIS in decision-making, infrastructure planning, and territorial management.

Challenges identified included **data updating**, **limited sharing between institutions**, and **high collection costs**, leading to proposals for an **inter-institutional framework** and **open data policies** to improve accessibility and transparency.

Key stakeholder categories include:

Government Organizations

- **ARTCI (Regulator):** Acts as the central aggregator and custodian of broadband data. They define the data standards, enforce reporting compliance, and manage the public mapping platform.
- **ANSUT (Agence Nationale du Service Universel des Télécommunications-TIC):** A critical user of mapping data. ANSUT relies on coverage maps to identify "white zones" (underserved areas) where state intervention is necessary to deploy the National Data Transmission Backbone (**Réseau National Haut Débit - RNHD**) or subsidize rural connectivity.
- **Ministry of Digital Transition and Technological Innovation (MTNIT):** Uses high-level mapping insights to formulate national digital strategies and monitor the country's progress toward digital maturity.

Telecommunications Operators

- **MNOs (Orange, Moov, MTN):** These are the primary data suppliers. Their engagement is vital for the accuracy of the map. They provide proprietary data on cell tower locations, signal strength, and technology rollout.
- **ISPs and Tower Companies:** Smaller Internet Service Providers and passive infrastructure managers (tower companies) also contribute data regarding fixed-line assets and fiber optic routes, which are essential for a holistic map.

Current engagement and readiness of operators from received responses to the question presented to operators during the policy analysis process is as follows:

Infrastructure Data

- **MTN:** BTS sites, POPs, fiber routes, data centers.
- **Orange Cote d'Ivoire:** Mobile antennas, nodes (manholes, poles), links, telecom nodes (connection/splicing boxes), fiber routes.

Coverage Maps

- Both operators maintain GIS-based coverage maps (polygons, grids).
- Orange uses GIS software.

Reporting to ARTCI

- **MTN:** Monthly reports (by the 10th) in Excel format.

- **Orange:** Supports multiple formats (CSV, JSON, GEOJSON, KML, KMZ, ShapeFile).

Geospatial Reporting Readiness

- **MTN:** Not prepared.
- **Orange:** Fully prepared.

API Availability

- No API currently provided by either operator.
- **MTN:** Open API capability.
- **Orange:** Supports API, automated and manual reporting.

Barriers to Data Sharing

- **MTN:** Cost, security, confidentiality.
- **Orange:** Confidentiality agreements, upgrade budgets, security audits, resource constraints.

Data Anonymization

- **MTN:** Required for confidentiality.
- **Orange:** Not required; ownership must remain clear.

Cost Assessment

- Both operators: Pending evaluation.

Regulatory Incentives & Updates

- Both operators: Pending response.
- **MTN:** Suggests assessing local authority and operator challenges.

Right of Way & Permits

- Both face issues on private and protected areas.
- **Orange:** Examples include ports and military zones.
- **Permit Duration:** MTN estimates 1 year; Orange pending.

Utility Companies and Non-Governmental Organizations

- **Road Infrastructure Agency (AGEROUTE)**

The stakeholder consultation gathered essential information on available datasets, data governance practices, and readiness for integration into the Broadband Mapping System. The agency manages a wide range of geospatial road datasets, including interurban and urban road networks, bridges, road equipment, traffic lights, interventions, and technical measurements such as UNI, IRI, surface degradation, geotechnical surveys, and traffic data.

These datasets are provided mainly in GIS formats (SHP, KMZ) and AutoCAD, following national standards for road network classification. Data sharing is regulated due to the strategic nature of road infrastructure; however, access can be granted in compliance with Law n°2013-867 on access to public information and the agency's internal ethics charter.

Data updates follow structured procedures: intercity roads are updated annually, while urban road data in Abidjan is monitored daily. The agency confirms its readiness to integrate datasets into the Broadband Mapping System, provided that integration conditions are agreed upon by stakeholders.

Currently, the agency does not provide APIs, though it acknowledges the need for future development. Spatial queries are not yet supported via API but can be performed internally through Esri tools. API development would require financial and regulatory support. The agency recommends establishing a formal inter-agency agreement to facilitate data exchange.

The agency confirms that address data can be linked to ARTCI's mapping system and highlights technical barriers such as lack of API documentation. Modernization initiatives are underway through ArcGIS Online, although these depend on vendor ecosystems.

- **Utility Companies (Electricity & Water):** Entities such as **CIE (Compagnie Ivoirienne d'Electricité)** are strategic stakeholders for infrastructure sharing. Mapping their utility poles and ducts alongside broadband networks can reveal opportunities to lower deployment costs through cross-sector constructive collaboration. These entities contribute complementary datasets that enrich mapping efforts.
- **International Development Partners:** Organizations such as the **World Bank** and the **ITU** provide technical assistance, mapping solutions, and frameworks for data validation.
- **Civil Society & Consumer Associations:** These groups advocate for transparency and verify the "ground truth" of the maps. They use the data to hold operators, and the government accountable for service quality and coverage promises.

Effective engagement should be institutionalized through multi-stakeholder forums, data-sharing agreements, and capacity-building programs. Such collaboration will foster trust, reduce duplication, and accelerate progress toward universal broadband access.

3.6 Impact Assessment of Broadband Mapping

Comprehensive broadband mapping has significant socio-economic implications for Cote d'Ivoire. As in any other country, a robust mapping framework provides policymakers and industry stakeholders with valuable insights that drive development and connectivity. Broadband mapping can be a strategic enabler for Cote d'Ivoire's digital transformation as it enables optimized investments in telecom networks, reduces the digital divide between urban and rural areas, and supports universal connectivity for schools, hospitals, and underserved communities.

Accurate geospatial data enables:

Informed Policy and Investment Decisions

The most immediate impact of broadband mapping is the transition to evidence-based policymaking. Accurate mapping allows ARTCI, ANSUT and the government to precisely identify digital divides, identifying underserved rural areas for priority deployment. Instead of blanket subsidies, funds can be allocated to targeted infrastructure investments to specific villages or corridors that lack connectivity, maximizing the return on public investment, and accelerating the goal of universal access. Improved broadband access stimulates entrepreneurship, supports small and medium enterprises (SMEs), and facilitates participation in digital markets, contributing to GDP growth.

Governance is led by ARTCI, which manages the national broadband mapping system and coordinates stakeholders under a legal framework defined by Law 2024-352. This law outlines universal service obligations and mandates data submission by ISPs, enforced with penalties for non-compliance. The mapping system is publicly accessible via <https://cartodonnees.artci.ci/> and includes backbone networks, fiber backhaul, mobile towers (3G/4G/5G), and fixed broadband access networks.

Infrastructure Optimization and Cost Reduction

A unified map of digital and civil infrastructure (including fiber routes and utility ducts) facilitates infrastructure sharing and efficient utilization of available resources. Operators can identify overlapping assets or potential sharing opportunities, reducing the need for duplicative civil works (digging up roads twice) and lowering the overall cost of broadband deployment. Also, avoiding damage to existing infrastructure is easier if construction planners have access to maps of existing infrastructure in the locality.

The country's broadband expansion strategy prioritizes mobile broadband development (3G/4G/5G) and fiber optic extension, supported by incentives for rural deployment and a Universal Service Fund with clear criteria. Integration with other national infrastructure planning systems remains limited, and local municipalities have minimal involvement.

Capacity building is addressed through a roadmap from 2026 to 2028 via ITU Academy, certifying professionals in GIS, data governance, and broadband policy.

Stimulation of Market Competition

Publicly available maps democratize information. When consumers can view and compare the actual coverage and Quality of Service (QoS) of different operators in their specific neighborhood, it forces operators to compete on network performance rather than just marketing claims. This transparency drives operators to invest in infrastructure upgrades to avoid losing market share in "low-quality" zones.

Enhanced Consumer Protection

By visualizing QoS data, the regulator empowers the consumer. The map serves as a verification tool, ensuring that the service levels paid for by the consumer match the reality on the ground. This reduces information asymmetry and strengthens trust in the digital economy.

Social and Developmental Impact

Enhanced mapping supports digital inclusion by bridging the urban-rural divide. Reliable connectivity enables access to e-learning platforms, telemedicine services, and e-government applications,

improving education outcomes, healthcare delivery, and citizen engagement. Broadband availability also empowers marginalized communities, fostering social equity and reducing regional disparities.

Resilience and Future Readiness

Comprehensive mapping underpins national resilience strategies by identifying critical infrastructure vulnerabilities and supporting disaster recovery planning. It also facilitates integration with emerging technologies such as 5G and IoT, positioning Cote d'Ivoire to leverage digital innovation for economic competitiveness.

In summary, broadband mapping is not merely a technical exercise; it is a cornerstone of Cote d'Ivoire's digital economy strategy, driving inclusive growth, social development, and regulatory efficiency.

3.6.1 Expected Impacts

Expected impacts include improved planning and cost efficiency by identifying underserved areas, reducing deployment costs, and avoiding redundant investments. Governance and transparency are enhanced through centralized platforms fostering collaboration between ministries, operators, and regulators. Socio-economic development accelerates as digital inclusion expands, supporting smart urban planning and laying the foundation for advanced technologies such as AI and digital twins.

3.6.2 Challenges & Outlook

Challenges remain: lack of standardized GIS protocols, absence of external validation, high costs for GIS implementation, and limited involvement of municipalities. Yet, the outlook is promising: broadband mapping is not merely technical—it is a catalyst for digital transformation, driving inclusive growth, better governance, and sustainable infrastructure development.

4. Policy and Regulatory assessment of Cote d'Ivoire

This chapter will first describe the evolution of regulation of telecommunication in Cote d'Ivoire by mentioning bullet wise the major milestones and developments (par. 4.1). In paragraph 4.2 the current legal and regulatory environment will be described, with emphasis on the right to request information and enforcement. The final paragraph will analyse the gaps in the regulatory environment, and opportunities to strengthen the regulation and enforcement.

4.1 Evolution of Electronic Communication Regulation in Cote d'Ivoire

Background

For decades, telecommunications in Cote d'Ivoire operated under a state monopoly for national security reasons. Major reforms have progressively liberalized the sector, introduced competition, and supported digital transformation.

1995 Reform – Telecommunications Code (Law No. 95-526 from July 1995)

- Initiated structural reform and market liberalisation.
- Introduction of mobile telephony and privatization with licenses granted to Comstar, Ivoiris and Telecel.
- New institutional framework to control this new competitive environment with the creation of the Côte d'Ivoire Telecommunications Agency (ATCI) and the Côte d'Ivoire Telecommunications Council (CTCI)
- Despite progress, legal gaps or inadequacies have led to conflicts and inefficiencies in the sector.

2012 Reform – Ordinance No. 2012-293 on Telecommunications and Information and Communication Technologies (Telecommunications/ICT)

The 2012 reform encompassed a full liberalization of telecommunications/ICT sector, including an institutional restructuring:

- **AIGF** (Ivorian Agency for the Management of Radio Frequencies): Manages radio frequencies.
- **ANSUT** (National Agency for the Universal Service of Telecommunications/ICT): Implements universal service programs.
- **ARTCI** (Telecommunications/ICT Regulatory Authority of Côte d'Ivoire): Provides independent regulation for the telecommunications/ICT sector, postal services, personal data protection, internet governance and the management of domain names (.ci).

