

Digital Trade Protocols and AI Governance in AfCFTA: Toward a Harmonized Regulatory Framework

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Abstract

As the African Continental Free Trade Area (AfCFTA) pursues its regional integration agenda, digital trade represents a transformative opportunity for intra-African commerce. The emergence of artificial intelligence (AI) across digital platforms including e-commerce and trade logistics has created significant efficiencies while presenting challenges in data sovereignty, privacy, algorithmic transparency, and cross-border regulatory coherence. This study examines the intersection of digital trade protocols and AI governance to inform the development of legal and policy frameworks for the AfCFTA. Employing a comparative policy analysis methodology, this paper systematically reviews national data protection laws, AI strategies, and digital trade instruments across five key African states: Nigeria, Kenya, South Africa, Egypt, and Ghana. By mapping gaps in legal definitions, data localization provisions, ethical AI frameworks, and enforcement procedures, the study identifies critical variations and opportunities for harmonization. The analysis draws on regulatory governance theory and policy convergence frameworks to assess the potential alignment of national approaches with continental objectives. This paper identifies fragmented national regulations as significant obstacles to digital trust and innovation under AfCFTA, proposing that without a coordinated and interoperable approach to governance, the continent risks undermining its digital economic potential. The study contributes both theoretically by extending regulatory governance frameworks to the African digital trade context and practically by providing actionable policy recommendations for developing a pan-African AI governance framework that promotes ethical data use while fostering an inclusive digital economy.

Keywords

AfCFTA, Artificial Intelligence, Digital Trade, AI Governance, Customs Automation, Trade Facilitation, Digital Infrastructure, Regulatory Harmonization, Data Protection, SME Digitalization

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INTRODUCTION

Background and Context

The commission of the African Continental Free Trade Area (AfCFTA) represents a critical development in Africa's ongoing pursuit of economic integration and industrial transformation. As the continent enters the fourth industrial revolution, AI technologies are increasingly integrated into trade facilitation mechanisms from predictive customs clearance and e-logistics to interoperable digital identity systems. However, the promise of an integrated digital leap remains hindered by a lack of coordinated regulatory frameworks, uneven levels of AI readiness, and inefficient digital governance structures (Kugler, 2024).

The AfCFTA aims to unify 55 African countries into a single market for trade in goods, services, movement of persons, and capital flows by eliminating tariffs and non-tariff barriers. World Bank estimates indicate that such integration could raise Africa's income by \$450

billion and increase intra-African trade by 52 percent by 2035 (World Bank, 2020b). Yet contemporary trade cannot be understood solely through the lens of physical goods. With rapid digitization of the global economy, trade now encompasses digital services, data flows, and e-commerce transactions, necessitating a reconceptualization of the AfCFTA's potential within the digital economy paradigm.

Digital trade provisions are central to the success of the AfCFTA rather than merely auxiliary components (Banga *et al.*, 2021). Cross-border e-commerce, digitally enabled services, and online platforms now serve as primary sources of innovation, productivity, and economic inclusiveness. This requires regulatory provisions that enable harmonization of digital payments, data governance, and electronic transactions. Without a cohesive digital policy framework, Africa risks fragmenting its digital economy, thereby undermining the potential benefits of trade integration and excluding large segments of the

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population particularly women and youth from the emerging digital economy (Chang *et al.*, 2022).

Problem Statement

Despite the transformative potential of AI-enabled digital trade under AfCFTA, a fundamental governance gap exists between national regulatory approaches and the requirements for continental integration. African nations exhibit significant heterogeneity in data protection legislation, AI policy development, and digital trade regulations. This regulatory fragmentation creates legal uncertainty for cross-border digital transactions, impedes the development of regional AI systems for trade facilitation, and risks perpetuating digital inequalities across member states. The absence of a harmonized governance framework threatens to undermine the AfCFTA's digital trade objectives while leaving the continent vulnerable to external technological dependencies and governance standards that may not align with African developmental priorities.

Research Questions

This study addresses three interconnected research questions. First, what are the current patterns of convergence and divergence in national data protection laws, AI strategies, and digital trade instruments across key AfCFTA member states? Second, what governance mechanisms can enable the harmonization of AI and digital trade regulations while respecting national sovereignty and developmental diversity? Third, which policy interventions are most critical for establishing a pan-African framework to promote the ethical deployment of AI in trade facilitation?

Research Objectives

This study pursues three specific objectives. The first objective is to conduct a systematic comparative analysis of national regulatory frameworks governing data protection, AI deployment, and digital trade across Nigeria, Kenya, South Africa, Egypt, and Ghana, identifying areas of convergence and fragmentation. The second objective is to assess the applicability of existing regional instruments including the AU Digital Transformation Strategy (2020-2030) and the Malabo Convention on Cybersecurity and Personal Data Protection to the development of a continent-wide regulatory framework for AI-enabled digital trade. The third objective is to develop evidence-based policy recommendations to establish a harmonized pan-African AI governance framework that supports the AfCFTA's digital trade objectives while addressing ethical considerations, data sovereignty concerns, and development priorities.

Scope and Study Type

This study employs a comparative policy analysis approach, combining a systematic literature review with documentary analysis of primary legal and policy instruments. The analysis focuses on five strategically selected African states representing diverse regional, economic, and regulatory contexts. The research is conceptual and review-oriented, synthesizing existing scholarship with primary policy documents to generate analytical insights rather than conducting original empirical investigation. The timeframe encompasses regulatory developments from 2016 to 2025, capturing the evolution of data protection frameworks, AI strategies, and digital trade provisions during the formative period of AfCFTA implementation (Akintoye *et al.*, 2022).

Significance of the Study

Digital trade is critical in connecting African companies especially micro, small, and medium-sized enterprises (MSMEs) to regional and global opportunities through competitive participation in value chains. For MSMEs, which constitute over 90% of African businesses and employ approximately 60% of the workforce, digital platforms offer unprecedented access to markets, payment systems, and supply chain networks that were previously inaccessible due to geographical and infrastructural constraints. AI technologies enhance this digital trade ecosystem by optimizing customs processes, reducing transaction costs, improving logistics efficiency, and enabling predictive analytics for market trends. However, the benefits of AI-driven digital trade can only be fully realized within a coherent regulatory environment that ensures data protection, algorithmic accountability, and interoperability across borders. Without harmonized governance frameworks, African nations risk creating digital barriers that replicate the very trade obstacles AfCFTA seeks to eliminate (Bongomin *et al.*, 2025). This research contributes to both academic scholarship and policy practice by providing a systematic analysis of regulatory fragmentation and offering actionable recommendations for harmonization. The findings will inform policymakers, trade negotiators, and digital governance stakeholders engaged in implementing the AfCFTA's digital trade protocol.

