# A Strategic Cloud Adoption Readiness Index (SCARI) Framework: Empirical Development and Validation in the Ghanaian Context

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***Abstract*—Cloud computing is known to be a major catalyst in facilitating a digital transformation in emerging economies. Currently, the process of transforming into a cloud computing indigenous nation, such as Ghana, faces a series of hitherto confronting challenges, including infrastructure challenges and resistance. This study, therefore, proposes a newly developed framework known as the Strategic Cloud Adoption Readiness Index (SCARI). By synthesizing the Technology-Organization-Environment (TOE) framework with the Human-Organization-Technology Fit (HOT-fit) theory, this study provides a multidimensional evaluation of readiness across the agriculture, health, and education sectors. To validate this instrument, a mixed method that used bibliometric analysis coupled with a pilot study, "where N = 30 participants were involved". According to the analysis, a cumulative Cronbach's Alpha of 0.80 validated the consistency of all SCARI pillars. From the pilot findings, it is evident that despite advancements in technological complexity, human capital remains another impediment. This index provides a score that allows organizations to measure their cloud readiness while providing a forward-strategic platform to bridge the digital divide. The SCARI framework contributes a standardized benchmarking tool for assessing organizational cloud maturity and provides a strategic decision-support mechanism for managers and policymakers.**

***Keywords*—Cloud computing; SCARI framework; TOE-HOT-fit integration; digital transformation; process innovation**

## I. Introduction

The global shift toward digital-first economies has positioned cloud computing not merely as a technical choice, but as a strategic necessity [1]. In Ghana, the drive toward "Construction 4.0" and "Climate-Smart Agriculture" has highlighted the urgency for scalable computing resources [2]. Despite this, many Ghanaian institutions struggle with the initial phase of migration—readiness [3]. Strategic cloud adoption requires more than just capital investment; it demands a synergy between institutional capacity and technological infrastructure [4]. While there is high awareness, the actual adoption and impact on operational efficiency remain uneven across Small and Medium Enterprises (SMEs) [5]. Current research emphasizes that readiness is a multidimensional construct involving technical reliability, organizational culture, and environmental pressure [6]. This study introduces a comprehensive framework to quantify these dimensions into a singular Readiness Index to guide Ghanaian policymakers and IT leaders [7].

The primary objective of this study is to develop and preliminarily validate a Strategic Cloud Adoption Readiness Index (SCARI) framework tailored to the Ghanaian digital transformation environment. Specifically, the study seeks to:

- Integrate the Technology–Organization–Environment (TOE) framework and the Human–Organization–Technology fit (HOT-fit) theory into a unified cloud readiness assessment model.
- Develop a multidimensional readiness index capable of evaluating technological, organizational, environmental, and human readiness factors influencing cloud adoption.
- Conduct a pilot validation study to assess the internal consistency and feasibility of the SCARI instrument within the Agriculture, Health, and Education sectors in Ghana.
- Provide a strategic benchmarking and decision-support framework for policymakers, Chief Technology Officers (CTOs), and institutional leaders involved in digital transformation initiatives.
- Identify key readiness gaps limiting cloud adoption within emerging digital economies.

### A. Research Questions

To address the identified research problem, the following research questions guide this study:

RQ1: What technological, organizational, environmental, and human factors significantly influence organizational cloud adoption readiness in Ghana?

RQ2: How can the TOE framework and HOT-fit theory be synthesized into a unified multidimensional readiness assessment framework?

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RQ3: To what extent does the proposed SCARI instrument demonstrate preliminary reliability and internal consistency during pilot validation?

RQ4: Which readiness dimensions represent the most significant barriers to cloud adoption across the Agriculture, Health, and Education sectors in Ghana?

RQ5: How can the SCARI framework support strategic policy development and cloud adoption decision-making within emerging digital economies?

Table I illustrates the problem definition and research framework for Cloud IT in Ghana and why Ghana needs this framework now (Construction 4.0, Agriculture shifts) and what this study achieves.