Key measures included:

- Establishment of an independent administrative authority to act as regulator of the Telecommunications/ICT sector

- Clear division of regulatory and regulatory functions Allocation of a single global licence for operators.
- Single global license for operators.
 - Strengthened competition and consumer protection.
 - Incentives for investment and digital development.

The reform resulted in (a.o.) a growth of internet services and cybercafés; by 2009, 72% of internet access was via cybercafés.

Complementary laws were adopted from 2013 to 2017 in the fields of cybersecurity, personal data protection, electronic transactions, and information society framework.

2021 Strategies

- National Digital Development Strategy (SNNCI), Innovation Strategy, and Cybersecurity Strategy (2021–2025) to coordinate digital initiatives.

2024 Strategies – SNGD 2030

The SNGD 2030 is Cote d'Ivoire's national framework to harness data as a strategic asset for governance and development. Its vision is to make data the State's privileged decision making tool, improving services and transparency by 2030.

The strategy rests on six pillars: ethical data culture, infrastructure, interoperability, governance, innovation, and skills development. It seeks to establish a national institutional framework and adopt a standardized data nomenclature aligned with international norms.

Key objectives of the strategy include operationalizing interoperability frameworks, promoting open data, and stimulating data driven innovation.

- By 2030, Cote d'Ivoire aims to rank first in Africa and among the top 20 globally in cybersecurity.
- Infrastructure targets include 100% digitalization of administrative procedures, nationwide 3G/4G coverage, and 30% 5G penetration.
- The plan calls for building a national data center, a national cloud, and a unified open data portal.
- Human capital goals include tripling ICT engineer training, forming 1,000 data stewards, and training 10,000 public officials in data governance.

Overall, the SNGD 2030 positions data as the foundation of inclusive growth, innovation, and sustainable development in Cote d'Ivoire.

2024 Reform – Law No. 2024-352 on electronic communications

The third reform addresses inconsistencies and overlaps in previous regulations and has the following objectives:

- Define a modern legal regime for activities carried out in the electronic communications sector;
- Protect critical networks and infrastructure;
- Ensure fair competition and user protection;
- Expand access and promote regional digital development;
- Drive socio-economic growth through ICT.

Overall Impact

Cote d'Ivoire's regulatory evolution reflects a shift from monopoly to a competitive, innovation-driven digital economy, supported by robust governance and strategic planning.

4.2 Existing Legal and Regulatory Environment

At the basis of the telecom regulation, and the mapping of broadband networks, is Cote d'Ivoire's new electronic communication law, Loi n ° 2024-352 from 6 June 2024. The electronic communications law covers both the fixed and mobile telecom markets. For the mobile operators there are more specific obligations put in place through the spectrum licenses ("Cahier des charges").

The framework for Cote d'Ivoire's digital sector, Loi n ° 2017-803 from 7 December 2017 arranges for the further roll-out of telecom networks. And more detailed guidance for network sharing is provided through the Network Sharing Guidelines from 2025.

The following paragraphs give a short summary of the relevant parts relating to broadband mapping, and the collection of data.

4.2.1 Electronic Communications Law

Legal basis for information requests *Law No. 2024-352 on electronic communications*

Based on this law the regulator, ARCTI, can request information and data from network operators for a variety of purposes. The purposes include contributing to ensure service quality and performance, regulating competition and markets, creating / updating network and infrastructure maps (broadband mapping), advancing universal service / coverage, and protecting consumers.

The general basis for information requests is art. 141 that entitles the regulator to collect any information necessary from the operators to execute its mission. This article is reinforced for data requests for specific purposes by art. 123 for collecting market and competition data from operators, and art. 141, second paragraph, establishes that the regulator can use the data for three other purposes: 1) to monitor service quality, coverage and overall network performance as well as 2) supporting the universal service and territorial coverage obligations and 3) protecting consumers and ensuring transparency.

The regulator has the authority to establish rules on which information operators must provide, in what format, and how it can be shared or published. This allows ARTCI to create infrastructure maps and manage data disclosure for broadband mapping (art. 142).

Confidentiality of information and sanctions for non-compliance

Article 133, electronic communications law, ensures protection of any sensitive or confidential data that is collected and balances the right to demand information with a duty of confidentiality.

Framework law for the digital sector

Loi 2017-803 Orientation de la société de l'information is the framework law for Cote d'Ivoire's digital sector. It defines who does what (government, regulator, private operators etc.), sets the principles for building and operating networks, and aligns market rules with public goals like inclusion and innovation. It also enables broadband expansion and public digital services to develop coherently by tying digital policy to consumer protection and cybersecurity.

With regard to broadband mapping, articles 28 – 30 are relevant.

Article 28 allows the state to maintain a national telecom infrastructure map and coordinate development of networks by mandating telecom and ICT operators to share detailed infrastructure data (fiber, towers, antennas, etc.) with the state, on its request.

For maintaining a national database and mapping of broadband infrastructure, article 29 introduces an annual reporting system:

- Operators must report by January 31 where new high-speed infrastructure was built in the previous year and planned expansions in the current year.
- ARTCI compiles and publishes a national coverage report by December 31, showing which areas have connectivity, which areas are unserved and underserved and ARTCI reports about the progress being made to fill the coverage gaps.

Article 30 ensures telecom infrastructure is integrated into all public works (electricity, water, roads) and grants operators free access rights to install and maintain networks on public or private land. This article facilitates the expansion of mapping of national broadband infrastructure through coordination.

Confidentiality of information and sanctions for non-compliance

Any refusal to provide information or other non-compliance can be sanctioned by ARTCI.

4.2.2 Infrastructure sharing Guidelines

The decision from ARTCI establishing guidelines for the sharing of active and passive telecom network infrastructure aims to make infrastructure sharing fair, transparent and non-discriminatory and avoid redundant construction, reduce costs and expand broadband coverage.

In order to facilitate network sharing, operators must share data, that ARTCI will use to produce a national broadband map.

Every provider or infrastructure owner must publish and maintain a database and cartography (digital map) of their infrastructure including:

- Exact location
- Type of infrastructure
- Technical specifications

- Current use and available capacity
- And which companies are hosted

These databases must be shared with ARTCI, annually by November 30 and made available to other operators who request access within 10 working days after the request. ARCTI builds and publishes a national broadband infrastructure map from these submissions.

When an operator wants to deploy a network it must first check the ARCTI map or contact operators in the area to see if sharing is possible. Before installing new ducts, towers or fiber, the operator must prove that no suitable infrastructure exists in the zone or existing ones are technically inadequate or at full capacity.

With the approval of ARCTI, new infrastructure can be deployed. New infrastructure must be dimensioned to host at least three other operators in the future. This is applicable to cables and ducts (aerial and underground); sites and radio stations; fiber optic networks (transport, distribution and FTTH) and active infrastructure (antennas, base stations, network elements).

The Guidelines stipulate a limited number of grounds for refusal of infrastructure, like no available capacity, national security or public safety or certain technical or legal restrictions. If ARTCI finds the refusal unjustified, or finds sharing necessary to promote competition, expand broadband coverage or optimize the use of national resources it can force the operator to share the infrastructure.

4.3.3 Spectrum licenses (cahiers des charges)

The spectrum licenses contain several paragraphs related to collection of data and broadband mapping. The purposes are range from monitoring coverage obligations, monitoring quality of service obligations and establishing white zones.

With regard to monitoring the (annually increasing) coverage obligations, the operators are expected to report annually by 31 January about the coverage of communes (localité) and highways.

The annexes of the spectrum licenses contain a lot of information about the coverage obligations. It includes the level of granularity, measurement and calculations. Only the most crucial parts are mentioned here:

Operators are required to be available in all areas of the national territory where a mobile operator's network is available through roaming agreements or by using its own infrastructure, if available. No later than 31 January each year, operators shall declare the list of localities and roads covered by its own network.

A locality is considered covered if its entire habitable area is covered. A highway is considered to be covered, if there is coverage for at least 90% of the length of the highway.

In order to achieve its coverage objectives, the operator with market power shall submit its coverage programme to ARTCI for information purposes by 30 November each year. ARTCI may request to modify the draft coverage programme in order to minimise the risk of infrastructure duplication in

sparsely populated areas and along major roads, to promote good distribution of coverage across the national territory and/or for other objective reasons.

Art. 7.2 of the spectrum license mentions ARTCI's task to identify white zones and priority zones and proposes to the Minister how to ensure coverage in those areas. Operators may then offer to serve or cover these areas. In the absence of proven solutions ARTCI shall ensure that the remaining white areas can be taken into account in compliance with the standards of the coverage obligations. In any event, operators shall cooperate with the ARTCI in mapping white zones.

Art. 13.1 compels the operator to make available to ARTCI any financial, technical and commercial information with respect to obligations following from laws and regulations, in the format as requested by ARTCI. ARTCI has the right to check the information.

Reporting requirements

The reporting requirements include monthly and annual reporting obligations, as well as the requirement to make data available on request. The reported data can be relevant for broadband mapping.

Monthly reporting obligations include

- Quality of Service
- Traffic volumes
- network changes, in particular base stations, base station controllers, switches and interconnection interfaces and their location
- changes of the installed and utilised capacity of switches
- and all other data requested by ARTCI or the Ministry.

Annual reporting obligations (latest by 31 March) include:

- the list of radio station locations and their characteristics, and the deployment plan for the coming year
- the coverage that it claims to have obtained on its own network, in a file that can be directly integrated into a geographic information system (GIS), or the indicated system by ARTCI, as well as all the elements of its calculation of the population coverage rate.

At the request of ARTCI the following information needs to be made available:

- the characteristics of the network, including the technical specifications of the equipment and its capacity
- all information necessary for the investigation of settlements and disputes
- all information necessary to verify compliance with the current laws and regulations

Any operator wishing to deploy networks may request access to mapping information for the relevant area (art. 77 Law no 2024-352). The Regulatory Authority must provide the information, requested based this article, within two months, except where disclosure would compromise security, defense, public safety, health, or confidentiality.

Confidentiality of information and sanctions for non-compliance

The ARTCI may request any information necessary to carry out its duties. Business secrecy is not enforceable against the ARTCI. However, the ARTCI is required to respect the confidentiality of the information it receives.

For the monthly and annual reports there is a penalty for every day of delay. Penalties relating to other breaches not defined in the license specifications will be specified by ARTCI.

4.3 Gaps and Challenges

Based on the provided documents, the policy and regulatory framework in Cote d'Ivoire for broadband mapping and information collection appears to be largely aligned with the principles of the European situation, particularly regarding the mandate for data collection, infrastructure mapping, and fostering network sharing.

ARTCI has ample authority to request information from telecom operators, fixed and mobile. This authority is both general (“any information necessary to execute its mission”) and specific (e.g. for monitoring coverage obligations, competition etc.) and sometimes even strengthened by obligations in other decisions or regulations (e.g. the spectrum licenses).

The law provides a basis to balance the interest of requesting the data and the possible confidential nature of certain data. The rules and regulations also provide for enforcement instruments in case operators to not report the requested data, or not in time.

The law allows the regulator to publish a decision on the details and the format of the requested data. The regulator has not used that possibility so far and currently informs the operators on case by case basis about the format it wants to receive the information. A published decision about a consistent way of requesting information could facilitate a better and more efficient way of collecting data.

The main gap between the Ivorian and European framework is the level of granularity of the requested data, and in particular the coverage date. Whereas some paragraphs authorise ARTCI to asked quite detailed information, like installed technical equipment, the paragraphs about coverage ask with a very limited granularity.

