

# A Framework for Big Data Applications for ECOWAS

*Experience-Sharing Workshop on Big Data  
Applications Across ECOWAS Member States,  
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# Contributors

This section recognises and documents the valuable contributions of individuals and institutions who actively participated in the development and implementation of this initiative. Drawn from a diverse range of sectors—including national statistics offices, regulatory bodies, academia, mobile network operators, and international organisations — these contributors brought unique perspectives and expertise from across ECOWAS member states. Their insights, collaboration, and commitment were instrumental in advancing the shared objectives of the project, particularly in fostering data-driven innovation and strengthening statistical capacity in the region.

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# Terms

**AI:** Artificial Intelligence — technologies that enable machines to perform tasks that typically require human intelligence.

**API:** Application Programming Interface — a set of rules that allows different software entities to communicate and exchange data.

**Big Data:** Extremely large datasets that require advanced tools and methods to capture, process, and analyze.

**CDR:** Call Detail Records — metadata generated by telecom operators about phone calls and messages, often used for mobility and network analysis.

**Cloud:** Remote servers hosted on the internet used to store, manage, and process data.

**Capacity Building:** Activities or programs designed to improve individuals' or organizations' abilities and skills.

**Dashboard:** A visual interface showing key metrics, trends, and data points for monitoring or decision-making.

**Data Ecosystem:** The interdependent environment of data producers, users, platforms, and policies.

**Data Governance:** The processes and policies for managing the availability, usability, integrity, and security of data.

**Data Pipeline:** A sequence of processes for collecting, transforming, and storing data from source to destination.

**Data Policy:** Guidelines and principles governing data access, use, sharing, and protection.

**Data Protection:** Legal and technical measures to ensure personal data is stored and handled securely and ethically.

**Data Schema:** A structured format defining how data is organized, labeled, and stored.

**Data Sharing:** The practice of making data available to others, often under specific conditions or agreements.

**Data Stewardship:** The responsible oversight and management of data assets.

**Data Warehouse:** A centralized repository that stores integrated data from multiple sources for analysis and reporting.

**Demographics:** Statistical data relating to the population and particular groups within it.

**Digital Transformation:** The integration of digital technologies into all areas of operation, fundamentally changing how organizations operate and deliver value.

**ECOWAS:** Economic Community of West African States — a regional political and economic union of 15 countries in West Africa.

**ENEAM:** École Nationale d'Économie Appliquée et de Management — a Beninese higher education institution focused on economics and management.

**ETL:** Extract, Transform, Load — a data integration process that prepares data for analysis.

**Framework:** A structured approach or conceptual model that outlines methods, objectives, and procedures for a particular initiative.

**GDPR:** General Data Protection Regulation — a European regulation that serves as a reference for data privacy frameworks worldwide.

**Hackathon:** A collaborative event in which participants rapidly develop software solutions to specific problems.

**INE:** Institut National de l'Économie — a typical name format for national economic institutes in Francophone countries.

**Innovation Lab:** A collaborative environment designed to foster innovation, research, and development of new technologies and data applications.

**INS:** Institut National de la Statistique — National Institute of Statistics.

**Interoperability:** The ability of systems, organizations, or software to exchange and make use of information in a coordinated manner.

**MNO:** Mobile Network Operator — a provider of wireless communication services (e.g., MTN, Orange).

**Metadata:** Data that describes other data (e.g., when and how it was collected, its structure, format).

**Mobile Data:** Digital information collected through mobile network usage, including location and communication metadata.

**NNI:** Numéro National d’Identification — a national unique identification number used for linking data.

**NSO:** National Statistics Office — the government agency responsible for official statistics in a country.

**ODD:** Objectifs de Développement Durable (Sustainable Development Goals) — the UN’s blueprint for achieving a better and more sustainable future.

**ODP:** Open Data Platform — a system that provides public access to structured datasets.

**Open Data:** Data that is freely available to everyone to use and republish without restrictions.

**Privacy:** The right of individuals to control the collection and use of their personal information.

**Regulator:** An organization or agency responsible for supervising and enforcing laws and regulations in a specific sector.

**Sandbox:** A secure and isolated testing environment used for experimentation with new tools, data, or models.

**Satellite Imagery:** Images of Earth collected by imaging satellites, often used in environmental monitoring and urban planning.

**Statistical Office:** See NSO; responsible for gathering and analyzing official data.

**Survey Integration:** Combining survey data with other data sources (e.g., mobile or satellite data) to improve coverage and accuracy.

**UNECA:** United Nations Economic Commission for Africa — a regional arm of the UN that supports economic development in African countries.

**Use Case:** A specific scenario in which a system or technology is used to accomplish a goal (e.g., using CDRs for urban mobility).

**WADSNET:** West African Data and Statistical Network — a proposed regional infrastructure for secure, real-time statistical data sharing.

# Executive Summary

# Chapter 1

## Introduction

### 1.1 Background and Motivation

#### 1.1.1 Introduction to the Big Data Opportunity

The rise of digital technologies and the exponential growth in data generation have ushered in a new era in which "big data" has become a strategic asset for development. Big data, characterized by its high volume, velocity, variety, veracity, and value (the 5 V's), presents unique opportunities to enhance decision-making, optimize resource allocation, and foster innovation across sectors [MSC13]. In the context of statistical systems, big data holds the potential to supplement traditional methods of data collection, address information gaps, and enable real-time analysis and forecasting [UNE21c].

Globally, governments and institutions are recognizing the transformative role of big data in public service delivery, crisis response, environmental monitoring, health management, and economic planning [Div18]. For regions like ECOWAS, leveraging big data offers a pathway to strengthen evidence-based policymaking, support the Sustainable Development Goals (SDGs), and accelerate regional integration [Uni20].

#### 1.1.2 ECOWAS Regional Context

The Economic Community of West African States (ECOWAS), comprising 15 member states, is a regional bloc with a mandate to promote economic integration and development in West Africa [ECO22]. The region is home to over 400 million people, with a rapidly expanding digital footprint due to increased mobile phone penetration, internet access, and digital service uptake [GSM22].

Despite the strides in ICT adoption, ECOWAS member states face common challenges in the production and use of statistics. These include reliance on outdated data collection methods, resource constraints, data quality issues, and fragmented data governance structures [Ban23a]. At the same time, mobile

network operators, social media platforms, satellite systems, and administrative institutions are generating vast quantities of data that remain largely untapped for statistical and policy purposes.

The heterogeneity in national capabilities across ECOWAS countries, including disparities in infrastructure, legal frameworks, and human capital, further complicates efforts to adopt and utilize big data at scale. Yet, this diversity also presents an opportunity for regional coordination and shared learning to harmonize efforts, build collective capacity, and pilot regionally relevant solutions [fA22a].

### 1.1.3 Motivation for a Regional Big Data Framework

The impetus for developing a Big Data Adoption Framework for ECOWAS stems from several interrelated needs:

1. **Modernizing Statistical Systems:** National Statistics Offices (NSOs) in the region are under increasing pressure to deliver timely, granular, and high-quality data. Integrating big data into official statistics can help bridge data gaps, particularly in fast-changing sectors like health, mobility, and urbanization [Div18].
2. **Improving Policy Responsiveness:** With real-time insights from big data, governments can respond more effectively to societal needs, monitor policy impacts, and design adaptive programs [Ban21].
3. **Fostering Regional Integration:** A shared framework enables harmonization of methodologies, facilitates cross-border collaboration, and strengthens ECOWAS' collective data ecosystem [ECO22].
4. **Aligning with Global Trends:** International organizations such as the United Nations, World Bank, and African Union are promoting the use of non-traditional data sources for development [Uni20, Ban23a]. ECOWAS must position itself to harness this global momentum.
5. **Mobilizing Innovation and Investment:** The development of data innovation labs, pilot programs, and public-private partnerships can stimulate regional innovation, support entrepreneurship, and attract investment in data infrastructure and skills [UNE21c].

The framework aims not only to outline a roadmap for big data adoption but also to encourage a mindset shift across the region: from data scarcity to data opportunity, from fragmented efforts to collective action, and from manual systems to AI-powered platforms.

### 1.1.4 Strategic Alignment with Continental and Global Goals

This initiative is aligned with multiple high-level development agendas:

- **ECOWAS Vision 2050:** Calls for inclusive and sustainable development driven by innovation, digital transformation, and regional cooperation [ECO22].
- **AU Agenda 2063:** Prioritizes the use of science, technology, and innovation to transform Africa’s economies [Uni20].
- **UN Sustainable Development Goals (SDGs):** Emphasize the role of data in tracking progress, informing action, and ensuring accountability [Uni15].

The Big Data Adoption Framework for ECOWAS is thus not an isolated intervention, but a strategic effort to embed data-driven decision-making at the heart of regional development.

Harnessing the power of big data is no longer optional for ECOWAS; it is imperative. This framework responds to a clear call for transformation in how data is sourced, managed, analyzed, and applied. It is about building systems that are resilient, agile, and capable of addressing the complexities of 21st-century development. By leveraging the shared experiences of member states, the support of global partners, and the vision of a data-driven ECOWAS, this initiative sets the foundation for a more integrated, informed, and innovative West Africa.

### 1.1.5 Alignment with ECOWAS Vision 2050

The *ECOWAS Vision 2050*, titled “*The ECOWAS We Want*”, is a long-term strategic framework adopted in 2021 to guide the socio-economic transformation of West Africa through to the year 2050. It builds upon the foundation of Vision 2020 and articulates a collective ambition for a peaceful, prosperous, and integrated region underpinned by democratic governance and inclusive development. The vision is organized around five strategic pillars: peace, security and stability; governance and rule of law; economic integration and interconnectivity; transformation and inclusive development; and social inclusion alongside environmental sustainability. It highlights the need for enhanced digital infrastructure, institutional cooperation, youth empowerment, and equitable access to technology [ECO22].

In this context, the proposed **Big Data Adoption Framework** is a direct enabler of Vision 2050. It aims to strengthen the statistical capacity of ECOWAS member states by leveraging emerging technologies, harmonizing data practices, and promoting secure, ethical, and innovative data usage across national and regional institutions. By fostering cross-border collaboration, enabling the use of big data for evidence-based policy, and advancing digital integration, this framework operationalizes key aspirations of Vision 2050—especially those related to governance, data-driven decision-making, and re-

gional resilience. It is therefore both aligned with and instrumental to the realization of the ECOWAS Vision 2050.

## 1.2 Purpose of the Framework

The primary purpose of the ECOWAS Big Data Adoption Framework is to establish a coherent, inclusive, and regionally tailored strategy for integrating big data into national and regional statistical ecosystems. The framework serves as a roadmap to empower ECOWAS Member States in harnessing emerging data sources and advanced analytics to produce more timely, relevant, and reliable statistics.