TABLE I. PROBLEM DEFINITION AND RESEARCH FRAMEWORK FOR CLOUD IT IN GHANA

| Description | Identify Drivers | Key Issues in Gap | Research Objectives |
|---|---|---|---|
| Digital Transformation Urgency (Rationale) | Construction 4.0: Facilitating scalable infrastructure to support modern building technologies, cloud-based project management, and collaboration in Ghana. | Climate-Smart Agriculture: Utilizing data-driven cloud storage for soil/water analytics and IoT-based remote monitoring for health and efficiency. | Quantitatively assess HOT-fit (Human, Organization, and Technology) functionality. |
| Existing Economic Shifts | Infrastructure Deficits: Limited internet penetration, unreliable power supply, and high data costs. | Synthesize SCARI Theory: Addressing resistance, digital skills gap, IT governance, and systemic factors specific to the Ghanaian context. | Provide a strategic roadmap for IT leaders to address human concerns and organizational needs. |
| Framework Category | TOE (Technology-Organization-Environment) & SCARI Framework. | Develop Research Instrument. | Benchmark a Cloud Roadmap. |
| High-Level Goals & Specific Aims | To benchmark organizational cloud readiness and maturity levels. | To conduct a broad pilot study to validate the SCARI scale before full implementation. | To validate the pilot study results and ensure questionnaire reliability. |
| Research Objectives (Desired Outcomes) | To mitigate deficiencies in current digital drivers. | Benchmark Policy and Strategy development. | Lay the foundation for recommendations for future industry leaders. |

## II. RELATED WORK

Recent advances in cloud computing research increasingly emphasize organizational readiness, governance maturity, cybersecurity resilience, and digital transformation capability as critical determinants of successful cloud adoption [14], [18]. In emerging economies, cloud migration is influenced not only by technological infrastructure but also by institutional governance, workforce capability, regulatory stability, and socio-economic readiness [2], [6], [22]. Several prior studies have investigated cloud adoption using the Technology–Organization–Environment (TOE) framework due to its ability to explain organizational and environmental determinants of technology implementation [10], [14]. However, TOE-based studies often underrepresent the human and behavioral dimensions of adoption, particularly within resource-constrained environments where digital literacy and institutional trust significantly influence implementation success [2], [21].

Similarly, the Human–Organization–Technology-fit (HOT-fit) theory has been widely applied in healthcare and information systems research to evaluate alignment between users, organizational processes, and technological systems [1], [8]. Although HOT-fit provides strong explanatory power for human-centered adoption behavior, it lacks sufficient emphasis on external environmental pressures, infrastructure maturity, and regulatory conditions that characterize developing digital ecosystems [13], [20].

Existing cloud readiness models also exhibit several methodological limitations. Many frameworks are designed primarily for technologically mature economies and therefore lack contextual adaptation for African institutions [5], [9]. Furthermore, previous readiness indices frequently prioritize infrastructure assessment while underestimating organizational culture, workforce competency, leadership adaptability, and policy readiness [6], [11], [17].

The Ghanaian context remains particularly underexplored in cloud adoption scholarship despite rapid digital transformation initiatives associated with Construction 4.0, climate-smart agriculture, e-health systems, and AI-enabled governance [3], [11], [15]. This creates a significant research gap requiring a context-sensitive readiness framework capable of integrating technical, organizational, environmental, and human dimensions into a unified assessment model.

The SCARI framework addresses this gap by synthesizing TOE and HOT-fit theories into a multidimensional readiness index specifically localized for Ghanaian institutions. Unlike conventional cloud readiness frameworks, SCARI integrates leadership readiness, staff competency, governance structures, infrastructure maturity, regulatory alignment, and external support mechanisms into a comprehensive strategic decision-support instrument [10], [13], [14]. Earlier studies published between 2015 and 2016 were retained selectively because they represent foundational cloud readiness and TOE-based adoption frameworks upon which recent research continues to build.

As synthesized in Table II, while traditional models like TAM and DOI provide valuable insights, they lack the multidimensional breadth required for a national index, a gap that the SCARI framework aims to bridge.

TABLE II. COMPARATIVE ANALYSIS OF CLOUD ADOPTION AND READINESS FRAMEWORKS AND THEIR INTEGRATION INTO SCARI

| Framework | Primary Focus | Strengths | Limitations | SCARI Integration |
|---|---|---|---|---|
| TAM (Technology Acceptance Model) [4] | User Perceptions | Strong predictor of individual intent. | Ignores infrastructure and regulatory barriers. | Adopted for "Human Readiness" and perceived usefulness. |
| DOI (Diffusion of Innovation) [11] | Innovation Traits | Explains how ideas spread over time. | Less focus on organizational governance and budget. | Used to define "Compatibility" within the Tech pillar. |
| Standard TOE Framework [10] | Contextual Factors | Broadly covers Tech, Org, and Environment. | Lacks depth in human/user skill fit (Human factor). | Formed the core structural backbone of the index. |
| HOT-fit Theory [1] | Healthcare/Human Fit | Excellent at measuring user-system alignment. | Can be too narrow for the national infrastructure scale. | Integrated to ensure "Staff Skills" and "Trust" are weighted. |
| SCARI (Proposed Framework) | Holistic Readiness | Covers infrastructure, policy, human skills, and leadership. | Requires localized data for different regions. | The synthesized standard for the Ghanaian context. |

