Cloud Readiness and Digital Infrastructure Gaps in Ghana

Roland Yaw Kudozia[1], Abdul-Razak Salifu[2], Daniel Owusu-Donkor[3], Reginal Gyane[2]

[1]Gdirst Institute, Ghana

[2]National Communications Authority, Ghana

[3]All Nations University, Ghana

DOI: https://dx.doi.org/10.51244/IJRSI.2025.12110180

Received: 04 December 2025; Accepted: 12 December 2025; Published: 24 December 2025

ABSTRACT

Cloud computing has become a critical driver of digital transformation in emerging economies, enabling organizations to scale ICT capabilities without substantial capital investment. Ghana has made notable progress in expanding mobile and broadband connectivity, yet significant gaps remain in the country's overall cloud readiness. This paper provides a secondary-data assessment of Ghana's digital infrastructure, policy environment, and market maturity to evaluate the conditions that enable or constrain cloud adoption. Drawing on real-world datasets from the National Communications Authority (NCA), the International Telecommunication Union (ITU), the World Bank, and recent academic studies, the analysis highlights a strong submarine cable footprint but persistent bottlenecks in last-mile connectivity, broadband affordability, and data centre capacity. While banks, telecom operators, and fintech firms increasingly use cloud services, adoption across public institutions and SMEs remains uneven due to infrastructural limitations, regulatory uncertainties, and skills shortages. Through a structured cloud readiness framework, the paper identifies Ghana's major strengths and weaknesses and proposes policy measures to accelerate cloud adoption. The findings contribute to ongoing discussions on Africa's digital transformation by offering a country-specific analysis that integrates technical, regulatory, and market perspectives.

Keywords: Ghana, Digital Infrastructure, Cloud readiness, Broadband connectivity, human capital, market maturity, broadband affordability, Data Center Capacity, regulatory uncertainty.

INTRODUCTION

The rise of cloud computing

Cloud computing has emerged as one of the most transformative developments in modern information systems. It allows organisations to access scalable computing resources, digital platforms, and software tools without substantial investment in physical infrastructure. For many developing countries, cloud computing presents an opportunity to modernise public administration, enhance business competitiveness, and accelerate the transition to a digital economy. Global assessments of digital development highlight that progress in connectivity and broadband infrastructure is closely associated with a country's ability to deploy advanced digital services, including cloud-based applications (International Telecommunication Union [ITU], 2023; World Bank Group, 2019).

Ghana's digital economy and cloud adoption patterns

Ghana is frequently cited as one of West Africa's more dynamic digital markets. The country has recorded steady growth in mobile broadband usage, and its technology ecosystem continues to expand through the activities of financial technology companies, telecommunications operators and digitally oriented start-ups (World Bank

Group, 2019). Ghana's Digital Economy Policy and Strategy emphasises the development of national digital infrastructure and government cloud services as key enablers of the broader digitalisation agenda (Ministry of Communications and Digitalisation, 2023). In parallel, commercial and investment briefings underline the growing contribution of information and communications technology (ICT) to Ghana's economy and highlight continuing opportunities for cloud-based solutions (International Trade Administration, 2024).

Despite these advances, Ghana's cloud readiness is not yet uniform across sectors. While mobile broadband penetration is relatively strong, fixed broadband access remains limited and comparatively expensive, reflecting a pattern that is common in many lower-middle-income countries (ITU, 2023). The World Bank Group's Ghana Digital Economy Diagnostic report notes that the country has benefitted from multiple submarine cable landings and a national fibre backbone, but that last-mile connectivity, especially in rural areas, remains constrained and affects the reliability and affordability of high-capacity internet access (World Bank Group, 2019). These limitations shape the feasibility and cost of large-scale cloud adoption, a topic elaborated in the detailed infrastructure analysis in Section 4.

Cloud adoption patterns within Ghana also exhibit significant variation. Large enterprises, banks, telecommunications firms and financial technology actors have begun integrating cloud infrastructure into their operations, often through hybrid arrangements that combine local data centres with regional hyperscale services. According to recent commercial overviews, the primary adopters of cloud computing in Ghana include IT service providers, educational institutions, financial organisations and telecommunications firms, with a marked preference for Software-as-a-Service solutions, while the uptake of Infrastructure-as-a-Service and Platform-as-a-Service remains uneven (International Trade Administration, 2024). In contrast, many public-sector bodies and small and medium-sized enterprises demonstrate more cautious adoption, shaped by concerns over costs, organisational capacity and compliance with data protection and cybersecurity requirements.

Regulatory environment and cloud governance

The regulatory environment forms an important part of this context. Data protection in Ghana is principally governed by the Data Protection Act, 2012 (Act 843), which establishes the Data Protection Commission and sets out rules for the collection, processing and disclosure of personal data (Republic of Ghana, 2012). Recent legal and practitioner analyses emphasise that the Act, together with related sectoral regulations, plays a central role in shaping decisions about data outsourcing and cloud deployment, particularly for entities that handle sensitive personal information (DLA Piper, 2024; Mensah, 2023). As a result, questions of data sovereignty, cross-border data transfer,s and regulatory oversight are closely linked to Ghana's evolving cloud ecosystem. Parallel instruments such as the Electronic Transactions Act, 2008 (Act 772) and the Cybersecurity Act, 2020 (Act 1038) further influence how cloud services are procured, secured and supervised, especially for critical information infrastructure.

Study purpose and contribution

The purpose of this paper is to examine Ghana's cloud readiness through a structured analysis of secondary data. The study draws on academic literature, national policy documents, industry reports and official statistics to evaluate Ghana's digital infrastructure, market conditions, regulatory landscape, and institutional capabilities. The study further adapts elements of international frameworks, including the World Bank Group's Digital Economy for Africa (DE4A) initiative and the African Union's Digital Transformation Strategy for Africa (2020–2030), both of which emphasise digital infrastructure, digital platforms, digital skills, digital entrepreneurship and an enabling regulatory environment as foundational pillars of digital transformation (African Union Commission, 2020; World Bank Group, 2023).

By applying these concepts to the Ghanaian context, the paper identifies key gaps that constrain cloud adoption and proposes policy and industry measures to strengthen Ghana's participation in the regional and global digital economy. In doing so, it contributes to the emerging literature on cloud computing and digital transformation in Africa and offers insights that are relevant to policymakers, regulators and industry stakeholders. More

specifically, the paper undertakes a secondary-data-based analytical review that (a) adapts and operationalises a four-pillar cloud-readiness framework for Ghana, (b) integrates very recent developments such as the March 2024 multi-cable outage into the assessment of infrastructure resilience and (c) derives policy-oriented gap analysis and recommendations that go beyond existing diagnostics.

Data sources and review approach

This paper is based on a structured review of secondary data rather than primary fieldwork. The review focuses on materials published between 2015 and 2025, with particular emphasis on post-2019 diagnostics and post-2023 infrastructure and policy reports, when Ghana's digital economy agenda and major connectivity investments began to mature (Ministry of Communications and Digitalisation, 2023; World Bank Group, 2019, 2022). Earlier sources are used selectively where they provide essential historical context or help to trace the evolution of policy and infrastructure.

Peer-reviewed literature was identified using searches in Scopus, Web of Science and Google Scholar with combinations of terms such as "cloud computing", "cloud adoption", "digital infrastructure", "data centres", "digital economy", "Ghana" and "West Africa". The search prioritised empirical studies and conceptual papers that explicitly address Ghana's digital infrastructure, digital financial services, cloud adoption or related institutional and regulatory issues (Adjei et al., 2021; Agyei et al., 2022; Agyapong, 2021; Ammah et al., 2025; Coffie et al., 2021; Senyo et al., 2022). Where multiple studies examined similar questions, more recent work and articles published in indexed journals were given precedence.

Policy, regulatory and statistical sources were collected from the official portals of key international and regional organisations including the International Telecommunication Union, the World Bank Group, the African Union Commission, Smart Africa, the World Trade Organization and the Digital Cooperation Organization as well as Ghanaian institutions such as the Ministry of Communications, Digital Technology and Innovation, the National Communications Authority, the National Information Technology Agency, the Data Protection Commission, the Cyber Security Authority, the Bank of Ghana, Ghana Statistical Service and the Ghana Investment Promotion Centre (African Union Commission, 2020, 2022; Bank of Ghana, 2024; Ghana Statistical Service & National Communications Authority, 2020; International Telecommunication Union, 2023; Ministry of Communications and Digitalisation, 2023; National Information Technology Agency, 2023; Smart Africa, 2023; World Bank Group, 2019, 2022). For the data-centre and interconnection landscape, the analysis draws on recognised market assessments from the Africa Data Centres Association and a co-branded focus report with Oxford Business Group, which provide structured overviews of data-centre supply, carrier-neutral capacity and regional positioning (Africa Data Centres Association, 2023; Africa Data Centres Association & Oxford Business Group, 2024).

Inclusion criteria required that sources either (a) provide country-level data for Ghana on connectivity, data-centre capacity, cloud, or digital-economy indicators; (b) offer regional or continental benchmarks within which Ghana can be situated; or (c) present conceptual or empirical analyses that speak directly to drivers, barriers or institutional conditions relevant to cloud readiness. Preference was given to documents with transparent methodologies and clearly defined indicators. Where statistical figures differed across sources, the most recent official or multilateral dataset was treated as authoritative, and earlier or alternative estimates were used primarily to illustrate trends over time.

Grey literature and peer-reviewed work are treated in complementary ways. Official statistics, legal texts and policy documents provide the primary evidence base for factual claims about infrastructure, regulatory instruments and institutional mandates, while interpretations of adoption dynamics, trust, skills and organisational capacity are anchored as far as possible in peer-reviewed studies (Adjei et al., 2021; Agyei et al., 2022; Agyapong, 2021; Ammah et al., 2025; Coffie et al., 2021; Senyo et al., 2022). Industry and association reports are used mainly to triangulate these findings in areas where academic coverage remains thin, particularly with respect to data-centre investments, interconnection patterns and emerging cloud markets (Africa Data Centres Association, 2023; Africa Data Centres Association & Oxford Business Group, 2024). Overall, the

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

approach is best characterised as a structured analytical review that synthesises convergent evidence on Ghana's cloud readiness, rather than a formal systematic review aiming to exhaustively catalogue all publications on the topic.

While the paper does not incorporate original interviews or organisational case studies, this is a deliberate design choice consistent with its aim of providing a framework-based diagnostic grounded in authoritative secondary sources. Primary qualitative and quantitative work including expert interviews and sectoral case studies is therefore positioned as a complementary next step, as elaborated in the limitations and future research sections

Conceptualising Cloud Readiness

Cloud readiness refers to the extent to which a country, sector or organisation possesses the technical, institutional and human capabilities required to adopt and effectively utilise cloud-based services. It is inherently multidimensional, encompassing not only the availability of digital infrastructure but also the regulatory environment, market maturity and the capacity of institutions and individuals to manage digital systems. In national development discourse, cloud readiness helps to explain why some countries are able to integrate cloud services rapidly, while others progress more slowly despite broader technological diffusion.

The international literature offers several frameworks for understanding this concept. Within the United Nations system, the ITU situates cloud-related capabilities within broader measures of digital development, focusing on indicators such as internet usage, broadband availability, affordability and digital skills. The ITU's "Measuring digital development: Facts and figures" series highlights the persistent disparities in connectivity and affordability between high-income and low-income countries and underscores the importance of both fixed and mobile broadband as foundations for data-intensive applications and services (ITU, 2023). These indicators emphasise that without reliable and affordable connectivity, especially at sufficient bandwidth and quality, cloud services cannot be deployed at scale.

The World Bank's Digital Economy for Africa (DE4A) initiative adopts a systems perspective in which digital infrastructure is one of several foundational pillars of a functioning digital economy, alongside digital platforms, digital financial services, digital skills and digital entrepreneurship (World Bank, 2023). The DE4A framework is complemented at country level by diagnostic exercises, such as the Ghana Digital Economy Diagnostic, which examine how these pillars interact in specific national contexts and identify constraints to digital transformation (World Bank, 2020). From this perspective, cloud readiness is not simply an ICT issue; it is linked to financial inclusion, government service delivery, skills development and the wider innovation ecosystem.

Regional policy frameworks in Africa further embed cloud readiness within broader digital transformation agendas. The African Union's Digital Transformation Strategy for Africa (2020–2030) identifies enabling environment and regulation, digital infrastructure, digital skills and human capacity, and digital innovation and entrepreneurship as foundation pillars for a digitally transformed continent (African Union Commission, 2020). These pillars are explicitly connected to critical sectors such as digital government, digital trade and financial services, education, health and agriculture. Within this strategy, secure and affordable connectivity, appropriate data protection and cybersecurity frameworks, and interoperable digital platforms are treated as prerequisites for the effective use of cloud services in public and private organisations.

industry-oriented analyses also contribute to the conceptualization of cloud readiness. Omwansa (2019) introduces an Africa Cloud Readiness Index that combines infrastructure, regulatory and market criteria to benchmark the preparedness of different African countries for cloud adoption. Global indices such as the Asia Cloud Computing Association's Cloud Readiness Index (2018) similarly bring together indicators on connectivity, data-centre risk, security, regulation and business sophistication to assess how ready economies are for large-scale cloud deployment. Although these indices differ in methodology, they broadly converge on the view that cloud readiness is shaped by both "hard" infrastructure and "soft" governance factors..

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Synthesising these perspectives, cloud readiness for the purposes of this paper can be organised into four interrelated dimensions that are particularly relevant to Ghana:

1. Infrastructure Readiness. This dimension concerns the robustness of network and computing infrastructure, including international bandwidth capacity, national fibre backbones, mobile and fixed broadband networks, last-mile connectivity and the availability of data centres, cloud-connected facilities and power. Without a reliable and affordable infrastructure base, cloud services cannot be delivered with the quality of service required for mission-critical applications.