Specifically, the framework seeks to:

1. **Guide Capacity Building:** Provide a structured approach to develop technical, legal, and institutional capacities for big data usage within NSOs and allied institutions [Div18, Ban23a].
2. **Promote Data Governance:** Establish common principles for ethical data use, privacy protection, and legal compliance across member states [fA22a].
3. **Encourage Innovation:** Facilitate the establishment of data innovation labs, AI-powered tools, and open-source platforms that support experimentation and creative problem solving [Uni20].
4. **Strengthen Regional Collaboration:** Enhance data sharing, policy harmonization, and joint projects among member states and with international partners [ECO22].
5. **Support Policy Impact:** Enable governments to monitor socio-economic trends, evaluate development outcomes, and respond proactively to emerging challenges [Ban21].
6. **Foster Sustainability:** Provide a foundation for long-term, locally owned big data initiatives that can evolve with technology and user needs.

By anchoring big data development within a structured framework, ECOWAS positions itself to build resilient and forward-looking statistical systems that align with both continental aspirations and global data norms.

## 1.3 Methodology

This report follows a mixed-methods approach to conceptualize, validate, and present a practical framework for the adoption of Big Data across ECOWAS member states. The methodology incorporates expert consultation, stakeholder input, comparative policy analysis, and iterative refinement based on regional



realities and technical constraints.

The first phase of the methodology involved a comprehensive review of strategic documents and digital agendas from ECOWAS and its member states, notably the *ECOWAS Vision 2050* [ECO22], national statistical strategies, and digital transformation roadmaps. This ensured alignment between the proposed framework and existing regional goals for integration, resilience, and inclusive development.

The second phase included an experience-sharing workshop, bringing together national statistics offices (NSOs), mobile network operators (MNOs), regulators, academia, and regional development bodies. Stakeholder feedback was collected using structured forms and real-time workshop discussions, focusing on readiness assessment, key use cases, data governance, infrastructure needs, and strategic alignment. Contributions were later analyzed thematically and synthesized to form the foundational components of this framework.

The third phase integrated insights from successful frameworks implemented in other regions. For instance, the European Statistical System (ESS) Big Data Task Team outlined pathways for integrating non-traditional data into official statistics through sandboxing, data stewardship roles, and legal harmonization [Eur19]. Similarly, the ASEAN Framework on Digital Data Governance promotes interoperability, cross-border data flows, and inclusive governance structures to support regional collaboration [ASE18]. These models were adapted contextually to fit the legal, infrastructural, and institutional environment of West Africa.

## 1.4 Structure of the Report

This report is structured into ten thematic chapters, each building upon the previous to progressively articulate the rationale, design, and implementation pathway for a Big Data Adoption Framework within ECOWAS. The structure balances strategic visioning with operational detail, ensuring the framework is both visionary and actionable. Each chapter reflects stakeholder insights, comparative analyses, and implementation considerations.

- **Chapter 1 – Introduction:** Provides background and motivation for the framework, outlines its purpose, and details its alignment with ECOWAS Vision 2050 and other continental and global development agendas.
- **Chapter 2 – Global and Regional Context:** Reviews the role of Big Data and Artificial Intelligence (AI) in societal transformation, presents global best practices, and reflects on trends shaping the statistics profession in Africa and globally.

- **Chapter 3 – Stakeholder Engagement:** Summarizes the experience-sharing workshop, key insights from delegates, and contributions from national, regional, and international actors.
- **Chapter 4 – The ECOWAS Big Data Framework:** Introduces the framework’s core components, including regional vision, readiness assessment, use case prioritization, governance models, infrastructure requirements, and scaling strategy.
- **Chapter 5 – Innovation and Data Products:** Explores pathways for developing public and private data products, establishing innovation labs, and promoting open-source tools and community engagement through hackathons and research.
- **Chapter 6 – Commercialisation and Monetization:** Discusses models for generating value from data infrastructure and usage, while balancing public good with commercial incentives.
- **Chapter 7 – Institutional Mechanisms and Partnerships:** Recommends institutional roles, coordination mechanisms, and the establishment of a proposed Big Data and Insights Association for ECOWAS.
- **Chapter 8 – Implementation Strategy:** Outlines a phased rollout plan, institutional responsibilities, risk mitigation strategies, and approaches to capacity building and resource mobilization.
- **Chapter 9 – Monitoring and Evaluation:** Defines key performance indicators (KPIs), feedback loops, and reporting tools to track progress and ensure continuous learning and improvement.
- **Chapter 10 – Future Outlook:** Reflects on the future of the statistics profession in ECOWAS, anticipates trends in AI and Big Data, and presents a forward-looking roadmap for the next decade.

This comprehensive structure is designed to ensure that the Big Data Framework is grounded in both technical rigor and regional relevance, supporting ECOWAS in building a data-driven, interoperable, and resilient statistical ecosystem.

## Chapter 2

# Global and Regional Context

### 2.1 The Role of Big Data and AI in Societal Transformation

The convergence of Big Data and Artificial Intelligence (AI) represents a transformative shift in how societies function, make decisions, and deliver services. In the past decade, the exponential increase in data generation—driven by mobile phones, social media, satellite technologies, sensors, and digital transactions—has created both opportunities and challenges for governance, development, and economic growth. The capacity to collect, process, and analyze these massive datasets enables new modes of real-time insight and adaptive policy design [MSC13].

In the context of public administration, Big Data enhances decision-making by revealing granular patterns in health, mobility, education, agriculture, and employment. For example, AI models using telecom-derived mobility data have been used to guide pandemic response and traffic management. In agriculture, satellite data combined with machine learning supports yield prediction and drought early warning systems. These innovations, increasingly integrated into national statistics and planning, help governments transition from reactive to predictive governance [Div22].

AI further amplifies this transformation by automating analysis, detecting anomalies, and enabling systems to “learn” from data over time. In the education sector, AI is being used to tailor learning pathways, identify at-risk learners, and improve curriculum design—contributing to more inclusive and effective learning systems [UNE21b]. In finance, AI drives digital lending and fraud detection. In the environment sector, remote sensing data processed with

deep learning supports deforestation tracking and climate adaptation strategies.

For regions like ECOWAS, the societal promise of Big Data and AI is significant. The demographic diversity, growing digital penetration, and increasing urgency to address development bottlenecks position the region to leapfrog traditional infrastructure and adopt digital-first solutions. This includes deploying AI-enhanced dashboards in ministries, linking mobile network data with poverty indicators, and enhancing agricultural productivity through precision monitoring systems. These applications are not futuristic but actively piloted in several African countries, offering replicable models for ECOWAS member states.

Nevertheless, the deployment of Big Data and AI must be accompanied by appropriate governance, legal safeguards, and ethical frameworks. Issues such as data privacy, algorithmic bias, data ownership, and the digital divide remain critical challenges. International frameworks such as the OECD’s principles for trustworthy AI and the UN’s Big Data Global Platform stress the importance of ethical standards, institutional capacity, and international collaboration [OEC22, Div22].

In line with ECOWAS Vision 2050—which prioritizes innovation, digital transformation, and regional resilience—Big Data and AI are not merely tools for modernization but enablers of equitable, responsive, and sustainable development. Their integration into statistical systems and public administration can catalyze regional integration, enhance policy agility, and support the achievement of the Sustainable Development Goals (SDGs). Thus, this framework proposes a coordinated, ethical, and scalable approach to embedding Big Data and AI across ECOWAS governance and development processes.

## 2.2 Review of Global Big Data Frameworks and Lessons Learned

Across the globe, governments and international bodies have made considerable progress in designing frameworks that guide the adoption of Big Data into public sector operations, especially in the realm of official statistics. These frameworks provide valuable reference points for ECOWAS as it develops its own regionally tailored Big Data Adoption Framework.

One of the most advanced and mature models is the **European Statistical System (ESS) Big Data Action Plan and Roadmap 2.0**, developed by Eurostat. This initiative outlines a strategic vision to integrate Big Data into European statistical production systems by investing in experimentation (e.g., sandbox environments), defining use cases, enhancing cross-border data access, and establishing quality assurance frameworks for non-traditional data sources [Eur20]. Among its key lessons is the critical importance of involving both na-

tional and regional actors in coordinated pilot projects while aligning efforts with existing legal and institutional mandates.

In Southeast Asia, the **ASEAN Framework on Digital Data Governance** offers another example of cross-country collaboration in managing digital transformation. Adopted in 2018, it introduces principles for data portability, transparency, data security, and accountability across member states, with special emphasis on cross-border data flows and trust-building between governments and private sector players [Sec18]. It underscores the role of legal harmonization and stakeholder engagement as central elements in regional digital strategies.

The **United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)** has also published a comprehensive guide for the modernization of official statistics using Big Data. Their approach stresses incremental capacity building, the development of multi-source statistical ecosystems, and the creation of institutional sandboxes to de-risk innovation [UNE21a]. This model is particularly relevant for ECOWAS, where member states show varied levels of statistical and technological maturity.

In the African context, the **African Development Bank (AfDB)** has been instrumental in strengthening national statistical systems through its *Data for Governance* initiatives. The AfDB advocates for country-led data strategies supported by regional platforms and emphasizes the integration of new data sources, including geospatial and mobile data, into national development plans [Ban22]. Lessons from these efforts highlight the importance of sustained investment in data infrastructure, partnerships with private data holders, and policy clarity around data governance.

Each of these frameworks offers insights for ECOWAS. For instance:

1. **From Europe:** The importance of structured experimentation (e.g., sandboxing), centralized guidance with decentralized implementation, and legal frameworks that support innovation.
2. **From ASEAN:** Regional coordination on data governance and the necessity of building mutual trust across borders.
3. **From UNESCAP:** The emphasis on step-by-step institutional modernization and enabling NSOs through pilot models.
4. **From AfDB and Africa:** The primacy of context-driven strategies and the need to mobilize both public and private data ecosystems.

Furthermore, international frameworks increasingly recognize that Big Data strategies must balance utility with ethics. Issues like data sovereignty, bias in AI models, and the risk of exclusion must be tackled through participatory

policy design, localized standards, and institutional checks. For ECOWAS, integrating these lessons means crafting a framework that is scalable, collaborative, and aligned with regional socio-political realities.

The ECOWAS Big Data Adoption Framework, therefore, draws from these precedents while addressing the unique infrastructural, legal, and human capital contexts of West Africa. Rather than replicate external models, it adapts them—focusing on readiness assessments, shared infrastructure, regulatory capacity, and the development of regional use cases that reflect ECOWAS’ development priorities.

## 2.3 Trends in the Statistics Profession: Global and African Perspectives

The statistics profession is undergoing profound transformation globally, shaped by technological innovation, data proliferation, and shifting demands for faster, more granular insights. Traditional statistical systems—once centered around structured survey design and censuses—are increasingly required to integrate real-time, high-frequency, and unstructured data into their workflows. This evolution is not only redefining the skill sets required of statisticians, but also reshaping institutional mandates and public expectations.

Globally, national statistical offices (NSOs) are transitioning from being *data producers* to becoming *data stewards and ecosystem facilitators*. According to the UN Statistics Division, modern statisticians must now understand data science, manage complex data partnerships, and ensure ethical standards in the application of big data and AI tools [UNE21a]. The concept of *official statistics as a service* is gaining traction, where NSOs curate, validate, and disseminate diverse data streams—including administrative, geospatial, sensor, and mobile data—to support real-time policymaking.