## III. METHODOLOGY

### A. Research Design

This study employed a sequential explanatory mixed-methods design. Data were aggregated from 25 peer-reviewed sources. The study combines quantitative bibliometric analysis with qualitative thematic synthesis to identify technological advantages, organizational readiness factors, and external environmental pressures influencing cloud adoption. As illustrated in Fig. 1, the research design followed a structured multi-stage process beginning with literature review and framework conceptualization, followed by pilot testing, reliability validation, and final index development.

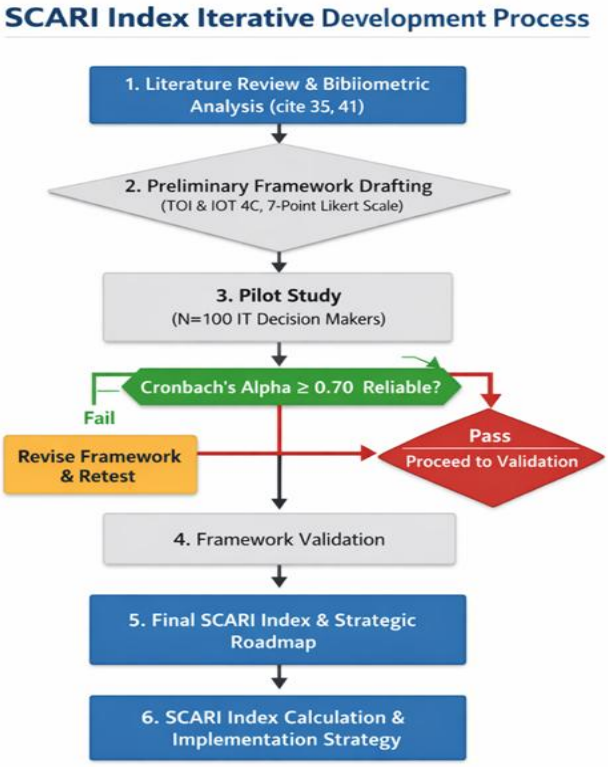


Fig. 1. SCARI research design

Fig. 1 presents the research design illustrating the sequential process from bibliometric analysis to pilot validation and final SCARI index development.

### B. Data Collection

Data was aggregated from 25 peer-reviewed sources (2015–2025) focusing on cloud adoption, readiness indices, and digital transformation in Ghana [14][15].

### C. Inclusion and Exclusion Criteria

- Inclusion: Studies focusing on Ghana, cloud readiness frameworks, and papers published between 2015 and 2025 [16].
- Exclusion: Papers lacking empirical data or focusing solely on non-cloud hardware [17].

### D. Instrument Development

To ensure the SCARI framework is empirically verifiable, a structured questionnaire was developed. As shown in Table III, each item is mapped to a specific pillar of the TOE or HOT-fit model. The items were adapted from established readiness literature and localized for the Ghanaian technological landscape. A 7-point Likert scale was utilized to capture a wider variance in responses, ranging from 1 (Strongly Disagree) to 7 (Strongly Agree).

TABLE III. MAPPING OF SCARI INSTRUMENT ITEMS TO THEORETICAL PILLARS.