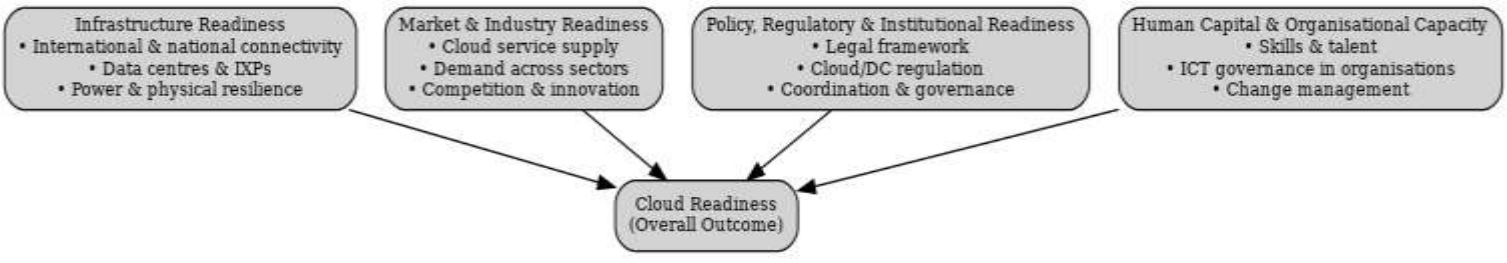
2. Policy and Regulatory Readiness. Effective cloud adoption depends on a legal and regulatory framework that addresses data protection, privacy, cybersecurity, cross-border data flows, consumer protection and competition. In the African context, regional instruments such as the AU Digital Transformation Strategy and national laws such as Ghana's Data Protection Act, 2012 (Act 843) play an important role in shaping how cloud services are adopted and governed (African Union Commission, 2020; Republic of Ghana, 2012).

3. Market and Industry Readiness. This dimension reflects the maturity of the ICT and digital services market, including the presence of local and regional cloud providers, telecommunications operators, data centre operators, software firms and digital start-ups. It also encompasses adoption patterns across sectors such as banking, telecommunications, education, manufacturing and government. In Ghana, commercial assessments emphasise the growing use of cloud services by financial organisations, IT firms and telecommunications operators, but note that adoption remains uneven across other sectors (U.S. Department of Commerce, 2024; World Bank, 2020).

4. Human Capital and Institutional Readiness. Cloud computing requires specialised skills in areas such as network engineering, systems administration, cybersecurity, data architecture and digital service management. It also requires institutional capacity within government agencies and organisations to design, procure, oversee and regulate cloud solutions. The DE4A initiative and associated digital skills studies stress that digital literacy and advanced ICT competencies are foundational for building robust digital economies (World Bank, 2023).

These four dimensions provide a coherent conceptual lens for assessing Ghana's cloud readiness using secondary data. They align with internationally recognised frameworks while remaining sensitive to the institutional and infrastructural realities of an emerging digital economy. The following sections apply this framework to Ghana through a synthesis of academic literature, policy documents, industry reports and national statistics.

Figure 1. Conceptual framework for assessing cloud readiness in Ghana.



Note. Cloud readiness is conceptualised as the combined outcome of four interrelated dimensions: infrastructure readiness, market and industry readiness, policy, regulatory and institutional readiness, and human capital and organisational capacity.

Ghana's Digital Infrastructure Landscape

Ghana's cloud readiness is fundamentally constrained and enabled by the structure and quality of its underlying

digital infrastructure. As the World Bank's *Ghana Digital Economy Diagnostic* emphasises, affordable, reliable connectivity is a foundational pillar of any digital economy strategy (World Bank, 2019). In line with broader African trends, Ghana has made substantial progress in mobile connectivity and government backbone networks, but continues to face gaps in fixed broadband, resilient international capacity, and high-availability data-centre and cloud infrastructure (International Telecommunication Union [ITU], 2023; World Bank, 2019).

International connectivity, subsea cable dependence, and Terrestrial Fiber

Ghana is now integrated into multiple subsea cable systems that connect West Africa to Europe and the global internet. Six subsea cables are associated with Ghana: SAT-3, MainOne, WACS, Glo-1, and ACE, as established landing systems. The Meta-led 2Africa cable was landed in November 2023 and is expected to become operational with a very high design capacity (Ministry of Communications and Digitalisation [MoCD], 2024). Until October 2023, Ghana had five active submarine cable providers; 2Africa thus adds a sixth high-capacity path and significantly increases potential international bandwidth (MoCD, 2024). This diversified international connectivity underpins the expansion of mobile broadband and data-driven services documented in the World Bank's Ghana Digital Economy Diagnostic (World Bank Group, 2019).

Available utilisation data illustrate how capacity has evolved and how much headroom exists. Compiled National Communications Authority (NCA) data reproduced in the World Bank diagnostic show that, as of 2017, operators in Ghana had access to a combined international submarine cable capacity of 341.25 Gbps, of which only 92.34 Gbps (about 27%) was then in use (National Communications Authority [NCA], 2017, as cited in World Bank Group, 2019, p. 38). Although these figures predate recent cable additions and traffic growth, they provide an early indication that "landed" capacity substantially exceeds lit and actively utilised capacity, with implications for pricing, redundancy and long-term planning.

The 14 March 2024 multi-cable outage starkly demonstrated the fragility of this architecture. According to the NCA, four then-active subsea cable landing service providers in Ghana (ACE, MainOne, SAT-3 and WACS) were simultaneously cut off from international data services, leading to a severe degradation of mobile and fixed data connectivity (NCA, 2024a). A follow-up statement and subsequent reporting confirm that faults were located near the Le Trou Sans Fond canyon off the coast of Côte d'Ivoire and affected at least 13 West African countries (Internet Society, 2024; NCA, 2024a). Repairs to the four cables were only completed between early April and early May 2024 (NCA, 2024b), underlining both the technical vulnerability of the routes and the time required to restore full capacity. Complementing the international submarine capacity is a growing terrestrial fibre infrastructure network.

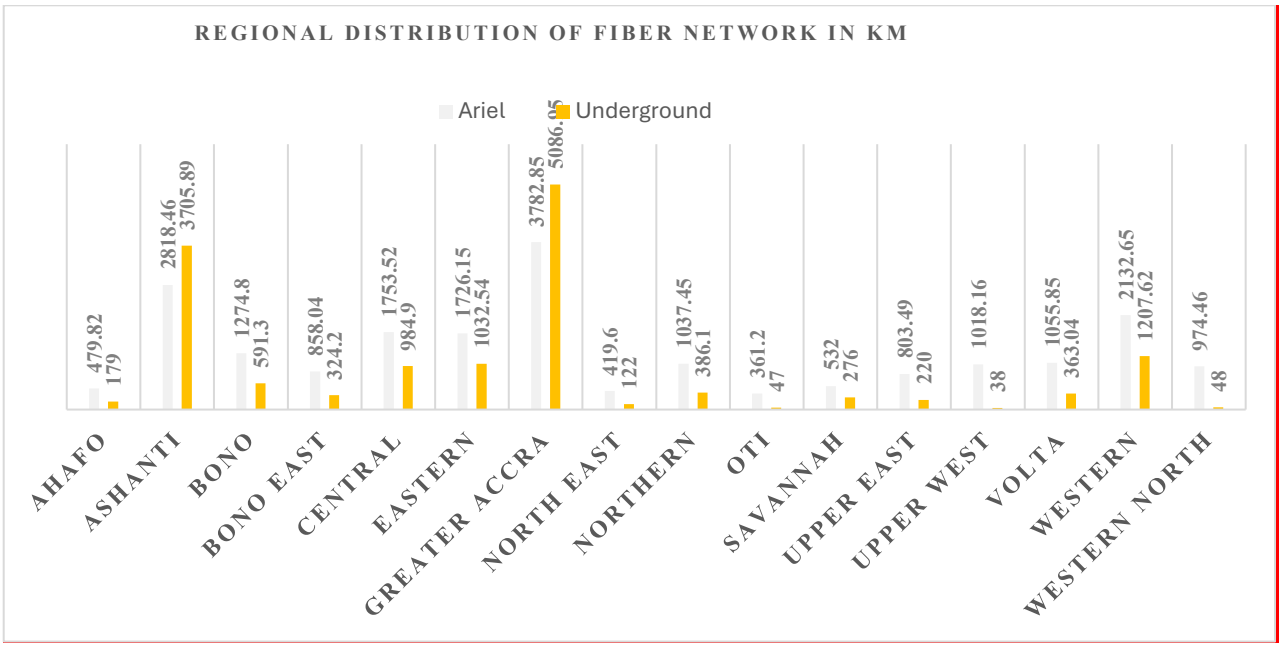
Ghana currently boasts a total fibre length of approximately 33,854 kilometers with a collective available capacity of 3,768 Gigabits (Gbits). This substantial infrastructure is maintained by a competitive landscape of eleven terrestrial fibre providers, including major Mobile Network Operators (MNOs) like MTN, Telecel (formerly Vodafone), and AirtelTigo, alongside dedicated infrastructure companies such as GridCo, NITA, CSquared, and Spectrum Fibre.

This market structure is dual-layered: MNOs primarily deploy underground and aerial fibre for their own backbone and metropolitan needs (FTTx), while utility-backed entities like GridCo which inherited the initial network from the Volta River Authority and wholesale providers offer critical inter-regional and national backhaul services providing the vital link between the terrestrial network and global internet traffic. The significant terrestrial network infrastructure is challenged by a high incidence of fiber cuts. In 2024, the Ghana Chamber of Telecommunications recorded 5,600 incidents of fiber cuts.

From a cloud-readiness perspective, these events underscore that, even where domestic data-centre and platform capacity exist, end-to-end service quality remains highly exposed to exogenous submarine cable failures. For mission-critical cloud workloads in finance, health or government, such large-scale outages increase the perceived risk of full public-cloud migration and reinforce the case for hybrid architectures, local redundancy, more diverse regional routes, and deeper investment in local content caches and internet exchange points (Internet Society, 2024; World Bank Group, 2019).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Figure 2: Terrestrial Fiber Distribution per Administrative Region



Note. Authors compilation based on data from National Communications Authority, 2024.

National backbone, eGovernment Network Infrastructure and government connectivity

At the national level, Ghana has invested in a government backbone and last-mile network (eGOVNET) under the World-Bank-supported eTransform Ghana project. A 2024 communication by the MoCD reports that backbone connectivity has been extended to 254 district centres, and that government network connectivity at a minimum of 1 Gbit/s has been provided to 951 government institutions across the country on a long-term indefeasible right-of-use basis (MoCD, 2024b). The same statement emphasises that all planned sites have been connected and accepted by NITA, and that the project's development objective is to improve coverage and efficiency of government service delivery using ICT (MoCD, 2024b).

The March 2024 parliamentary briefing further notes that the national data centre and internet gateway have been engineered with redundancy and that eGOVNET connectivity extends to all 261 districts, linking critical public facilities such as hospitals, post offices, courts, and police stations (MoCD, 2024a). These backbone and institutional connections create a baseline platform for government cloud adoption, particularly for shared services such as financial management, tax systems, and sectoral e-services, which the World Bank identifies as central to Ghana's digitalisation agenda (World Bank, 2019).

Nonetheless, resilience is uneven. MoCD explicitly calls for mixed infrastructure, additional terrestrial links, satellite backhaul, and more domestic and regional internet exchange points to avoid over-reliance on any single technology or cable path (MoCD, 2024a). Until these measures are fully implemented, there remains a structural gap between the aspiration of "always-on" e-government services and the actual robustness of the underlying transport network.

National data centre and emerging commercial data-centre ecosystem

The National Information Technology Agency (NITA) operates a national data centre that forms the core of Ghana's e-government infrastructure. NITA describes this data centre as a crucial feature of the e-government communication network, hosting critical equipment and applications, and supplying government ministries, departments, and agencies with email, document-management systems, antivirus services, Active Directory, and other shared applications (NITA, n.d.). The facility is equipped with racks of high-performance servers, fibre-channel storage, backup systems, and sufficient power conditioning to enable continuous operation even in the absence of mains power (NITA, n.d.).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

The MoCD's 2024 parliamentary briefing further notes that public organisations are encouraged to use the national data centre as a primary or backup host for critical platforms (e.g., banking products, government portals, educational platforms) and that national policies aim to localise hosting of essential content and services (MoCD, 2024a). At the same time, the briefing refers to large-scale private data-centre investments, including an African Data Centres facility at the Accra Trade Fair site designed to host local and international cloud workloads (MoCD, 2024a).

These developments suggest that Ghana is transitioning from a model dominated by foreign hosting and offshore data centres toward a more hybrid, domestically anchored cloud ecosystem, with a mix of public and commercial Tier III/IV facilities. For cloud readiness, this is significant: it enables data-sovereign deployments, lowers latency for local users, and creates an institutional pathway for ministries and regulated sectors (banking, utilities, education) to migrate workloads without relying entirely on data centres outside the country.