Coverage is measured in by number of inhabitants of a community (“localité”). In case of mobile telephony, a community is considered covered only in case that the entire community is covered.

In case of fixed lines a community is considered covered if the fixed network has a connection, point-of-presence or point of interconnect in that community. The BEREC Broadband mapping Guidelines recommend using a grid of 100x100 meters, or at individual household level.

Based on the regulation it seems that connectivity gets priority over (network) competition. Legislation facilitates national roaming and network sharing. And the regulator has the authority to intervene when networks are duplicated.

Despite the guidelines on infrastructure sharing, infrastructure sharing is only happening at a large scale. The wholesale rates seem too high. More passive infrastructure sharing can take place with alternative infrastructures.

Although the law mandates coordination for network expansion, ensuring telecom infrastructure is integrated into all public works (roads, water, electricity), there is no obligation for alternative network operators to share details about their network (exact location, capacity to support cables).

Such reporting rules for infrastructure sharing for telecom operators do not apply for network owners of other utilities even though they could promote passive network sharing. However, the Digital Strategy mentions poor intersectoral coordination for infrastructure planning.

The SWOT-analysis of the Digital Strategy mentions a weak governance of public telecom infrastructure and a vision there upon. This directly affects planning, mapping and efficient deployment. It also suggests that the regulator does not maximise the use of its enforcement powers.

A better intersectoral coordination, with complete data collection and mapping of all the telecom and alternative infrastructures could also reduce disruptions to telecom and other networks caused by uncoordinated public works.

The strategy emphasizes a detailed Monitoring-Evaluation Plan to define the workflow and timetable for collecting, processing, verifying, analysing, and disseminating data. This suggests the formal procedures and capacity for data quality are still being developed or formalized.

5. Data governance and interoperability frameworks

This analysis explores the institutional and legal frameworks governing data in Cote d'Ivoire, as well as the protocols established for data sharing and access rights.

5.1 Institutional and legal foundations for data governance

The data governance landscape in Cote d'Ivoire is anchored by Law No. 2013-450 on the Protection of Personal Data, which serves as the primary legal framework for the nation. This legislation establishes comprehensive rules regarding user consent, the processing of sensitive information, and the transfer of data across borders. Furthermore, it mandates the appointment of Data Protection Officers and requires prior authorization for specific high-risk processing activities. Oversight and enforcement of these regulations are managed by the ARTCI.

To ensure international alignment, the law is harmonized with the ECOWAS Supplementary Act on Personal Data Protection (2010) and the African Union Malabo Convention, which Cote d'Ivoire formally ratified in April 2023.

Complementing this core protection law are two critical statutes:

- Law No. 2013-451 (Cybercrime Law), which regulates cybersecurity offenses, including illegal access and digital fraud.
- Law No. 2013-546 (Electronic Transactions Law), which provides the legal basis for digital contracts and electronic signatures to foster trust in digital commerce.

On a strategic level, the **National Data Governance Strategy (2024–2030)**, adopted in August 2024, provides a long-term policy vision. While not a law itself, this framework guides public sector data management and interoperability, ensuring that responsible data use remains integrated with national development plans like the PND 2021–2025.

5.2 Data sharing protocols and access rights

Under the mandatory principles of Law 2013-450, any data sharing must adhere to strict ethical and legal standards. These include **legality**, ensuring a valid legal basis exists; **purpose limitation**, which restricts sharing to defined objectives; and **data minimization**, which ensures only strictly necessary information is exchanged. Additionally, organizations must uphold **transparency** by informing data subjects and maintain rigorous **security and confidentiality** through access controls.

5.2.1 Individual Rights and Response Obligations

Individuals are granted explicit rights to control their personal information. These include the right to access their data in an intelligible format, request corrections or deletions, and object to processing

for legitimate reasons or direct marketing. Data subjects also have the right to avoid decisions based solely on automated processing. In response, data controllers are legally obligated to verify the identity of the requester and provide a response within a reasonable timeframe, generally free of charge.

5.2.2 Institutional and Third-Party Access

Access rights for external entities are categorized by their role:

- **Public Authorities:** Government bodies may only access or share personal data when explicitly authorized by law or for missions of public interest, such as health or national security. While security and defense investigations may benefit from limited exemptions, these actions must remain proportionate and documented.
- **Private Sector:** Private entities must declare all data-sharing activities to the ARTCI and establish formal Data Sharing Agreements (DSAs) with their partners. They remain legally responsible as data controllers, even when using subcontractors who must act strictly on documented instructions.

5.2.3 Sensitive and Cross-Border Data

Specific categories of data—including health, biometric, and criminal records—are classified as sensitive. Any processing or sharing of this information requires prior authorization from the ARTCI. Similarly, cross-border data transfers are strictly regulated. Personal data may only leave Cote d'Ivoire if the recipient country ensures adequate protection, if contractual safeguards are in place, or if the ARTCI provides explicit authorization.

5.2.4 Security Standards and Sanctions

To safeguard data integrity, organizations must implement robust technical measures, including role-based access controls (RBAC), encryption, and comprehensive logging and traceability. Failure to maintain these standards can result in severe sanctions from the ARTCI, regardless of whether data misuse occurred. Administrative penalties may include formal warnings, the suspension of data activities, orders to delete unlawfully shared data, or fines reaching up to CFA 100 million.

5.3. Governance models for multi-stakeholder collaboration

The proposed national broadband mapping platform operates through a structured hierarchy of stakeholders, each with specific accountability for data integrity and system continuity. These roles range from high-level policy oversight to the technical management of datasets and end-user engagement.

Policy and Regulatory Oversight

This role serves as the strategic foundation for data governance. Entities in this position are responsible for providing national policy direction and ensuring that all mapping activities align with

legal and regional frameworks. Their primary objective is to ensure alignment by integrating broadband mapping outputs into national digital strategies and overarching policies. They are also tasked with strengthening coordination between data providers and regulatory bodies like ARTCI to improve information exchange and resolve institutional limitations.

Data Owners

Data Owners hold the ultimate authority and accountability over specific datasets. Their responsibilities are governance-focused; they define the core purpose of the data and establish the rules for its usage. Beyond setting the vision, they must approve all data access and sharing policies while ensuring that every aspect of the data management process remains in legal compliance.

GIS Infrastructure Lead (Primary Hub & Operation Lead)

Acting as the central operational entity, the GIS Infrastructure Lead is accountable for the full lifecycle of the national broadband mapping platform, including its operation, maintenance, and future upgrades. They ensure system continuity by hosting the primary mapping system and enforcing data reporting obligations from various contributors. Furthermore, they serve as the central coordinator among national stakeholders to facilitate data sharing and governance.

Data Custodians

While the Infrastructure Lead manages the platform, the Data Custodian focuses on the technical hosting and security of the data itself. Their responsibilities include the day-to-day operation and maintenance of the enterprise GIS system or geoportal. They are also responsible for coordinating with national stakeholders specifically regarding border or regional datasets to ensure geographic consistency.

Data Stewards

Data Stewards are the guardians of data quality and standards. Their role is to ensure that datasets are not only up to date but also strictly aligned with defined metadata standards. A critical part of their workflow involves validating data before it is ever published or integrated into the broader system, ensuring that the information remains reliable for decision-makers.

Data Providers

These are the entities responsible for generating and submitting the raw or processed datasets that fuel the platform. Their duties are highly technical and schedule-driven; they must submit data according to a defined schema and at the required frequency. Additionally, they act as the first line of support for their data, responding to queries or making necessary corrections when issues are identified.

Data Consumers

Data Consumers are the individuals or institutions who utilize the platform's outputs for advocacy and decision-making. Their role is to drive impact by applying broadband mapping data to evidence-based decisions. To complete the feedback loop, they are responsible for providing input on the platform's usability and accuracy, thereby promoting overall transparency.

6. Institutional capacity

6.1 Relevant stakeholders and institutional roles

Broadband mapping requires a coordinated, multistakeholder governance model that spans policy, regulation, data production, validation, hosting, and use. Based on the Africa-BB-Maps national event outcomes, the following stakeholder categories and institutional roles are identified.

6.1.1 Lead Institutional Authority

National Telecommunications Regulator (ARTCI)

Role: ARTCI is designated as the **national lead authority** and operational coordinator for broadband mapping systems.

Key responsibilities:

- Operate, maintain, and upgrade the national broadband mapping platform (e.g. CARTODONNEES);
- Define regulatory and technical requirements for data submission;
- Ensure compliance with national laws, decrees, and licensing obligations;
- Coordinate public-private data sharing frameworks;
- Validate coverage and infrastructure data before publication;
- Ensure transparency, open data policies (where applicable), and controlled access for sensitive infrastructure data;
- Act as the central interface with international partners (ITU, EU).

6.1.2 Policy and Strategic Authorities

Line Ministries (e.g. Ministry of Digital Transition and Digitalization)

Role: Policy orientation and strategic oversight.

Key responsibilities:

- Define national broadband objectives (connectivity of localities, schools, hospitals);
- Integrate broadband mapping into national digital development strategies;
- Ensure alignment between broadband policy, investment planning, and territorial development;
- Facilitate interministerial coordination.

6.1.3 Data Owners (Final Data Authorities)

State Institutions and Infrastructure Owners

Role: Legal and functional ownership of datasets related to broadband and supporting infrastructures.

Key responsibilities:

- Govern strategic datasets (telecom, energy, water, roads, urban infrastructure);
- Define objectives and rules for data use and dissemination;

- Approve access rights and sharing conditions;
- Ensure legal compliance, confidentiality, and protection of critical infrastructure;
- Oversee long term sustainability of national datasets.

6.1.4 Data Providers

Mobile Network Operators, ISPs, Utilities, Road Management Agency

Role: Primary sources of broadband and infrastructure data.

Key responsibilities:

- Submit accurate, georeferenced data (coverage, sites, backbone, access networks);
- Provide metadata in defined formats and within specified update cycles;
- Respond to data validation requests and corrections;
- Maintain dataset quality, completeness, and consistency over time;
- Participate in coordinated data sharing mechanisms.

6.1.5 Data Managers, Directors, and Validators

Designated National Data Managers and Technical Validation Authorities (under ARTCI coordination)

Role: Operational data management combined with data quality assurance, validation, and standardization.

Key responsibilities:

- Collect, store, and securely host datasets;
- Implement access rights and user roles;
- Ensure cybersecurity and data integrity;
- Manage structured geodatabases and geoportals;
- Control publication workflows (public vs. restricted layers);
- Maintain data quality standards;
- Ensure compliance with metadata and geodetic reference frameworks;
- Validate datasets prior to publication or sharing;
- Monitor coherence between multisource datasets;
- Enforce consistency with national cartographic and GIS standards

6.1.6 National Cartographic and Geographic Institutions

National Mapping and Statistical Agencies (e.g. BNETD/CIGN, ANSTAT, CNTIG)

Role: Provision of authoritative geospatial reference data.

Key responsibilities:

- Maintain national geodetic and cartographic reference systems;
- Provide base layers (administrative boundaries, roads, settlements);
- Support interoperability between sectoral datasets;
- Supervise largescale cartographic production;

- Contribute to normalization and spatial accuracy assurance.