In this context, skill profiles are also shifting. Increasing demand is placed on data scientists, statisticians with AI/ML proficiency, data engineers, and data ethicists. Institutions like the OECD and UNECE have emphasized the integration of programming, machine learning, cloud platforms, and privacy-preserving technologies into statistical training curricula [OEC22]. These trends are reflected in global strategies to modernize statistical systems, such as the Global Statistical Geospatial Framework and the UN’s Big Data Global Platform [Div22].

In Africa, the trends are similar but more nuanced. While many NSOs still struggle with resource constraints and infrastructural gaps, there is a growing movement toward modernization and regional collaboration. The *Harmonizing and Improving Statistics in West Africa (HISWA)* project, spearheaded by the

World Bank, the African Union, and ECOWAS, exemplifies this shift. It supports not only statistical harmonization but also the use of new data sources and advanced technologies for official statistics [Ban23b].

Furthermore, African universities and research institutes are beginning to align curricula with digital-era demands. Initiatives such as UNECA’s “Big Data for Development in Africa” and the African Centre for Statistics promote interdisciplinary training that combines statistical theory with computational methods and real-world problem solving [fA22b]. These programs aim to equip statisticians with the capacity to contribute meaningfully to national planning, crisis response, and sustainable development initiatives.

However, challenges remain. Issues such as lack of reliable broadband access, insufficient funding, and limited institutional autonomy continue to inhibit innovation in many African NSOs. Moreover, brain drain—where skilled statisticians migrate to private or international organizations—undermines national statistical capacity.

Despite these hurdles, the trajectory is clear: the statistics profession in Africa is moving toward greater dynamism, interdisciplinarity, and regional coordination. For ECOWAS, this trend offers a critical opportunity. By embedding these emerging professional standards into its Big Data Adoption Framework, ECOWAS can ensure that its member states develop a modern, resilient, and trusted statistical community that is capable of navigating the demands of the data-rich 21st century.

## 2.4 Case Studies of Big Data and AI Applications (ECOWAS, Africa, Global)

The application of Big Data and Artificial Intelligence (AI) across the world offers compelling case studies that highlight both the promise and complexity of integrating these technologies into development planning, public service delivery, and governance.

### 2.4.1 ECOWAS Region

In Nigeria, the National Bureau of Statistics (NBS) collaborated with mobile network operators and development partners to leverage *Call Detail Records (CDRs)* for urban mobility and poverty mapping. These datasets allowed for the construction of real-time commuter profiles and identification of underserved areas in urban planning exercises. The integration of mobile phone data has improved both the timeliness and granularity of transport-related statistics [Ban23b].

In Côte d’Ivoire, the telecom regulator ARTCI piloted the use of CDRs during the COVID-19 pandemic to monitor mobility trends and inform contain-

ment measures. The anonymized data helped assess compliance with lockdown directives and supported early warning systems for infection hotspots [fA22b]. Similarly, Ghana’s Statistical Service has used AI-based text mining tools on social media and news streams to monitor public sentiment on government health and education policies.

### 2.4.2 Africa-Wide Initiatives

The African Development Bank (AfDB) supported Kenya, Rwanda, and Tunisia in launching national *data innovation labs*—spaces where NSOs, start-ups, and research institutions co-develop digital solutions for pressing challenges. These labs facilitate rapid prototyping of data-driven services, such as agricultural early warning systems and automated land use classification from satellite imagery [Ban22].

In South Africa, the Department of Social Development applied machine learning models to integrate data from health, education, and housing sectors to identify vulnerable households for social grant distribution. This project drastically improved targeting accuracy while reducing administrative costs. Ethiopia and Malawi, on the other hand, have successfully used AI-driven drought monitoring systems using multispectral satellite data and meteorological feeds to activate pre-emptive food relief programs.

UNECA’s work on the Africa Information Highway (AIH)—an open data platform that links national databases from over 50 African countries—demonstrates the growing emphasis on cross-border data integration and harmonization for macroeconomic planning and continental reporting [fA22b].

### 2.4.3 Global Perspectives

In the European Union, the ESS Big Data Task Team facilitated the use of scanner data, web scraping, and mobile app data in compiling inflation statistics, especially during disruptions caused by the COVID-19 pandemic [Eur20]. Eurostat’s sandbox environment also enabled member states to test AI tools on satellite and administrative data for agricultural statistics and labor force estimations.

In India, the Aadhaar program—one of the world’s largest biometric identity systems—has enabled integration of AI and Big Data in the delivery of public services. AI models use transaction and geolocation data to predict eligibility and detect anomalies in social welfare distribution, minimizing fraud and enhancing inclusiveness [Ban18].

In Latin America, Chile and Colombia have adopted AI-powered tax monitoring systems that analyze digital transactions, invoices, and banking patterns to reduce tax evasion. These systems are now considered best practices and are



being shared with other emerging economies through South-South cooperation platforms.

These case studies demonstrate the potential of Big Data and AI when applied responsibly, collaboratively, and contextually. For ECOWAS, the emerging pattern is clear: success depends on strong governance, cross-sector partnerships, localized capacity, and secure access to high-quality data.

## Chapter 3

# Stakeholder Engagement

### 3.1 Workshop Overview and Objectives

As part of the development of the ECOWAS Big Data Adoption Framework, an experience-sharing workshop was convened from April 28 to May 2, 2025, in Lomé, Togo. The workshop brought together a diverse group of stakeholders, including representatives from national statistics offices (NSOs), mobile network operators (MNOs), telecommunications regulators, academia, regional and international organizations, and development institutions. This multi-stakeholder engagement was critical to ensuring that the framework reflects regional realities, institutional capacities, and practical pathways for implementation.

The overarching objective of the workshop was to collectively explore the opportunities, risks, and operational considerations involved in integrating Big Data into the statistical ecosystems of ECOWAS member states. The discussions were anchored around the strategic alignment of the framework with ECOWAS Vision 2050 and the Sustainable Development Goals (SDGs), while maintaining sensitivity to legal, ethical, and infrastructural disparities across countries.

More specifically, the workshop aimed to:

1. Identify and document current use cases of Big Data across member states.
2. Assess institutional readiness and infrastructure capabilities for big data adoption.
3. Collect expert and institutional input on governance models, legal frameworks, and ethical safeguards.
4. Propose cross-sector collaboration mechanisms between NSOs, MNOs, regulators, and academia.

5. Validate the key pillars and components proposed for the regional framework.

A significant feature of the workshop was its participatory format, starting with the resource person’s presentation to technical and non-technical presentations from all stakeholders, and survey-based feedback collection. This design allowed delegates not only to share existing initiatives but also to express aspirations, challenges, and conditions for success. The workshop also served to highlight common concerns around data privacy, institutional roles, compensation mechanisms, and capacity building—areas that would later shape the structure and orientation of the proposed framework.

The engagement underscored the regional appetite for a harmonized approach to Big Data that remains adaptable to national contexts. The next sections present the voices of the delegates, their experiences, and the thematic contributions that emerged from this landmark gathering.

## 3.2 Voices of the Delegates: Insights, Aspirations, and Challenges

The feedback collected during the stakeholder engagement workshop provided a rich source of insight into the diverse expectations, priorities, and apprehensions of participants. Stakeholders spoke candidly about both the promise and the practical complexities of Big Data integration in West Africa. Thematic analysis of the responses revealed five dominant concerns: capacity development, data governance, institutional collaboration, technical readiness, and ethical safeguards.

### 3.2.1 Aspirations for Capacity and Infrastructure

A recurring theme across responses was the urgent need for capacity building and infrastructure development. Delegates recognized that many National Statistics Offices (NSOs) still lack the tools, skills, and systems required to handle high-frequency, high-volume data. One respondent emphasized, *“A curriculum can be outlined in partnership with universities... Hands-on training should be organized frequently to equip member states with the latest tools”*. This sentiment was echoed by others who called for dedicated investment in cloud platforms, AI tools, and data engineering skills.

### 3.2.2 Desire for Regional Coherence and Shared Vision

Many delegates expressed the importance of having a common framework that promotes regional coherence while allowing national adaptation. As one stakeholder put it, *“We can help distinguish between use cases that are for national policy, and those that should be scaled regionally. This clarity is essential for*

*sustainable implementation.*” The desire for a shared roadmap—one that balances innovation with structure—was consistently voiced.

### 3.2.3 Concerns Around Governance and Ethical Use

Stakeholders were particularly vocal about the need for robust governance mechanisms and safeguards to protect data privacy. Multiple participants emphasized the necessity of clarifying roles and responsibilities among NSOs, MNOs, and regulators. A compelling contribution from a delegate in Côte d’Ivoire stated: *“The regulatory framework must assign confidentiality and accountability roles across all actors... and the infrastructure must ensure secure anonymization of CDRs before they are processed or shared.”* Another delegate warned of the *“risk of data leakage”* and urged the framework to provide not only technical solutions, but also legal instruments to mitigate such threats.

### 3.2.4 Incentivization and Trust-Building

Several MNOs and regulators raised questions around incentives for participation in data-sharing ecosystems. While some expressed openness to non-monetary compensation—such as access to training or policy consultation—others indicated a preference for structured agreements. A Nigerian delegate noted, *“As a regulator of the communications industry, we balance the safeguarding of data with the need to support national development. Our contribution to harmonization can be significant—if we are formally integrated into the framework.”*

### 3.2.5 Innovation and Experimentation

Stakeholders also championed innovation and experimentation, proposing sandboxes, innovation labs, and pilot programs to test Big Data use cases in real-time. One contributor proposed a detailed plan for a regional sandbox environment, including cloud-based access to open datasets and open-source tools. This was complemented by another delegate who wrote: *“We need labs where NSO staff, researchers, and startups can co-create solutions—not just theoretical policies.”*

These voices underscored not just the technical dimensions of the Big Data framework, but also its social and institutional dimensions. The workshop was a powerful reminder that while infrastructure and tools matter, the success of any regional data framework depends fundamentally on the people, institutions, and partnerships behind it.

## 3.3 Experiences and Contributions from Member States

During the workshop, representatives from ECOWAS member states shared concrete examples of their national engagements with Big Data and offered strate-

gic contributions to the regional framework. Their input revealed an evolving ecosystem across the region—one marked by varying levels of readiness, unique innovations, and a strong appetite for structured collaboration.

### 3.3.1 Nigeria

Nigeria’s contributions were particularly multifaceted. A representative from the Nigerian Communications Commission (NCC) emphasized the importance of regulatory involvement in Big Data governance. They noted: *“As a regulator of the communications industry, we have the unique balance of safeguarding consumers’ mobile phone data and supporting the development of policies and statistics for the digital economy in Nigeria.”* The NCC offered access to a centralized, one-stop platform for MNO data and emphasized the need for a harmonized structure for compensation and legal clarity.

Additionally, a delegate from the National Bureau of Statistics (NBS) proposed a comprehensive strategy for regional sandbox environments. They recommended the creation of a *shared experimental platform with curated datasets, open-source tools (e.g., Spark, Python, Jupyter), and scheduled data pipelines.* This sandbox would support cross-border collaboration, promote standardization, and enable NSOs to pilot hybrid models combining survey and Big Data methods.