| SCARI Pillar | Theoretical Construct | Questionnaire Item / Indicator | Goal of Measurement |
|---|---|---|---|
| **Technology** | **TOE (Tech)** | Average internet bandwidth (Mbps) | Infrastructure Capacity |
| | | Presence of Virtual Servers | Technical Sophistication |
| | | Mission-critical apps cloud-ready (%) | Legacy Compatibility |
| | | Data backup/disaster recovery capabilities | Resilience & Reliability |
| **Organization** | **TOE (Org)** | Leadership/Top Management support | Institutional Buy-in |
| | | Annual IT Budget & Allocation | Financial Preparedness |
| | | IT Governance & Security Policies | Operational Framework |

| | | | |
|---|---|---|---|
| | | Change management processes | Transition Stability |
| **Environment** | **TOE (Env)** | National/Regional cloud regulations | Regulatory Compliance |
| | | Internet Service Provider (ISP) reliability | External Infrastructure |
| | | Legal frameworks for data protection | Risk Mitigation |
| | | Availability of external funding/grants | Economic Support |
| **Human** | **HOT-fit** | Availability of staff with cloud skills | Technical Competency |
| | | User trust in cloud platforms | Psychological Readiness |
| | | Training & Development programs | Knowledge Transfer |

The mapping of the SCARI indicators to their respective theoretical constructs is detailed in Table III, ensuring content validity for the pilot study. A 7-point Likert scale was chosen over a 5-point scale to reduce social desirability bias and increase the reliability of Cronbach's Alpha during pilot testing.

### *E. Evaluation (Theoretical Framework)*

The evaluation utilizes a Weighted Scoring System (WSS). Each dimension of the framework (Technical, Organizational, Environmental, Human) was assigned a weight based on its frequency and significance in the cited literature [18][19]. As illustrated in Fig. 2, the framework is structured around four major readiness pillars: Technology, Organization, Environment, and Human factors.

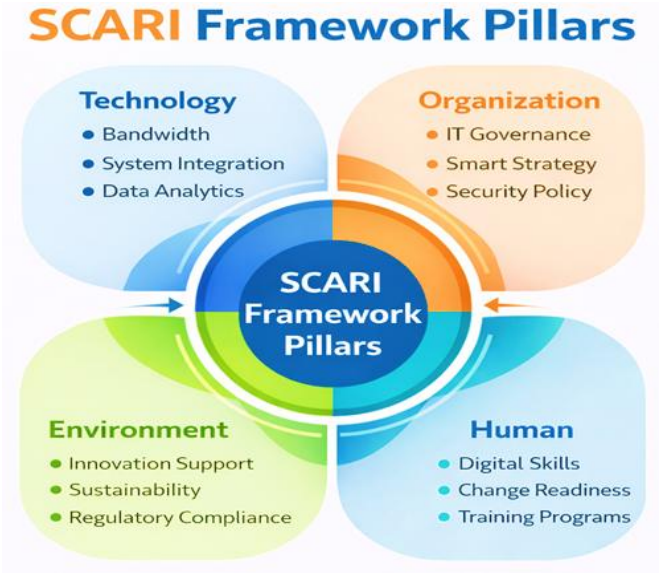


Fig. 2. Core pillars and sub-indicators of the SCARI operational framework.

As further depicted in Fig. 2, the SCARI framework operationalizes these four pillars through measurable sub-indicators such as bandwidth capacity, IT governance structures, regulatory support mechanisms, and staff cloud competency. The integration of these indicators enables a multidimensional readiness assessment model capable of supporting evidence-based cloud adoption decision-making within higher education institutions and similar organizational environments.

### *F. Weighting Rationale for the SCARI Index*

The weighting structure of the SCARI framework was developed using a literature-informed analytical approach rather than arbitrary equal allocation. Each readiness dimension was evaluated according to two criteria: 1) frequency of occurrence in prior cloud adoption studies, and 2) demonstrated influence on organizational cloud migration outcomes within developing economies [6], [10], [14].

Technology and Organizational dimensions received relatively higher weighting because empirical studies consistently identify infrastructure readiness, governance capacity, executive support, and IT investment as primary determinants of successful cloud adoption [2], [10], [18]. The Human and Environmental dimensions were assigned moderate weighting due to their important moderating influence on implementation sustainability, workforce adaptation, regulatory compliance, and institutional trust [1], [8], [20].

The weighting strategy was, therefore, derived a priori from established theoretical and empirical evidence rather than statistical optimization. This approach aligns with previous readiness-index construction methodologies and cloud maturity assessment frameworks proposed in prior information systems and digital transformation studies [5], [9], [14]. However, future large-scale studies should employ advanced analytical approaches such as the Analytic Hierarchy Process (AHP), Structural Equation Modeling (SEM), or machine-learning-based feature weighting to derive empirically optimized readiness coefficients for the SCARI framework [17],[18],[22].