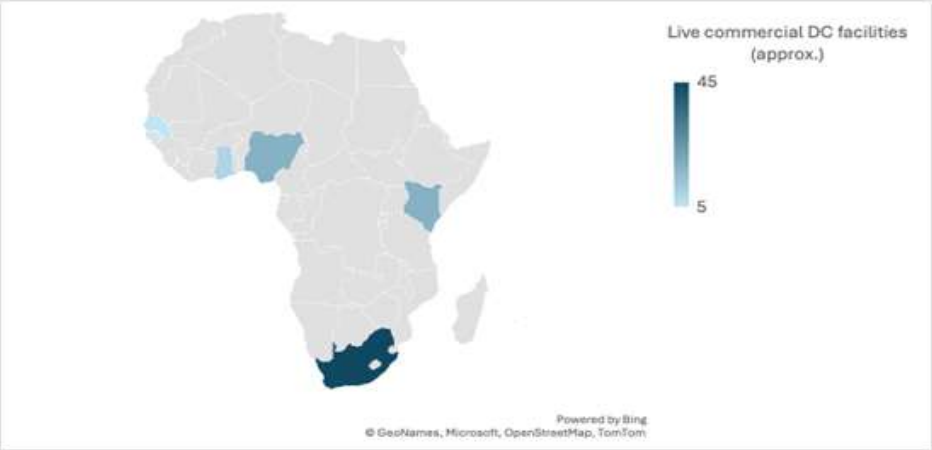
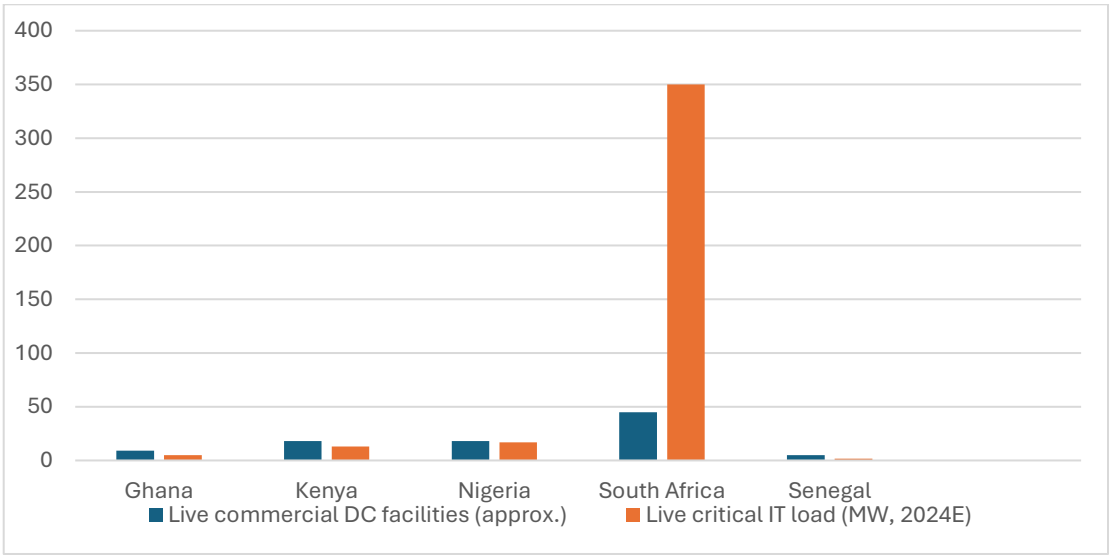


Figure 3 Number of live commercial data centres by country (2024E)

Note. Facility and megawatt figures are rounded estimates compiled from Xalam Analytics' country market briefings and the Africa Data Centres Association reports. The chart is intended to illustrate relative scale rather than provide a census of facilities.

The figure 4 compares the number of live commercial data-centre facilities and the associated critical IT load in Ghana, Kenya, Nigeria, South Africa and Senegal, based on Xalam Analytics' 2025 Data Center Market Briefings and related Africa data-centre market reports. South Africa remains the dominant continental hub, while Ghana is emerging as a secondary West African hub with modest but growing capacity.

Figure 4*:* Live critical IT load (MW) by country (2024E)



Note. Facility and megawatt figures are rounded estimates compiled from Xalam Analytics' country market briefings and the Africa Data Centres Association reports. The chart is intended to illustrate relative scale rather than provide a census of facilities.

Access networks, broadband penetration and usage patterns

At the access layer, Ghana follows the wider African pattern in which mobile broadband is the dominant form of connectivity. The ITU's *Measuring Digital Development: Facts and Figures 2023* shows that Africa's average internet use remains around 37% of the population, with a pronounced gap between urban and rural areas and between high-income and lower-income country groups (ITU, 2023). Within this continental context, Ghana is classified by the World Bank as a lower-middle-income economy that has expanded mobile broadband subscriptions rapidly while fixed broadband remains limited and relatively expensive, consistent with regional trends of high fixed-broadband prices relative to income (World Bank, 2019; ITU, 2025).

Household-level survey evidence reinforces this picture. The Ghana Statistical Service (GSS) and National Communications Authority (NCA) *Household Survey on ICT in Ghana* reports very high levels of individual mobile-phone ownership, widespread use of multiple SIM cards, and comparatively low household ownership of functioning computers and fixed telephones, with household internet access concentrated in a minority of homes (GSS & NCA, 2020). The report highlights that in Ghana and in many developing countries fixed telephone and fixed broadband connections are "almost non-existent," while mobile telephony is widely adopted, which has implications for how ICT indicators should be interpreted in such contexts (GSS & NCA, 2020, p. 1).

Recent empirical work on specific population segments confirms the centrality of mobile-based internet access. For example, a 2024 study using the 2021 Population and Housing Census shows that among Ghanaian older adults, just over half had used the internet in the three months preceding the census, and that mobile phones are by far the main device used to access the internet, with laptops and other devices accounting for a very small share (Kyei-Arthur et al., 2024). While this study focuses on older adults, it illustrates a broader pattern in which cloud-delivered services must be optimised for mobile, bandwidth-constrained environments, rather than assuming ubiquitous high-speed fixed connectivity.

For cloud readiness, these access-network characteristics imply that Ghana's digital infrastructure is "mobile-first but not yet broadband-rich". Cloud applications targeting citizens and SMEs must be designed for intermittent connectivity, modest speeds, and pervasive handset-based access, even as government backbones and institutional links achieve higher capacities.

Structural vulnerabilities and resilience gaps

Despite clear progress, several structural vulnerabilities in Ghana's digital infrastructure have direct implications for cloud adoption and service reliability:

1. Concentration of international capacity in a small number of routes and landing points. The March 2024 outage demonstrated that multiple cable breaks along shared corridors can simultaneously degrade service across all major mobile and fixed networks (MoCD, 2024a; Internet Society, 2024). Until additional independent routes, satellite backhaul, and cross-border terrestrial links are fully developed, cloud workloads remain exposed to correlated international failures.

2. Urban–rural and income-related disparities in broadband access. ITU statistics show that in Africa, urban internet use is more than twice rural use, and that low-income countries have substantially lower connectivity levels overall (ITU, 2023). The Ghana ICT household survey and related work indicate similar divides within Ghana, where rural households and lower-income groups have more limited access to devices and data services (GSS & NCA, 2020; Kyei-Arthur et al., 2024). This constrains inclusive uptake of cloud-based public services and commercial offerings.

3. Limited domestic cloud and data-centre competition relative to regional hubs. While NITA's national data centre and new commercial facilities represent important progress, Ghana still relies heavily on

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

regional hyperscale hubs (e.g., in Nigeria and South Africa) for some advanced cloud services, as noted in policy discussions about inter-country exchanges and regional data-centre integration (MoCD, 2024a; World Bank, 2019). This can increase latency and complicate data-sovereignty compliance for sensitive workloads.

4. Evolving but incomplete resilience and localisation policies. The MoCD briefing outlines forward-looking measures mandatory multi-cable connectivity for operators, expansion of internet exchange points, and directives for critical platforms to be hosted locally but also acknowledges that much content is still exchanged via international transit links (MoCD, 2024a).(The effectiveness of these measures will be a key determinant of Ghana's practical cloud readiness over the medium term.

Ghana's digital infrastructure provides a solid but uneven foundation for cloud computing: strong mobile penetration, a growing government backbone and data-centre base, and multiple subsea cables, juxtaposed with high dependence on a few international routes, limited fixed broadband, and persistent access inequalities. These characteristics will shape both the opportunities and constraints analysed in subsequent sections of this paper.

Market and Industry Readiness for Cloud Adoption in Ghana

Ghana's cloud readiness is not only a function of its infrastructure but also of how different market actors actually use and supply cloud-based services. This section examines the structure of the ICT market, sectoral patterns of cloud adoption, the types of services in use, and the main drivers and constraints, using secondary data from policy documents, industry reports and academic literature.

Structure of the ICT and Cloud Services Market

The Ghana Investment Promotion Centre's ICT and fintech sector report estimates that the broader ICT sector contributed about 5 percent of GDP in 2021 and was valued at around 1 billion US dollars, with projections suggesting potential growth to 5 billion dollars by 2030 if current trends persist (Ghana Investment Promotion Centre, 2021). Trade and investment guides produced by the U.S. Department of Commerce similarly describe the ICT market as a growth sector, with strong demand for computer hardware, software and IT services and increasing interest in cloud-based solutions (U.S. Department of Commerce, 2024a, 2025).

Within this broader ICT landscape, the primary adopters of cloud computing in Ghana are reported to be IT service companies, educational institutions, financial organisations and telecommunications firms. A 2024 commercial guide on Ghana's digital economy notes a clear preference for Software as a Service among these early adopters, driven by the large number of software firms building web and mobile applications and the relative simplicity of consuming SaaS compared to building and managing infrastructure (U.S. Department of Commerce, 2024b). In contrast, the uptake of Infrastructure as a Service and Platform as a Service is described as uneven, with only a subset of more technologically advanced firms making substantial use of these models (U.S. Department of Commerce, 2024b; World Bank, 2019).

Academic studies on cloud computing adoption in Ghana reinforce this picture. Research on institutional determinants of cloud adoption highlights that Ghanaian organisations are typically embedded in an environment shaped by regulatory requirements, sectoral norms and infrastructure constraints, which lead to differentiated adoption trajectories across industries (Adjei, 2021; Amuah, 2022). These studies show that while some large organisations deploy cloud services as part of broader digital transformation strategies, many smaller firms remain at exploratory or experimental stages, often limited to basic SaaS tools such as email and collaboration platforms.

Sectoral Patterns of Cloud Adoption

Financial sector and fintech

The financial sector is one of the most dynamic users of digital technologies in Ghana. The World Bank and other analysts have documented the rapid growth of digital financial services, including mobile money, online

payments and platform-based financial products, which have expanded financial inclusion and altered the way banks and non-bank institutions deliver services (Pazarbasioglu et al., 2020; Agyapong, 2021).

Ghana's fintech ecosystem has attracted particular attention in recent years. A theory-generating case study of fintech in Ghana shows that the fintech ecosystem comprises banks, telecommunications operators, start-ups, mobile money operators and regulators whose interactions have collectively reshaped the financial-services landscape (Senyo & Osabutey, 2022). The Bank of Ghana's 2024 FinTech Sector Report records a substantial number of licensed payment-service and fintech providers, with a distribution that includes enhanced and standard payment service providers, dedicated electronic money issuers, and other categories, underscoring the maturity and diversity of this ecosystem (Bank of Ghana, 2024).

Although most of these reports focus on payments, digital channels and regulatory frameworks rather than on cloud infrastructure itself, the reliance of fintech firms and digital banking channels on scalable, resilient computing resources implies extensive use of cloud or cloud-like architectures. Studies of digital product adoption and bank performance in Ghana also point to the role of business intelligence systems, data analytics and digital platforms in enhancing efficiency and profitability, which are often implemented on cloud-based or virtualised infrastructure (Owusu, 2017; Lamey, 2024). Together, this evidence suggests that within Ghana's financial sector, cloud computing is primarily embedded in the delivery of digital channels and analytics rather than treated as a stand-alone strategic topic.

Telecommunications operators and ISPs

Telecommunications operators and internet service providers are both consumers and suppliers of cloud-related services. The World Bank's diagnostic for Ghana notes that mobile network operators have invested heavily in upgrading their core networks and service platforms, and that they increasingly offer value-added services, including hosting, co-location and managed IT solutions, to corporate clients and public institutions (World Bank, 2019). Commercial reports on the ICT sector describe a market in which operators and independent tower and data-centre companies collaborate to expand infrastructure, while also competing in managed services and enterprise connectivity (Research and Markets, 2024).

Earlier sectoral analyses, including your own previous work, observed that Ghanaian operators often positioned themselves as integrated providers of connectivity, hosting and application services, effectively serving as the primary gateway to cloud-like offerings for many enterprises and educational institutions. Recent policy briefings by the Ministry of Communications and Digitalisation reaffirm this role by emphasising the expectation that operators maintain multiple international links, participate in local internet exchange points and support national data-centre initiatives in order to deliver resilient digital services, including cloud-based applications, to their customers (Ministry of Communications and Digitalisation, 2024).

Public sector and e-government

Public sector cloud adoption in Ghana is closely connected to the e-government infrastructure described earlier. The national data centre operated by the National Information Technology Agency hosts government email, document management and various line-of-business applications, while the eTransform project has expanded connectivity to central and local government entities (NITA, n.d.; Ministry of Communications and Digitalisation, 2024).

The Ghana Digital Economy Policy and Strategy explicitly calls for the automation of public services and the use of shared infrastructure, including government cloud platforms, to improve service delivery and reduce duplication of investment across ministries, departments and agencies (Ministry of Communications and Digitalisation, 2023). In practice, the World Bank's diagnostic notes that while some flagship systems have migrated to centralised hosting environments, many agencies still operate standalone legacy systems, and institutional fragmentation can slow the consolidation of workloads onto shared platforms (World Bank, 2019). Nevertheless, the combination of eGOVNET, the national data centre and the policy emphasis on digital public services provides a clear pathway for expanding cloud use within government, particularly for common

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

platforms such as identity management, financial management and tax systems.

Small and medium enterprises and digital start-ups

The literature on cloud computing adoption among Ghanaian small and medium enterprises is more limited but suggests a gradual and uneven pattern of uptake. Studies of cloud adoption frameworks and SME performance in Ghana highlight perceived benefits such as cost savings, scalability and access to advanced applications, but also point to concerns about data security, broadband reliability and the availability of skilled support (Adjei, 2021; Amuah, 2022).