### 3.3.2 Benin

Benin offered valuable insights from both statistical and regulatory institutions. A delegate from INStAD (Institut National de la Statistique et de la Démographie) proposed an inter-agency data governance model: *“The data and the ETL process should be reviewed and validated by a project team with data scientists, engineers, regulators, and demographers from NSOs, MNOs, and regulatory bodies.”* They stressed the importance of protecting personally identifiable data and recommended revising legal frameworks to impose accountability and confidentiality obligations across stakeholders.

A second delegate from the Ministry of Digital Affairs proposed leveraging existing planning mechanisms and advocated for state-sponsored funding to support operator participation. The representative from ARCEP Benin emphasized the need for building public trust through institutional transparency and the professionalization of data management.

### 3.3.3 Côte d’Ivoire

Côte d’Ivoire presented one of the most detailed national case studies. The telecom regulator (ARTCI) shared insights from the country’s use of mobile data during the COVID-19 response. Their model involved MNOs anonymizing and preprocessing data before handing it to the regulator for aggregation and analysis—a flow that aligned with national privacy laws. They recommended

the institutionalization of such processes and proposed that regional frameworks provide templates for technical flows and legal contracts.

A delegate also emphasized the need for a *unique identification number (NIN)* linked to national ID systems to enhance data interoperability. They proposed integrating demographic, telecom, and administrative data to improve data quality and reduce redundancy.

### **3.3.4 Guinea and Gambia**

Guinea’s INS reported ongoing efforts to modernize internal data systems and shared their experience in cross-ministerial collaboration. Their contribution focused on strengthening national capacity through curriculum development and strategic planning: *“A curriculum can be outlined in partnership with universities based on an assessment of each member state’s current capacities.”*

From The Gambia, the Bureau of Statistics reported the application of CDR data in mobility studies and called for better legal frameworks and staff training. The Public Utilities Regulatory Authority offered ICT infrastructure support and advocated for data security audits to be integrated into framework rollouts.

### **3.3.5 Liberia and Mali**

Liberia’s representatives from MTN and ORANGE Liberia showcased successful partnerships with their national statistical office. They provided anonymized, aggregated data for public health, urban planning, and digital lending. They expressed strong interest in participating in the regional framework, especially under structured legal agreements and technical support mechanisms.

Mali’s AFRISTAT emphasized the role of regional coordination in operationalizing innovations and offered to support capacity building and readiness assessments. Their feedback reflected institutional trust and long-term engagement with national partners.

### **3.3.6 Mauritania, Senegal, and Ethiopia**

Mauritania’s statistical agency emphasized data protection, proposing mandatory anonymization of CDRs before transmission to regulators or NSOs. Senegal’s ORANGE office recommended the use of federated models where raw data remains with MNOs, and only aggregated indicators are shared. From Ethiopia, the United Nations Economic Commission for Africa (UNECA) offered technical support, including access to digital policy templates and peer-learning networks.

### **3.3.7 Pan-African and Regional Institutions**

UNECA, African Development Bank, and other regional bodies echoed the need for cross-country experimentation, grant mechanisms for innovation, and the inclusion of universities in prototype development. One respondent wrote:

*“We need labs where NSO staff, researchers, and startups can co-create solutions—not just theoretical policies.”* The call for institutional sandboxes and real-world pilot environments was common among African and international contributors alike.

### 3.3.8 Synthesis of National Experiences

Overall, the contributions from member states reveal:

1. Broad support for a harmonized regional framework.
2. Demand for localized pilots, experimentation labs, and curriculum alignment.
3. An emerging consensus around the importance of governance, legal reform, and shared infrastructure.
4. A willingness among MNOs and regulators to contribute, provided that incentives and data safeguards are in place.

These national experiences form the foundation of the ECOWAS Big Data Framework, reflecting both regional aspirations and practical realities. The next section focuses on the views of industry, academia, and development partners who reinforced and extended these contributions.

## 3.4 Perspectives from Industry, Academia, and Development Partners

In addition to national governments and statistical offices, the development of the ECOWAS Big Data Framework has been enriched by the participation of industry stakeholders (especially Mobile Network Operators), academic institutions, and development partners. Their perspectives provide a broader ecosystem view—one that accounts for technological feasibility, innovation pathways, regulatory expectations, and sustainable partnerships. These actors emphasized actionable strategies for operationalizing the framework, grounded in real-world implementation experience.

### 3.4.1 Mobile Network Operators (MNOs)

MNOs are central to the Big Data ecosystem, as they control some of the most valuable datasets for official statistics—Call Detail Records (CDRs), geolocation patterns, and customer usage data. Participants from MTN Nigeria, Orange Côte d’Ivoire, QCell Gambia, Moov Africa Mali, Globacom, and Africell Gambia brought forward critical considerations around access, privacy, compensation, and interoperability.

A recurring recommendation was the adoption of a **federated data model**, wherein MNOs retain raw data while sharing pre-aggregated, anonymized indicators with authorized institutions. This model reduces risks related to data breaches and regulatory violations. As one MNO delegate remarked: *“Operational simplicity must be built into the framework—automated pipelines, pre-defined KPIs, and secure APIs are non-negotiables if MNOs are to participate meaningfully.”*

There was strong consensus that compensation models should not be strictly financial. MNOs expressed openness to receiving access to analytical insights, capacity-building programs, and enhanced regulatory alignment as forms of value exchange. A participant noted: *“Our contribution is not just data—we offer technical infrastructure, engineering expertise, and continuous service delivery. We need this acknowledged and structured.”*

MNOs also highlighted their role during public health crises. One cited experience included the sharing of anonymized mobility data during the COVID-19 pandemic to support epidemiological modeling. Others reported use cases in urban planning, financial inclusion (e.g., airtime credit scoring), and energy grid optimization. These existing engagements demonstrate MNOs’ willingness and ability to support national priorities, provided safeguards and frameworks are clearly articulated.

### 3.4.2 Regulators and Data Protection Authorities

Participants from telecommunications and ICT regulatory agencies—such as ARCEP Benin, ARTCI Côte d’Ivoire, and the Gambia Public Utilities Regulatory Authority—offered strategic input on legal and procedural matters. They emphasized that any regional Big Data initiative must operate within clear legal mandates, particularly in relation to data privacy laws, national identification systems, and regulatory jurisdiction.

A senior representative stressed the need for *inter-institutional memoranda of understanding* (MoUs) to clearly delineate data flows and responsibilities. Another delegate from Côte d’Ivoire noted: *“Only the regulator has legal authority to request data from operators. That data must be anonymized before transmission, and the regulator is responsible for secure storage, aggregation, and ethical use.”*

Regulators advocated for the creation of compliance frameworks within the regional model, including:

1. Pre-approved data schemas and data use protocols.
2. Third-party audits for data handling infrastructure.
3. Joint legal reviews and legislative modernization at the national level.



### 3.4.3 Academic and Research Institutions

Academia played a vital role in the workshop, with delegates from universities and applied research centers across the region—including ENEAM (Benin), INP-HB (Côte d’Ivoire), and Nasarawa State University (Nigeria)—offering both theoretical insight and practical collaboration proposals.

One academic contribution stood out for proposing the integration of Big Data into national educational curricula: *“Universities must partner with statistical offices to train the next generation of data scientists. We need accredited programs that focus on Big Data engineering, ethical AI, and statistical programming.”* Others called for joint research projects between universities and NSOs, especially around high-priority use cases such as digital economy measurement, agricultural forecasting, and urban analytics.

Furthermore, the academic community expressed strong interest in participating in innovation labs and sandbox environments. Several delegates emphasized that universities should not be seen only as training institutions but also as **co-creators of policy and tools**. One noted: *“We can contribute not just skills but also frameworks for anonymization, quality assurance, and citizen-centric design.”*

### 3.4.4 Development Partners and Regional Organizations

Development institutions—including the African Development Bank (AfDB), United Nations Economic Commission for Africa (UNECA), and United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)—shared valuable perspectives based on their experience in supporting statistical modernization efforts across Africa and Asia.

UNECA, in particular, highlighted its *Big Data for Development in Africa* program, which provides templates for governance structures, use case libraries, and implementation toolkits. They offered to support ECOWAS through technical assistance, access to regional datasets, and peer-learning platforms. AfDB representatives echoed this by offering advisory services on statistical ecosystem diagnostics and funding support for data innovation labs.

These development partners emphasized the importance of:

1. Ensuring donor alignment to avoid duplication and fatigue.
2. Prioritizing sustainability and government ownership from the outset.
3. Adopting *modular frameworks* that allow gradual participation from low-capacity countries.

One notable quote captured the sentiment of this group: *“We are here not just to fund solutions but to co-develop them—based on evidence, collaboration,*

*and respect for data sovereignty.”*

### 3.4.5 Key Takeaways

Collectively, the perspectives of industry, academia, and development partners reinforced several themes:

1. The importance of trust-building and mutual accountability in data partnerships.
2. The strategic value of multi-stakeholder labs and sandboxes to co-design policies, tools, and services.
3. The need for a clear, enforceable regional legal architecture for Big Data governance.
4. A strong appetite for regional training programs, academic collaboration, and public-private data-sharing models.

Their inputs significantly shaped the institutional and operational components of the ECOWAS Big Data Framework. **These actors will be essential partners not only in implementing the framework but also in sustaining its impact.**

## Chapter 4

# The ECOWAS Big Data Framework

### 4.1 Guiding Principles and Strategic Alignment

The ECOWAS Big Data Adoption Framework is designed as a forward-looking, inclusive, and context-sensitive instrument for accelerating the use of Big Data across the region. Its formulation is grounded in core guiding principles that ensure its relevance, resilience, and sustainability across diverse member state contexts. These principles have been shaped by a combination of stakeholder feedback, global best practices, and continental policy agendas.

#### 4.1.1 Guiding Principles

1. **Inclusivity and Regional Equity:** The framework is structured to accommodate countries at various stages of digital and statistical maturity. A modular, tiered approach enables both high-capacity and low-capacity member states to engage meaningfully.
2. **Ethical Data Governance:** The framework adheres to strong principles of privacy, security, and responsible data use. All data flows are expected to be compliant with national laws, regional data protection instruments, and international standards such as the GDPR.
3. **Interoperability and Standardization:** To facilitate cross-border data flows and collaborative analytics, the framework encourages the use of shared data schemas, metadata standards, and federated system designs.
4. **Evidence-Driven Policy and Innovation:** The framework is not only a statistical strategy but also a policy-enabling tool that supports adaptive governance, economic planning, and social development through timely insights.

5. **Public-Private-Academic Collaboration:** Building on the workshop’s insights, the framework is grounded in the belief that innovation emerges from co-creation among government, industry, academia, and civil society.
6. **Scalability and Sustainability:** Designed to evolve with technological advancements, the framework proposes phased rollouts, continuous learning mechanisms, and self-sustaining ecosystems such as innovation labs and regional sandboxes.