6.1.7 Sectoral Public Infrastructure Agencies

Roads, Energy, Water, Urbanism Authorities (e.g. AGEROUTE, CIENERGIES, SODECI, MCLU)

Role: Integration of broadband mapping with other infrastructure layers.

Key responsibilities:

- Provide datasets on underground and aboveground infrastructures;
- Support coordinated works planning to reduce infrastructure damage;
- Share planning data for optimized fiber and mobile deployment;
- Contribute to multiutility GIS integration.

6.1.8 Technical and Private Sector Partners

Technology Vendors, System Integrators, Consultants

Role: Technical implementation and innovation support.

Key responsibilities:

- Develop GIS platforms and mapping tools;
- Support data collection and verification technologies (drone, LiDAR, GPS, EMF tools);
- Assist operators and regulators in system design;
- Contribute to capacity building and transfer of expertise.

6.1.9 International Partners

ITU, European Union, Development Partners

Role: Strategic, technical, and financial support.

- Key responsibilities:
- Provide international standards and methodologies;
- Finance broadband mapping initiatives;
- Support capacity development (ITU Academy);
- Promote regional and international harmonization;
- Facilitate knowledge exchange and best practices.

6.1.10 Local Authorities and Civil Society

Municipalities, Associations of Cities, Consumer Groups

Role: Local validation and user oriented feedback.

Key responsibilities:

- Support local data collection and validation;
- Facilitate community awareness and use of mapping tools;
- Provide feedback on service gaps and coverage quality;
- Promote digital inclusion and accessibility.

6.1.11 Capacity Building Actors

Local Trainers and Academic Institutions

Role: Human capacity development.

Key responsibilities:

- Train stakeholders in GIS, data governance, and policy frameworks;
- Support longterm sustainability of mapping systems;
- Act as national focal points for knowledge dissemination.

6.1.12 Summary View

Broadband mapping relies on:

- ARTCI as the central orchestrator,
- Strong public-private data sharing,
- Clear separation of roles (data owner, provider, manager, validator), and
- Continuous capacity building and governance frameworks.

This institutional model ensures reliability, transparency, investment optimization, and effective regulatory oversight of broadband coverage.

6.2 Human and technical capacity development

6.2.1 Existing Human and Technical Capacity within ARTCI for Broadband Mapping

ARTCI currently relies on established internal capacities for the implementation and operation of national broadband mapping activities. These capacities are structured around two operational departments, with complementary roles covering data acquisition, quality assessment, and platform management Department of Service Quality and Infrastructure (DQI) and Department of Market Regulation (DRM).

Department of Service Quality and Infrastructure

DQI comprises four technical experts and is primarily responsible for data collection and field based verification activities.

Its main responsibilities include:

- Collecting broadband coverage and infrastructure data directly from mobile network operators and other relevant stakeholders;
- Managing operator provided datasets in accordance with regulatory and technical requirements;

- Conducting biannual field measurement campaigns to assess quality of service and verify declared network coverage in areas reported as covered;
- Producing validated datasets and measurement results used as inputs for broadband mapping and regulatory analysis.
- Collection of infrastructure data (fiber optics, radio stations).

Through its field campaigns and direct engagement with operators, the DQI ensures accuracy, reliability, and representativeness of coverage and quality of service data.

Department of Market Regulation

DRM is composed of three staff members and is responsible for the development, operation, and continuous updating of the broadband mapping platform.

Its core functions include:

- Integrating all datasets collected and validated by the DQI into the national broadband mapping system;
- Maintaining and improving the mapping platform, including data visualization, coverage layers, and analytical functionalities;
- Ensuring consistency, coherence, and completeness of the published broadband maps;
- Supporting regulatory decision making through spatial analysis and reporting tools derived from the platform.

The DRM therefore acts as the technical and analytical backbone of ARTCI's broadband mapping activities.

Emerging Capacity: GIS and Remote Sensing

In addition to the existing structure, ARTCI has recently established a dedicated GIS and Remote Sensing Department. While this department is not yet fully integrated into the broadband mapping workflow, it represents a strategic reinforcement of ARTCI's technical capacity.

This capacity development plan is designed to elevate the ARTCI from initial to advanced maturity in broadband mapping, aligning it with international best practices and the ITU Africa-BB-Maps framework. By reducing dependency on ad-hoc processes, the plan ensures long-term institutional sustainability and scalability and enables a transition toward data-driven regulation, investment planning and service monitoring.

6.2.2 Strategic Pillars of Development

The plan is structured around three core pillars: human resources, technical systems, and operational governance. These pillars directly support the five dimensions of ITU maturity, which include 1) policy and strategic planning, 2) infrastructure mapping systems, 3) service mapping and regulatory monitoring, 4) data collection, verification and accuracy and 5) infrastructure coverage, resilience and expansion.

Proposed Target Human Capacity

To strengthen field verification, through drive and walk testing and probe-based measurement, and data reliability, DQI will expand its team of field engineers. These professionals will undergo specialized training in advanced LTE/5G methodologies, measurement automation, and crowdsourced data verification. Higher temporal accuracy and faster verification of operator reported coverage data is expected to reduce the number of disputes with operators.

Simultaneously, DRM will expand. An additional data engineer is needed, with experience in ETL, databases and APIs. An additional GIS analyst with experience in spatial analysis and dashboards will be hired. Both will contribute to transform the mapping platform from a simple visualization tool into a robust decision-support system. To support this further, training will be provided in the fields of enterprise GIS management, spatial databases like PostGIS, and coverage modeling. The resulting automated workflows and advanced regulatory dashboards will be the basis for better analytical output for policy decisions.

Finally, a new GIS and Remote Sensing Department is proposed to act as the technical backbone for broadband mapping innovation. A GIS lead with knowledge of cartography, standards and interoperability will, together with a remote sensing specialist and a data quality expert provide advanced geospatial intelligence and multisource data integration. This team will utilize satellite and aerial data, perform underground infrastructure mapping and provide high-level geospatial intelligence. With the integration of non-telecom infrastructures layers the geospatial analyses will be in alignment with the ITU advanced maturity standards.

Technical Systems and Infrastructure

The technical evolution involves upgrading the current architecture to an Enterprise GIS geoportal. Key improvements include:

- **Automated Pipelines:** Implementing automated data ingestion and validation to reduce manual processing. A spatial database with versioning and audit trails need to be set up. APIs must be introduced for controlled data access.
- **Advanced Toolsets:** Introducing portable probes, drones, and crowdsourcing tools and remote sensing where relevant, to increase the frequency of data collection.
- **Analytical Modules:** Deploying a Connectivity Planning Platform (CPP) to run investment and expansion scenarios as well as assess infrastructure resilience and underground damages.

Operational Processes and Governance

To institutionalize knowledge and improve legal defensibility, the plan mandates the development of formal Standard Operating Procedures (SOPs). These SOPs will govern everything from data collection and field measurements, data quality verification to platform publication and incident and change management.

The SOPs are supported by a comprehensive Data Governance Framework that defines data ownership and stewardship roles, classifies data by criticality and establishes clear access rights in alignment with national laws.

6.2.3 Expected Outcomes

Upon implementation, ARTCI expects to see higher accuracy in its broadband maps, while gaining higher credibility, leading to optimized public and private investments. Furthermore, the enhanced

system will reduce infrastructure damage and duplication and ensure that regulatory decisions are both faster and more reliable.

6.3. Institutional coordination mechanisms

Ministry of Digital Transition and Digitalization (MTND)

Key responsibilities:

- Approve national broadband mapping strategy and roadmap;
- Endorse data governance principles and sharing agreements;
- Resolve inter-institutional disputes;
- Validate publication policies for sensitive infrastructure;
- Ensure alignment with national digital development objectives.

ARTCI

Role: Day-to-day coordination, technical execution, and platform operation.

Core functions:

- Operate and maintain the national broadband mapping platform;
- Coordinate data collection, validation, and integration workflows;
- Interface with data providers (operators, utilities, agencies);
- Ensure compliance with approved SOPs and standards;
- Prepare analytical outputs for relevant departments of ARCTI, government agencies and policymakers.

Internal composition:

- DQI (field measurements and verification),
- DRM (platform management and analytics),
- GIS & Remote Sensing Department (advanced geospatial processing).

Interinstitutional Data Sharing Framework Instrument:

- Multilateral Memorandum of Understanding (MoU) or national decree

Scope:

- Telecommunications infrastructure and coverage data;
- Passive and underground infrastructure (fiber, ducts, energy);
- Supporting geospatial layers (roads, administrative boundaries, address database or population grid).

Key principles:

- “Once collected, shared securely”;
- Reciprocity and proportionality;
- Protection of critical infrastructure;
- Alignment with national data protection laws.

Infrastructure Agencies

Participants: ARCTI, AGEROUTE, CIENERGIES, SODECI, MCLU

Mechanism:

- Dedicated “Infrastructure Mapping Technical Group”
- Quarterly technical coordination meetings

Objectives:

- Exchange planning data for works and deployments;
- Reduce cable cuts and public works incidents;
- Promote infrastructure sharing opportunities;
- Harmonize geospatial reference systems.

Local Authorities

- Facilitate field verification and complaint collection;
- Provide local development and planning data;
- Promote use of broadband maps for territorial planning.

Civil Society and Consumers

- Participate through crowdsourcing tools;
- Report coverage gaps or service quality issues;
- Support transparency and accountability.

7. Proposals and Recommendations

Our proposal to strengthen ARTCI's ability to operate a sustainable, accurate, and policy relevant national broadband mapping system, in line with the ITU Africa-BB-Maps framework and international best practices.

Specifically, the plan aims to:

- Move ARTCI from initial maturity to advanced maturity in broadband mapping;
- Reduce dependency on ad hoc processes and individuals;
- Enable data driven regulation, investment planning, and service monitoring;
- Ensure long term institutional sustainability and scalability.

This proposal aligns with ITU's five broadband mapping maturity dimensions:

- Policy and strategic planning
- Infrastructure mapping systems
- Service mapping and regulatory monitoring
- Data collection, verification and accuracy
- Infrastructure coverage, resilience and expansion

7.1 Policy and Strategic Recommendations

Cote d'Ivoire can accelerate universal, affordable, and good quality connectivity by institutionalizing a single national broadband mapping system led by ARTCI. The system should integrate infrastructure, service, investment, and demand mapping, with clear legal mandates, standardized data submissions, verification, and secure publication—following ITU Guidelines and Africa-BB-Maps maturity practices and drawing on EU experience (INSPIRE, State Aid, BCRD, EECC/BEREC).

7.1.1 Legal Mandate & Enforcement

Designate ARTCI as the single competent authority for the national broadband mapping system; formalize obligations for operators/ISPs and relevant utilities to submit standardized, georeferenced data on a fixed schedule. Include clear penalties for late/misleading submissions and rights based access control for sensitive infrastructure data.