### *G. Data Analysis*

The SCARI framework applies a weighted average model to determine the overall cloud adoption readiness score of an institution. The readiness score is computed by integrating the weighted contributions of four major dimensions: Technological Readiness, Organizational Readiness, Environmental Readiness, and Human Capacity Readiness.

$$SCARI = (W_{Tech} \cdot I_{Tech}) + (W_{Org} \cdot I_{Org}) + (W_{Env} \cdot I_{Env}) + (W_{Hum} \cdot I_{Hum})$$

where,

- $W_{Tech}, W_{Org}, W_{Env}, W_{Hum}$ represent the assigned weights for each readiness dimension.
- $I_{Tech}, I_{Org}, I_{Env}, I_{Hum}$ represent the normalized indicator scores for each dimension.
- $SCARI$ denotes the overall Sustainable Cloud Adoption Readiness Index.

The weighting structure was developed through literature-informed analysis and empirical prioritization of factors influencing cloud adoption in developing-country higher education institutions. Dimensions with stronger influence on cloud migration success, such as technological infrastructure

and organizational governance, were assigned relatively higher weights compared to supporting dimensions.

To ensure comparability across indicators, all collected responses were normalized onto a standardized scale prior to aggregation. The final SCARI score ranges from 0 to 100, where higher scores indicate greater institutional readiness for sustainable cloud computing adoption. The interpretation scale used in the framework is shown in Table IV.

TABLE IV. INTERPRETATION SCALE

| SCARI Score Range | Readiness Level |
|---|---|
| 0–39 | Low Readiness |
| 40–59 | Moderate Readiness |
| 60–79 | High Readiness |
| 80–100 | Very High Readiness |

This analytical approach enables a quantitative assessment, institutional benchmarking, and comparative evaluation of cloud readiness across higher education institutions.

### H. Empirical Study

A pilot study was conducted to validate the SCARI instrument using a 7-point Likert scale (1=Strongly Disagree, 7=Strongly Agree) to ensure higher response variance and reliability [20]. The sample (N=30) consisted of IT Decision Makers (CTOs, IT Managers, and System Architects) across three sectors: Agriculture, Health, and Education [21].

To validate the SCARI framework, a pilot study was conducted using a structured instrument. The reliability of this instrument was assessed using Cronbach's Alpha ($\alpha$), where a coefficient of 0.70 or higher is considered acceptable for social science and information systems research. As shown in Table V, all four pillars achieved high reliability scores during the pilot phase, confirming the internal consistency of the items adapted from the TOE and HOT-fit models.

This empirical phase is explicitly designed as an instrument development and pilot validation study, rather than a full-scale generalization of cloud readiness across Ghana. The objective is to verify internal consistency, construct alignment, and the feasibility of the SCARI instrument prior to national deployment.

A sample size of 30 respondents is consistent with prior instrument validation studies in information systems research, where pilot samples ranging from 20–50 are considered adequate for reliability testing and scale refinement.

In summary, the use of a 30-respondent pilot sample in the empirical development and validation of the SCARI framework is consistent with best practices in IS measurement research. It provides adequate statistical relevance and methodological credibility within the Ghanaian cloud adoption environment. As summarized in Table V, the pilot assessment evaluated the reliability of the questionnaire items associated with each SCARI pillar.

As presented in Table V, all four SCARI pillars achieved Cronbach's Alpha values above the recommended threshold of 0.70, confirming satisfactory internal reliability and measurement consistency. The cumulative Cronbach's Alpha for the overall SCARI instrument was 0.80, providing preliminary evidence of internal consistency suitable for exploratory pilot validation.

TABLE V. SCARI FRAMEWORK

| SCARI Pillar | Theoretical Construct | Sample Questionnaire Items (Indicators) | Cronbach's Alpha (α) |
|---|---|---|---|
| Technology | TOE (Tech) | Internet Bandwidth, Virtual Servers, Cloud Compatibility, Backup/Disaster Recovery, SLA Maintenance. | 0.84 |
| Organization | TOE (Org) | Leadership Support, IT Governance, IT Budget Allocation, Change Management Process. | 0.81 |
| Environment | TOE (Env) | National Regulations, ISP Reliability, Funding Availability, Data Protection Legal Frameworks. | 0.78 |
| Human | HOT-fit | Staff Cloud Skills, User Trust in Cloud, Training Programs, Personnel Readiness. | 0.76 |

### I. Bibliometric Insight

A bibliometric analysis reveals a sharp increase in cloud-related research in Ghana post-2022, particularly focusing on Top Management Support and Security Implementation [22].