### 4.1.2 Strategic Alignment with Regional and Global Goals

The framework aligns strongly with the ECOWAS Vision 2050, particularly its pillars on digital transformation, economic integration, governance, and youth empowerment [ECO22]. It supports the African Union’s Digital Transformation Strategy (2020–2030) [Afr20] and contributes to the United Nations’ Sustainable Development Goals (SDGs) by improving data for health, education, infrastructure, and inequality metrics.

Moreover, the framework reflects lessons learned from other regional models:

- *From the EU:* Sandboxing and agile governance through the ESS Big Data Action Plan [Eur20].
- *From ASEAN:* Regional digital trust-building and standardized cross-border data governance [Sec18].
- *From UNESCAP:* Tiered capacity development models to support varied readiness levels [UNE21a].
- *From Africa:* The importance of institutional resilience, political will, and citizen-facing innovations [fA22b, Ban22].

### 4.1.3 Visualizing the Principles in Action

The diagram below illustrates how the guiding principles serve as the foundational layer upon which the framework’s operational pillars rest. Each principle feeds directly into core components such as governance, infrastructure, and capacity building.

The ECOWAS Big Data Framework does not aim to replace national strategies but to amplify and harmonize them. It offers shared tools, templates, governance norms, and technical pathways that member states can adapt to their local contexts. Through this coordinated yet flexible approach, the framework seeks to build a connected, capable, and confident ECOWAS data ecosystem—ready to harness the power of Big Data for transformative impact.

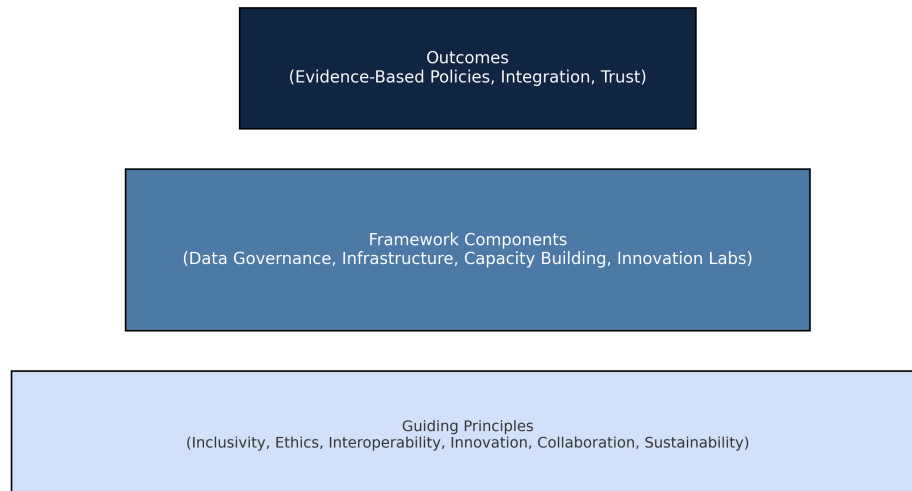


Figure 4.1: Guiding Principles as the Foundation of the ECOWAS Big Data Framework

## 4.2 Key Objectives and Value Propositions

The ECOWAS Big Data Framework is driven by the imperative to transform the region’s data ecosystem into one that is adaptive, ethical, inclusive, and evidence-driven. To this end, the framework outlines six core objectives that reflect the strategic intent of ECOWAS to leverage data as an enabler of development, integration, and governance.

### 4.2.1 Key Objectives

1. **Enhance Statistical Capacity and Timeliness:** Empower National Statistics Offices (NSOs) and regional agencies to complement traditional data sources with alternative data streams (e.g., mobile, geospatial, administrative) to deliver faster, more granular, and real-time insights.
2. **Institutionalize Data Governance and Legal Clarity:** Establish a harmonized regional legal framework that defines roles, responsibilities, standards, and safeguards for data sharing, processing, and use—especially with respect to personal data, commercial data, and public interest.
3. **Develop Shared Infrastructure and Data Services:** Facilitate access to regional infrastructure, including cloud-based sandboxes, data warehouses, secure APIs, and metadata repositories that enable cost-effective, cross-border collaboration.
4. **Foster Innovation and Research:** Support the creation of data innovation labs, AI-powered applications, open-source tools, and interdisci-

plinary research networks that accelerate experimentation and knowledge generation.

5. **Promote Interoperability and Integration:** Define and promote the use of standardized data formats, taxonomies, and processing protocols to ensure that data flows smoothly between institutions and jurisdictions.
6. **Ensure Sustainability and Institutional Ownership:** Embed the framework within national planning processes, budget cycles, and human capital strategies to ensure it is not donor-dependent but nationally owned and regionally coordinated.

#### 4.2.2 Value Propositions

The framework provides multiple layers of value to different stakeholder groups. These propositions reflect both short-term utility and long-term impact.

##### 4.2.2.1 For Governments and NSOs

1. Faster and more accurate data to inform social policy, disaster response, infrastructure planning, and macroeconomic analysis.
2. Institutional templates and legal instruments to build trust and enforce data ethics.
3. Capacity-building programs tailored to national readiness levels.

##### 4.2.2.2 For Mobile Network Operators and Industry Partners

1. Structured pathways to contribute data in line with regulatory expectations and data protection laws.
2. Access to regional data insights and participation in co-developed public-private products (e.g., early warning systems, digital ID integrations).
3. Recognition and integration as key contributors to regional development.

##### 4.2.2.3 For Academia and Research Institutions

1. New avenues for research funding, curriculum development, and prototype development through regional data labs and fellowships.
2. Participation in data stewardship models and national advisory panels.

#### 4.2.2.4 For Development Partners and International Organizations

1. A ready-made, stakeholder-endorsed architecture for investing in digital public goods.
2. Monitoring tools and dashboards that improve the accountability and visibility of investments.
3. Opportunities to scale successful pilots across multiple countries with aligned governance mechanisms.

#### 4.2.3 Strategic Fit

The framework’s objectives are strategically aligned with:

1. **ECOWAS Vision 2050:** Supporting digital integration, responsive governance, and inclusive growth.
2. **UN SDGs:** Strengthening data for development across health (SDG 3), education (SDG 4), innovation (SDG 9), and partnerships (SDG 17).
3. **AU Agenda 2063:** Contributing to a knowledge-based African economy powered by technology and youth innovation.

This alignment ensures that the value delivered by the framework is not only operational but transformative—building a foundation for resilient, informed, and people-centered governance in West Africa.

### 4.3 Components of the Framework

The ECOWAS Big Data Framework is organized into seven interlinked components, each addressing a core functional area required to operationalize Big Data across member states. These components are informed by empirical feedback from stakeholders, technical insights from regional case studies, and global best practices in data governance and innovation.

Each component is designed to be modular, scalable, and adaptable—ensuring that countries at different stages of readiness can engage progressively while contributing to a coherent regional data ecosystem. The following diagram illustrates the high-level architecture of the framework:

The components are as follows:

1. **Regional Vision and Strategic Alignment:** Articulates a unified long-term vision that aligns with ECOWAS Vision 2050 and the digital transformation strategies of member states. It provides the conceptual and political coherence necessary for cross-country collaboration and harmonization.

### Core Components of the ECOWAS Big Data Framework



Figure 4.2: Core Components of the ECOWAS Big Data Framework

2. **Readiness and Capability Assessment:** Provides diagnostic tools to assess member states' technical, legal, and institutional preparedness for Big Data adoption. This enables tailored support and phased participation.
3. **Use Case Prioritization with Regional Relevance:** Establishes a method for selecting high-impact, scalable use cases that reflect the development priorities of ECOWAS (e.g., health surveillance, urban mobility, food security, digital economy).
4. **Technology and Infrastructure Development:** Outlines technical architectures, including data sandboxes, cloud services, APIs, and open-source toolkits that support the secure and efficient processing of Big Data.
5. **Governance, Legal, Data Security, and Ethical Frameworks:** Provides standardized legal templates, governance protocols, and privacy-preserving mechanisms to ensure trust, compliance, and ethical use of data.



6. **Pilot Implementation and Regional Scaling:** Describes pathways for designing, executing, and scaling pilot programs in member states, fostering innovation while managing operational risk.
7. **Sustainability, Monitoring, and Innovation:** Proposes mechanisms for long-term viability, including financial models, institutional ownership, monitoring indicators, and research partnerships.

In the sections that follow, each component is elaborated in detail. Together, they form a holistic roadmap for unlocking the value of Big Data in West Africa—building not only statistical capacity but also regional integration, innovation, and evidence-informed governance.

### 4.3.1 Regional Vision and Strategic Alignment

A robust regional vision is foundational to the ECOWAS Big Data Framework. It ensures coherence across national strategies, supports cross-border collaboration, and articulates a collective ambition for the use of Big Data to advance development, resilience, and integration.

This component aligns the framework with the strategic priorities outlined in *ECOWAS Vision 2050: The ECOWAS We Want* [ECO22], which envisions a peaceful, prosperous, and integrated West Africa underpinned by innovation, digital transformation, and evidence-based governance. The framework is also closely tied to the African Union’s Agenda 2063 and the UN Sustainable Development Goals (SDGs), particularly in terms of inclusive growth, public sector modernization, and digital infrastructure.

#### 4.3.1.1 Key Functions of this Component

1. **Vision Setting:** Establishes a shared understanding among ECOWAS member states of how Big Data can drive regional transformation and strengthen governance.
2. **Strategic Framing:** Ensures alignment between the regional Big Data strategy and national development plans, digital economy strategies, and statistical roadmaps.
3. **Harmonization of Objectives:** Enables alignment of key focus areas (e.g., health, mobility, agriculture, education) with regionally agreed-upon indicators and development targets.
4. **Political Mobilization:** Secures high-level buy-in and sustained commitment from political, administrative, and institutional leaders across the region.
5. **Messaging and Communication:** Provides a unified narrative that promotes the role of Big Data as a public good and development catalyst, fostering support from citizens, donors, and private sector stakeholders.

#### 4.3.1.2 Strategic Anchors and Cross-Regional Synergies

This component does not exist in isolation. It connects with and amplifies multiple existing agendas:

**ECOWAS Vision 2050:** Supports Pillars 2 (Governance and Rule of Law), 3 (Economic Integration and Interconnectivity), and 4 (Transformation and Inclusive Development).

**AU Digital Transformation Strategy (2020–2030):** Advances the continental agenda for digital governance, innovation, and skills development [Afr20].

**UN SDGs:** Enables more timely, disaggregated, and real-time data to monitor progress on SDGs, particularly 3 (Good Health), 4 (Quality Education), 9 (Industry, Innovation and Infrastructure), and 17 (Partnerships for the Goals).

**Regional Digital Economy Blueprints:** Builds synergy with national and regional strategies on digital economy, e-government, and ICT infrastructure.