At the same time, research on fintech adoption among Ghanaian SMEs indicates that many firms have integrated basic digital financial tools such as mobile payments and online banking, while adoption of more advanced digital and cloud-based solutions remains relatively low and is mediated by financial literacy and organisational capacity (Mensah & Adukpo, 2025; Coffie et al., 2021; Pazarbasioglu et al., 2020). This pattern aligns with broader assessments of the ICT market, which show that while the ecosystem of tech hubs and start-ups is expanding, most SMEs still operate with limited digital intensity and treat cloud services as ancillary rather than core to their business strategy (Ghana Investment Promotion Centre, 2021; U.S. Department of Commerce, 2024a).

Education, health and other sectors

In the education sector, universities and some secondary schools have adopted cloud-based learning management systems, collaboration tools and email services, often through global platforms such as Google Workspace or Microsoft 365. Trade and investment reports note that educational institutions feature among the early adopters of cloud services, particularly for hosted email, online learning and research data management (U.S. Department of Commerce, 2024b). Similar trends are observed in the health sector, where pilot e-health and telemedicine initiatives rely on cloud-hosted platforms and shared data repositories, although deployment remains fragmented and constrained by connectivity and funding (World Bank, 2019).

Beyond these sectors, there is evidence of cloud use in logistics, agriculture and creative industries, especially where digital platforms mediate transactions and information exchange. However, systematic sectoral data are scarce, and most evidence comes from case studies or project documentation rather than comprehensive market surveys.

Types of Cloud Services in Use

Across sectors, secondary data suggest a clear hierarchy of cloud service models in Ghana. The Trade.gov guide on the Ghanaian digital economy reports that organisations predominantly consume Software as a Service, including hosted email, office productivity suites, customer relationship management systems, human resource platforms and learning management systems (U.S. Department of Commerce, 2024b). This preference is attributed to the relative ease of adoption, subscription-based pricing and the fact that many Ghanaian software firms build web and mobile applications that are themselves delivered as SaaS.

Infrastructure as a Service and Platform as a Service are less pervasive. Where they are used, it is often by larger IT service companies, telecom operators, fintech firms and certain banks that require more control over their infrastructure, development environments or data-processing pipelines (Adjei, 2021; World Bank, 2019). These services are typically sourced from regional hyperscale providers located in South Africa or Europe, or from local and regional data centres that offer virtual servers and storage. The uneven uptake of IaaS and PaaS reflects both the limited supply of local cloud infrastructure and the scarcity of advanced cloud engineering skills in the domestic labour market.

Hybrid arrangements are increasingly common at the institutional level. Public agencies and regulated financial institutions often maintain on-premises or national data-centre infrastructure for sensitive systems while consuming SaaS or IaaS for less sensitive workloads and development activities, a pattern noted in both the

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

World Bank diagnostic and subsequent policy documents (World Bank, 2019; Ministry of Communications and Digitalisation, 2023).

Market Drivers and Enabling Factors

Several factors drive demand for cloud services in Ghana. The most prominent is the rapid expansion of digital financial services and fintech, which depends on scalable, secure and resilient platforms to manage transactions and customer data. Global and regional analyses of digital financial services underscore that cloud-based architectures are well suited to the elasticity, speed and cost-efficiency requirements of such systems (Pazarbasioglu et al., 2020; Chivunga, 2024).

A second driver is the government's digitalisation agenda, articulated in the Digital Economy Policy and Strategy and operationalised through projects such as eTransform Ghana. These initiatives create demand for shared infrastructure, standardised platforms and centralised hosting, all of which align with cloud-computing principles (Ministry of Communications and Digitalisation, 2023, 2024).

Third, the presence of an emerging local data-centre and co-location market, together with regional hyperscale investments in Africa, lowers barriers for organisations seeking to migrate workloads, since they can combine local hosting for latency-sensitive or regulated data with regional cloud services for other applications (Africa Data Centres Association, 2023; MoCD, 2024a).

Finally, the growth of the ICT and fintech ecosystem itself, supported by incubators, accelerators and investment schemes, contributes to a gradual accumulation of skills and experience related to cloud technologies. Sector reports emphasise Ghana's aspiration to serve as a regional hub for digital services under the African Continental Free Trade Area, which could further stimulate demand for cloud infrastructure and services (Ghana Investment Promotion Centre, 2021; Chivunga, 2024).

Market Barriers and Constraints

Despite these drivers, several market-related constraints limit cloud adoption in Ghana.

First, perceived and real costs remain a barrier, particularly for SMEs. Limited competition in certain connectivity segments and the need to purchase reliable, high-capacity links to support cloud workloads mean that total cost of ownership for cloud-based solutions can be significant, especially when denominated in foreign currency. The World Bank diagnostic and commercial reports both note concerns among Ghanaian enterprises about recurring subscription costs and exchange-rate exposure (World Bank, 2019; U.S. Department of Commerce, 2024a).

Second, concerns about data protection, security and compliance influence adoption decisions. Ghana's Data Protection Act imposes obligations on data controllers and processors, and interpretations of its provisions in relation to cross-border data transfer can be cautious, particularly in sectors such as banking and health (Republic of Ghana, 2012; DLA Piper, 2024). Academic work on cloud adoption in Ghana confirms that security, privacy and compliance concerns remain among the most frequently cited inhibitors of migration to cloud services (Adjei, 2021; Owusu, 2020).

Third, skills shortages in advanced cloud engineering, cybersecurity and digital architecture affect both supply and demand. While general ICT skills have expanded, reports on Ghana's digital ecosystem note a shortage of specialised professionals who can design, deploy and manage complex cloud environments, leading many organisations to rely on external consultants or to limit their use of cloud services to simpler SaaS offerings (World Bank, 2019; Ghana Investment Promotion Centre, 2021).

Fourth, there are information and trust gaps. Smaller firms in particular may have limited information about the reliability and benefits of cloud services, and some associate cloud with loss of control over data and systems. Studies of digital product and mobile banking adoption in Ghana suggest that trust in providers and intermediaries is a critical factor in technology acceptance (Agyei et al., 2022; Ammah et al., 2025; Agyapong,

2021). Similar dynamics can reasonably be expected in the cloud-computing context, reinforcing the need for clear communication, transparent service-level agreements and demonstrable compliance by cloud providers.

Overall, the synthesis of secondary data indicates that Ghana possesses an active and growing market for cloud-related services, led by financial institutions, telecommunications operators, IT service firms and selected public-sector and educational institutions. However, adoption remains uneven across sectors and firm sizes, with persistent concerns around cost, connectivity, security, skills and trust. These market characteristics, together with the infrastructural conditions described earlier, shape the cloud readiness gap that will be analysed in the next section of the paper.

Policy, Regulatory and Institutional Readiness

Cloud readiness in Ghana is shaped not only by the country's infrastructure and market conditions but also by the quality and coherence of its legal, regulatory and institutional frameworks. This section synthesises secondary evidence on the main laws that govern data protection, electronic transactions and cybersecurity, and examines emerging regulatory initiatives for data centres and cloud services, as well as Ghana's alignment with regional and continental digital strategies.

National Legal Framework for Data, Transactions and Cybersecurity

Data Protection Act, 2012 (Act 843)

Data protection in Ghana is principally governed by the Data Protection Act, 2012 (Act 843). The Act establishes the Data Protection Commission, sets out principles for lawful and fair processing of personal data, and defines the rights of data subjects and obligations of data controllers and processors (Republic of Ghana, 2012). Its stated object is to protect the privacy of individuals by regulating the collection, use, disclosure and care of personal data, and to provide procedures for obtaining, holding and disclosing such information.

For cloud computing, several provisions of Act 843 are particularly relevant. The Act requires that personal data be processed for specific, explicit and legitimate purposes, and mandates appropriate security safeguards to protect against loss, unauthorised access or other forms of misuse. It also regulates cross-border transfers of personal data, permitting them only where the recipient country or organisation ensures an adequate level of protection or where specific conditions, such as consent or contractual safeguards, are met. Legal commentaries emphasise that these provisions apply equally to domestic and foreign cloud providers when they act as processors or controllers for Ghanaian organisations, making data-protection compliance a central consideration in cloud migration decisions (DLA Piper, 2024; Mensah, 2023).

Electronic Transactions Act, 2008 (Act 772)

The Electronic Transactions Act, 2008 (Act 772) provides the general legal foundation for electronic communications, electronic records and online transactions in Ghana. Its object is to "provide for and facilitate electronic communications and related transactions and to provide for connected purposes," thereby according legal recognition to electronic messages, records and signatures (Republic of Ghana, 2008).

Act 772 contains provisions on the recognition of electronic records and signatures, the validity and enforceability of electronic contracts, and the responsibilities and liability of intermediaries that transmit, route or store electronic records. It explicitly clarifies that intermediaries are not generally liable for the content they transmit or store, provided they do not initiate the transmission, select recipients or modify the content, and they are not obliged to monitor electronic records for potential offences (Digital Policy Alert, 2023). Recent practice notes on digital business regulation in Ghana highlight that Act 772 underpins the legal validity of online payments, e-commerce, and platform-based services, and complements more recent sector-specific legislation (ICLG, 2025).

In the context of cloud computing, Act 772 provides the contractual and evidentiary basis for cloud service agreements, electronic service-level agreements, and the use of electronic signatures in contracting with cloud providers. It also defines a regulatory baseline for consumer protection in digital transactions, relevant where

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

cloud services are integrated into retail-facing platforms.

Cybersecurity Act, 2020 (Act 1038)

The Cybersecurity Act, 2020 (Act 1038) establishes the Cyber Security Authority, regulates cybersecurity activities and services, and provides a framework for protecting Ghana's critical information infrastructure and digital ecosystem (Republic of Ghana, 2020). The Act sets out provisions on the designation and protection of critical information infrastructure, licensing and regulation of cybersecurity service providers, incident reporting, and the establishment of a Cybersecurity Fund.

Analyses of Act 1038 note that it aims to enhance Ghana's cybersecurity posture, align national practice with international standards, and create mechanisms for cooperation with international organisations and other states in addressing cyber threats (Netsweeper, 2024; DiploFoundation, 2023). For cloud providers and large cloud users, the Act is important in several respects: entities designated as critical information infrastructure operators may be required to meet specific security obligations; cybersecurity service providers require authorisation; and incident-reporting and response requirements apply to digital service providers and infrastructure operators.

Together, Acts 843, 772 and 1038 form a triad of core legislation that govern data protection, electronic transactions and cybersecurity. Their combined effect is to create a legal environment in which cloud computing is permitted and in principle supported, but subject to data-protection obligations, secure processing requirements and cybersecurity oversight.

Sectoral Regulation and Emerging Cloud/Data Centre Rules

Beyond horizontal legislation, sectoral and technical regulation also affect cloud readiness. The National Communications Authority (NCA) serves as the regulator for the communications sector, responsible for licensing telecommunications operators, internet and public data service providers, and other communications services (NCA, 2024; Trade.gov, 2024). Authorisations for Internet/Public Data Services permit licensees to establish and operate internet and public data services for the public, providing the regulatory basis for ISPs and some cloud-related connectivity offerings (NCA, 2024).

The National Information Technology Agency (NITA) has a distinct but complementary mandate. It is charged with enforcing ICT standards and security for government systems and, increasingly, with regulating the data-centre and cloud ecosystem. A policy note issued in November 2023 describes NITA as the "Regulator of the Data Centre and Cloud Market in Ghana" and reports that, with support from the Smart Africa alliance, Ghana is developing a national regulatory framework for data centres and cloud services (NITA, 2023). The same note highlights that a harmonised framework is expected to facilitate trade and investment in data-centre and cloud services and to position Ghana as a regional hub within Africa's emerging data economy (NITA, 2023).

Draft guidance on data centres published by national authorities outlines proposed requirements for registration, compliance inspections, and the adoption of international standards and certifications, and explicitly encourages data-centre providers to align with global best practices while NITA develops national ICT standards (Regulatory Framework for Data Centres, n.d.). Although these frameworks are still evolving, they signal a move toward explicit regulation of data-centre and cloud infrastructure, which is central to cloud readiness.

Sector-specific regulation also shapes cloud use. For example, the Bank of Ghana's regulatory instruments on payment services and financial technologies, together with its cybersecurity directives, influence how banks and fintech providers design and outsource ICT systems, including cloud-based platforms (Bank of Ghana, 2024). Similar considerations apply in health and other regulated sectors, where data sensitivity and sectoral compliance obligations interact with general data-protection and cybersecurity laws.

Institutional Landscape and Governance Arrangements

Ghana's institutional landscape for digital governance involves multiple bodies with overlapping but distinct responsibilities. At the apex, the Ministry of Communications, Digitalisation (MoCD) provides policy direction

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

for the communications and digital sectors. Subordinate agencies include the NCA, NITA, the Data Protection Commission (DPC) and the Cyber Security Authority (CSA), each with defined mandates (Trade.gov, 2024; World Bank, 2019).

1. The Data Protection Commission oversees implementation of Act 843, maintains the data protection register, investigates complaints and issues guidelines on compliance (Republic of Ghana, 2012; DPC, n.d.).

2. The Cyber Security Authority is responsible for regulating cybersecurity activities, protecting critical information infrastructure, coordinating incident response and implementing national cybersecurity strategies in accordance with Act 1038 (Republic of Ghana, 2020; Cyber Security Authority, 2024).