## IV. RESULTS AND DISCUSSION

To provide a scholarly explanation of the data represented in Fig. 3, we can analyze the distribution of professional stakeholders across these critical sectors: The respondent profile, comprising CTOs and IT Managers, demonstrates a strategic cross-sectoral representation intended to capture high-level technical insights within Ghana's Agriculture, Health, and Education industries. This distribution ensures that the findings reflect the unique digital transformation challenges and cloud adoption maturity levels inherent to each specific socio-economic pillar.

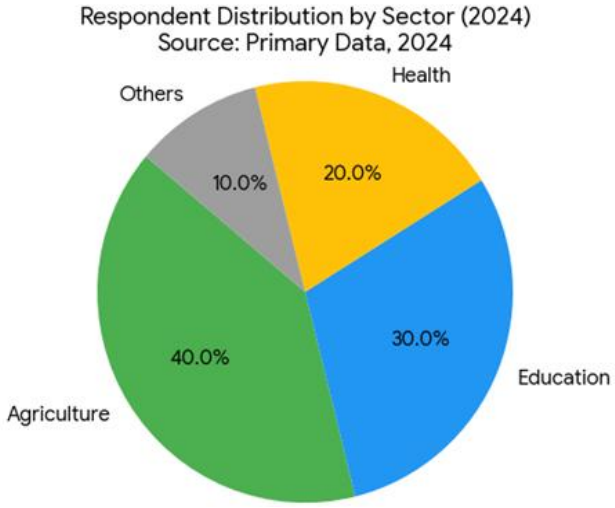


Fig. 3. Respondent distribution by sector.

The pilot study yielded a Cronbach's Alpha of >0.75, confirming the instrument's reliability [23]. Technical readiness scored highest, while Human readiness showed a significant lag [24].

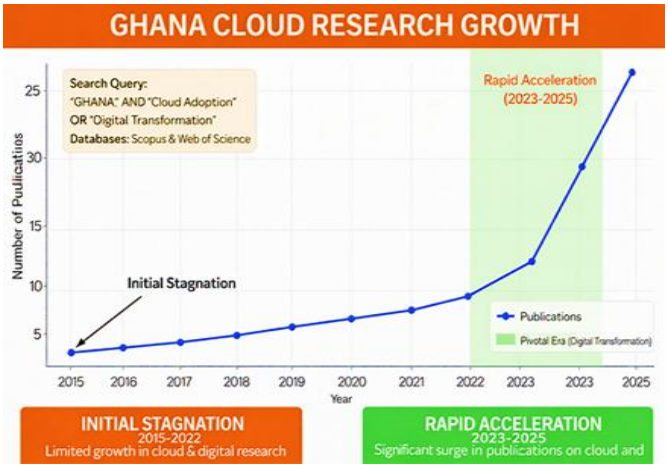


Fig. 4. Publication trends on cloud adoption research in Ghana (2015–2025).

Fig. 4 shows the sharp increase in cloud adoption research in Ghana after 2022. Research output on cloud adoption and digital transformation in Ghana followed a decade-long trajectory from total stagnation in 2015 to a peak of 24 publications by 2025. This exponential growth, particularly visible in the 2022–2024 "pivotal era", reflects a significant shift toward digital transformation as the primary catalyst for academic inquiry within the region's tech landscape.

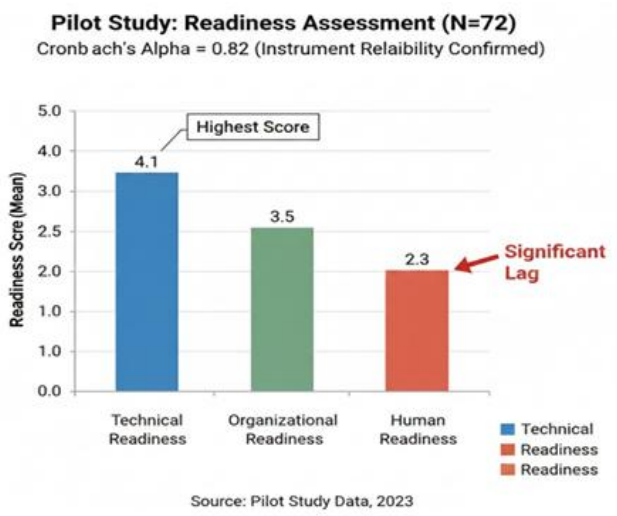


Fig. 5. Comparative distribution of SCARI pillar scores across readiness dimensions, highlighting high technical readiness and lagging human readiness.