THEORETICAL FRAMEWORK

The intersection of digital trade, AI governance, and regional economic integration represents an emerging area of scholarly inquiry with significant policy implications. This literature review synthesizes research across multiple domains international trade law, digital governance, AI ethics, and African regional

integration to establish the theoretical and empirical foundations for this study. Rather than merely describing existing research, this review critically analyzes divergent scholarly perspectives, identifies conceptual gaps, and highlights debates that inform the research questions (Kouty, 2024). This study draws upon two complementary theoretical perspectives: regulatory governance theory and policy convergence frameworks. These frameworks provide analytical lenses for understanding the dynamics of regulatory harmonization in the context of regional economic integration and technological transformation.

Regulatory Governance Theory

Regulatory governance theory examines how rules, standards, and enforcement mechanisms shape economic and social behavior across jurisdictions. In the context of digital trade and AI governance, this framework illuminates the tensions between national regulatory autonomy and the functional requirements of cross-border integration. Regulatory governance encompasses formal legal instruments (legislation, treaties, and binding agreements), soft law mechanisms (guidelines, recommendations, and standards), and institutional arrangements for implementation and enforcement. The framework recognizes that effective governance of emerging technologies requires adaptive regulatory approaches that can respond to rapid technological change while maintaining legal certainty and stakeholder trust (Zhao, 2023). The framework helps identify which aspects of AI governance require strict harmonization (e.g., interoperability standards, mutual recognition principles) versus areas where regulatory diversity may be acceptable or even beneficial (e.g., sector-specific applications, culturally informed ethical guidelines).

In the AfCFTA context, regulatory governance theory suggests that successful digital trade integration requires not merely harmonized rules but also coordinated institutional capacity for implementation, monitoring, and adaptation. The theory emphasizes the importance of multi-level governance arrangements that distribute regulatory authority appropriately between continental, regional economic community, and national levels.

Policy Convergence Framework

Policy convergence theory analyzes the processes through which regulatory approaches across jurisdictions become more similar over time. Convergence may occur through various mechanisms: coercion (external pressure from international organizations or powerful states), competition (regulatory arbitrage and investment races), learning

(policy emulation based on perceived best practices), and harmonization (deliberate coordination through regional agreements). Understanding these mechanisms is essential for designing effective strategies to align regulation under the AfCFTA (Yakovleva, 2022). This framework is particularly relevant for AI governance in AfCFTA, where effective regulation requires coordination among trade ministries, data protection authorities, telecommunications regulators, standards bodies, and industry stakeholders across 55 member states. Network governance emphasizes mechanisms such as information sharing, capacity building, peer learning, multi-stakeholder dialogue, and soft-law instruments (guidelines, principles, best practices), alongside traditional hard-law approaches.

The convergence framework also identifies factors that facilitate or impede alignment, including institutional capacity, stakeholder interests, existing legal traditions, and economic conditions. For African digital trade governance, this framework helps explain the varying pace of regulatory development across member states and identifies leverage points for accelerating harmonization while respecting legitimate diversity.

Conceptual Model for Analysis

Integrating these theoretical perspectives, this study employs a conceptual model that examines AI governance for digital trade across four analytical dimensions: legal framework alignment (examining convergence in substantive regulatory provisions), institutional capacity (assessing capabilities for implementation and enforcement), interoperability mechanisms (evaluating technical and procedural arrangements for cross-border coordination), and developmental appropriateness (analyzing alignment with national and continental development priorities). This multi-dimensional approach enables systematic comparison across jurisdictions while recognizing the complex interactions between regulatory design, institutional context, and developmental objectives. In the context of AfCFTA's digital governance challenge, institutional theory helps explain why member states adopt divergent regulatory approaches despite shared economic integration objectives. Variations in colonial legal legacies, political systems, regulatory capacity, and relationships with external powers (the EU, the US, and China) create distinct institutional environments that shape national AI and digital trade policies. Understanding these institutional forces is essential for designing harmonization strategies that account for legitimate diversity while achieving necessary interoperability (Kugler & Tavengerwei, 2024).

Table 1: Comparative Analysis of National Regulatory Frameworks (2024)

Country	Data Protection Framework	AI Policy Status	Digital Trade Readiness	Enforcement Capacity	GDPR Alignment
Nigeria	Comprehensive (Data Protection Act 2023)	In Development	Moderate	Active	High
Kenya	Comprehensive (Data Protection Act 2019)	Integrated into Digital Strategy	Advanced	Active	High
South Africa	Mature (POPIA 2021)	Draft National Framework	Advanced	Established	High
Egypt	Basic (Personal Data Protection Law 2020)	National AI Strategy	Moderate	Nascent	Moderate
Ghana	Early (Data Protection Act 2012)	Sector-Specific Only	Progressive	Limited	Moderate

Source: Compilation based on national legislation, policy documents, and secondary literature review (2024).

METHODOLOGY

Research Design

This study employs a qualitative comparative policy analysis methodology, combining systematic literature review with documentary analysis of primary legal and policy instruments. The research design enables examination of regulatory frameworks across multiple jurisdictions while maintaining analytical depth in assessing convergence patterns and governance gaps.

Literature Search Strategy

The literature review followed a systematic search protocol conducted across multiple academic databases, including Web of Science, Scopus, Google Scholar, and the Social Science Research Network (SSRN). Search terms included combinations of: 'AfCFTA digital trade,' 'African data protection,' 'AI governance Africa,' 'cross-border data flows Africa,' 'digital trade regulation,' and 'algorithmic governance developing countries.' The search was limited to English-language publications from 2016 to 2025, capturing the period of intensified AfCFTA negotiations and implementation. Initial searches yielded 847 results, which were screened for relevance to African digital trade governance, yielding 156 sources for full-text review. After applying quality criteria (peer-reviewed status, methodological rigor, and substantive relevance), 68 academic sources were retained for inclusion in the analysis.