7.1.2 Standard Operating Procedures (SOPs) as Binding Operational Instruments

Adopt a national SOP suite (approved by ministerial order/decreed) that is binding on all data providers and ARTCI units. Core SOPs:

- **Data Collection SOP (Operators & Utilities)**
Defines what must be submitted (coverage, services, sites, routes, planned investments), how (formats, metadata), when (frequency), and where (secure SFTP/API).
- **Field Measurement & Verification SOP (DQI)**
Specifies biannual drive/walk tests, receiver calibration, sampling, SINR/Ec/I₀ thresholds, and verification procedures consistent with ITU/BEREC guidance for address/grid level surveys.
- **Data Validation & QA SOP**
Implements automated plausibility checks, topology checks, cross validation with BNETD/ANSTAT authoritative datasets, crowd/probe feedback loops, and dispositions (validated/returned/rejected) with SLAs.
- **Platform Integration & Publication SOP (DRM)**
Enforces versioned repository, audit trails, API endpoints, and publication tiers (public 1 km², restricted, sensitive), with transparency notices.
- **Data Governance & Access SOP**
Classifies datasets (public/restricted/sensitive), sets roles/permissions, and prescribes confidentiality clauses, incident response, and open data rules for noncritical layers.

Why: SOPs elevate Cote d'Ivoire from initial/medium to advanced maturity, making processes repeatable, auditable, and scalable, consistent with the ITU matrix and BEREC guidance on geographical surveys and verification.

7.1.3 Update Frequencies (Strategic)

- Annual: service coverage (fixed & mobile), QoS tiers.
- Semiannual: infrastructure lines/nodes/towers.
- Annual: planned investments (public/private) and demand surveys.
- Continuous: crowd complaints and probe data ingestion.

7.1.4 Resolution & Formats (Strategic)

- Fixed networks: address level (geocoded premises).
- Mobile networks: 100 m × 100 m grids; publish aggregated 1 km² layers.
- Vector geodata (GeoJSON/CSV/XML) + attributes; WGS84 CRS/Ivory Coast CRS.
- Metadata & accuracy classes (e.g., 0–10 cm for underground assets) per INSPIRE style dictionaries adapted for telecom.

7.2 Implementation Roadmap

This document outlines the strategic roadmap for implementing a national broadband mapping framework in Cote d'Ivoire, structured across seven distinct phases spanning 24 months. The plan transitions from legal authorization to technical automation, culminating in a fully institutionalized data ecosystem.



Figure 7. Implementation roadmap

Phase 0 & 1: Legal Foundation and Operator Engagement

The implementation begins with Phase 0 (Policy Authorization), which focuses on creating the legal and institutional conditions necessary to enforce standardized data schemas. A formal Ministerial Order or Decree will designate the ARTCI as the sole competent authority for broadband mapping, establishing strict penalties for incomplete or misleading data submissions. Central to this phase is the approval of a National SOP Suite covering:

- **Data Collection & Validation:** Specific protocols for operator submissions and ARTCI quality assurance.
- **Governance:** Rules for platform integration, publication, and data access.

Following the legal decree, Phase 1 (Month 2–4) initiates direct engagement with industry stakeholders. The objective is to ensure that all operators and ISPs technically align with the new schemas. This is achieved through technical consultations and the publication of an Operator Reporting Handbook, which defines mandatory fields, validation rules, and the official submission calendar. Success in this phase is measured by the 100% onboarding of operators and the nomination of technical focal points.

Phase 2 & 3: Technical Enablement and the First Data Cycle

Phase 2 (Month 4–8) focuses on the technical infrastructure required for secure and automated data ingestion. ARTCI will deploy SFTP or API endpoints featuring Automatic Schema Validation to check for coordinate reference system (CRS) accuracy and attribute completeness. The system will also include automated QA rules to verify the plausibility of reported technology speeds.

This technical readiness leads directly into Phase 3 (Month 8–10), the first mandatory data cycle. This marks the first legally binding collection of national coverage data, including:

- **Fixed Services:** Address-level coverage data.
- **Mobile Services:** High-resolution 100m grid data.
- **Infrastructure:** Locations of physical sites and assets.

A feedback loop will be established where operators must address correction requests within a 15-day SLA before the ARTCI locks "Validated Version 1.0" of the national dataset.

Phase 4 & 5: Transparency and Verification

Once the data is validated, Phase 4 (Month 10–12) operationalizes controlled public access. To protect sensitive infrastructure, the public map will feature aggregated 1km² coverage layers rather than raw vector data. Full infrastructure details will be reserved for Restricted Institutional Access by authorized users.

To maintain the credibility of this public data, Phase 5 (Month 12–15) introduces a reinforcement layer. The ARTCI will conduct biannual field campaigns to perform spot verifications of fixed addresses and mobile signal quality (SINR/Ec/I_o). This phase also integrates **crowdsourced feedback**, allowing the regulator to resolve mismatches between declared operator coverage and actual user experience.

Phase 6: Institutionalization and Long-Term Scaling

The final phase, Phase 6 (Month 15–24), seeks to make the mapping process a permanent and scalable part of the regulatory landscape. The framework will move beyond basic mapping to support advanced policy goals:

- **SOP Evolution:** Annual reviews to adjust schemas for emerging technologies like 5G Standalone (SA).
- **Performance Scoring:** Operators will be indexed based on their data quality and submission timeliness.
- **Investment Targeting:** The data will guide State-aid and universal service funds to ensure infrastructure reaches underserved areas.

The ultimate KPI for this roadmap is for the Cote d'Ivoire to achieve an "Advanced" maturity rating in the ITU Broadband Maps (BBMaps) index.

7.3 Monitoring and Evaluation Framework

7.3.1 Objectives and Scope

The Monitoring and Evaluation (M&E) framework serves as the primary mechanism for driving continuous improvement and steering the initiative toward "advanced maturity" under the ITU BB-Maps standards. Its scope extends beyond simple oversight; it is designed to guarantee the consistent implementation of Standard Operating Procedures (SOPs) while rigorously monitoring operator compliance with mandatory data schemas and reporting timelines.

Crucially, the framework assesses the integrity of the ecosystem by evaluating data quality, accuracy, and the effectiveness of verification protocols. It also measures the operational performance of the broadband mapping system itself and tracks the strategic utilization of mapping outputs for regulation, planning, and policy decisions. By integrating these elements, the framework ensures that the system remains robust, reliable, and relevant to national goals.

7.3.2 Operational Structure and Implementation

To translate these high-level objectives into practice, the M&E framework is organized into specific governance roles, logical models, and measurable indicators. The following sections and tables detail the architectural components of this system, defining the responsibilities, performance metrics, and feedback loops necessary for successful execution:

- **M&E Governance and Responsibilities:** Defining the actors and their specific duties.
- **Results Chain (Logic Model):** Visualizing the path from inputs to impact.
- **Key Performance Indicators (KPIs):** Measuring success across data quality, compliance, and system performance.
- **Operational Workflows:** Detailing data collection methods, reporting structures, and corrective mechanisms.
- **Evaluation Schedule:** Establishing the timeline for regular assessment and review.

The Monitoring and Evaluation (M&E) framework aims to:

- Ensure consistent implementation of SOPs for broadband mapping
- Monitor operator compliance with mandatory data schemas and reporting timelines
- Assess data quality, accuracy, and verification effectiveness
- Measure the operational performance of the broadband mapping system
- Evaluate the use of mapping outputs for regulation, planning, and policy decisions

This framework supports continuous improvement and progression toward advanced ITU BBMaps maturity.

M&E Governance and Responsibilities

Actor	Responsibilities
ARTCI	Overall M&E coordination, KPI collection, reporting
DQI	Field verification data, QoS comparison, discrepancy analysis
DRM	Platform performance metrics, data ingestion/validation indicators
Operators / ISPs	Timely data submission, correction of identified issues
MTND	Oversight, policy review, corrective measures
Steering Committee	Strategic review, endorsement of corrective actions

Table 7. Governance and responsibilities in monitoring and evaluation.

Results Chain (Logic Model)

Inputs	Outputs	Outcomes	Impact
			
SOPs adopted and enforced Standardized operator data schemas Secure submission and validation tools Trained ARTCI staff	Validated broadband datasets Public and restricted broadband maps Verification and compliance reports	Reliable national broadband coverage data Improved regulatory decision making Reduced disputes with operators Optimized investment targeting	Reduced digital divide Efficient public and private broadband investments Strengthened evidence based digital policy

Figure 8. Results chain

Key Performance Indicators (KPIs)

SOP and Operator Compliance

Indicator	Definition	Target	Frequency
Operator submission compliance rate	% of operators submitting complete datasets on time	≥ 95%	Quarterly
Schema compliance rate	% of files passing automated validation on first submission	≥ 85%	Quarterly
Correction turnaround time	Average days to resolve validation issues	≤ 15 days	Quarterly
SOP adherence score	Compliance with submission, format, metadata, and deadlines	High	Annual

Table 8. Key performance indicators for Standard Operating Procedures and operator compliance.

Data Quality and Verification

Indicator	Definition	Target	Frequency
Data validation pass rate	% of datasets validated after QA	≥ 95%	Quarterly

Coverage accuracy rate	Agreement between operator data and field measurements	≥ 95%	Biannual
Discrepancy resolution rate	% of detected mismatches resolved	100%	Biannual
Crowdsourced feedback resolution	% of complaints investigated and closed	≥ 90%	Quarterly

Table 9. Key performance indicators for data quality and verification.

System and Process Performance

Indicator	Definition	Target	Frequency
Data ingestion time	Time from submission to validation report	< 24h	Quarterly
Platform availability	System uptime	≥ 99%	Monthly
Dataset versioning completeness	% datasets with full metadata & audit trail	100%	Quarterly
SOP update cycle	SOPs reviewed and adjusted	Annual	Annual

Table 10. Key performance indicators for system and process performance.

Use of Mapping Outputs

Indicator	Definition	Target	Frequency
Regulatory decisions using maps	% decisions referencing mapping data	Increasing	Annual
Investment planning use	Use in universal service / funding decisions	Yes	Annual
Inter-institutional use	Number of agencies using restricted access	Increasing	Annual
Public map consultations	Number of public map visits/downloads	Increasing	Quarterly

Table 11. Key performance indicators for use of mapping outputs.

Data Collection Methods

KPI Source	Method
Operator submissions	Automated validation logs
SOP compliance	Checklists and audits

Data quality	QA reports, cross-checks with BNETD/ANSTAT
Verification	Field measurements (DQI), probes
System KPIs	Platform monitoring tools
Use indicators	Decision documents, access logs

Table 12. Data collection methods.

Reporting Structure

Three kinds of reporting are required: monitoring, verification and an evaluation report, each with their own timing and frequency.

Quarterly Monitoring Report (ARTCI)	Biannual Verification Report (DQI)	Annual Evaluation Report (Steering Committee)
Operator compliance dashboard	Field measurement results	SOP effectiveness assessment
Data quality metrics	Comparison with operator declarations	Operator performance scoring
Validation and correction statistics	Identified gaps and corrective actions	ITU BB Maps maturity self-assessment
Platform operational KPIs		Recommendations for policy, SOP, or schema updates

Table 13. Types and frequency of reporting

Feedback and Corrective Mechanisms

Issue Identified	Corrective Action
Late or incomplete data	Formal notice → penalties if recurrent
Low schema compliance	Mandatory technical support / clarification
Recurrent data inaccuracies	Targeted verification & enforcement
SOP inefficiencies	SOP revision and retraining
Platform bottlenecks	Technical upgrades

Table 14. Feedback and corrective mechanisms

Evaluation Schedule

Evaluation Type	Timing	Responsibility
Process monitoring	Continuous	ARTCI
Operator compliance review	Quarterly	ARTCI
Verification evaluation	Biannual	ARTCI
SOP effectiveness review	Annual	Steering Committee
System maturity assessment	Annual	ARTCI / ITU support

Table 15. Evaluation schedule.