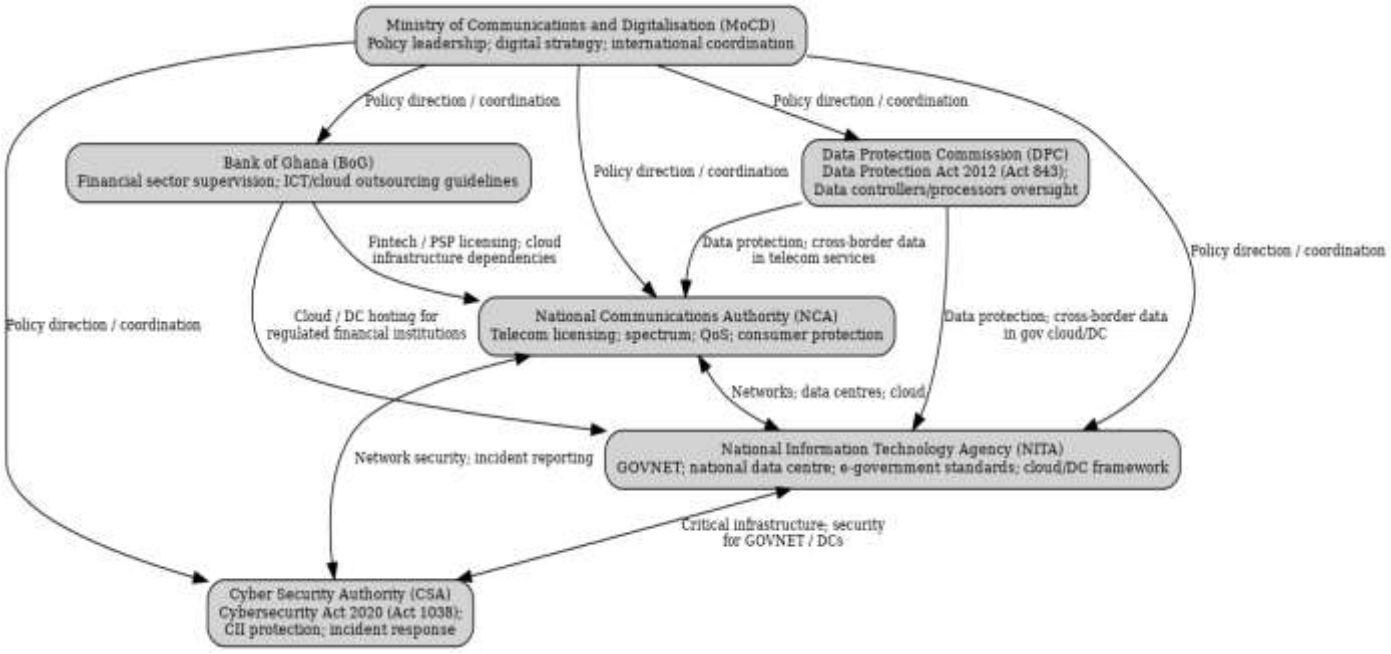
3. The National Information Technology Agency manages government ICT infrastructure, including the national data centre and eGOVNET, sets technical standards for government systems and, as noted, is assuming a regulatory role for data centres and cloud services (NITA, n.d.; NITA, 2023).

4. The National Communications Authority licenses and regulates communications networks and services that provide the connectivity layer on which cloud services depend (NCA, 2024).

From a cloud-readiness standpoint, this institutional configuration offers both strengths and challenges. On the one hand, responsibilities for data protection, cybersecurity, infrastructure regulation and ICT standards are clearly assigned to specialised bodies, which is consistent with international good practice. On the other hand, coordination among these agencies is essential to avoid regulatory fragmentation and overlapping or inconsistent requirements for cloud providers and users. World Bank assessments of Ghana's digital governance highlight the importance of strengthened inter-agency coordination and policy coherence to support digital transformation initiatives, including cloud-based e-government and digital public services (World Bank, 2019).

The distribution of mandates across these entities is depicted in Figure 5. The diagram shows how cloud and data-centre services sit at the intersection of several regulatory domains, with the National Communications Authority, the National Information Technology Agency, the Cyber Security Authority, the Data Protection Commission and the Bank of Ghana all exercising some degree of oversight alongside the Ministry of Communications and Digitalisation's policy role. As indicated in the figure, this configuration can easily generate duplicative approvals, overlapping audits and multiple, sometimes inconsistent, compliance expectations for cloud providers and large users.

Figure 5. Institutional landscape for digital governance and cloud/data-centre oversight in Ghana.



ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Note. The Ministry of Communications and Digitalisation (MoCD) provides overall policy direction, while regulatory and implementation responsibilities are distributed across specialised bodies. Overlapping mandates among NCA, NITA, CSA, DPC and BoG in areas such as data centres, cloud services, data protection and cybersecurity increase compliance complexity and highlight the need for structured coordination mechanisms.

Regional and Continental Frameworks

Ghana's policy and regulatory choices are also informed by regional and continental instruments that increasingly emphasise data governance, cybersecurity and digital markets. The African Union Digital Transformation Strategy for Africa (2020–2030) identifies "Enabling Environment, Policy and Regulation" and "Digital Infrastructure" as foundational pillars, and explicitly references data protection, cybersecurity and the development of a Digital Single Market as key objectives (African Union Commission, 2020). The Strategy is complemented by the African Union Data Policy Framework, which builds on the Digital Transformation Strategy and other initiatives to provide guidance on data governance, cross-border data flows and data sovereignty across the continent (African Union Commission, 2022).

These documents sit alongside the African Union Convention on Cyber Security and Personal Data Protection (the Malabo Convention), which, although not yet universally ratified, sets out principles for harmonised data-protection and cybersecurity regimes. Ghana's national laws and policies, particularly in data protection and cybersecurity, are broadly aligned with the objectives of these regional instruments, and participation in regional initiatives such as Smart Africa's data-centre and cloud regulatory work further embeds Ghana's approach within a wider continental context (NITA, 2023; Smart Africa, 2023).

At the subregional level, ECOWAS has adopted supplementary acts and guidelines on personal data protection and cybersecurity, which influence national practice and encourage harmonisation among member states. While this section focuses on Ghana's national framework, it is important to note that cloud providers and large cloud users operating across borders must navigate both national laws and these regional frameworks.

Gaps and Challenges in Policy and Regulatory Readiness

The synthesis of secondary evidence suggests that Ghana has established the core components of a modern legal and regulatory framework relevant to cloud computing: data protection, electronic transactions, cybersecurity, sectoral regulation and evolving data-centre and cloud standards. However, several gaps and challenges remain.

First, implementation and enforcement capacity are uneven. Commentaries on the Data Protection Act note that while the legal framework is comprehensive, resource constraints have limited the Data Protection Commission's ability to fully enforce compliance across all sectors, particularly among smaller organisations (Mensah, 2023; DLA Piper, 2024). Similar concerns apply to cybersecurity, where the Cyber Security Authority is still institutionalising its role and scaling up oversight of critical information infrastructure and cybersecurity service providers (Republic of Ghana, 2020; Cyber Security Authority, 2024).

Second, although work on a data-centre and cloud regulatory framework is underway, it is still relatively new and has yet to be fully operationalised. Stakeholder engagement led by NITA in 2023 marks an important step, but practical details on licensing, supervision, cross-border data arrangements and interoperability standards are still emerging (NITA, 2023; Regulatory Framework for Data Centres, n.d.). Until these are clarified, uncertainties may persist for investors and service providers considering major cloud infrastructure deployments in Ghana.

Third, there is a need for clearer guidance on cross-border data flows and localisation expectations. While Act 843 provides rules for cross-border transfers, and regional frameworks emphasise balanced approaches to data sovereignty and free flow of data, business and legal analyses highlight that organisations often remain cautious about hosting sensitive data outside Ghana, especially in sectors such as banking and health (DLA Piper, 2024;

African Union Commission, 2022). This can inhibit the use of regional hyperscale cloud services even where they may offer resilience and cost benefits.

Fourth, policy coordination and strategic clarity remain works in progress. The Ghana Digital Economy Policy and Strategy provides high-level direction, but translating it into consistent, cloud-supportive regulations and procurement practices across all ministries and agencies is an ongoing challenge (Ministry of Communications and Digitalisation, 2023; World Bank, 2019). Overlapping mandates and evolving roles among MoCD, NCA, NITA, the Data Protection Commission and the Cyber Security Authority require structured coordination mechanisms to ensure predictable requirements for cloud providers and users.

In summary, Ghana's policy, regulatory and institutional landscape exhibits significant strengths—a functioning data-protection regime, recognised legal status for electronic transactions, a dedicated cybersecurity law and institutions, and emerging cloud-specific regulation—but also important gaps in enforcement, clarity and coordination. These factors collectively influence the country's overall cloud readiness and will be central to the gap analysis and policy recommendations developed in subsequent sections of this paper.

Regulatory Fragmentation and Overlapping Mandates

A further concern relates to the potential for regulatory fragmentation arising from overlapping mandates in the digital and communications ecosystem. Cloud computing and data-centre services sit at the intersection of several regulatory domains, including electronic communications, data protection, cybersecurity, sector-specific financial and health regulation, and government ICT standards. In Ghana, these domains are overseen respectively by institutions such as the National Communications Authority, the Data Protection Commission, the Cyber Security Authority, the Bank of Ghana and the National Information Technology Agency, in addition to the Ministry of Communications and Digitalisation's policy role. While the existence of specialised regulators is consistent with international good practice, the absence of a clearly articulated coordination mechanism for cloud-related matters can result in duplicative approvals, overlapping audits and multiple, sometimes inconsistent, compliance expectations.

From the perspective of cloud providers and large cloud users, such fragmentation increases the transaction costs of compliance, lengthens project timelines and introduces uncertainty about which authority has ultimate decision-making competence for particular issues. For smaller domestic firms and public entities with limited legal and technical resources, navigating several different regulators can be particularly burdensome, and may discourage the adoption of more sophisticated cloud solutions. The risk is that, instead of providing assurance and fostering trust, an uncoordinated multi-regulator environment inadvertently raises the cost of regulation and slows the pace of cloud adoption.

Cloud Readiness Gap Analysis

Using the four-dimensional framework outlined earlier, Ghana's cloud readiness can be assessed in terms of infrastructure, market and industry conditions, policy and regulation, and human capital and institutional capacity. This integrated, Ghana-specific application of the framework is the contribution, not original survey data. Secondary evidence suggests that Ghana is relatively advanced in some respects compared with many African peers, but still faces important gaps that constrain broader and more mature cloud adoption.

Infrastructure Readiness Gaps

Ghana's infrastructure exhibits a mixed profile. On the positive side, the country benefits from multiple submarine cable landings and a growing national backbone and government network. The *Ghana Digital Economy Diagnostic* notes that Ghana has "strong international connectivity" and a national fibre infrastructure connecting key regions, but also records "gaps in network quality and coverage" and high fixed-broadband prices relative to income (World Bank Group, 2019, pp. 32–40). At the household level, the *Household Survey on ICT in Ghana* reports that only 16.8% of households have internet access at home, while mobile phones are the

primary access device for individuals, reflecting a mobile-first and largely wireless access paradigm (Ghana Statistical Service & National Communications Authority, 2020).

Recent ITU data indicate that 69.9% of individuals in Ghana used the internet in 2023, placing Ghana above the average for Sub-Saharan Africa but still well below penetration levels in high-income economies (International Telecommunication Union [ITU], 2023). These aggregate figures conceal pronounced spatial and socio-economic inequalities: the GSS–NCA survey shows lower internet access in rural areas and among lower-income households, illustrating a significant internal digital divide (Ghana Statistical Service & National Communications Authority, 2020).

With respect to data-centre infrastructure, continental assessments show that South Africa, Nigeria, Kenya and Egypt dominate African data-centre capacity, while countries such as Ghana and Angola are emerging as secondary hubs. The *Africa Interconnection Report 2025* notes that Ghana hosts around eight data centres, placing it in a lower tier compared with major hubs that have dozens of facilities and substantially higher aggregate capacity (Console Connect & Balancing Act, 2025). A market briefing on Ghana's data-centre opportunity similarly characterises the Ghanaian market as "promising but still nascent" in terms of scale and diversity of facilities (Xalam Analytics, 2025).

A further constraint on cloud readiness is the stability and cost of power supply. High-quality data-centre operations require reliable electricity with minimal outage frequency and voltage fluctuations, yet national reports and operator briefings continue to highlight grid instability and the widespread use of diesel backup generation. This raises operating costs and complicates efforts to position Ghana as a regional data-centre hub. Integrating renewable-energy strategies and grid-modernisation initiatives into data-centre planning would therefore not only enhance resilience but also align cloud infrastructure development with Ghana's climate and sustainable development commitments.

Overall, the main infrastructure gaps for cloud readiness in Ghana can be summarised as:

1. Limited fixed broadband and high-capacity last-mile connectivity, especially outside major cities, which constrains latency-sensitive and bandwidth-intensive cloud applications (World Bank Group, 2019; Ghana Statistical Service & National Communications Authority, 2020).

2. Marked urban–rural and income-related disparities in access and quality of connectivity, reducing the potential for inclusive cloud-based public services (Ghana Statistical Service & National Communications Authority, 2020; ITU, 2023).

3. Modest domestic data-centre capacity compared with leading African hubs, which affects options for low-latency, sovereign cloud deployments (Console Connect & Balancing Act, 2025; Xalam Analytics, 2025).

Market and Industry Readiness Gaps

Ghana's ICT and digital-services market is active and growing, yet cloud adoption remains uneven. The ICT and fintech sector already contributes several percentage points to GDP and is projected to expand significantly (Ghana Investment Promotion Centre, 2022). The World Bank diagnostic and trade guides agree that banks, fintech firms, telecommunications operators and larger IT service companies are the primary cloud adopters, often integrating cloud infrastructure into digital financial services, enterprise platforms and web-based applications (World Bank Group, 2019; International Trade Administration, 2024).

Empirical work on cloud adoption in Ghana indicates that many organisations remain cautious. Adjei et al. (2021) find that institutional factors, including regulatory expectations and perceived risks related to data transfer and compliance, play a significant role in adoption decisions and help explain the relatively slow and selective uptake of cloud services. In practice, Software as a Service dominates: most organisations rely on hosted email, collaboration tools, basic business applications and learning management systems, while Infrastructure as a

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Service and Platform as a Service are mainly used by a small subset of technologically advanced firms (International Trade Administration, 2024; World Bank Group, 2019).

By contrast, in leading African markets such as South Africa and Kenya, large-scale cloud investments and partnerships have resulted in more visible, strategic cloud initiatives and a deeper local provider ecosystem (Africa Data Centres Association & Oxford Business Group, 2024; Console Connect & Balancing Act, 2025). Relative to these benchmarks, Ghana's cloud market is still developing.