Document Analysis

Primary documentary sources included national legislation (data protection acts, electronic transactions laws, and cybersecurity legislation), national AI strategies and digital economy policies, the

AfCFTA Digital Trade Protocol and related annexes, the AU Digital Transformation Strategy (2020-2030), the Malabo Convention on Cybersecurity and Personal Data Protection, and policy documents from regional economic communities. Documents were analyzed using a structured coding framework that examined legal definitions, scope of application, cross-border data transfer provisions, AI-specific provisions, enforcement mechanisms, and institutional arrangements.

Case Selection

Five countries were selected for in-depth comparative analysis based on the criteria of regional representation, regulatory maturity, economic significance, and data availability. Nigeria is West Africa's largest economy and has comprehensive data protection legislation. Kenya exemplifies East Africa's advanced digital economy and active regulatory development. South Africa represents the Southern African region through sophisticated legal frameworks and significant AI development activity. Egypt represents North Africa with substantial digital infrastructure and emerging AI initiatives. Ghana offers a West African comparator with progressive digital policy development and regional leadership in digital identity systems. These cases collectively represent approximately 60 percent of Africa's GDP and encompass the continent's most advanced digital regulatory environments.

Analytical Approach

Data analysis employed thematic synthesis, integrating findings from literature review and documentary analysis to identify patterns of regulatory convergence

and divergence. The analysis proceeded iteratively, with initial coding categories derived from the conceptual framework subsequently refined through engagement with empirical material. Comparative matrices were developed to systematically assess alignment across jurisdictions with respect to key regulatory dimensions. The analysis also incorporated a critical assessment of the identified patterns against the theoretical framework, examining how regulatory governance theory and policy-convergence mechanisms explain the observed variations.

LITERATURE REVIEW AND CRITICAL ANALYSIS

AI Applications in Trade Facilitation

The literature identifies multiple domains in which AI technologies can enhance trade facilitation under the AfCFTA. Zhong (2024) demonstrates that AI-powered customs automation can significantly reduce clearance times through automated risk profiling, in which machine learning algorithms analyze historical trade data, shipping patterns, and behavioral indicators to generate risk scores that enable targeted inspections while expediting low-risk shipments. Natural language processing technologies can verify trade documents invoices, bills of lading, and certificates of origin—by extracting and cross-checking information to identify inconsistencies (Kouty, 2024). These capabilities address persistent challenges in African trade, particularly for landlocked countries facing substantial

transportation costs and productivity losses due to border delays.

The World Customs Organization (WCO, 2023) and the United Nations Economic Commission for Africa (UNECA, 2022) report that pilot implementations of AI-powered customs technologies in Kenya and Rwanda have achieved clearance-time reductions of nearly 40 percent. However, as Raman Mishra and Tushar Pradhan (2025) caution, realizing these benefits at a continental scale requires substantial investment in data infrastructure, digital skills, and interoperable systems. The literature thus reveals a tension between demonstrated technological potential and the significant preconditions for effective deployment.

In supply chain optimization, AI-enabled predictive analytics transforms logistics management by enabling real-time decision-making in dynamic environments (Suman Choudhuri, 2024). Machine learning models can forecast demand fluctuations, optimize routing, and enhance fleet management capabilities particularly valuable for addressing Africa's infrastructure challenges. The International Transport Forum (ITF, 2021) estimates that AI applications in African freight and logistics could reduce transport costs by 20 percent. Yet this literature tends toward technological optimism, with less attention to implementation barriers, including data availability, connectivity constraints, and institutional capacity for adopting advanced analytics.

Table 2: AI Applications in AfCFTA Trade Facilitation

AI Application Area	Potential Impact	Implementation Stage	Est. Time Reduction	Est. Savings	Cost
Customs Automation & Risk Profiling	High	Pilot Stage (Kenya, Rwanda)	40%	25-30%	
Supply Chain & Logistics Optimization	High	Early Adoption	30%	20%	
Trade Intelligence & Market Forecasting	Medium	Emerging	20%	15%	
Fraud Detection & Anomaly Identification	High	Pilot Stage	N/A	10-15%	
Cross-Border Digital Payments	Medium	Expanding	50%	30%	
Document Verification (NLP)	Medium	Early Adoption	60%	20%	

Source: Compiled from WCO (2023), UNECA (2022), ITF (2021), and WTO/WCO (2022).

Regulatory Governance Challenges

A substantial body of literature examines the regulatory governance challenges confronting AI-enabled digital trade in Africa. Rens et al. (2025) characterize the continental regulatory landscape as exhibiting pronounced 'unevenness,' with

comprehensive data protection frameworks in countries such as Nigeria, Kenya, South Africa, and Ghana contrasting sharply with the absence or weak enforcement of legislation elsewhere. This regulatory heterogeneity creates legal uncertainty for cross-border transactions and may impede innovation and

foreign investment through unpredictable compliance requirements.

Sucker and Beyleveld (2022) provide the most comprehensive analysis of cross-border data flow governance under the AfCFTA Digital Trade Protocol. They argue that while data mobility is crucial for AI development and digital trade, unrestricted flows raise legitimate concerns about digital sovereignty, foreign exploitation of African data, and regulatory capacity limitations. The authors advocate a balanced multilateral framework that enables interoperability while protecting national interests—a position echoed by Chang et al. (2022), who emphasize the need for governance approaches that address historical vulnerabilities to external influence.

Chivunga et al. (2024) identify the absence of continental AI governance as a critical gap that undermines the AfCFTA's digital transformation objectives. Unlike the European Union's AI Act, which provides a comprehensive regulatory framework, African countries largely operate independently in AI policy development. This fragmentation creates challenges for cross-border interoperability, increases compliance costs for businesses seeking regional expansion, and risks positioning Africa as a passive recipient rather than an active shaper of global AI governance norms.

Comparative Regulatory Models

The literature offers competing perspectives on appropriate regulatory models for African digital governance. Yakovleva (2022) analyzes the EU's approach to cross-border data flows, noting its emphasis on adequacy determinations that permit transfers only to jurisdictions ensuring equivalent protection levels. While this approach maintains strong privacy protections, its compliance requirements may pose challenges for countries with limited legal and institutional infrastructure. In contrast, the APEC Cross-Border Privacy Rules (CBPR) system offers greater flexibility, enabling data flows while accommodating regulatory diversity a model that may be more adaptable to African contexts.