Alignment with ITU BBMaps Maturity Model

This M&E framework supports progression from Initial to Advanced maturity by ensuring mandatory, standardized data collection, regular verification and auditability, automation and performance tracking and institutionalized learning and improvement.

8. Risk Analysis and Mitigation Strategies

This chapter will identify, discuss and analyse the risks along different dimensions. Each dimension brings its own type of risks and needs a specific mitigation strategy. The dimensions of the analysis of the risks are Institutional and Governance, Operator and Market Related Risks, Data Quality and Verification Risks, Technical and Operational Risks, Capacity and Sustainability Risks.

This risk analysis identifies key implementation risks that may affect the effective rollout of SOP driven broadband mapping in Cote d'Ivoire and proposes practical mitigation strategies adapted to the national institutional, regulatory, and market context.

Focus is placed on risks related to:

- SOP enforcement,
- operator data submission and quality,
- institutional coordination,
- technical deployment,
- sustainability and policy use.

Risks are assessed using three levels of likelihood (Low / Medium / High) and three levels of impact (Low / Medium / High). Priority risks are those assessed as Medium–High or High–High. The analysis shows that there are high risks, but also mitigation opportunities that can ensure that broadband mapping becomes a trusted regulatory instrument.

8.1 Risk analysis and Mitigation Measures

#	Type of Risk	Description	Chance/ Impact	Mitigation strategies
	Institutional and Governance Risks			
1	Weak interinstitutional coordination	Overlapping mandates or limited cooperation between ARTCI, ministries, and infrastructure agencies may delay SOP enforcement and data exchange.	Medium/ High	<ul style="list-style-type: none"> • Establish a formal Steering Committee with binding terms of reference. • Anchor SOPs and coordination roles in a ministerial decree, not informal agreements. • Designate ARTCI as the single technical authority and data arbiter.

2	Insufficient legal enforceability of SOPs	SOPs perceived as technical guidelines rather than binding regulatory instruments.	Medium/High	<ul style="list-style-type: none"> Annex SOPs directly to the ministerial order/decree. Reference SOP compliance explicitly in licence obligations. Include graduated sanctions for noncompliance.
Operator and Market Related Risks				
3	Operator resistance to data submission	Operators may be reluctant to share granular data, citing confidentiality or competitive concern.	High/High	<ul style="list-style-type: none"> Apply data classification rules (public vs restricted vs sensitive). Limit public publication to aggregated coverage layers only. Communicate regulatory purpose clearly (planning, verification, universal service). Apply enforcement only after a structured onboarding phase.
4	Low compliance with data schemas	Operators submit inconsistent, incomplete, or non-standardized datasets.	High/Medium	<ul style="list-style-type: none"> Publish a clear Operator Reporting Handbook. Implement automated schema validation before acceptance. Introduce a correction SLA (e.g. 15 days). Provide initial technical support, followed by enforcement.
Data Quality and Verification Risks				
5	Inaccurate or inflated coverage declarations	Discrepancies between declared coverage and actual service performance.	Medium/High	<ul style="list-style-type: none"> Institutionalize biannual field measurement campaigns (DQI). Crosscheck operator data with crowdsourced complaints and probes. Publish verification methodologies (without exposing sensitive data). Apply corrective and sanctioning mechanisms for recurrent inaccuracies.
6	Limited national geospatial reference quality	Inconsistent address systems or base layers reduce precision of mapping.	Medium/Medium	<ul style="list-style-type: none"> Use BNETD / ANSTAT authoritative datasets as reference layers. Require operators to align to national identifiers where available. Accept transitional use of grids where address precision is insufficient.
Technical and Operational Risks				
7	Insufficient automation of data workflows	Manual validation and integration create delays and errors.	Medium/Medium	<ul style="list-style-type: none"> Prioritize automation early (ingestion, schema checks, plausibility rules). Keep manual review limited to flagged cases.

				<ul style="list-style-type: none"> • Version datasets and maintain audit trails.
8	Cybersecurity and data leakage	Exposure of sensitive infrastructure data through platform misuse or breach.	Low-Medium/High	<ul style="list-style-type: none"> • Implement rolebased access control (RBAC). • Separate public and restricted environments. • Log all access and data exports. • Prohibit external export of sensitive layers.
	Capacity and Sustainability Risks			
9	Insufficient human capacity within ARTCI	Limited number of trained staff to manage SOPs, validation, and analytics.	Medium/Medium	<ul style="list-style-type: none"> • Focus training on SOP execution, not only GIS tools. • Crosstrain DQI and DRM staff. • Use ITU Academy certifications to standardize skills. • Gradually integrate the GIS & Remote Sensing department.
10	Loss of momentum after initial implementation	SOPs and schemas not updated as technologies evolve (5G SA, FWA, satellite).	Medium/Medium	<ul style="list-style-type: none"> • Schedule annual SOP and schema reviews. • Integrate mapping KPIs into ARTCI annual performance plans. • Link mapping outputs to concrete regulatory decisions and funding programs.

Table 16. Risk assessment.

8.2 Analysis of Priority Zones

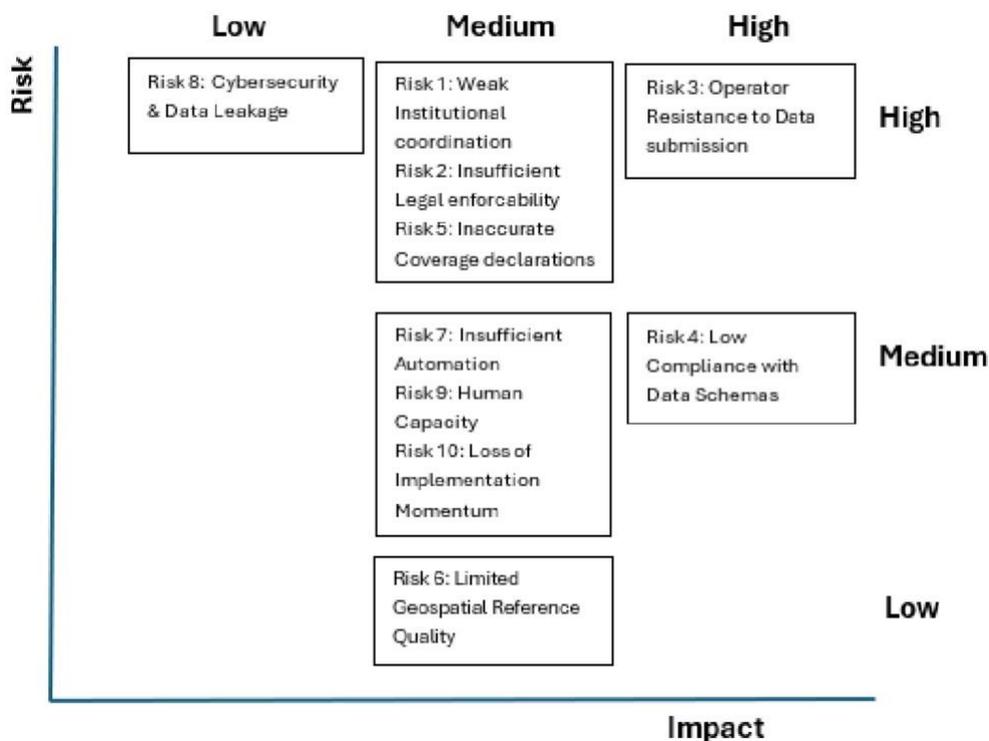


Figure 9. Risk zones

The graph above shows the nine different risk zones, defined by combined level of risk and the level of impact. The framework defines Priority Risks as those falling into the Medium–High or High–High categories.

- **The Critical Zone (High-High):** Risk 3 (Operator Resistance) is the most significant hurdle. Operators may hesitate to share granular data due to competitive concerns, making data classification (public vs. restricted) and a structured onboarding phase essential mitigation step.
- **The Regulatory Fragility Zone (Medium Likelihood / High Impact):** Risks 1, 2, and 5 represent the foundational health of the project. Regulations must be clear and, enforcement strong, with good delineation of responsibilities of agencies and coordination among them.
- **The Technical & Capacity Zone (Medium/Medium):** While Risks 7, 9, and 10 have a lower impact, they can still jeopardise the project by frequent repetition, are the most likely to cause through manual errors and stagnant technology.

Risk Category	Priority	Core Mitigation
Legal enforceability	High	SOPs annexed to decree
Operator resistance	High	Data classification & enforcement
Data quality	High	Field verification & QA

Institutional coordination	Medium–High	Steering Committee
Technical automation	Medium	Early ETL deployment
Cybersecurity	High	RBAC and segregation
Capacity gaps	Medium	Focused SOP training

Table 17. Overview of priority risks and mitigation.

The risks should be monitored through:

- Quarterly compliance reports (operator submissions, corrections),
- Biannual verification reports (field vs declared data),
- Annual SOP effectiveness reviews,
- Steering Committee oversight for escalated risks.

To address risks regarding interinstitutional coordination, a formal Steering Committee could be established. Simultaneously it could protect the momentum of the implementation. Such a committee should have the mandate to provide oversight for escalated risks and ensure the alignment of mapping outputs with national funding programs and regulatory decisions. It should operate under binding terms of reference anchored in a ministerial decree rather than informal agreements. The Committee could conduct annual effectiveness reviews of Standard Operating Procedures (SOPs) to ensure they evolve alongside new technologies like 5G and satellite.

ARTCI will also have an important role in risk mitigation. ARTCI will be responsible for the automation of data workflows, including ingestion, schema validation, and maintaining audit trails. ARTCI will also have to actively enforce compliance. This could be done by managing an "Operator Reporting Handbook" and execute graduated sanctions for noncompliance or recurrent data inaccuracies. Capacity building will remain important, with a focus on cross-training staff across the Data Quality Infrastructure (DQI) and Data Resource Management (DRM) departments to ensure technical sustainability

8.3 Conclusion

The successful implementation and long-term sustainability of broadband mapping in Ivory Coast rely on a structured governance model that balances technical authority with high-level political support. It is not primarily dependent on technology. It's a balance of clear rules (binding SOPs), consistent enforcement, and trusted data by controlled data governance, and credible verification mechanisms.

By anticipating the identified risks and applying the proposed mitigation strategies, Cote d'Ivoire can ensure that broadband mapping becomes a trusted regulatory instrument, rather than a static technical platform.

9. Sustainability and Long-Term Vision

ARTCI is well positioned to institutionalize a permanent, broadband mapping system that operates as a core regulatory instrument—continuously updated, financially sustainable, and strategically useful across policy, market oversight, and universal access objectives. This proposal outlines how ARTCI can embed the system into its statutory mandate, secure long-term financing, build durable institutional capacity, and align with regional and international frameworks, ensuring the platform endures well beyond any single project or funding cycle

9.1 Vision and Value

Vision. Create a single, authoritative national reference for broadband infrastructure and service availability, owned and operated by ARTCI, and designed to evolve with the market and technology landscape.

Value for ARTCI and Côte d’Ivoire.

- Provides a decisive evidence base for licensing, quality-of-service oversight, market analysis, and universal access programs.
- Rationalizes public and private investment by highlighting where connectivity gaps intersect with population, roads, schools, health facilities, and other priorities.
- Ensures continuity of operations, data quality, and transparency, strengthening ARTCI’s leadership in the national digital agenda.