#### 4.3.1.3 Stakeholder Alignment and Voices

Feedback from workshop participants reinforced the need for a shared regional vision. As one delegate from Nigeria noted: *“We need to move from fragmented efforts to collective ambition. The regional framework gives us a common language, purpose, and set of tools.”* Another participant from Côte d’Ivoire emphasized the importance of harmonizing digital laws: *“The vision should include legal interoperability—what works for one country must be translatable across borders.”*

#### 4.3.1.4 Outcome and Deliverables

This component produces a high-level **Strategic Vision Statement** for Big Data in ECOWAS, which:

1. Frames regional priorities.
2. Serves as a preamble to national-level Big Data strategies.
3. Anchors communication, advocacy, and policy efforts.
4. Guides the sequencing of technical and governance interventions across the framework.

By setting a unified direction of travel, this component ensures that Big Data is not simply treated as a technical novelty, but as a regional strategic asset—one that enables integration, equity, and evidence-based leadership.

### 4.3.2 Readiness and Capability Assessment

Effective implementation of the ECOWAS Big Data Framework requires a clear understanding of where each member state currently stands in terms of institutional, legal, technical, and human capacity. This component introduces a structured readiness and capability assessment model to identify strengths, gaps, and tailored pathways for participation.

#### 4.3.2.1 Purpose and Rationale

ECOWAS member states vary significantly in their digital infrastructure, availability of skilled personnel, legal provisions for data governance, and experience with non-traditional data sources. A one-size-fits-all implementation plan would therefore be impractical and inequitable. Instead, this component proposes a diagnostic toolset that enables:

1. Customized technical assistance and support based on country-specific conditions.
2. Prioritization of investments in infrastructure, training, and institutional reform.
3. Targeted piloting of use cases based on feasibility and risk assessment.
4. Monitoring of capacity improvement over time.

#### 4.3.2.2 Readiness Assessment Framework

The proposed assessment model comprises five dimensions:

##### 1. Institutional and Legal Readiness:

- (a) Presence of legal frameworks for data protection and sharing.
- (b) Existing mandates of NSOs to use alternative data.
- (c) Inter-agency coordination mechanisms (e.g., NSO–Regulator–MNO MoUs).

##### 2. Technical Infrastructure:

- (a) Access to cloud infrastructure, sandbox environments, secure APIs.
- (b) Data storage, anonymization, and processing capabilities.
- (c) Use of open-source data platforms and ETL pipelines.

##### 3. Human Capital and Skills:

- (a) Availability of data scientists, engineers, statisticians with AI/ML expertise.
- (b) Training programs and university curricula aligned with Big Data competencies.

- (c) Capacity of regulators to manage compliance and data quality.

#### 4. **Operational Experience:**

- (a) Past or ongoing use of Big Data in official statistics or policymaking.
- (b) Existence of innovation labs, pilot studies, or public-private partnerships.

#### 5. **Political and Financial Commitment:**

- (a) Presence of national digital transformation or open data strategies.
- (b) Budgetary allocations for statistical and ICT modernization.
- (c) Engagement in regional initiatives such as HISWA or Smart Africa.

##### 4.3.2.3 **Stakeholder Feedback**

Several delegates emphasized the necessity of tiered participation. As one participant from Guinea noted: “*Member states need to be assessed not to rank them, but to identify realistic starting points.*” Another, from Benin, suggested linking readiness assessments to funding eligibility: “*It should guide resource allocation—not only diagnose problems.*” Others called for self-assessment tools to be developed in collaboration with academic institutions.

##### 4.3.2.4 **Output and Tools**

The readiness component will produce a standardized diagnostic toolset comprising:

1. A **Readiness Index** scorecard and dashboard for internal benchmarking.
2. A **Country Readiness Profile** for each ECOWAS member state.
3. A set of **Technical Assistance Pathways**, mapped to readiness tiers (e.g., foundational, intermediate, advanced).

These outputs will feed directly into the implementation strategy and pilot planning process, ensuring that no country is left behind and that investments in capacity building are data-driven.

##### 4.3.2.5 **Strategic Benefit**

This component will:

1. De-risk implementation by aligning support to readiness.
2. Enable cross-country mentorship and shared learning.
3. Provide baseline indicators for monitoring capacity growth over time.
4. Guide the formation of regional innovation clusters and sandboxes.

In summary, the Readiness and Capability Assessment component ensures that the ECOWAS Big Data Framework is grounded in practical realities, while enabling every member state to participate progressively and meaningfully.

### 4.3.3 Use Case Prioritization with Regional Relevance

A key objective of the ECOWAS Big Data Framework is to identify and scale the most impactful and feasible use cases for Big Data across member states. This component presents a methodology for selecting use cases based on regional priorities, institutional capacity, and the availability of data, while encouraging co-creation and experimentation.

#### 4.3.3.1 Why Use Case Prioritization Matters

Given the diversity of needs and resources across ECOWAS countries, not all use cases can or should be pursued simultaneously. Prioritizing use cases helps:

1. Focus limited resources on high-impact domains.
2. Avoid duplication and fragmentation of efforts.
3. Ensure regional comparability of indicators and outcomes.
4. Facilitate cross-border pilot programs and shared learning.

#### 4.3.3.2 Criteria for Use Case Selection

The framework proposes a transparent and iterative process for prioritization, based on the following criteria:

1. **Development Relevance:** Alignment with national development plans, ECOWAS Vision 2050, and the UN SDGs.
2. **Feasibility:** Availability of data sources (e.g., CDRs, satellite, social media), readiness of institutions, and maturity of technology.
3. **Cross-Border Scalability:** Applicability in multiple countries and potential for regional comparability or coordination.
4. **Innovation Potential:** Scope for AI, machine learning, and advanced analytics to generate new insights.
5. **Public Value:** Potential to improve governance, service delivery, crisis response, or economic opportunity.

#### 4.3.3.3 Proposed Priority Use Case Clusters

Based on stakeholder input, policy priorities, and feasibility analysis, the framework recommends the following thematic clusters of priority use cases:

1. **Health and Epidemiology:** Use of CDRs, geolocation, and search trends to monitor disease outbreaks, vaccine uptake, and healthcare access.
2. **Urban Mobility and Infrastructure:** Analysis of mobile phone data and GPS signals to map congestion zones, plan public transport, and optimize infrastructure investments.
3. **Agriculture and Food Security:** Integration of satellite imagery, weather data, and AI models to predict crop yields, detect droughts, and guide input distribution.
4. **Economic Inclusion and Informality:** Use of mobile money data, air-time usage, and retail transactions to track informal sector dynamics and extend financial services.
5. **Crisis Response and Early Warning Systems:** Rapid data collection and analytics for disaster response, forced displacement, and humanitarian targeting.
6. **Education and Human Capital:** Tracking of school attendance, remote learning patterns, and regional skills gaps using telco and platform analytics.
7. **Environmental Monitoring and Climate Adaptation:** Use of remote sensing and crowdsourced data to monitor land use, pollution, and climate risk.

#### 4.3.3.4 Stakeholder Contributions

Several participants at the workshop emphasized the importance of focusing on replicable use cases with clear public benefit. One contributor from Côte d'Ivoire noted: *"We need a regional map of use cases—some can be permanent (e.g., mobility), others can be reactive (e.g., pandemics)."* Another stakeholder proposed the formation of a joint working group to define standardized KPIs and data schemas for each approved use case.

#### 4.3.3.5 Process and Tools

The framework will support use case prioritization by offering:

1. A **Use Case Registry** maintained by the ECOWAS Commission and periodically updated through consultations.
2. A **Selection and Vetting Toolkit** with templates for feasibility assessments and stakeholder mapping.

3. **Technical and Legal Checklists** for readiness evaluation and ethical compliance.

#### **4.3.3.6 Outcomes and Value**

This component ensures that the adoption of Big Data across the ECOWAS region is grounded in meaningful applications that reflect the real needs of citizens and policymakers. It also provides a structure for experimentation and iteration, while maintaining strategic coherence across the region.

The end result will be a portfolio of validated, high-impact use cases that inform regional dashboards, feed national statistical systems, and build trust in data-driven governance.

### **4.3.4 Technology and Infrastructure Development**

Technology and infrastructure are the operational backbone of the ECOWAS Big Data Framework. Without appropriate tools, platforms, and connectivity, the most ambitious data policies cannot be translated into practice. This component provides a roadmap for building scalable, secure, and context-appropriate infrastructure to support Big Data collection, storage, processing, and sharing across the region.

#### **4.3.4.1 Core Objectives**

1. Provide member states with access to foundational digital infrastructure, including cloud storage, computing environments, secure APIs, and open-source analytics tools.
2. Promote regional standardization and interoperability through shared protocols, architecture templates, and federated systems.
3. Enable secure and privacy-preserving data exchange between stakeholders—including NSOs, MNOs, regulators, and academic institutions.
4. Support the creation of national and regional Big Data sandboxes and innovation labs.

#### **4.3.4.2 Key Infrastructure Layers**

The technical architecture is organized into four infrastructure layers:

1. **Data Ingestion and Collection Layer:**
  - (a) Secure connectors to mobile data (CDRs), satellite imagery, administrative records, social media APIs.
  - (b) Support for structured and unstructured data types.
2. **Storage and Processing Layer:**

- (a) Cloud-hosted data lakes and secure data warehouses.
- (b) Support for batch and real-time processing using ETL pipelines (e.g., Apache NiFi, Airflow).
- (c) Access-controlled data vaults for sensitive data.

### 3. Analytics and Modeling Layer:

- (a) Toolkits for statistical analysis (e.g., R, Python, Jupyter).
- (b) AI/ML libraries for classification, forecasting, and anomaly detection.
- (c) Integration with dashboard platforms (e.g., Metabase, Superset, PowerBI).

### 4. Access and Interoperability Layer:

- (a) Role-based APIs for access to aggregated datasets.
- (b) Interoperable metadata catalogs and semantic ontologies.
- (c) Federated identity and authentication services.

#### 4.3.4.3 Regional Sandbox Architecture

One of the flagship deliverables of this component is the establishment of a **Regional Big Data Sandbox**, accessible by NSOs and authorized partners. This sandbox will:

1. Provide a controlled environment for experimentation with real and synthetic data.
2. Enable pre-approved pilot projects using open-source models and anonymized datasets.
3. Include collaboration features such as version control, joint dashboards, and model repositories.

#### 4.3.4.4 Stakeholder Recommendations

Stakeholders were strongly supportive of technical investments. One participant from Nigeria proposed that *“cloud-based sandbox environments should come preloaded with satellite and telecom datasets and be accessed through secure, role-based portals.”* Another delegate noted the importance of having pre-built pipelines and starter kits to reduce the barrier to experimentation.

A representative from Côte d’Ivoire recommended mapping existing national infrastructure to avoid redundancy and allow layering rather than duplication: *“Many NSOs already have servers—we don’t need to replace them; we need to interconnect them.”*



#### 4.3.4.5 Open-Source and Vendor-Neutral Philosophy

The framework promotes a vendor-neutral and open-source-first approach. Tools like Apache Spark, PostgreSQL, Docker, CKAN, and Jupyter will be recommended for deployment to ensure accessibility, cost-effectiveness, and long-term sustainability.

Where proprietary systems are required (e.g., telecom APIs, health platforms), integration should be achieved through standardized interfaces and data interoperability protocols.