Zhao (2023) examines emerging divergences in national AI regulatory approaches, highlighting tensions between innovation-promoting and precautionary orientations. For Africa, this analysis suggests that regulatory design involves trade-offs between attracting AI investment through permissive frameworks and protecting citizens from algorithmic harms through stringent oversight. The literature does not conclusively resolve this tension, with scholars

emphasizing different priorities according to their analytical perspectives and normative commitments.

Identified Research Gaps

The literature review reveals several significant gaps warranting attention. First, while studies examine individual country frameworks or specific regulatory dimensions, few offer systematic comparative analysis across multiple AfCFTA member states using consistent analytical criteria. Second, the literature on AI governance in Africa remains largely aspirational, with limited empirical assessment of existing AI deployments in trade facilitation and their regulatory implications. Third, theoretical frameworks developed primarily in European and North American contexts may inadequately capture the distinctive governance challenges facing African digital economies, including colonial legacies, infrastructure constraints, and developmental priorities. Fourth, the relationship between formal regulatory frameworks and actual implementation capacity receives insufficient attention, with most analyses focusing on legal provisions rather than enforcement effectiveness. By addressing the gaps in the literature, this research establishes a systematic comparative approach, using Institutional Theory and the Regulatory Convergence Frameworks, to provide unique insights into the structural, legal, and institutional issues that will shape AI governance within the AfCFTA's digital trade architecture. The research goes beyond providing descriptive information and offers analytical explanations of why regulatory divergence exists and evidence-based recommendations for potential paths toward harmonized digital governance systems, with a specific focus on implementation mechanisms and institutional capacity requirements necessary to achieve effective and sustainable regional governance.

Comparative Analysis of National Frameworks Data Protection Frameworks

Analysis of data protection legislation across the five selected countries reveals substantial variation in regulatory maturity, scope, and enforcement mechanisms. Nigeria's Data Protection Act 2023 establishes comprehensive provisions aligned with the GDPR, including requirements for lawful bases, data subject rights, and data protection impact assessments. The Nigeria Data Protection Commission exercises enforcement authority with significant penalty powers. Kenya's Data Protection Act 2019 similarly reflects the influence of the GDPR, establishing the Office of the Data Protection Commissioner with investigative and enforcement powers. South Africa's Protection of Personal Information Act (POPIA), fully effective since 2021, represents Africa's most mature data protection

framework, with established jurisprudence and active enforcement by the Information Regulator.

Ghana's Data Protection Act 2012 was among Africa's earliest comprehensive frameworks, but it now requires updating to address emerging requirements in digital trade and AI governance. Egypt's Personal Data Protection Law 2020 establishes foundational protections, but implementation remains nascent, with limited enforcement. These variations create challenges for cross-border data transfers, as adequacy assessments require case-by-case evaluation rather than mutual recognition based on equivalent standards.

AI Policy Development

AI policy development across the selected countries exhibits even greater heterogeneity than data protection frameworks. South Africa has progressed furthest, with a draft National AI Policy Framework

undergoing consultation and active AI research programs at multiple universities and research institutions. Egypt's National AI Strategy positions AI as central to economic development, with government investment in AI infrastructure and training programs. Kenya has integrated AI considerations into its broader digital economy strategy but lacks dedicated AI legislation or a comprehensive governance framework.

Nigeria has announced the development of an AI strategy, but formalization remains pending, whereas Ghana's approach remains sector-specific and lacks overarching AI governance provisions. Notably, none of the five countries has enacted binding AI legislation comparable to the EU AI Act; instead, they rely on existing sector regulations, voluntary guidelines, or draft frameworks. This creates significant governance gaps for AI applications in trade facilitation, where automated decision-making directly affects economic opportunities and regulatory compliance.

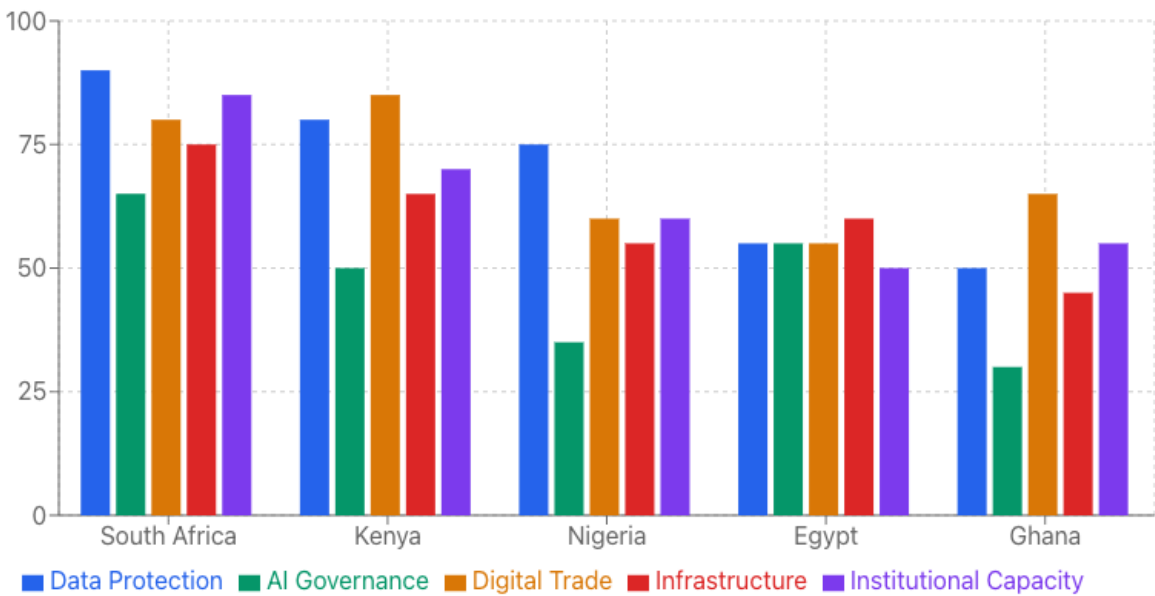


Figure 1. Regulatory Maturity Scores by Dimension. Bar chart comparing five countries across five dimensions: Data Protection, AI Governance, Digital Trade, Infrastructure, and Institutional Capacity. Scores on 0-100 scale. South Africa leads overall, with Kenya close behind in Digital Trade. AI Governance scores are lowest across all countries, indicating the most significant gap.