9.2 Institutional Sustainability

Integration into mandate. ARTCI will embed broadband mapping alongside licensing, service quality monitoring, and market regulation. Responsibilities will be assigned to the relevant departments (e.g., DQI, DRM, GIS/Remote Sensing), and annual work plans and KPIs will reflect ongoing mapping duties. After initial rollout, the system will no longer be managed as a time-bound project but as a standard regulatory function.

Operating model. Standard Operating Procedures (SOPs) will govern data intake, validation, publication, access control, and change/incident management. Annual SOP reviews will allow continuous improvement without disrupting service, ensuring repeatable, auditable, and staff-independent operations.

9.3 Financial Sustainability

Transition plan. External support from ITU Africa BB Maps will be leveraged for design, setup, and targeted training in the near term. Thereafter, ARTCI will assume full financing through its regular budget.

Cost control. Sustainability will be achieved by avoiding duplicate tools, favoring modular and open components where appropriate, sharing validated datasets with government partners via controlled access, and absorbing routine costs into existing regulatory and inspection budgets. Reuse of mapping outputs across multiple regulatory functions further improves cost efficiency.

9.4 Technical and Operational Continuity (High-Level)

Architecture principles. A schema-driven, scalable design will standardize operator data for fixed and mobile networks, support automated validation and versioning, and maintain full auditability. This enables orderly integration of emerging access technologies (e.g., 5G standalone, fixed wireless, satellite) and increasing data volumes—without proportional cost escalation.

Data quality pathway. Routine submission cycles, targeted field verification, and structured discrepancy resolution will steadily raise data accuracy. Performance feedback to operators will reinforce timely, high-quality reporting and reduce enforcement burden over time.

9.5 Human Capacity and Knowledge Retention

Institutional capacity. Knowledge will be anchored in ARTCI through a structured transfer from external experts, staff certification, via ITU Academy, and cross-training between technical, regulatory, and geospatial teams. Documentation will remain linked to SOPs and data schemas to ensure day-to-day usability.

Continuity planning. Skills development will align with career paths, internal repositories will capture critical know-how, and essential competencies will be distributed across multiple staff to prevent single points of failure.

9.6 Policy and Strategic Use

Decision integration. The system’s outputs will routinely inform regulatory rulings, market studies, universal service programs, public investment prioritization, and cross-infrastructure coordination (including resilience planning). Embedding the platform in these workflows ensures sustained relevance and broad institutional demand.

Regional alignment. Methods and indicators will align with ITU Africa BB Maps, ECOWAS initiatives, and international benchmarks, keeping Côte d’Ivoire interoperable, comparable, and regionally visible.

9.7 Evolution Roadmap (5–10 Years)

Over the medium term, ARTCI’s broadband mapping system will progressively introduce advanced analytics for investment scenarios, integrate resilience and critical-infrastructure layers, expand links to non-telecom datasets, and support data-driven planning for smart cities and digital public services. All changes will follow SOP-controlled, budget-aligned iterations to preserve stability.

9.8 Governance, Milestones, and Risk Management

Governance. Establish a light-touch Steering Group within ARTCI to validate scope, approve SOP changes, and oversee annual plans and KPIs.

Milestones (illustrative).

- 0–6 months: finalize operating model, SOP set v1, data schema agreements with operators, and governance cadence.
- 6-12 months: first national publication cycle; staff training and certification plan launched; initial inter-agency data-sharing protocols.

- 12–18 months: routine update cadence; performance feedback to operators; first policy briefs using the platform; budget anchoring for Year 2+.
Risks & Mitigation.
- Data inconsistency: mitigate with schema enforcement, automated checks, and operator feedback loops.
- Staff turnover: mitigate with cross-training, documentation, and role redundancy.
- Funding gaps: mitigate by early budget integration and demonstrating multi-use value across ARTCI functions.

Success Measures (What ARTCI Should Expect)

- Continuity: on-time national updates per agreed cadence, with audit trails.
- Quality: rising accuracy and completeness scores across successive cycles.
- Usefulness: documented use in regulatory decisions, universal access planning, and public investment briefs.
- Efficiency: declining rework and enforcement overhead as SOP compliance improves.
- Impact: measurable reductions in identified coverage gaps and clearer investment prioritization.

Immediate Next Steps (For ARTCI Decision)

1. Endorse the vision and governance model;
2. Mandate departmental roles and KPIs;
3. Approve the SOP set v1 and operator schema agreements;
4. Confirm the Year-1 budget line and training plan;
5. Schedule the first national publication cycle and policy use-cases.

9.9 Conclusion

By adopting these principles, ARTCI will transform broadband mapping into a durable, nationally owned governance instrument—integral to regulation, investment, and universal access—thereby advancing Côte d’Ivoire’s digital ambitions well beyond the lifespan of any single project or funding program.

10. Conclusion

Under the ITU Africa-BB-Maps programme, broadband mapping is understood as a foundational public policy instrument—essential for identifying connectivity gaps, guiding investment, strengthening regulation, and accelerating inclusive digital transformation. In this context, the analysis for Cote d'Ivoire confirms both the strategic relevance of broadband mapping and the country's strong readiness for system maturation.

Cote d'Ivoire benefits from a robust enabling environment, including a clear regulatory mandate for data collection, infrastructure mapping, and enforcement vested in ARTCI, as well as an active institutional ecosystem spanning telecommunications, utilities, transport, statistics, and territorial authorities. These conditions place Cote d'Ivoire in a favourable position within the Africa-BB-Maps maturity framework, with the primary challenge lying not in legal authority, but in the standardisation, operationalisation, and systematisation of existing practices.

The Africa-BB-Maps initiative, funded by the European Union and implemented by ITU, plays a catalytic role in this transition. Through policy alignment, technical guidance, and capacity building, the programme enables Cote d'Ivoire to evolve from fragmented or adhoc data collection towards a national, interoperable, and sustainable broadband mapping system, aligned with international best practices and regional harmonisation objectives.

The core contribution of this report is the articulation of a clear pathway from medium to advanced broadband mapping maturity, anchored in five Africa-BB-Maps priority dimensions:

- Policy and regulatory anchoring, ensuring broadband mapping is a permanent regulatory function;
- Standardised data schemas and binding SOPs, enabling repeatability, automation, and auditability;
- Systematic data validation and verification, strengthening trust, accuracy, and regulatory defensibility;
- Institutional capacity development, ensuring longterm national ownership beyond project cycles;
- Sustainability and governance mechanisms, supporting continuity, interoperability, and scalability.

Consistent with Africa-BB-Maps principles, this document emphasises that broadband mapping is not an end in itself, but a means to:

- identify unserved and underserved areas with precision;
- support targeted universal service and public investment interventions;
- enhance transparency, consumer protection, and competition;
- reduce deployment costs through infrastructure coordination;
- align national efforts with regional and continental digital agendas.

The implementation roadmap, monitoring and evaluation framework, risk mitigation measures, and funding strategy collectively ensure that broadband mapping in Cote d'Ivoire progresses as a living system, capable of adapting to technological evolution, market dynamics, and policy priorities, while steadily advancing along the Africa-BB-Maps maturity trajectory.

In line with the Africa-BB-Maps exit and sustainability model, longterm success depends on a planned transition from projectbased support to full national ownership, with ARTCI operating the system as a core regulatory instrument and broadband mapping results consistently informing decisionmaking across government and the sector.

By implementing the recommendations of this report, Cote d'Ivoire can position itself as a reference country within the Africa-BB-Maps programme, demonstrating how structured policy reform, institutional leadership, and international cooperation can translate broadband mapping into measurable impact for digital inclusion, economic development, and social cohesion.

Annex 1: Data Sources and Methodological Notes

This policy analysis and the associated recommendations are based on a combination of primary national sources, institutional data, international datasets, and authoritative policy and regulatory references. No proprietary or classified datasets were accessed beyond those formally shared by national institutions during the Africa-BB-Maps process.

1. National Institutional Sources (Cote d'Ivoire)

- ARTCI – Autorité de Régulation des Télécommunications/TIC de Cote d'Ivoire
 - National broadband coverage and Quality of Service (QoS) reports submitted by operators
 - Existing national mapping platform: cartodonnees.artci.ci
 - Annual Information Society Measurement (MSI) surveys
 - Regulatory decisions, guidelines, licence obligations, and reporting templates
- ANSUT – Agence Nationale du Service Universel des Télécommunications/TIC
 - Universal service planning data
 - Identification of underserved (“white”) areas
 - Inputs related to publicly funded broadband deployment programmes
- BNETD / CIGN (Institut National de l'Information Géographique)
 - National cartographic references
 - Administrative boundaries, base maps, road networks
 - Geodetic and largescale cartographic datasets
- ANSTAT – Agence Nationale de la Statistique
 - Official demographic and territorial statistics
 - Georeferenced locality and population datasets
- Sectoral Infrastructure Institutions
 - AGEROUTE (roads and transport infrastructure)
 - CIENERGIES (electricity network)
 - SODECI (water infrastructure)
 - MCLU (urban planning and land management datasets)

These institutions provided contextual information and confirmed the availability of complementary infrastructure datasets relevant to coordinated infrastructure mapping.

2. Telecommunications Operators

- Mobile Network Operators (Orange Cote d'Ivoire, MTN Cote d'Ivoire, Moov Africa)
 - Selfreported broadband coverage data (fixed and mobile)
 - Infrastructure inventories (sites, fibre routes, network elements)
 - Planned network expansion information (where shared)
 - Responses to structured questionnaires and consultations conducted under the Africa-BB-Maps workstream

Operator data was used as a declared source, with the report explicitly identifying the need for enhanced verification and standardisation.

3. International and Regional Policy & Regulatory Sources

- International Telecommunication Union (ITU)
 - Guidelines for Establishing or Strengthening National Broadband Mapping Systems (2022)
 - ITU Compendium of Case Studies on Broadband Mapping Systems (2024)
 - Africa-BB-Maps project documentation and regional workshop outputs
 - ITU Academy materials related to broadband mapping, data governance, and GIS
- European Union and BEREC References
 - European Electronic Communications Code (Directive (EU) 2018/1972)
 - Gigabit Infrastructure Act (Regulation (EU) 2024/1309)
 - State Aid Guidelines for Broadband Networks (2023)
 - BEREC Guidelines on Geographical Surveys and Data Verification
 - EU studies on broadband and infrastructure mapping interoperability
 - ANCOM Decision no. 247/2023 format and manner of transmission of information on the development and geographical location of public transport networks
 - electronic communications and the physical infrastructure elements associated with them

These sources informed the comparative analysis, bestpractice benchmarks, and alignment with international standards.

4. Global Geospatial and Population Datasets

- WorldPop Programme
 - Highresolution population distribution datasets (100 m and 1 km grids)
Used to contextualize the limitations of localitylevel coverage reporting and demonstrate the benefits of gridbased mapping approaches.
- Open global geospatial references
 - Used only for analytical context and visual illustration where national datasets were not sufficiently granular.

5. Stakeholder Consultations and Events

- Africa-BB-Maps National Event – Cote d'Ivoire (August 2025)
 - Contributions from government ministries, ARTCI, operators, utilities, municipalities, and development partners
 - Identification of key challenges such as underground infrastructure damage and coordination gaps
- Targeted Stakeholder Questionnaires and Interviews (November – December 2025)
 - ARTCI
 - Operators and infrastructure owners
 - Public institutions and local authorities

These inputs constitute a core qualitative data source for institutional, regulatory, and capacity assessments.