#### 4.3.4.6 Infrastructure Governance

To maintain security, accountability, and sustainability:

1. All infrastructure components must be governed by access policies aligned with national data protection laws.
2. Regular security audits and performance monitoring should be instituted.
3. Infrastructure ownership should be shared among NSOs, regional bodies, and local institutions to promote redundancy and local capacity.

#### 4.3.4.7 Strategic Output

This component will deliver:

1. An ECOWAS **Big Data Infrastructure Blueprint** adaptable by member states.
2. A fully functional **Regional Sandbox Environment** with use case templates and pre-configured tools.
3. A suite of **Reference Architectures and Playbooks** for national deployments.

By building resilient digital foundations, this component enables the entire framework to operate efficiently, securely, and at scale—across sectors, use cases, and national boundaries.

### 4.3.5 Governance, Legal, Data Security, and Ethical Frameworks

The success of Big Data initiatives depends not only on technical infrastructure but also on the presence of strong governance, legal certainty, and public trust. This component of the ECOWAS Big Data Framework establishes the policy, legal, and ethical architecture required to enable responsible data sharing and usage while ensuring compliance with national laws and international norms.

#### 4.3.5.1 Governance Principles

This component is grounded in five core governance principles:

1. **Legitimacy and Legal Mandate:** All data processing activities must fall within clear legal mandates that protect the rights of individuals and institutions.
2. **Transparency and Accountability:** All data flows, especially those involving personally identifiable or sensitive data, must be auditable and fully documented.
3. **Subsidiarity and Coordination:** National agencies retain autonomy but collaborate through clearly defined roles within a regional governance structure.
4. **Participatory Oversight:** Civil society, academia, and technical experts should be involved in governance bodies to provide oversight and legitimacy.
5. **Risk-Proportionate Security:** Data protection measures must reflect the sensitivity of the data being processed and the potential risks of misuse or breach.

#### 4.3.5.2 Legal Instruments and Templates

To support implementation, the framework provides model legal instruments including:

1. **Data Sharing Agreements (DSAs):** Templates that define scope, responsibilities, duration, and protections for cross-institutional data exchange.
2. **Memoranda of Understanding (MoUs):** Agreements between NSOs, regulators, and MNOs for joint initiatives, pilot projects, and long-term collaboration.
3. **Data Protection Clauses:** Standard language for embedding GDPR-style privacy principles into national legal systems, where such instruments do not yet exist.
4. **Compliance Checklists:** Tools for evaluating legal and institutional readiness before accessing or processing data.

#### 4.3.5.3 Security Architecture and Controls

Data security is a foundational requirement for trust. The framework outlines minimum technical standards for data management, including:

1. **Encryption Standards:** Data must be encrypted in transit and at rest using up-to-date protocols (e.g., AES-256, TLS 1.3).
2. **Role-Based Access Control (RBAC):** Access to sensitive data should be governed by roles defined in policy and enforced by technical systems.
3. **Audit Trails and Logging:** All access and usage events must be logged, monitored, and periodically reviewed.
4. **Secure APIs:** All interfaces must support authentication and data minimization principles.
5. **Incident Response Protocols:** Each institution must adopt and test a protocol for responding to data breaches or misuse.

#### 4.3.5.4 Ethical Frameworks and Public Trust

The ethical use of data is paramount. Based on the African Union Convention on Cybersecurity and Personal Data Protection (Malabo Convention), as well as international models like the OECD AI Principles and UNESCO’s ethics frameworks, the ECOWAS Big Data Framework recommends:

1. **Informed Consent and Notice:** Where feasible, individuals should be informed when their data may be used, even in aggregated or anonymized form.
2. **Bias and Fairness Audits:** AI models and automated data processing pipelines should be reviewed for potential discriminatory impacts.
3. **Representation and Justice:** Data practices should not reinforce structural inequalities or underrepresent marginalized populations.
4. **Independent Ethics Panels:** Regional or national ethics committees should oversee use cases involving sensitive data or high-stakes decisions.

#### 4.3.5.5 Stakeholder Input

Many workshop participants emphasized the importance of legal clarity and protections. A delegate from Côte d’Ivoire stated: *“The regulator must be the one to receive and manage CDRs. The MNO must anonymize the data, and only aggregated results must be shared.”* Another participant from Nigeria noted the importance of alignment with emerging regional standards: *“Our 2023 Data Protection Act aligns with ECOWAS priorities—this regional framework helps us deepen our implementation.”*

#### 4.3.5.6 Deliverables

This component will produce:

1. A comprehensive **ECOWAS Big Data Governance Manual**.
2. A suite of model **legal agreements, policy templates, and operational protocols**.
3. A catalog of **security and ethics audit tools** to support implementation and continuous improvement.

By institutionalizing governance and embedding ethical safeguards, this component ensures that the ECOWAS Big Data Framework is not only technically viable but also legally sound and socially responsible.

#### 4.3.6 Pilot Implementation and Regional Scaling

This component of the ECOWAS Big Data Framework defines a strategy for testing, validating, and scaling Big Data use cases through structured pilot programs. These pilots act as real-world laboratories—translating theory into action, surfacing implementation challenges, and building institutional momentum through hands-on experience.

##### 4.3.6.1 Objectives of the Pilot Phase

1. Test the technical, legal, and operational feasibility of selected use cases in controlled environments.
2. Build stakeholder capacity and foster institutional coordination through practice.
3. Generate evidence for refining components of the framework before full-scale deployment.
4. Identify and document lessons learned and reusable assets (e.g., data pipelines, legal templates, KPIs).
5. Demonstrate early value to secure long-term political and financial support.

##### 4.3.6.2 Pilot Design Framework

Each pilot will be co-designed by the ECOWAS Commission, participating member states, and relevant stakeholders (e.g., MNOs, regulators, academia). Pilots will follow a structured lifecycle:

1. **Use Case Selection:** From the prioritized registry (see Section 4.3.3), one or more use cases will be chosen based on readiness, data availability, and policy relevance.

2. **Institutional Alignment:** Stakeholder roles and responsibilities will be clarified through formal MoUs or collaboration agreements.
3. **Infrastructure Setup:** Technical environments—sandbox or cloud—will be provisioned and configured with data access controls and analytic tools.
4. **Execution Phase:** Data pipelines will be activated, models tested, outputs validated, and early results shared in iterative sprints.
5. **Monitoring and Documentation:** Lessons, challenges, and results will be systematically documented using standardized templates.
6. **Evaluation and Scale-readiness Assessment:** Independent or peer review will evaluate technical feasibility, institutional capacity, and public value of the pilot.

#### 4.3.6.3 Country and Regional Pathways

Pilots may be national or regional. For instance:

1. A mobility analytics pilot in Lagos, Nigeria may be scaled to Accra and Abidjan after evaluating context-specific adaptations.
2. A food security pilot using satellite and market price data in Mali may evolve into a regional early warning dashboard for the Sahel.
3. A regulatory API integration test in Senegal could feed into a continental legal interoperability protocol under the Smart Africa initiative.

To manage complexity and ensure equity, the framework will provide a tiered implementation ladder:

1. **Tier 1 – Demonstration Pilots:** Short-term, narrowly scoped initiatives in low-risk environments.
2. **Tier 2 – Operational Pilots:** Extended tests involving multiple institutions and more sensitive data.
3. **Tier 3 – Integrated Use Cases:** Multi-country implementations feeding into regional dashboards and policy mechanisms.

#### 4.3.6.4 Stakeholder Contributions

Stakeholders expressed strong support for pilot-based rollout. A delegate from Benin noted: *“Pilots allow us to experiment safely. If a model works in one country, it’s easier to adapt it with confidence in others.”* A partner from UNECA proposed a joint observatory to monitor pilot results and facilitate cross-country learning.

MNOs emphasized the need for clear protocols during pilots to protect data and avoid reputational risk. One participant remarked: *“We’re open to pilots, but they must be tightly scoped, auditable, and aligned with our data governance practices.”*

### 4.3.7 Key Outputs and Resources

Each pilot will produce:

1. A full **Pilot Implementation Report**, documenting results, stakeholder feedback, and technical artifacts.
2. A reusable **Data Toolkit**, including cleaned datasets, pipelines, and dashboard templates.
3. An updated **Readiness Profile** for participating countries.
4. A formal **Scale-up Recommendation**, identifying countries and conditions for regional replication.

#### 4.3.7.1 Strategic Role in Framework Execution

Pilots provide the vital “learning-by-doing” bridge between planning and institutionalization. They enable the ECOWAS Big Data Framework to evolve through practice, ensure credibility, and catalyze adoption by showcasing early success stories.

Through a phased and carefully supported pilot program, the framework aims to seed a new generation of data-driven public services and statistical innovations across West Africa.

### 4.3.8 Sustainability, Monitoring, and Innovation

To be transformative, the ECOWAS Big Data Framework must be more than a one-time strategy—it must be a dynamic, learning-oriented system capable of adapting to technological, institutional, and social change. This final component outlines mechanisms for sustainability, monitoring, and continuous innovation, ensuring that the framework remains relevant, effective, and resilient over time.

#### 4.3.8.1 Sustainability Pillars

The sustainability model is built on five key pillars:

1. **Institutional Ownership:** Ensure that NSOs, regulators, ministries, and ECOWAS bodies internalize framework responsibilities within their mandates and staffing plans.

2. **Financial Viability:** Diversify funding sources—including national budgets, donor contributions, private-sector partnerships, and cost-recovery models (e.g., subscription-based access to value-added dashboards).
3. **Policy Integration:** Align framework activities with national and regional development strategies to ensure political relevance and cross-ministerial support.
4. **Human Capital Development:** Invest continuously in training programs, university curricula, secondments, and regional fellowship programs.
5. **Community of Practice:** Establish a regional network of practitioners, researchers, and institutions engaged in Big Data for development—driving peer learning, tool exchange, and co-authorship.

#### 4.3.8.2 Monitoring and Evaluation (M&E) Framework

Monitoring progress is critical to accountability, learning, and improvement. The ECOWAS Big Data Framework proposes a comprehensive M&E model with the following features:

1. **Key Performance Indicators (KPIs):** Quantitative and qualitative metrics aligned to each component of the framework—e.g., number of pilots completed, data sharing agreements signed, data scientists trained, public dashboards deployed.
2. **Country Progress Reports:** Annual self-assessments and peer reviews by member states using a standardized reporting template.
3. **Regional Dashboard:** A live dashboard hosted by the ECOWAS Commission to track indicators across countries and components.
4. **Mid-Term and Final Reviews:** Independent evaluations at Year 2 and Year 5 to assess impact, course-correct, and inform future strategy.

#### 4.3.8.3 Fostering Continuous Innovation

Innovation is not a one-off product; it is a capability. This component proposes a set of permanent innovation mechanisms embedded in the framework:

1. **Data Innovation Labs:** Physical or virtual labs hosted by universities, NSOs, or regional hubs to co-create data products and explore new methods (e.g., federated learning, edge analytics, ethical AI).
2. **Challenge Funds and Hackathons:** Competitive funding rounds and regional data competitions focused on priority sectors (e.g., climate, health, education).