Digital Trade Provisions

Digital trade provisions vary substantially across jurisdictions, with different approaches to electronic transactions, digital signatures, and cross-border e-commerce. Kenya's legal framework for digital trade is the most developed, with comprehensive electronic transactions legislation, active mobile-money regulation, and participation in regional digital payment systems. Nigeria's framework facilitates

electronic transactions, but the implementation of single-window systems and paperless trade remains incomplete. South Africa has sophisticated electronic commerce legislation but faces challenges in integrating its systems with those of other African countries due to differing technical standards and regulatory requirements.

Cross-border data transfer provisions reveal a fundamental tension between facilitating digital trade and asserting regulatory control. Nigeria and Kenya permit international data transfers subject to adequacy requirements or appropriate safeguards, broadly following GDPR models. Ghana's framework includes more restrictive provisions that may require explicit ministerial approval for certain transfers. Egypt's approach remains unclear until full implementation guidance is provided. These variations create compliance complexity for businesses operating across multiple jurisdictions and impede the development of integrated regional digital systems.

Convergence Assessment

Applying the policy convergence framework, the analysis reveals mixed patterns across regulatory dimensions. Substantive convergence appears strongest in data protection principles, where the influence of the GDPR has promoted similar foundational concepts (lawfulness, purpose limitation,

data minimization, accuracy, storage limitation, integrity, and confidentiality). However, procedural convergence in enforcement mechanisms, institutional arrangements, and cross-border cooperation remains limited. AI governance exhibits minimal convergence, with countries pursuing independent approaches without significant coordination.

The primary convergence mechanism observed is policy learning, with African regulators drawing upon GDPR and other international frameworks as reference models. Harmonization through AfCFTA negotiations represents deliberate coordination but remains incomplete. Competition effects are less evident, as countries have not engaged in significant regulatory arbitrage to attract digital businesses. Coercive pressure from adequacy requirements of trading partners (particularly the EU) may increasingly drive convergence, though this raises concerns about regulatory autonomy and developmental appropriateness.

Table 3: Policy Convergence Assessment Across Key Dimensions

Governance Dimension	Convergence Level	Key Observations
Data Protection Principles	High (75%)	Strong GDPR influence; similar foundational concepts across jurisdictions
E-Commerce Regulation	Moderate (55%)	Variable electronic transaction frameworks; different approaches to digital signatures
Cross-Border Data Transfer Rules	Low-Moderate (45%)	Divergent transfer restrictions; no mutual recognition mechanisms
Cybersecurity Frameworks	Low-Moderate (40%)	Uneven legislative coverage; limited cross-border coordination
Digital Identity Systems	Low (35%)	Fragmented national systems; limited interoperability
AI Governance Standards	Very Low (25%)	No continental framework; minimal coordination across countries

Source: Analysis based on comparative policy review. Convergence is measured as the degree of substantive alignment across five selected countries.

CRITICAL CHALLENGES AND RISK ANALYSIS

Algorithmic Bias and Discrimination

Algorithmic bias presents significant risks for AI deployment in AfCFTA trade systems. AI models used in customs profiling, trade finance eligibility, and compliance auditing typically draw upon historical datasets that may replicate systemic inequities or lack representation from African markets (Sargeant, 2025). Machine learning models trained predominantly on non-African trade data may mischaracterize or undervalue locally significant commodities, disadvantaging African exporters. Biased risk-scoring algorithms could systematically disadvantage traders from regions or sectors based on historical patterns

rooted in structural inequity rather than genuine risk indicators.

As Chivunga et al. (2024) observe, AI deployments in African trade frequently utilize imported software solutions developed in dramatically different regulatory, cultural, and economic contexts. This creates risks that model assumptions will not align with local realities, potentially excluding or misidentifying marginalized groups—particularly small-scale traders and women-led enterprises. UNESCO (2021) guidelines on AI ethics emphasize the need for impact assessments and bias auditing, but implementation mechanisms remain underdeveloped in most African jurisdictions.

Cybersecurity and System Vulnerability

AI-enabled trade infrastructure creates expanded attack surfaces for malicious actors. The interconnection of customs processing, logistics, trade finance, and regulatory compliance systems increases vulnerability to data manipulation, system compromise, and coordinated attacks (Ray, 2022). Adversarial manipulation of risk-scoring algorithms could enable illicit goods to evade detection or legitimate traders to face unjustified delays. Supply chain systems that integrate AI for demand prediction and inventory management present opportunities for competitive intelligence gathering or market manipulation.

UNECA (2022) reports that most African customs agencies lack baseline AI security protocols, real-time threat detection capabilities, or secure national cloud infrastructure. These vulnerabilities are amplified at land borders and regional trade corridors where digital infrastructure is least developed. Reliance on third-party AI solutions often from external vendors introduces additional risks, including software backdoors, data sovereignty concerns, and limited capacity for due diligence in technology procurement. Without comprehensive cybersecurity frameworks, including encryption standards, AI system integrity audits, and coordinated incident response mechanisms, AI deployment in trade facilitation creates systemic vulnerabilities alongside operational efficiencies.

Economic Displacement and Skills Mismatch

AI-enabled automation in trade facilitation raises concerns about labor displacement, particularly for workers in routine, manual, or clerical functions. Customs authorities that implement AI-powered risk profiling may reduce staffing for human inspectors; logistics firms that use predictive analytics may require fewer warehouse clerks and dispatch staff. Without proactive reskilling strategies, automation could exacerbate unemployment in contexts already characterized by limited formal employment

opportunities, particularly affecting youth and informal sector workers (World Bank, 2020a).

The International Trade Centre (ITC, 2021) emphasizes that many African countries lack educational systems and upskilling infrastructure capable of preparing workers for AI-augmented roles. Digital literacy gaps disproportionately affect women, rural populations, and lower-income groups who face limited access to ICT tools and internet connectivity. Without deliberate policy intervention to embed social protections and skills development in national AI strategies, the economic transformation associated with the AfCFTA risks benefiting a digitally privileged elite while marginalizing broader populations.

Digital Infrastructure Divide

Significant inequalities persist across Africa in broadband access, cloud computing availability, and data center localization all critical enablers for AI-powered digital trade. The World Bank (2020a) estimates that 40 percent of Sub-Saharan Africa's population lacks broadband connectivity, with rural areas experiencing particularly severe disadvantages. North and Southern Africa possess superior ICT infrastructure compared to Central and West Africa, where lower broadband penetration, affordability constraints, and quality limitations impede digital participation (Edeh, 2025).