6. Legal and Regulatory Documents (Cote d'Ivoire)

- Law No. 2024352 on Electronic Communications
- Law No. 2017803 on the Information Society
- Law No. 2013-451 (Cybercrime Law)
- Law No. 2013-546 (Electronic Transactions Law)
- Law No. 2017-803 on the Information Society in Cote d'Ivoire
- Spectrum licences (“Cahiers des charges”)
- Stratégie Nationale de la Gouvernance des Données (2024)
- Stratégie Nationale de Développement du Numérique_V1.4
- ARCTI Decision No 2025-1295 Infrastructure sharing guidelines

Note on Data Usage

This report does not create new primary datasets.

All analyses are based on:

- Declared national data,
- Existing public or institutional datasets,
- Documented stakeholder inputs, and
- International policy references.

The proposed broadband mapping framework explicitly recommends future improvements in data granularity, validation, and interoperability, building on these sources.

Annex 2: Stakeholder List

1. Policy and Executive Authorities

Government of Cote d'Ivoire

- Role: Strategic leadership and national policy direction
- Responsibilities:
 - Define national digital and broadband objectives
 - Ensure alignment with development strategies and national legislation
 - Validate interministerial coordination mechanisms

Ministry of Digital Transition and Digitalization (MTND)

- Role: Sector policy authority
- Responsibilities:
 - Translate national digital priorities into sector strategies
 - Provide ministerial oversight for broadband mapping
 - Endorse regulatory instruments, SOPs, and datasharing frameworks

2. Lead Regulatory Authority

Autorité de Régulation des Télécommunications/TIC de Cote d'Ivoire (ARTCI)

- Role: National lead authority for broadband mapping
- Responsibilities:
 - Operate and maintain the national broadband mapping platform
 - Define and enforce data submission requirements and SOPs
 - Collect, validate, verify, and publish broadband coverage and infrastructure data
 - Ensure data governance, confidentiality, and compliance with legal frameworks
 - Act as focal point for ITU Africa-BB-Maps implementation

Internal ARTCI Units Involved

- Department of Service Quality and Infrastructure (DQI): Field measurements, QoS campaigns, data verification
- Department of Market Regulation (DRM): Platform management, data integration, analytics
- GIS and Remote Sensing Department: Advanced geospatial processing and cartographic support

3. Universal Service and Implementation Bodies

Agence Nationale du Service Universel des Télécommunications/TIC (ANSUT)

- Role: Universal service implementation agency
- Responsibilities:
 - Use broadband maps to identify underserved and unserved areas (“white zones”)
 - Design and implement publicly funded connectivity projects
 - Coordinate with ARTCI on targeting and monitoring interventions

4. Telecommunications Operators and Infrastructure Providers

Mobile Network Operators (MNOs)

- Orange Côte d'Ivoire
- MTN Cote d'Ivoire
- Moov Africa Côte d'Ivoire
- Role: Primary broadband data providers
- Responsibilities:
 - Submit georeferenced coverage, QoS, infrastructure, and investment data
 - Comply with reporting obligations defined by law and licence conditions
 - Participate in validation and correction processes

Internet Service Providers (ISPs) and Fixed Network Operators

- Role: Contributors of fixed broadband infrastructure and service data
- Responsibilities:
 - Provide addresslevel coverage and infrastructure information
 - Support completeness of national broadband maps

5. National Geospatial and Statistical Authorities

Bureau National d'Études Techniques et de Développement (BNETD) / CIGN

- Role: National Geographic Institute
- Responsibilities:
 - Provide authoritative cartographic base layers and geodetic references
 - Support spatial accuracy and interoperability

Agence Nationale de la Statistique (ANSTAT)

- Role: National statistical authority
- Responsibilities:
 - Provide official demographic and territorial statistics
 - Support populationbased analysis of broadband availability

6. Sectoral Infrastructure Agencies

Agence de Gestion des Routes (AGEROUTE)

- Responsibilities:
 - Road network mapping and civil works coordination

CIENERGIES

- Responsibilities:
 - Electricity network infrastructure data
 - Support passive infrastructure sharing opportunities

SODECI

- Responsibilities:
 - Water network infrastructure mapping

Ministry of Construction, Housing and Urbanization (MCLU)

- Responsibilities:
 - Urban planning, land management, and georeferenced urban datasets

Ministry of Education (MENA)

- Responsibilities:
 - georeferenced education institutions dataset

7. Local Authorities

Municipalities and Local Governments

- Role: Locallevel facilitators
- Responsibilities:
 - Support validation of coverage at community level
 - Facilitate field verification and citizen feedback

Union of Cities and Municipalities of Cote d'Ivoire (UVICOCI / AUICI)

- Role: Representative body of local authorities
- Responsibilities:
 - Promote municipal involvement in broadband mapping
 - Support capacity building and local data use

Annex 3: Funding and Resource Mobilization

1.1 Objectives of Funding and Resource Mobilization

The primary purpose of mobilizing resources for broadband mapping in Côte d'Ivoire is to guarantee stable financing for both immediate implementation and long-term sustainability. The funding structure supports a comprehensive roadmap aimed at elevating the country's status to "advanced maturity" within the ITU Africa-BB-Maps framework.

Financial resources are first allocated to the backbone of the project: the creation and enforcement of binding standard operating procedures (SOPs). This legal anchoring is supported by the rollout of standardized systems that allow operators to submit data for automated validation. To verify the reality on the ground against these digital submissions, the budget provides for regular data quality checks and extensive field measurement campaigns.

Beyond technical infrastructure, the funding is dedicated to strengthening the institution itself. Significant emphasis is placed on capacity building within ARTCI to manage these complex systems effectively. The ultimate goal of this financial planning is to facilitate a progressive handover, transitioning the initiative from its current state into a permanent, nationally funded operation.

1.2 Role of ITU Africa-BB-Maps in Funding

Strategic Positioning

The ITU Africa-BB-Maps Programme, funded by the European Union and implemented by the ITU Telecommunication Development Bureau, serves as the central external funding pillar for the initial and intermediate phases of broadband mapping in Côte d'Ivoire. This support is strategically calibrated to act as a catalyst rather than a permanent crutch.

The programme's funding is specifically designed to finance non-recurrent investments—such as platform design, the development of Standard Operating Procedures (SOPs), and specialized training—that are essential for system establishment. By focusing on the transfer of technical know-how and international standards, the initiative ensures that the necessary infrastructure is not only built but also understood. Ultimately, this foundational support is intended to enable a structured and secure transition, handing over a fully strengthened system to national ownership.

1.3 Funding Needs by Cost Category and Source

Activity	Funding needs	Funding sources	Funding rationale
SOP Development and Regulatory Framework	<ul style="list-style-type: none">Drafting and formalization of SOPs (data collection,	ITU Africa-BB-Maps: <ul style="list-style-type: none">Technical assistance for SOP design	SOP development is a one-time enabling investment,

	<p>validation, publication);</p> <ul style="list-style-type: none"> • Legal anchoring of SOPs in decrees and licence obligations; • Inter-institutional coordination instruments (MoUs). 	<p>aligned with ITU Guidelines;</p> <ul style="list-style-type: none"> • Expert support for data governance and regulatory harmonization. <p>National budget (ARTCI / MTDN):</p> <ul style="list-style-type: none"> • Legal processes, gazetting, and long-term enforcement 	<p>well-suited for ITU project funding.</p>
Operator Data Submission and Validation Platform	<ul style="list-style-type: none"> • Secure SFTP / API ingestion mechanisms; • Automated schema-validation and QA tools; • Core GIS infrastructure for controlled access. 	<p>ITU Africa-BB-Maps:</p> <ul style="list-style-type: none"> • Initial platform architecture and configuration; • Integration of ITU reference data models and templates <p>European Union (via Africa-BB-Maps):</p> <ul style="list-style-type: none"> • Capital expenditure for platform establishment. <p>National budget (medium term):</p> <ul style="list-style-type: none"> • Hosting, maintenance, and upgrades. 	<p>Platform establishment is capital-intensive and fits the Africa-BB-Maps system-building mandate.</p>
Capacity Building and Skills Transfer	<ul style="list-style-type: none"> • Training ARTCI staff on SOP execution and data validation; • Certification in GIS, geospatial QA, and data governance; • Knowledge transfer from ITU experts. 	<p>ITU Africa-BB-Maps:</p> <ul style="list-style-type: none"> • ITU Academy courses and certifications; • On-the-job coaching and regional workshops. <p>National budget:</p> <ul style="list-style-type: none"> • Staff costs and skills retention. 	<p>Capacity building is a pillar of Africa-BB-Maps and a prerequisite for sustainability.</p>

Field Verification and Measurements	<ul style="list-style-type: none"> • Biannual measurement campaigns (QoS verification); • Data processing and discrepancy resolution. 	Mixed model: ITU Africa-BB-Maps (initial methodology and tools); ARTCI operational budget (routine campaigns).	Africa-BB-Maps supports methodological setup, while recurrent measurements must be nationally funded.
Governance, Monitoring, and Evaluation	<ul style="list-style-type: none"> • SOP reviews and updates; • Operator compliance monitoring; • Annual evaluation and maturity assessment. 	ITU Africa-BB-Maps: <ul style="list-style-type: none"> • Initial maturity assessments; • Performance monitoring templates. National budget: <ul style="list-style-type: none"> • Permanent governance and reporting structures. 	

1.4 Consolidated Funding Sources Matrix

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

1.5 Phased Resource Mobilization Strategy

Resource mobilisation phase	Primary funding
Phase 1 – Establishment (0–6 months)	ITU Africa-BB-Maps
<ul style="list-style-type: none"> • SOP drafting and approval 	
<ul style="list-style-type: none"> • Operator schema finalization 	
<ul style="list-style-type: none"> • Platform architecture and onboarding 	
Phase 2 – Scaling (6–18 months)	ITU Africa-BB-Maps + National Budget
<ul style="list-style-type: none"> • Automated validation 	
<ul style="list-style-type: none"> • First mandatory data cycles 	

<ul style="list-style-type: none"> • Capacity building and verification 	
Phase 3 – Sustainability (18+ months)	National Budget
<ul style="list-style-type: none"> • Routine operations 	
<ul style="list-style-type: none"> • SOP updates 	
<ul style="list-style-type: none"> • Long-term regulatory use 	

1.6 Sustainability and Exit Strategy from Donor Funding

To prevent dependency on external financing, the project is structured around a clear exit strategy. Since the Africa-BB-Maps funding is strictly timebound and non-recurrent, the financial responsibility for platform operations will be progressively absorbed into ARTCI’s core mandate budget. This shift ensures that the system’s maintenance is treated as a permanent operational necessity rather than a project-based expense.

Operational continuity is guaranteed by institutionalizing Standard Operating Procedures (SOPs), which embed these processes into the daily workflow beyond the project's closure. Furthermore, the strategy prioritizes the internal retention of skills acquired through ITU support, ensuring that technical expertise remains within the organization. Finally, the sustainability of the investment is maximized by the multi-purpose utility of the data; the mapping outputs are designed to be reused across various regulatory functions—including licensing, Quality of Service (QoS) monitoring, universal access planning, and infrastructure coordination—thereby justifying the ongoing operational costs.

1.7 Key Funding Risks and Mitigation

Risk	Mitigation
Overreliance 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