Key market and industry gaps therefore include:

1. Sectoral imbalance, with advanced adoption in finance and telecoms but more limited use among SMEs, health providers and many local government entities (World Bank Group, 2019; Adjei et al., 2021).

2. Service-model concentration, with a heavy reliance on SaaS and comparatively limited use of IaaS and PaaS beyond a small group of early adopters (International Trade Administration, 2024).

3. Lack of local cloud platforms of scale, resulting in dependence on regional or overseas facilities for advanced workloads and reducing competitive pressure on price and service quality (Console Connect & Balancing Act, 2025; Xalam Analytics, 2025).

Policy, Regulatory and Institutional Gaps

On paper, Ghana's legal framework is relatively comprehensive. The Data Protection Act, 2012 (Act 843) regulates the collection, processing and transfer of personal data and establishes the Data Protection Commission; the Electronic Transactions Act, 2008 (Act 772) provides legal recognition for electronic records, signatures and contracts; and the Cybersecurity Act, 2020 (Act 1038) creates the Cyber Security Authority and a regime for protecting critical information infrastructure (Republic of Ghana, 2008, 2012, 2020). Legal analyses emphasise that these instruments together form a coherent basis for lawful and secure digital operations, including cloud computing (DLA Piper, 2024; Mensah, 2023).

At the same time, several sources point to implementation and enforcement challenges. Commentaries on Act 843 note that the Data Protection Commission faces resource and capacity constraints, which limit its ability to supervise and enforce compliance across all sectors and organisations (DLA Piper, 2024; Mensah, 2023). The Cyber Security Authority is still consolidating its role and scaling oversight of critical information infrastructure and cybersecurity providers under Act 1038 (Republic of Ghana, 2020; Cyber Security Authority, n.d.).

Cloud-specific regulation is also a work in progress. Stakeholder-engagement materials from the National Information Technology Agency (NITA) and Smart Africa indicate that Ghana is in the process of developing a national regulatory framework for data centres and cloud services, with the aim of harmonising standards, facilitating investment and positioning Ghana as a regional hub (National Information Technology Agency, 2023). Draft guidance proposes registration and compliance regimes for data-centre operators, but detailed requirements, including licensing, service-level standards and cross-border data arrangements, are still emerging (Regulatory Framework for Data Centres, n.d.).

Existing coordination challenges among MoCD, NCA, NITA, the Data Protection Commission, the Cyber Security Authority and sector regulators such as the Bank of Ghana translate, in practice, into a fragmented regulatory experience for cloud providers and users, increasing the effective cost of compliance and introducing delays that can dampen the rate of cloud adoption.

These observations highlight several policy and regulatory gaps:

1. Incomplete operationalisation of cloud and data-centre regulation, which creates uncertainty for potential investors and large users (National Information Technology Agency, 2023).

2. Limited enforcement capacity for existing data-protection and cybersecurity obligations, especially among smaller organisations (DLA Piper, 2024; Mensah, 2023).

3. Need for clearer guidance on cross-border data flows and localisation, balancing data-sovereignty concerns with the benefits of using regional hyperscale cloud services (African Union Commission, 2022; DLA Piper, 2024).

4. Coordination challenges among multiple institutions (MoCD, NCA, NITA, Data Protection Commission, Cyber Security Authority), which can result in fragmented or overlapping requirements (World Bank Group, 2019).

Human Capital and Institutional Readiness Gaps

Human capital and institutional capacity are less visible in headline indicators but are repeatedly identified as critical constraints. The Ghana Digital Economy Diagnostic stresses gaps in advanced ICT skills, including those relating to data engineering, cybersecurity and complex systems design, and identifies limited institutional capacity in parts of the public sector to manage digital projects and procure sophisticated ICT services (World Bank Group, 2019).

Across Africa, studies of digital transformation note that while connectivity and basic digital skills have improved, advanced digital skills remain scarce, particularly in areas such as cloud architecture, DevOps and cybersecurity (African Union Commission, 2020; Africa Data Centres Association & Oxford Business Group, 2024). Ghana fits this pattern. Although it has an increasingly vibrant technology and start-up ecosystem, there is limited evidence of a broad, domestically available pool of cloud specialists capable of driving large-scale, cloud-native transformations across sectors. While comparable cross-country data on cloud-specific skills remain limited, available DE4A diagnostics and national digital-skills assessments consistently rank Ghana below regional frontrunners on advanced ICT competencies, particularly in areas such as network engineering, cybersecurity and systems administration. This evidence, combined with qualitative reports from industry and government, supports the view that human capital constitutes a binding though not yet precisely quantifiable constraint on cloud adoption

In the public sector, institutional reforms such as the establishment of the national data centre and eGOVNET have provided shared infrastructure and an anchor for e-government services, but many ministries and agencies still maintain legacy systems and fragmented ICT governance structures, which complicate migration to shared cloud platforms (World Bank Group, 2019).

The main gaps in this dimension can be summarised as:

1. Shortages of advanced cloud-related skills in both public and private sectors.

2. Limited organisational capacity for cloud governance and change management, particularly in smaller enterprises and in subnational public institutions.

3. Fragmented ICT governance in parts of government, slowing consolidation and shared-services adoption.

Comparative Position and Overall Readiness Gap

When viewed in comparative perspective, Ghana occupies a transitional position in cloud readiness. It has higher internet-use levels and more developed legal frameworks than many low-income African countries (ITU, 2023; Republic of Ghana, 2008, 2012, 2020), and has made tangible progress with government backbone networks, national data-centre facilities and an active fintech ecosystem (World Bank Group, 2019; Ghana Investment Promotion Centre, 2022). At the same time, its fixed-broadband penetration, data-centre scale and domestic cloud provider base remain below those of regional leaders such as South Africa and Kenya (Africa Data Centres Association & Oxford Business Group, 2024; Console Connect & Balancing Act, 2025).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Table 1 presents a five-country comparison Ghana, Kenya, Nigeria, Rwanda and South Africa covering four cloud-relevant dimensions: population-level internet use, fixed broadband penetration, international bandwidth per thousand people, and estimated live carrier-neutral data-centre IT load. These metrics were selected because they correspond directly to the infrastructure, market, and institutional pillars operationalised in the analytical framework applied earlier in this study (see Figure 1). They also complement the regional snapshots already discussed in Sections 4.1 and 4.3, particularly the analysis of submarine-cable diversity and data-centre investments depicted in Figures 3 and 4.

Ghana's overall cloud readiness gap can be characterised as follows:

1. The foundational elements of a cloud-enabled environment—infrastructure, basic legal frameworks and an emerging provider ecosystem—are in place and improving.

2. Critical gaps persist in infrastructure quality and reach, market depth and diversity, regulatory operationalisation, advanced skills and institutional capacity.

3. Closing these gaps will require coordinated policy, infrastructure and capacity-building interventions, which will be the focus of the opportunities and recommendations sections that follow.

Table 1 Comparative Snapshot using four cloud-relevant indicators.

Country	Individuals Using Internet (% of population, 2023)	Fixed Broadband Subscriptions per 100 People (2023)	International Bandwidth per 1,000 People (Mbps, AU DES/TeleGeography c. 2021)	Estimated Carrier-Neutral Data-Centre Live IT Load (MW, 2024)
Ghana	69.9%	0.56	16.5 Mbps	≈1–2 MW live (≈7 MW commercial capacity)
Kenya	32.7%	2.39	25.0 Mbps	≈13 MW live
Nigeria	51.0%	0.09	≈8–10 Mbps (derived from 1,701 Gbps / 200M+ population)	≈10–15 MW live (Lagos is West Africa's major hub)
Rwanda	33.0%	0.17	≈4.0 Mbps	<1 MW live (Tier III Kigali DC; modest national capacity)
South Africa	72.3%	3.41	70.7 Mbps	>50 MW live (largest African DC market; hyperscale presence)

Note. Table 3 provides a comparative snapshot of five African economies Ghana, Kenya, Nigeria, Rwanda and South Africa using four cloud-relevant indicators derived from authoritative datasets. These indicators capture population-level connectivity (internet use), high-capacity access infrastructure (fixed broadband penetration), international transit capacity (bandwidth per thousand people), and the depth of the commercial cloud-hosting ecosystem (live carrier-neutral data-centre IT load). Together, the metrics offer a structured, multi-dimensional view of how each country's infrastructural and market conditions support cloud adoption. The comparative

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

perspective enables a clearer interpretation of Ghana's relative position in the region and complements the qualitative readiness assessment presented earlier in Figures 3, 4 and 6.

The comparative indicators highlight the tiered structure of cloud-enablement across the continent. South Africa remains the dominant regional hub, combining high internet adoption, comparatively strong fixed-broadband uptake, the largest international bandwidth availability per thousand people, and by far the deepest pool of carrier-neutral data-centre capacity. Kenya and Nigeria occupy an intermediate position: both countries significantly outperform Ghana in fixed-broadband penetration and live data-centre IT load, yet exhibit mixed performance in population-level connectivity. Ghana's digital-infrastructure outcomes particularly its relatively high internet-use rate compare favourably with peers such as Nigeria and Rwanda, but its fixed-broadband penetration and limited commercial data-centre footprint constrain its ability to match the readiness profiles of the continental leaders. These differences align with the qualitative assessment presented in Table 2 and visualised in the radar chart in Figure 6, which collectively place Ghana in a middle-readiness band: stronger than some regional economies on connectivity outcomes, but lagging the frontrunners on high-capacity infrastructure and cloud-conducive market conditions.

Table 2 summarises the qualitative scores assigned to each dimension and the underlying justification. Figure 6 translates these scores into a radar chart, providing a visual profile of Ghana's cloud readiness. The figure shows a relatively balanced position between infrastructure, market and policy readiness, contrasted with a more pronounced weakness in human capital and organisational capacity. The outer polygon represents an aspirational 2030 target profile consistent with current policy commitments, making the gap between present and desired states more immediately apparent.

Table 2 Qualitative scores assigned to each dimension and the underlying justification

Dimension	**Score (1–5)**	**Rationale (for your notes / caption, not the chart)**
Infrastructure Readiness	3.0	Strong subsea connectivity and 4G coverage, but low household internet access (~16.8% in 2019), patchy fixed broadband, and March 2024 outage exposed fragility in redundancy.
Market & Industry Readiness	3.5	Mature mobile operators and very dynamic FinTech/mobile money ecosystem; growing interest in colocation and cloud, but enterprise and public-sector cloud uptake still uneven.
Policy, Regulatory & Institutional Readiness	3.5	Solid base of electronic transactions, data protection and cybersecurity laws, plus digital economy strategy; however, no fully operational cloud-specific regulation yet and overlapping mandates (NCA, NITA, DPC, CSA, BoG).
Human Capital & Organisational Capacity	2.5	Significant progress on digital skills initiatives, but persistent skills gaps, limited cloud engineering capacity in public institutions, and uneven ICT competence across sectors and regions.

Note. Scores are based on the authors' synthesis of secondary sources.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Figure 6. Qualitative cloud readiness scores for Ghana across four dimensions.

Note. Scores are based on the authors' synthesis of secondary sources. Scores (1 = very weak, 5 = very strong) are based on the authors' synthesis of secondary evidence from international benchmarks, national statistics and policy documents. The "current (2024)" polygon reflects Ghana's present status, while the "target (2030)" polygon represents an aspirational trajectory aligned with ongoing digital economy and cloud-related reforms.

This visualisation reinforces the argument developed in the text: while Ghana's infrastructural and regulatory foundations for cloud adoption are not negligible, they remain incomplete, and the most binding constraints over the medium term are likely to arise from skills, institutional capacity and the ability of organisations to manage complex cloud transformations.

As an example, publicly available briefings on the Ghana.gov platform and digital payment systems for government services show how cloud-based and hosted solutions have been used to support revenue collection and service delivery, while simultaneously raising concerns around integration, security and institutional capacity. These experiences underline the relevance of the four-pillar framework for concrete sectoral initiatives, but a fuller understanding of implementation dynamics would require primary qualitative research with platform operators and oversight institutions.

Table 3 Summary of cloud readiness strengths and gaps in Ghana

Dimension	**Key strengths**	**Key gaps**
Infrastructure readiness	Multiple international submarine cables; regional gateway position; relatively widespread 3G/4G coverage; ongoing backbone and eGOVNET investments; initial national data-centre capacity.	Low household internet access and limited fixed broadband; affordability concerns for many users; connectivity and power resilience challenges revealed by recent submarine cable outages; limited edge facilities outside main urban centres.
Market & industry readiness	Strong mobile network operators; dynamic FinTech and mobile money ecosystem; growing interest in colocation and cloud services; emerging role for Ghana as a secondary regional hub; active ICT/FinTech investment promotion efforts.	Cloud uptake remains concentrated in a few leading sectors (finance, some public agencies, larger corporates); many SMEs still rely on basic digital tools; limited local provision of advanced cloud and managed services; concerns about cost, trust and vendor lock-in.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Policy, regulatory & institutional readiness	Existence of core digital laws (Acts 772, 843, 1038); data protection and cybersecurity authorities established; Ghana Digital Economy Policy and Strategy; ongoing work on data-centre and cloud regulation; participation in AU, AfCFTA and Smart Africa initiatives.	Absence of fully implemented cloud-specific regulatory framework; overlapping mandates among NCA, NITA, CSA, DPC and BoG; limited practical guidance on cross-border data flows and sector-specific cloud outsourcing; coordination mechanisms are still evolving and not formalised for cloud.
Human capital & organisational capacity	Expanding digital-skills programmes under national and regional initiatives; growing pool of ICT graduates and tech entrepreneurs; early exposure to cloud platforms in some universities and private academies.	Shortage of experienced cloud architects, DevOps and security professionals; uneven ICT governance capacity in ministries and regulators; limited change-management and procurement expertise for cloud migration; regional and socio-economic disparities in advanced digital skills.