Only a few African countries South Africa, Kenya, Nigeria, and Egypt host major data centers. Countries lacking local data center infrastructure rely on offshore cloud services hosted in Europe or North America, incurring latency costs, regulatory compliance challenges for cross-border data transfers, and increased operational expenses. As Sucker and Beyleveld (2022) note, limited infrastructure severely constrains regional capacity to host applications for customs automation, trade analytics, and smart logistics, thereby reinforcing technological dependence on external providers.

Table 4: Risk Assessment Matrix for AI Implementation in AfCFTA

Risk Category		Likelihood	Impact	Priority	Primary Mitigation		
Regulatory Fragmentation		Very High	High	Urgent	Continental AI Framework		
Digital Infrastructure Gaps		Very High	Very High	Urgent	Infrastructure Investment		
Cybersecurity Threats		High	Very High	Urgent	Security Standards & Protocols		
Data Sovereignty Concerns		High	Medium-High	High	Data Protection Protocol		

Algorithmic Bias	High	High	High	Mandatory Assessments	Impact
Economic Displacement	Medium-High	High	Medium	Skills Development Programs	

Source: Assessment synthesizing findings from Sargeant (2025), Ray (2022), UNECA (2022), and Chivunga et al. (2024).

POLICY RECOMMENDATIONS

Establishment of a Continental AI Governance Framework

The African Union, regional economic communities, and national governments should collaborate to establish a Pan-African AI Framework articulating minimum continental standards for algorithmic transparency, data governance, and human oversight in high-stakes AI applications, including customs automation, financial services, and trade compliance. This framework should establish risk-based classifications for AI systems, drawing upon the EU AI Act methodology while adapting requirements to African developmental contexts and institutional capacities (Chivunga et al., 2024).

The framework should address both private-sector AI applications and public-sector deployments, ensuring that government actors do not use non-transparent or discriminatory systems in areas that affect citizens' rights and economic opportunities. Harmonized rules would provide regulatory certainty for cross-border service providers and technology entrepreneurs while protecting against algorithmic harms. Implementation should include capacity-building provisions, collaborative institutional arrangements, and mechanisms for regular review responding to technological evolution. As Wakunuma et al. (2022) emphasize, this framework should advance inclusive, rights-based AI governance, positioning Africa as an active participant in shaping global norms rather than a passive recipient of externally developed standards.

Harmonized Data Protection and Cross-Border Data Rules

A Continental Data Protection Protocol developed by the African Union, with support from AfCFTA institutions and national data protection authorities, should establish a supranational framework for mutual recognition of national privacy regimes. This protocol should enable countries with equivalent protection levels to transfer data securely while providing pathways for countries developing their frameworks to achieve recognized standards (Abendin et al., 2022).

The protocol design could draw on the APEC Cross-Border Privacy Rules system, which enables business-based voluntary interoperability across diverse legal systems, and the GDPR adequacy mechanism, which allows transfers to jurisdictions with equivalent protections. However, any African solution must

account for the continent's legal pluralism, resource constraints, and differential levels of digital readiness. As Sucker and Beyleveld (2022) caution, a rigid one-size-fits-all approach will likely fail. A flexible, tiered model that establishes basic principles consent, purpose limitation, security, and redress while permitting national variation in implementation would enable trusted data flows within the AfCFTA while protecting citizens' rights and fostering innovation.

Capacity Building for Digital Trade Institutions

Addressing the limited institutional and human capacity of African regulators, policymakers, and judiciary requires systematic investment in technical training, legal workshops, and simulation exercises. The AfCFTA Secretariat, the African Union Commission, and international development partners should fund capacity-building programs that develop specialized expertise in AI ethics, data sovereignty, cross-border data transfers, and digital taxation. As Wathsmma (2023) emphasizes, knowledge-sharing mechanisms across jurisdictions can build a shared understanding of legal frameworks, enabling the uniform application of digital trade provisions.

Beyond institutional capacity, developing AI literacy among the private sector particularly MSMEs, which account for over 90 percent of African businesses is critical to inclusive economic participation. Many enterprises lack skills, structures, and tools to effectively utilize AI-enabled platforms for e-commerce, digital payments, supply chain analytics, and cross-border sales (ITC, 2021). National governments and regional organizations should develop programs to digitally upskill MSMEs, with training modules covering online marketplace operation, cybersecurity awareness, digital documentation, and AI applications for logistics and customer engagement.

Regulatory Sandboxes for Digital Trade Innovation

Regulatory sandboxes-controlled testing environments that allow innovators to trial new technologies under regulatory supervision offer promising mechanisms for facilitating AI innovation while managing associated risks. In the AfCFTA context, sandboxes could enable experimentation with AI applications for customs automation, digital identity validation, trade finance, smart contracts, and compliance monitoring. This

approach enables governments and innovators to co-develop frameworks, ensuring innovation while addressing legal and ethical considerations (Boura, 2024).

UNECA (2022) notes that sandboxes can mitigate 'regulatory lag' the phenomenon whereby technology advances faster than legislative response. Currently operational sandboxes exist in Kenya, Rwanda, Nigeria, and South Africa, primarily focused on fintech rather

than digital trade applications. Chivunga et al. (2024) recommend that AfCFTA member states develop national and regional sandboxes specifically to address innovations aligned with the Digital Trade Protocol, including cross-border components that enable experimentation under harmonized regulations. The AfCFTA Secretariat could adopt a coordinating role by establishing a Pan-African Innovation Lab that links national sandboxes, shares knowledge, and facilitates regulatory harmonization for emerging technologies.