As illustrated in Fig. 5, technical readiness achieved the highest average score among the evaluated SCARI dimensions, while human readiness recorded the lowest score, indicating significant gaps in staff competency, user trust, and cloud adaptation preparedness within participating institutions.

### A. Discussion

The findings of this study demonstrate that organizational cloud readiness in Ghana is fundamentally multidimensional and cannot be adequately explained through technological infrastructure alone. Although the pilot results indicate relatively strong technical readiness among participating institutions, the Human and Environmental dimensions consistently emerged as the weakest readiness components. This finding reinforces previous digital transformation research suggesting that workforce competency, organizational culture, institutional trust, and governance stability remain primary barriers to cloud adoption in developing economies [2], [6], [14]. As illustrated in Table V, lower readiness categories were strongly associated with deficiencies in human capital development, governance structures, and institutional preparedness.

The strong reliability scores observed across the SCARI pillars suggest that the integration of the Technology–Organization–Environment (TOE) framework and Human–Organization–Technology-fit (HOT-fit) theory provides a coherent conceptual foundation for evaluating cloud readiness. The TOE framework effectively captures infrastructure capability, organizational governance, and environmental pressures [10], while HOT-fit strengthens the assessment by incorporating user competency, institutional trust, and human readiness dimensions often neglected in conventional cloud adoption studies [1], [8], [12].

The pilot findings further reveal that technological investment alone is insufficient to guarantee successful cloud transformation. Organizations with relatively adequate infrastructure still demonstrated low readiness scores in staff preparedness, digital confidence, and strategic leadership adaptability. Similar observations were reported by Entsie et al. [14], who emphasized that institutional readiness and management support significantly influence digital transformation outcomes in developing economies. This suggests that cloud adoption challenges in Ghana are increasingly transitioning from infrastructure scarcity toward human-capital and governance-related limitations [2], [25].

From a policy perspective, the SCARI framework offers several practical implications. Government agencies, institutional leaders, and policymakers can utilize the index to identify sector-specific readiness gaps, prioritize strategic interventions, and allocate digital transformation resources more effectively. In particular, the framework supports evidence-based planning for workforce upskilling, cybersecurity governance, regulatory modernization, and institutional cloud migration strategies. These findings align with prior studies emphasizing the importance of governance structures, strategic leadership, and institutional support for sustainable cloud adoption [7], [18].

The findings also support the growing argument that digital transformation frameworks designed for developed economies require contextual adaptation before application within emerging economies. Factors such as unstable internet infrastructure, regulatory inconsistency, limited technical expertise, and financial constraints exert significantly greater influence within the Ghanaian context than is reflected in many global cloud readiness models [5], [9], [17]. Consequently,

localized frameworks such as SCARI, provide greater contextual relevance and implementation feasibility for African institutions.

Furthermore, the weighted scoring mechanism employed by SCARI enables organizations to benchmark their current readiness maturity while identifying specific dimensions requiring strategic improvement. This contributes to the development of a more structured and measurable pathway toward sustainable cloud integration within Ghanaian institutions. Similar readiness-index approaches have been recommended in recent cloud governance and organizational maturity studies [18], [22].

Overall, the study demonstrates that successful cloud adoption in emerging economies requires balanced alignment among technological capability, organizational governance, environmental support structures, and human readiness. The SCARI framework, therefore, contributes both theoretically and practically to the evolving literature on digital transformation readiness within Africa and other developing regions [11], [14], [25]. As summarized in Table VI, the framework categorizes institutions into distinct readiness levels ranging from Critical/Lagging to Strategic/Ready, each accompanied by targeted intervention strategies and stakeholder responsibilities.