Opportunities for Ghana's Cloud Adoption

While the preceding sections emphasise gaps and constraints, the same evidence also points to significant opportunities for Ghana to leverage cloud computing as a driver of digital transformation, economic diversification and regional integration.

Cloud as an Enabler of Digital Trade and AfCFTA Participation

Recent assessments show that Ghana plays a leading role in digitally delivered services trade. A WTO digital trade review reports that Ghana's exports of digitally delivered services have risen steadily since 2018 and that, by 2024, Ghana ranked among the top three African exporters of such services, with particular strength in business and financial services (World Trade Organization, 2024). Imports of digitally delivered services have also more than doubled over the same period, reflecting the growing importance of digital inputs for domestic firms (World Trade Organization, 2024).

In parallel, analysis of AfCFTA digital trade implementation in Ghana underscores that the digital economy is already a significant contributor to GDP and that deeper integration into regional digital markets could generate substantial gains in trade, jobs and productivity (Chivunga, 2024). The forthcoming AfCFTA Protocol on Digital Trade aims to harmonise rules for digital commerce, data flows and electronic transactions across Africa, offering Ghana a framework within which to scale cross-border digital services (Lemma et al., 2024).

Cloud computing can deepen Ghana's participation in these digital trade flows by:

1. Providing scalable, export-ready platforms for business-process outsourcing, software development, fintech solutions and other digitally delivered services.

2. Reducing entry barriers for firms that wish to serve regional markets, since cloud-based infrastructure can be provisioned without heavy capital expenditure.

3. Supporting compliance with emerging cross-border data and cybersecurity rules through well-governed cloud environments aligned with regional frameworks (African Union Commission, 2022; Republic of Ghana, 2020).

Given Ghana's strong position in digitally delivered services and its strategic role in AfCFTA processes, enhanced cloud readiness would reinforce the country's competitiveness in regional digital trade.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Positioning Ghana as a Regional Data and Services Hub

Ghana's geographical location, political stability and existing connectivity assets create an opportunity to position the country as a West African data and cloud services hub. The Ghana Digital Economy Policy and Strategy explicitly seeks to use digital infrastructure and platforms to position Ghana as a regional digital-services centre (Ministry of Communications and Digitalisation, 2023). The same policy highlights the need for robust data-centre infrastructure and government cloud capabilities as foundational elements of the digital economy.

Industrial and policy documents show that Ghana already hosts several commercial and public data centres and is developing a national regulatory framework for data centres and cloud services, with support from Smart Africa (National Information Technology Agency, 2023; Regulatory Framework for Data Centres, n.d.). Smart Africa's broader initiative to expand multi-tenant data-centre and cloud infrastructure across the continent aims to channel substantial investment into selected member states, including Ghana, to strengthen Africa's footprint in the global data economy (Smart Africa, 2023; Smart Africa, 2024).

If Ghana can combine:

1. its existing subsea and terrestrial connectivity,
2. a credible, predictable regulatory framework for data centres and cloud, and
3. a pipeline of skilled ICT professionals,

then it is well placed to attract additional regional workloads from neighbouring countries and multinational firms that seek a stable, well-governed location for West African hosting. This would generate foreign direct investment, create high-skilled jobs and broaden the tax base.

Cloud for Digital Public Infrastructure and Government Services

The Ghana Digital Economy Diagnostic and subsequent World Bank operations, particularly the Ghana Digital Acceleration Project (GDAP), highlight the modernisation of government systems and shared platforms as central pillars of Ghana's digital agenda (World Bank Group, 2019; World Bank Group, 2022). The eTransform programme, eGOVNET backbone and national data centre have already created a technical foundation for shared services and e-government platforms (Ministry of Communications and Digitalisation, 2024).

Cloud computing offers several opportunities in this context:

1. Consolidation of fragmented legacy systems into shared platforms for identity management, taxation, public financial management, health records and education services, improving interoperability and reducing duplication.
2. Elastic capacity to support peak loads during, for example, election periods, tax filing seasons or large-scale social programmes.
3. Improved resilience and disaster recovery for critical public systems through geographically redundant hosting within national and, where appropriate, regional data centres (World Bank Group, 2019; Regulatory Framework for Data Centres, n.d.).

The Digital Cooperation Organization's 2025 Ghana report notes that, as of 2022, Ghana had a government cloud strategy but no fully established government cloud platform, indicating that significant room remains to operationalise cloud-first approaches in public service delivery (Digital Cooperation Organization, 2025).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Implementing a coherent government cloud environment represents a major opportunity to accelerate the digitalisation of public services and to act as an anchor client for the domestic cloud ecosystem.

Supporting SMEs, Innovation and Skills Development

Analyses of Ghana's digital economy emphasise that small and medium enterprises are central to employment and inclusive growth but often lag in digital adoption (World Bank Group, 2019; Chivunga, 2024). Cloud services can reduce the cost and complexity of digitalisation for SMEs by providing:

1. Affordable access to enterprise-grade applications (accounting, inventory, CRM, HR) on a subscription basis.

2. Online marketplaces, payment gateways and logistics platforms that lower barriers to participation in domestic and regional e-commerce.

3. Development platforms and sandbox environments for start-ups and innovators.

Regional initiatives reinforce this opportunity. Programmes associated with AfCFTA and private-sector partners seek to equip African SMEs with digital trade and AI skills to support cross-border business growth (Ecofin Agency, 2025). Cloud-based tools and training can be integrated into such initiatives, enabling Ghanaian SMEs to build export-ready digital operations.

At the same time, cloud adoption can contribute to skills development. As organisations adopt cloud technologies, demand for cloud engineers, DevOps specialists, cybersecurity professionals and data analysts increases, creating incentives for universities, training institutions and professional bodies to expand relevant curricula (African Union Commission, 2020; World Bank Group, 2019). This dynamic can support Ghana's wider goals in national AI and digital-skills strategies (Republic of Ghana, 2023).

Sector-Specific Transformation Opportunities

Cloud computing offers sector-specific opportunities that align with Ghana's development priorities.

1. In finance and fintech, cloud-native architectures can support the expansion of digital financial services, regtech solutions, risk analytics and cross-border payments, reinforcing Ghana's position as a regional fintech hub (Pazarbasioglu et al., 2020; Bank of Ghana, 2024).

2. In agriculture and trade, cloud platforms can underpin digital extension services, market-information systems and supply-chain tracking, supporting implementation of AfCFTA and other trade frameworks (Chivunga, 2024; Lemma et al., 2024).

3. In health and education, cloud-based telemedicine, learning management systems and data platforms can help address service gaps, particularly when combined with targeted broadband expansion (World Bank Group, 2019; Republic of Ghana, 2023).

These opportunities will only be fully realised, however, if the readiness gaps identified in Section 7 are addressed through deliberate and coordinated policy action.

Policy and Strategic Recommendations

Building on the gap analysis and opportunities identified above, this section proposes strategic directions to strengthen Ghana's cloud readiness. The recommendations are aligned with existing national strategies and international best practice, and are intended to be feasible within Ghana's institutional and fiscal context.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Strengthen Broadband, Data-Centre and Interconnection Infrastructure

First, Ghana should continue to expand and diversify its digital infrastructure base in line with the Ghana Digital Economy Policy and Strategy and the National Communications Authority's strategic plan (Ministry of Communications and Digitalisation, 2023; National Communications Authority, 2024). Priority actions include:

1. Accelerate last-mile broadband and fixed access deployment- Use targeted incentives, public–private partnerships and universal access mechanisms to support fibre-to-the-premises and high-capacity wireless deployments in underserved urban and peri-urban areas, complementing mobile broadband (World Bank Group, 2019; Ghana Statistical Service & National Communications Authority, 2020).

2. Increase network resilience and route diversity- Implement the Ministry of Communications and Digitalisation's proposals for mandatory multi-cable connections, enhanced participation in local internet exchange points and mixed satellite/terrestrial backhaul for critical networks, to mitigate the risk of simultaneous subsea cable outages (Ministry of Communications and Digitalisation, 2024; Internet Society, 2024).

3. Enable competitive, standards-based data-centre growth- Finalise and implement the Regulatory Framework for Data Centres with clear, proportionate licensing, adherence to international standards (e.g., ANSI/TIA-942, ISO 27001) and incentives for green and energy-efficient designs (Regulatory Framework for Data Centres, n.d.; National Information Technology Agency, 2023).

   Align national measures with Smart Africa's regional initiatives to attract multi-tenant data-centre investments and to integrate Ghana into continental data infrastructure plans (Smart Africa, 2023; Smart Africa, 2024).

These measures would provide a more robust foundation for both domestic and cross-border cloud workloads.

Operationalise Cloud-Specific Regulation and Enhance Regulatory Coordination

Second, Ghana should move from general frameworks to operational cloud and data-centre regulation and improve inter-agency coordination.

1. Complete the cloud and data-centre regulatory framework- Translate the NITA–Smart Africa work into formal regulations and guidelines that define registration, supervision, minimum security requirements, incident reporting and service-level expectations for data-centre and cloud providers (National Information Technology Agency, 2023; Republic of Ghana, 2020).

2. Issue practical guidance on cross-border data flows- The Data Protection Commission, in consultation with NITA, the Cyber Security Authority and the Bank of Ghana, should provide sector-neutral and sector-specific guidance on the application of Act 843 to cloud services, including model contractual clauses and criteria for assessing "adequate protection" in recipient jurisdictions (Republic of Ghana, 2012; DLA Piper, 2024; African Union Commission, 2022).

3. Strengthen coordination mechanisms- Establish a formal Cloud and Data Governance Working Group bringing together MoCD, NCA, NITA, the Data Protection Commission, the Cyber Security Authority and key sector regulators. This body could align regulatory interventions, share information on incidents and emerging risks, and provide a single point of engagement for major cloud and data-centre investors (World Bank Group, 2019; Ministry of Communications and Digitalisation, 2023).

4. Reduce the cost and complexity of regulation through formal coordination- Establishing a Cloud and Data Governance Working Group that brings together the Ministry of Communications and Digitalisation, the National Communications Authority, the National Information Technology Agency,

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

the Data Protection Commission, the Cyber Security Authority and key sector regulators would help to streamline regulatory processes for cloud services. A single coordination forum can reduce duplication of audits and approvals, enable joint guidance on cross-cutting issues (such as incident reporting and cross-border data flows) and provide a consolidated interface for major cloud and data-centre projects. For regulated entities, this would lower the effective cost of compliance and shorten decision timelines, thereby removing an important non-technical barrier to cloud adoption.

Improved clarity and coordination would reduce uncertainty for cloud providers and users and increase trust in Ghana's regulatory environment. A central principle of Ghana's cloud strategy should be to "regulate once, supervise together": minimising duplicative requirements while preserving the specialised mandates of individual regulators.

Use Public Sector Demand to Catalyse the Cloud Ecosystem

Third, the public sector can act as a strategic anchor client for the domestic cloud ecosystem.

1. Implement a government cloud operating model- Building on the Digital Economy Policy and Strategy and the GDAP, Ghana could adopt a cloud-first or cloud-preferred approach for new government systems, with clear criteria for when workloads should be hosted in the national data centre, certified local data centres or regional cloud facilities (World Bank Group, 2022; Digital Cooperation Organization, 2025).

2. Rationalise and consolidate legacy systems- Prioritise migration of high-impact systems (such as identity, tax, public financial management and core registries) to shared platforms, using cloud infrastructure where appropriate. This would reduce fragmentation and demonstrate the feasibility and benefits of cloud adoption in a high-visibility context (World Bank Group, 2019).

3. Standardise procurement and security requirements- Develop common procurement templates, minimum security baselines and service-level clauses for cloud-related contracts, aligned with Act 843, Act 1038 and the data-centre regulatory framework, to streamline acquisition and oversight (Republic of Ghana, 2012, 2020; Regulatory Framework for Data Centres, n.d.).

By aggregating demand and providing predictable requirements, the public sector can help create the scale and certainty necessary for local cloud and data-centre markets to develop.

Invest in Advanced Digital Skills and Institutional Capacity

Fourth, Ghana should complement infrastructure and regulatory reforms with targeted investment in advanced digital skills and institutional capacity.

1. Expand cloud and cybersecurity curricula- Universities, technical universities and professional training institutions can integrate cloud architecture, DevOps, platform engineering and cybersecurity into ICT and engineering programmes, in line with national AI and digital-skills strategies (Republic of Ghana, 2023; African Union Commission, 2020).

2. Leverage regional and global skills initiatives- Participate actively in AfCFTA- and private-sector-led programmes that support SME digital and AI skills, ensuring that cloud literacy and practical cloud adoption modules are incorporated (Ecofin Agency, 2025; Chivunga, 2024).

3. Strengthen institutional capacity for digital governance- Provide focused capacity-building for ICT and procurement units in ministries, regulators and local government, enabling them to design cloud-ready projects, evaluate provider offerings and manage vendor relationships effectively (World Bank Group, 2019; National Communications Authority, 2024).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

A sustained focus on skills and institutional capacity will help ensure that cloud infrastructure and regulatory reforms translate into effective and secure adoption.

Align Cloud Strategy with Regional Integration and Investment Agendas

Finally, Ghana should ensure that its cloud strategy is closely aligned with regional integration and investment frameworks.

1. At continental level, alignment with the AU Digital Transformation Strategy, the AU Data Policy Framework and the AfCFTA Digital Trade Protocol can help Ghana shape and benefit from harmonised rules on digital trade, data flows and cybersecurity (African Union Commission, 2020, 2022; Lemma et al., 2024).

2. At subregional level, Ghana can leverage ECOWAS initiatives and cross-border infrastructure projects to promote interconnection and create a more integrated West African data and cloud market (World Trade Organization, 2024).