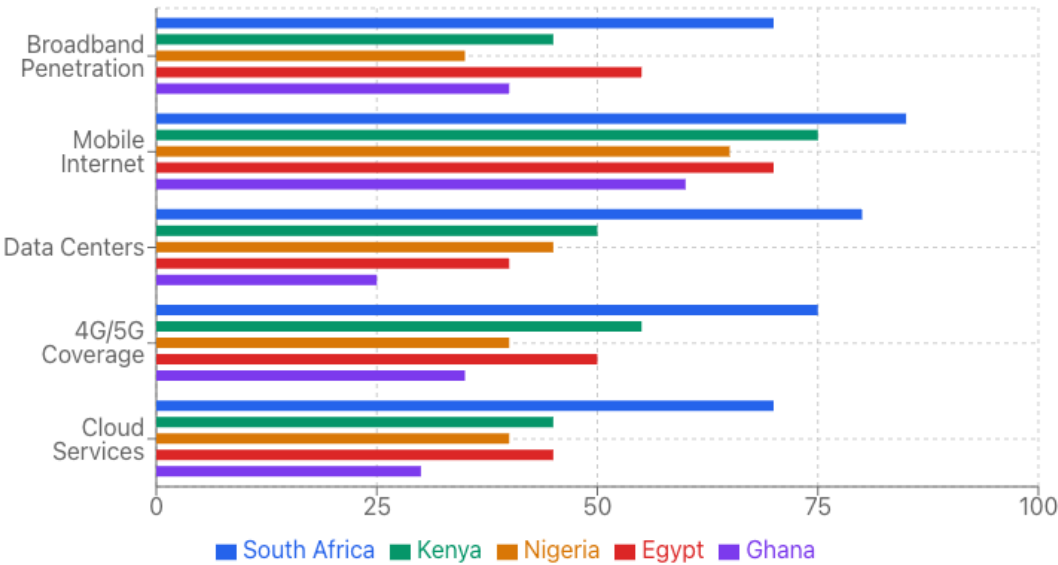


Figure 2. Digital Infrastructure Indicators. Horizontal bar chart displaying relative infrastructure development across broadband penetration, mobile internet, data centers, 4G/5G coverage, and cloud services. Demonstrates significant disparities between leading countries (South Africa, Kenya) and others.

Digital Infrastructure Investment

Realizing AI-enabled digital trade under AfCFTA requires substantial investment in broadband connectivity, cloud computing resources, and data center infrastructure. National broadband plans should prioritize connectivity for trade corridors, border regions, and underserved areas currently excluded from digital participation. Investment in local data center capacity including edge computing facilities and environmentally sustainable green data centers would reduce dependence on offshore cloud services while addressing latency and data sovereignty concerns.

Public-private partnerships should mobilize investment in shared digital infrastructure to support trade facilitation, including interoperable payment systems, single-window platforms, and regional logistics networks. As Chivunga et al. (2024) emphasize, digital infrastructure investment is not merely a form of technological modernization but is foundational to establishing sovereign AI capabilities, promoting regional digital trade, and reducing technological dependencies that currently constrain African digital economies.

Table 5: Summary of Key Governance Gaps and Recommended Interventions

Governance Dimension	Current Gap	Risk Level	Recommended Intervention	Priority
AI Governance Framework	No continental standards; fragmented national approaches	High	Establish Pan-African AI Framework aligned with AU Digital Strategy	Urgent

Cross-Border Data Flows	Divergent transfer restrictions; no mutual recognition	High	Develop Continental Data Protection Protocol with tiered approach	Urgent
Institutional Capacity	Limited expertise in AI ethics, digital trade regulation	Medium	Implement systematic capacity building programs for regulators	High
Digital Infrastructure	Uneven broadband access; limited local data centers	High	Prioritize infrastructure investment via public-private partnerships	High
Algorithmic Accountability	No bias auditing requirements; limited transparency mandates	Medium	Include mandatory impact assessments in AI framework	High
Innovation Ecosystem	Few trade-focused regulatory sandboxes; limited experimentation	Low	Establish Pan-African Innovation Lab linking national sandboxes	Medium

Source: Synthesis based on comparative analysis and literature review

DISCUSSION

Theoretical Implications

This analysis extends regulatory governance theory to the specific context of AI-enabled digital trade in regional integration arrangements among developing countries. The findings suggest that conventional regulatory governance frameworks developed in advanced economy contexts require adaptation to address the distinctive challenges facing African digital economies, including infrastructure constraints, institutional capacity limitations, and developmental priorities that may conflict with global regulatory models. The observed pattern of selective policy learning where African regulators adopt elements of GDPR and other international frameworks while adapting to local conditions suggests that convergence processes operate differently in contexts characterized by significant power asymmetries and development differentials.

The analysis also contributes to understanding multi-level regulatory governance in regional integration contexts. The relationship between continental (AU), regional economic community, and national regulatory authority remains contested and evolving. Effective governance of AI and digital trade under the AfCFTA likely requires innovative institutional arrangements that appropriately distribute regulatory responsibilities while maintaining coherence and interoperability. This represents a significant extension

of existing theoretical frameworks that have primarily examined federal systems or established regional integration arrangements.

Practical Implications

For policymakers, this study identifies specific areas requiring attention in the development of harmonized governance frameworks. The analysis of convergence patterns across data protection, AI governance, and digital trade provisions provides a roadmap for prioritizing harmonization efforts, focusing initially on areas showing substantive convergence while developing mechanisms to address more fundamental divergences. The emphasis on institutional capacity alongside formal legal frameworks highlights the need for comprehensive approaches that address implementation challenges rather than focusing exclusively on regulatory design.

For practitioner’s businesses, technology developers, and trade facilitation professionals the analysis clarifies the current regulatory landscape and its implications for operational decisions. Understanding the patterns of regulatory convergence and divergence enables more informed compliance strategies and investment decisions. The identification of emerging risks algorithmic bias, cybersecurity vulnerabilities, and economic displacement provides guidance for the responsible deployment of AI, anticipating regulatory evolution and social expectations.