3. **Open Source and Public Repositories:** Shared repositories for code, data schemas, models, and visualizations to reduce duplication and accelerate collaboration.
4. **Academic-Policy Exchange Programs:** Fellowships and sabbaticals for researchers to work inside statistical agencies, and for policymakers to spend time in academic institutions.
5. **Innovation Scouting and Partnerships:** A regional mechanism for identifying promising start-ups, civic tech organizations, or private sector innovations for public deployment.

#### 4.3.8.4 Stakeholder Input and Expectations

Stakeholders repeatedly emphasized sustainability and innovation during consultations. A senior official from UNECA noted: *“Innovation must be institutionalized. That means labs, budgets, training, and KPIs—not just pilots.”* One academic delegate suggested that data fellowships be integrated into national statistical development plans. A regulator proposed *“embedding innovation teams in data protection authorities to explore new privacy-preserving technologies.”*

#### 4.3.8.5 Strategic Outputs

Deliverables from this component will include:

1. An **ECOWAS Big Data Sustainability and Innovation Strategy**.
2. A formal **Monitoring and Evaluation Toolkit**.
3. Launch of the **ECOWAS Big Data Community of Practice** with annual convenings.
4. Deployment of a regionally maintained **M&E Dashboard**.

This final component ensures that the ECOWAS Big Data Framework is not only launched effectively but is also continually refreshed through data-driven insights, institutional commitment, and a culture of innovation.



## Chapter 5

# Innovation and Data Products

### 5.1 Data Product Development for Public and Private Use

Big Data holds little value unless translated into actionable insights and tools. This section of the framework focuses on the development and deployment of **data products**—digital tools, models, visualizations, and services derived from raw or processed data—for use by governments, businesses, and citizens across ECOWAS.

#### 5.1.1 Definition and Scope

Data products refer to any application, dashboard, report, predictive model, or alerting system that transforms raw data into an output usable by non-technical stakeholders. Examples include:

1. Real-time disease surveillance dashboards for Ministries of Health.
2. Crop monitoring and rainfall forecasting platforms for agricultural extension services.
3. Urban mobility visualizations for city planners based on CDRs.
4. Labor market dashboards integrating social media and vacancy data.
5. AI-powered customer segmentation tools for telecom or financial service providers.

### 5.1.2 Product Development Lifecycle

The framework recommends the following lifecycle for data product development:

1. **Co-Design:** Engage end-users from the outset to define problems, use cases, and expected functionality.
2. **Prototyping:** Rapid development of minimum viable products (MVPs) using open-source tools and real-world datasets.
3. **Validation:** Testing with actual users (e.g., government staff, analysts, farmers, citizens) and iterating based on feedback.
4. **Deployment:** Hosting on secure infrastructure with defined access controls, update protocols, and documentation.
5. **Sustainment:** Maintenance, user support, periodic review, and transition to national ownership or commercial models.

### 5.1.3 Public and Private Sector Integration

A unique value of the ECOWAS Big Data Framework is its dual orientation toward both public service improvement and private sector enablement. While many data products will be developed for government agencies, the framework also encourages:

1. Licensing of non-sensitive public datasets to startups or research teams.
2. Public-private co-development of products in health, mobility, education, and energy.
3. Creation of APIs that allow fintechs, agri-techs, and civic-techs to build on publicly funded infrastructure.

### 5.1.4 Examples from Stakeholder Contributions

During the workshop, delegates provided examples of successful or promising data product initiatives:

1. MTN Liberia described a collaboration where anonymized network usage data was used to optimize healthcare resource allocation.
2. Côte d'Ivoire regulators reported a pilot where real-time mobility heatmaps informed COVID-19 lockdown decisions.
3. Nigeria's NSO proposed public data dashboards that link telecom mobility trends with employment indicators.

### 5.1.5 Toolkits and Repositories

To accelerate innovation, the ECOWAS Commission will coordinate the creation of shared assets:

1. A **Data Product Starter Kit** with UI templates, analytics libraries, and documentation tools.
2. A **Code and Model Repository** hosted on a public platform (e.g., GitHub or ECOWAS Data Hub).
3. A **Design Playbook** with examples of successful public data tools from within Africa and globally.

### 5.1.6 Strategic Outcomes

By institutionalizing data product development, this component ensures that Big Data investments result in tangible value for citizens and businesses alike. It transforms abstract data systems into everyday tools that drive decisions, accountability, and innovation.

## 5.2 Data Innovation Labs in ECOWAS Member States

Innovation Labs are physical or virtual environments designed to support the development, testing, and scaling of data-driven solutions in a collaborative, interdisciplinary, and low-risk setting. Within the ECOWAS Big Data Framework, Data Innovation Labs serve as incubators for experimentation, co-creation, and regional learning. They bridge the gap between data availability and solution impact.

### 5.2.1 Objectives of Innovation Labs

The labs are established to:

1. Foster collaboration among NSOs, regulators, academia, startups, and civil society.
2. Provide a controlled sandbox for testing analytics pipelines, AI models, and dashboard prototypes.
3. Host joint training programs and technical workshops aligned with regional priorities.
4. Accelerate the translation of research and policy into operational tools and services.

### 5.2.2 Types of Innovation Labs

The framework recognizes three types of lab configurations, depending on national and regional contexts:

1. **University-Affiliated Labs:** Based in higher education institutions and focused on research, curriculum development, and talent incubation.
2. **NSO-Based Labs:** Housed within National Statistics Offices and focused on strengthening official statistics through Big Data integration.
3. **Regional Collaborative Labs:** Joint initiatives supported by ECOWAS institutions, designed to serve multiple countries and thematic use cases.

### 5.2.3 Core Features and Resources

Each Innovation Lab should have:

1. A team of data scientists, statisticians, domain experts, and developers.
2. Access to real and synthetic datasets within a secure sandbox environment.
3. Cloud-based development platforms and open-source analytical tools.
4. Collaboration tools (e.g., Git repositories, Slack-like workspaces, version control).
5. Governance protocols that define access, publication rights, and ethical safeguards.

### 5.2.4 Stakeholder Feedback

Stakeholders strongly endorsed the establishment of Data Innovation Labs. A participant from Benin stated: *“We need labs that allow us to test prototypes quickly and safely, in a space where statisticians and engineers can work together.”* Another delegate from UNECA highlighted that such labs are essential to reduce the time between insight generation and public value creation.

Several delegates proposed rotating regional fellowships and internships within these labs to strengthen skills and promote cultural and technical exchange.

### 5.2.5 Integration with Other Components

Innovation Labs are not stand-alone initiatives—they are interwoven with other parts of the framework:

1. They support the development and testing of data products (see Section 5.1).
2. They serve as testbeds for pilots and sandboxes (see Section 4.3.6).

3. They host training linked to capacity-building and sustainability (see Section 4.3.7).
4. They provide evidence and feedback to governance and legal structures (see Section 4.3.5).

### 5.2.6 Expected Deliverables

Each lab will be encouraged to produce:

1. At least two pilot-tested data products per year.
2. An annual research report or white paper co-authored by participants.
3. Technical documentation and learning materials for regional dissemination.
4. A roster of trained fellows, interns, and junior analysts embedded in national systems.

### 5.2.7 Strategic Value

Data Innovation Labs act as engines of agility, adaptation, and talent development. By embedding them into the ECOWAS Big Data Framework, the region creates long-term institutional capacity for solving 21st-century challenges through interdisciplinary collaboration and data innovation.

### 5.2.8 Product Development Lifecycle

The framework recommends the following lifecycle for data product development:

1. **Co-Design:** Engage end-users from the outset to define problems, use cases, and expected functionality.
2. **Prototyping:** Rapid development of minimum viable products (MVPs) using open-source tools and real-world datasets.
3. **Validation:** Testing with actual users (e.g., government staff, analysts, farmers, citizens) and iterating based on feedback.
4. **Deployment:** Hosting on secure infrastructure with defined access controls, update protocols, and documentation.
5. **Sustainment:** Maintenance, user support, periodic review, and transition to national ownership or commercial models.

### 5.2.9 Public and Private Sector Integration

A unique value of the ECOWAS Big Data Framework is its dual orientation toward both public service improvement and private sector enablement. While many data products will be developed for government agencies, the framework also encourages:

1. Licensing of non-sensitive public datasets to startups or research teams.
2. Public-private co-development of products in health, mobility, education, and energy.
3. Creation of APIs that allow fintechs, agri-techs, and civic-techs to build on publicly funded infrastructure.

### 5.2.10 Examples from Stakeholder Contributions

During the workshop, delegates provided examples of successful or promising data product initiatives:

1. MTN Liberia described a collaboration where anonymized network usage data was used to optimize healthcare resource allocation.
2. Côte d'Ivoire regulators reported a pilot where real-time mobility heatmaps informed COVID-19 lockdown decisions.
3. Nigeria's NSO proposed public data dashboards that link telecom mobility trends with employment indicators.

### 5.2.11 Toolkits and Repositories

To accelerate innovation, the ECOWAS Commission will coordinate the creation of shared assets:

1. A **Data Product Starter Kit** with UI templates, analytics libraries, and documentation tools.
2. A **Code and Model Repository** hosted on a public platform (e.g., GitHub or ECOWAS Data Hub).
3. A **Design Playbook** with examples of successful public data tools from within Africa and globally.

### 5.2.12 Strategic Outcomes

By institutionalizing data product development, this component ensures that Big Data investments result in tangible value for citizens and businesses alike. It transforms abstract data systems into everyday tools that drive decisions, accountability, and innovation.

## Chapter 6

# Commercialisation and Monetization

- 6.1 Models for Data and Infrastructure Monetization
- 6.2 Balancing Public Good with Commercial Interests
- 6.3 Case Studies on Monetized Data Sharing Models

## Chapter 7

# Institutional Mechanisms and Partnerships

- 7.1 Collaboration Models Across Stakeholder Groups
- 7.2 Partnership Agreements and MoUs
- 7.3 Proposing a Big Data and Insights Association for ECOWAS
- 7.4 Institutional Roles and Coordination Structures



## Chapter 8

# Implementation Strategy

8.1 Phased Rollout Plan

8.2 Institutional Roles and Responsibilities

8.3 Risk Management and Mitigation

8.4 Resource Mobilization and Capacity Building

## Chapter 9

# Monitoring and Evaluation

9.1 Key Performance Indicators (KPIs)

9.2 Feedback Loops and Continuous Learning

9.3 Data Collection and Reporting Mechanisms

## Chapter 10

# Future Outlook

- 10.1 The Future of the Statistics Profession in the ECOWAS Region
- 10.2 Emerging Trends in AI and Big Data
- 10.3 Sustainability and Policy Recommendations
- 10.4 Roadmap for the Next Decade

# Appendix A

## Annexes

- A.1 Glossary of Terms
- A.2 List of Stakeholders Consulted
- A.3 Survey Instruments and Feedback Forms
- A.4 Country Readiness Snapshots
- A.5 Workshop Programme and Delegate List

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