3. At the investment level, Ghana should position itself to benefit from international finance aimed at African data-centre and digital infrastructure, such as recent IFC-backed investments in regional data-centre providers, by offering a clear regulatory regime and bankable project pipeline (Reuters, 2025; Xalam Analytics, 2025).

Aligning domestic cloud strategy with these wider agendas would allow Ghana to capture a larger share of regional digital value chains and to secure long-term investment in its digital infrastructure.

Limitations and directions for future research

This study has several limitations that should be acknowledged when interpreting its findings.

Three limitations are particularly important for interpreting the findings. First, the analysis relies exclusively on secondary sources, which means that the institutional and organisational perspectives of cloud users and providers are inferred rather than directly observed; this constrains the depth of insight into implementation dynamics. Second, the underlying datasets are piecemeal across time and sectors, so estimates of connectivity, data-centre capacity and skills should be read as indicative of orders of magnitude and trends, not as precise real-time measurements. Third, there is no widely accepted, standardised index of cloud readiness for African economies, and the four-pillar framework used here is therefore interpretive rather than officially endorsed. Each of these limitations is mitigated, but not eliminated, by triangulation across independent sources and by transparent reporting of data vintages.

These limitations open up several avenues for future research. One important direction is the design and implementation of primary empirical studies on cloud adoption in Ghana, including surveys and qualitative case studies of enterprises, public-sector institutions, and cloud service providers. Such work could examine in more detail how organisational capacity, trust, affordability, regulatory compliance, and vendor relationships shape decisions about whether and how to migrate workloads to the cloud, and how these factors differ across sectors, firm sizes, and regions. A second priority is the development of a country-level cloud readiness index or dashboard for Ghana, grounded in transparent indicator selection, explicit weighting, and regular updates, which would allow progress in each of the four dimensions identified in this paper to be tracked over time.

Further research could also explore the economic and developmental impact of cloud adoption in Ghana through more formal modelling and evaluation. This might include estimating the contribution of cloud-based services to productivity growth, innovation, job creation, and SME competitiveness, as well as assessing the fiscal and regulatory implications of different cloud governance scenarios. Comparative studies that position Ghana alongside peer countries with different institutional configurations and infrastructure endowments would help to

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

clarify which aspects of Ghana's cloud ecosystem are distinctive and which challenges are shared regionally. Finally, there is scope for more detailed analysis of multi-regulator governance arrangements, examining how coordination mechanisms, regulatory sandboxes, and cross-agency cloud strategies can reduce compliance burdens while safeguarding data protection, cybersecurity, and consumer rights.

CONCLUSIONS

This paper has examined Ghana's cloud readiness through a structured review of secondary data on digital infrastructure, market conditions, regulatory frameworks and institutional capacity. Using a four-pillar framework encompassing infrastructure readiness; market and industry readiness; policy, regulatory and institutional readiness; and human capital and organisational capacity the analysis shows that Ghana has made tangible progress, but that readiness remains uneven and fragile across dimensions.

On the infrastructure side, Ghana benefits from multiple submarine cable landings, a national fibre backbone and ongoing investments in eGOVNET and other public-sector networks. These assets have underpinned the expansion of mobile broadband and the growth of digital services. At the same time, the March 2024 multi-cable outage exposed significant vulnerabilities in international connectivity and highlighted the continued importance of route diversity, redundancy and local interconnection. Fixed broadband remains limited and relatively expensive, especially outside major urban centres, constraining the reliability and affordability of high-capacity connectivity required for cloud-intensive applications.

From a market and industry perspective, Ghana's telecommunications operators, financial institutions and FinTech ecosystem have emerged as early adopters of cloud services, often through hybrid models that blend local hosting with regional or global hyperscale platforms. However, adoption among small and medium-sized enterprises and many public-sector entities is more cautious. Concerns about cost, vendor lock-in, skills, and compliance with data protection and cybersecurity requirements contribute to a pattern in which Software-as-a-Service solutions are relatively more widespread, while deeper use of Infrastructure-as-a-Service and Platform-as-a-Service remains limited.

The policy and regulatory environment is relatively advanced in African terms. Core legal instruments the Electronic Transactions Act, the Data Protection Act and the Cybersecurity Act provide a base for secure and trusted digital services, while the Ghana Digital Economy Policy and Strategy sets an overarching vision for digital transformation. Nevertheless, responsibilities for cloud and data-centre oversight are distributed across several bodies, including the Ministry of Communications and Digitalisation, the National Communications Authority, the National Information Technology Agency, the Cyber Security Authority, the Data Protection Commission and, in the financial sector, the Bank of Ghana. This multi-regulator configuration risks creating overlapping requirements, duplicative approvals and elevated compliance costs for providers and users of cloud services.

Human capital and organisational capacity emerge as the most binding constraints over the medium term. While Ghana has expanded basic digital skills and nurtured a growing pool of ICT graduates and entrepreneurs, there remain shortages of experienced cloud architects, DevOps engineers, cybersecurity specialists and digital transformation leaders. Many public institutions and traditional enterprises lack robust ICT governance structures, cloud procurement expertise and change-management capacity, which slows the pace and reduces the quality of cloud adoption.

Overall, the evidence suggests that Ghana can be characterised as a moderately cloud-ready economy: the foundational elements are present or emerging, but gaps in infrastructure resilience, institutional coordination and skills threaten to limit the scale and impact of cloud adoption. Addressing these gaps will not only improve the robustness and efficiency of national digital infrastructure, but also enhance Ghana's ability to serve as a trusted hub for data-driven services within West Africa.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

REFERENCES

1. Adjei, J. K., Adams, S., & Mamattah, L. (2021). Cloud computing adoption in Ghana: Accounting for institutional factors. Technology in Society, 65, 101583.
2. Africa Data Centres Association. (2023). Africa interconnection report 2023. Africa Data Centres Association.
3. Africa Data Centres Association, & Oxford Business Group. (2024). Africa Data Centres Association – Market report 2024. Africa Data Centres Association.
4. African Union Commission. (2020). Digital transformation strategy for Africa (2020–2030). African Union.
5. African Union Commission. (2022). AU data policy framework. African Union.
6. Agyei, J., Sun, S., Penney, E. K., Abrokwah, E., Boadi, E. K., & Fiifi, D. D. (2022). Internet banking services user adoption in Ghana: An empirical study. Journal of African Business, 23(3), 599–616.
7. Agyapong, D. (2021). Implications of digital economy for financial institutions in Ghana: An exploratory inquiry. Transnational Corporations Review, 13(1), 51–61.
8. Ammah, L., Kriebitz, A., & Lütge, C. (2025). Institutional trust and affordability on mobile banking adoption in Ghana: A system dynamic approach. Journal of Management and Sustainability, 15(1), 1–14.
9. Asia Cloud Computing Association. (2018). Cloud readiness index 2018. Asia Cloud Computing Association.
10. Bank of Ghana. (2024). FinTech sector report – 2024. Bank of Ghana.
11. Chivunga, M. (2024). Advancing AfCFTA digital trade implementation in Ghana. ODI.
12. Coffie, C. P. K., Hongjiang, Z., Mensah, I. A., Kiconco, R., & Simon, A. E. O. (2021). Determinants of FinTech payment services diffusion by SMEs in Sub-Saharan Africa: Evidence from Ghana. Information Technology for Development, 27(3), 539–560.
13. Console Connect, & Balancing Act. (2025). Africa interconnection report 2025: The region's data centre and cloud landscape prepares for AI. Console Connect.
14. Cyber Security Authority. (n.d.). Cyber Security Authority (CSA). Ministry of Communications and Digitalisation.
15. Data Protection Commission. (n.d.). Data Protection Commission – Home. Data Protection Commission.
16. Digital Cooperation Organization. (2025). Ghana country report. Digital Cooperation Organization.
17. DLA Piper. (2024). Data protection laws of the world: Ghana. In Data protection laws of the world handbook 2025. DLA Piper.
18. Ecofin Agency. (2025, November 17). Google, AfCFTA launch program to equip 7,500 African SMEs with AI and digital trade skills. Ecofin Agency.
19. Ghana Investment Promotion Centre. (2022). Ghana's ICT and fintech sector report. Ghana Investment Promotion Centre.
20. Ghana Statistical Service, & National Communications Authority. (2020). Household survey on ICT in Ghana (2019): Abridged report. Ghana Statistical Service & National Communications Authority.
21. Internet Society. (2024). 2024 West Africa submarine cable outage report. Internet Society. https://www.internetsociety.org/resources/doc/2024/2024-west-africa-submarine-cable-outage-report/
22. International Telecommunication Union. (2023). Measuring digital development: Facts and figures 2023. ITU.
23. International Telecommunication Union. (2025). Measuring digital development: Facts and figures – Africa. ITU.
24. International Trade Administration. (2024, September 20). Ghana – digital economy. U.S. Department of Commerce.
25. Kyei-Arthur, F. (2024). Prevalence and predictors of internet use among Ghanaian older adults: Evidence from the Ghana 2021 Population and Housing Census. Humanities and Social Sciences Communications, 11, Article 326.
26. Lemma, A., Agarwal, P., & te Velde, D. W. (2024). Implementing the Digital Trade Protocol of the African Continental Free Trade Area. ODI.

27. Mensah, A. (2023). An overview of Ghana's Data Protection Act: Legal framework for data outsourcing and cloud services. Journal of African Law and Technology, 5(2), 45–63.
28. Mensah, N., & Adukpo, T. K. (2025). Financial technology and its effects on small and medium-scale enterprises in Ghana: An explanatory research. Asian Journal of Economics, Business and Accounting, 25(3), 268–284.
29. Ministry of Communications and Digitalisation. (2023). Ghana digital economy policy and strategy. Government of Ghana.
30. Ministry of Communications and Digitalisation. (2024a, March 18). Briefing by the Minister for Communications and Digitalisation to Parliament on internet disruption in Ghana as a result of the damage to submarine cables. Government of Ghana. https://moc.gov.gh/wp-content/uploads/2023/03/Briefing-on-Submarine-Cable-Disruptions-2-1.pdf
31. Ministry of Communications and Digitalisation. (2024b, June 27). 951 government institutions connected with high-speed network under eTransform project. Government of Ghana.
32. National Communications Authority. (2017). Submarine cables in Ghana. In World Bank Group, Ghana digital economy diagnostic: Stock-taking report (p. 38). World Bank Group.
33. National Communications Authority. (2024). Strategic plan 2024–2028 (abridged). National Communications Authority.
34. National Communications Authority. (2024a, March 15). Update 3: Undersea cable disruptions affect data services. National Communications Authority. https://nca.org.gh/2024/03/15/update-3-undersea-cable-disruptions-affect-data-services/
35. National Communications Authority. (2024b, May 19). Repair works on damaged subsea cables completed – NCA (B. A. Commey, Reporter). Ghana News Agency. https://gna.org.gh/2024/05/repair-works-on-damaged-subsea-cables-completed-nca/
36. National Information Technology Agency. (n.d.-a). Data centre [Project description]. National Information Technology Agency.
37. National Information Technology Agency. (n.d.-b). Stakeholder engagement meeting: National data centre & cloud regulatory framework development. National Information Technology Agency.
38. National Information Technology Agency. (2023, November 15). Inaugural stakeholder engagement meeting (virtual): National data centre and cloud regulatory framework development – Smart Africa support to Ghana. National Information Technology Agency.
39. Omwansa, T. (2019). Towards a cloud readiness assessment framework and index for Africa. Microsoft Policy Innovation Centre / Strathmore University.
40. Pazarbasioglu, C., García Mora, A., Uttamchandani, M., Natarajan, H., Feyen, E., & Saal, M. (2020). Digital financial services. World Bank Group.
41. Regulatory Framework for Data Centres. (n.d.). Regulatory framework for data centres in Ghana [Draft guideline]. National Information Technology Agency.
42. Republic of Ghana. (2008). Electronic Transactions Act, 2008 (Act 772). Ghana Publishing Company.
43. Republic of Ghana. (2012). Data Protection Act, 2012 (Act 843). Ghana Publishing Company.
44. Republic of Ghana. (2020). Cybersecurity Act, 2020 (Act 1038). Ghana Publishing Company.
45. Republic of Ghana. (2023). National Artificial Intelligence Strategy of Ghana. Government of Ghana.
46. Reuters. (2025, April 3). World Bank backs Africa digital data push with $100 million Raxio deal. Reuters.
47. Senyo, P. K., Addae, E., & Adam, I. O. (2015). An overview of cloud computing adoption across industries in a developing country. In Proceedings of the Information Systems Education Conference (ISECON) (pp. 322–332).
48. Senyo, P. K., Karanasios, S., Gozman, D., & Baba, M. (2022). FinTech ecosystem practices shaping financial inclusion: The case of mobile money in Ghana. European Journal of Information Systems, 31(1), 112–127.
49. Smart Africa. (2022, April 5). SADA conducts workshops in Ghana to strengthen data centres and cloud services ecosystem. Smart Africa Digital Academy.
50. Smart Africa. (2023). The role of African governments and multilateral organizations in increasing the footprint of multi-tenant data centres and cloud infrastructure in Africa. Smart Africa.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

51. Smart Africa. (2024). Smart Africa Data Centre and Cloud Initiative. Smart Africa Secretariat.
52. World Bank Group. (2019). Ghana digital economy diagnostic: Stock-taking report. World Bank Group. http://hdl.handle.net/10986/34366
53. World Bank Group. (2022). Project appraisal document: Ghana Digital Acceleration Project (P176126). World Bank Group.
54. World Bank Group. (2023). Digital economy for Africa (DE4A) initiative: Ghana updates. World Bank Group.
55. World Trade Organization. (2024). Digital trade review and next steps for Ghana under the Digital Trade for Africa initiative [Working title used in manuscript; replace with exact title of the Ghana digital trade assessment once obtained]. World Trade Organization.
56. Xalam Analytics. (2025). Ghana data centre market briefing: A strategic overview of the data centre investment opportunity in Ghana. Digital for Development (D4D) Hub.