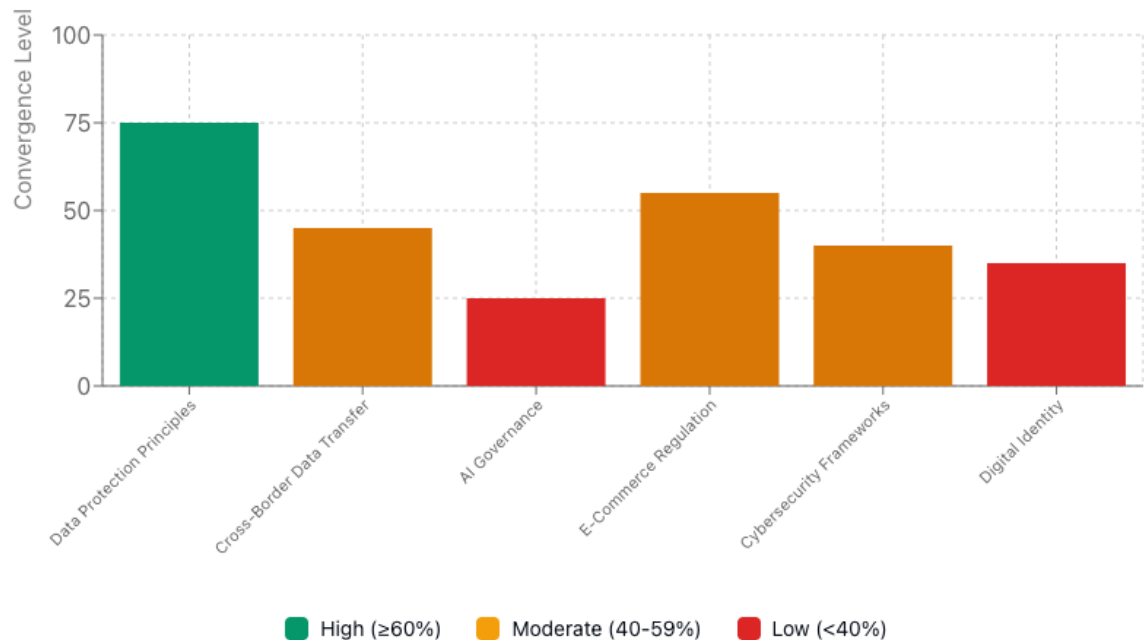


Figure 3. Policy Convergence Assessment. Bar chart showing convergence levels across governance dimensions. Color-coded: green (high, ≥60%), amber (moderate, 40-59%), red (low, <40%). Data Protection Principles show highest convergence; AI Governance shows lowest

CONCLUSION

Summary of Findings

This study has examined the intersection of digital trade protocols and AI governance within the AfCFTA framework, addressing the critical governance gaps that threaten to undermine the continent's digital economic potential. The comparative analysis of national regulatory frameworks across Nigeria, Kenya, South Africa, Egypt, and Ghana reveals significant heterogeneity in data protection legislation, AI policy development, and digital trade provisions. While substantive convergence appears strongest in data protection principles influenced by GDPR, procedural convergence in enforcement mechanisms and institutional arrangements remains limited, and AI governance exhibits minimal coordination across jurisdictions.

AI technologies offer substantial potential for enhancing trade facilitation under the AfCFTA from customs automation and reduced clearance times to predictive analytics, supply chain optimization, and trade intelligence that informs market strategies. However, realizing these benefits requires addressing significant challenges, including risks of algorithmic bias, cybersecurity vulnerabilities, economic displacement, and persistent digital infrastructure divides. Without coordinated governance frameworks, AI deployment risks perpetuating existing inequalities

while leaving the continent vulnerable to external technological dependencies.

Contributions

This study makes both theoretical and practical contributions to the emerging field of African digital trade governance. Theoretically, it extends regulatory governance and policy convergence frameworks to the specific context of AI-enabled digital trade in regional integration among developing countries, identifying distinctive dynamics that require adaptation of conventional analytical approaches. The proposed conceptual model, which examines legal framework alignment, institutional capacity, interoperability mechanisms, and developmental appropriateness, offers an analytical tool for future comparative studies.

In practice, the study provides evidence-based policy recommendations grounded in a systematic comparative analysis. The proposals for a continental AI governance framework, a harmonized data protection protocol, capacity-building initiatives, regulatory sandboxes, and digital infrastructure investment offer actionable guidance for policymakers, regional institutions, and development partners. By mapping the current regulatory landscape and identifying both convergence opportunities and persistent challenges, the study informs strategic prioritization of harmonization efforts.

Limitations

Several limitations constrain the scope and generalizability of this study. First, the focus on five countries, while strategically selected, cannot capture the full diversity of regulatory approaches across the 55 member states of the AfCFTA. Countries with less developed regulatory frameworks or distinctive legal traditions may face challenges distinct from those identified here. Second, the study's reliance on documentary analysis and literature review limits assessment of actual implementation effectiveness, which may diverge significantly from formal legal provisions. Third, the rapidly evolving nature of both AI technology and regulatory responses means that findings require continuous updating as the landscape develops.

Fourth, the study's conceptual and review-oriented methodology, while appropriate for addressing the research questions, does not generate the type of empirical evidence available through primary data collection. Finally, although adapted to the African context, the theoretical frameworks employed were primarily developed in other institutional settings and may not fully capture the distinctive dynamics of regulatory governance in African regional integration.

Directions for Future Research

This study identifies several promising directions for future research. Empirical investigation of AI deployments in African trade facilitation examining actual implementations, their regulatory implications, and stakeholder experiences would complement this policy-focused analysis. Comparative studies extending to additional AfCFTA member states, particularly smaller economies and those with distinctive legal traditions, would enhance understanding of the full range of governance challenges. Research examining the political economy of regulatory harmonization, including the interests and strategies of different stakeholders, would illuminate the feasibility and pathways for implementing proposed frameworks.

Longitudinal studies tracking regulatory evolution as AfCFTA implementation progresses would enable assessment of convergence dynamics and the effectiveness of harmonization mechanisms. Investigation of specific AI applications—customs automation, trade finance, logistics optimization—would provide a granular understanding of sector-specific governance requirements. Finally, research on developing indigenous African theoretical frameworks for digital governance, rather than adapting concepts developed elsewhere, represents an important agenda

for establishing African scholarship as an authoritative voice in global digital governance debates.

Concluding Remarks

The development of AI-enabled digital trade under AfCFTA represents both a transformative opportunity and a governance imperative for Africa. Success requires more than the deployment of technology; it demands the establishment of coordinated regulatory frameworks that ensure equitable access, protect digital rights, and foster sustainable innovation. The current heterogeneity in national approaches, while reflecting legitimate diversity, creates barriers to interoperability and risks fragmenting the continental digital economy. This study's recommendations for a pan-African AI governance framework, harmonized data protection protocol, capacity building initiatives, regulatory sandboxes, and infrastructure investment offer a pathway toward governance arrangements that support AfCFTA's digital trade objectives while addressing ethical considerations and developmental priorities.

Ultimately, AfCFTA's digital success depends not merely on the functionality of AI systems but on embedding technology within a coordinated, regulated, rights-focused environment that meets African aspirations and needs while enabling meaningful participation in the global digital economy. The frameworks and recommendations proposed here provide a foundation for achieving this vision; however, sustained commitment from political leaders, regulators, businesses, and civil society will be essential to translate policy proposals into effective governance practice.

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