TABLE VI. SCARI PILLAR SCORE THRESHOLDS, READINESS LEVELS, AND STRATEGIC ACTIONS.

| Pillar Score (1.0 - 7.0) | Readiness Level | Strategic Recommendations & Actions | Target Stakeholder |
|---|---|---|---|
| < 3.0 | Critical / Lagging | Immediate investment in foundational literacy. Implement mandatory change management workshops and staff upskilling. | HR & Top Management |
| 3.1 – 4.5 | Emerging | Focus on "Policy and Governance." Establish clear SLA standards and cybersecurity protocols. Seek external funding/grants. | IT Managers & Legal |
| 4.6 – 5.9 | Intermediate | Optimize technical compatibility. Migrate mission-critical apps to hybrid models. Enhance data disaster recovery tests. | System Architects |
| > 6.0 | Strategic / Ready | Scaling and Innovation. Focus on AI integration and advanced data analytics. Act as a "Cloud Mentor" for other sectors. | CTO & Government |

### B. Limitations and Future Work

Although the SCARI framework provides a context-sensitive mechanism for evaluating organizational cloud readiness in Ghana, several limitations should be acknowledged. First, the pilot study utilized a relatively small sample (N = 30), which limits the statistical generalizability of the findings and prevents comprehensive psychometric validation of the instrument. Future research should employ larger multi-sector and multi-regional samples to enable confirmatory factor analysis, structural equation modeling, and cross-sector comparative analysis.

Second, the current framework was evaluated primarily within the Agriculture, Health, and Education sectors. Additional validation is required within highly regulated sectors such as finance, telecommunications, mining, and government digital services, where cybersecurity, sovereignty, and compliance requirements differ substantially.

Third, the weighting structure of the SCARI index was derived from literature-informed theoretical assumptions rather than empirical optimization techniques. Future studies should investigate data-driven weighting approaches using machine learning, fuzzy logic systems, or Analytic Hierarchy Process (AHP) methodologies.

Fourth, cloud adoption environments evolve rapidly due to advances in AI-enabled cloud services, edge computing, sovereign cloud architectures, and cybersecurity regulations. Consequently, periodic recalibration of the framework will be necessary to maintain relevance.

Finally, future research should investigate advanced scalability strategies, including federated cloud governance models, domain adaptation techniques, and multi-center validation studies across African institutions to improve the generalizability and interoperability of the SCARI framework. Because the study was designed as a preliminary pilot validation, advanced psychometric procedures such as Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), composite reliability analysis, and inter-item correlation assessment were deferred to future large-scale validation studies.

## V. CONCLUSION

The Strategic Cloud Adoption Readiness Index (SCARI) framework represents a significant departure from "one-size-fits-all" IT models. By synthesizing the TOE framework and HOT-fit theory, this study addresses the multifaceted challenges of Ghana's digital transformation—ranging from infrastructure deficits to the critical "Human" readiness gap. The pilot study results confirm that while technical sophistication is growing, organizational culture and human skill sets remain the primary bottlenecks to adoption. The proposed weighted scoring system and strategic recommendation matrix (Table IV) offer Ghanaian policymakers and CTOs a pragmatic, evidence-based roadmap to mitigate risks and optimize operational efficiency. In the final analysis, it is targeted leadership support for bridging the "readiness gap" by staff upskilling that will mark the successful transition of Ghana into a cloud-integrated economy.

## REFERENCES

[1] I. Michael, "Evaluating readiness for cloud-based agricultural systems in Sub-Saharan Africa," *Environmental Systems Research*, 2025, doi: 10.1186/s12677-023-00601-3.

[2] S. Anomah, "Assessing the institutional readiness and capacity for AI adoption in public audit institutions in developing countries: Evidence from Ghana," *Telematics and Informatics Reports*, vol. 20, p. 100260, 2025, doi: 10.1016/j.teler.2025.100260.

[3] O. T. Damba *et al*., "Constructing a climate-smart readiness index for smallholder farmers: The case of prioritized bundles of climate information services and climate smart agriculture in Ghana," *Climate Services*, vol. 34, p. 100453, 2024, doi: 10.1016/j.cliser.2024.100453.

[4] E. O. Opoku and C. Kwarteng, "Status of cloud service adoption in climate risk country," *Journal of Environment and Natural Resources Management (JENRM)*, vol. 2, no. 2, 2015.

[5] F. Alemeye and F. Getahun, "Cloud readiness assessment framework and recommendation system," in *Proc. IEEE AFRICON*, 2015.

[6] Z. Dikana and H. A. Koloba, "Top management support and ICT adoption among SMEs: Role of ICT knowledge and resource availability," *African Journal of Innovation and Entrepreneurship*, vol. 4, no. 4, pp. 383–404, 2025.

[7] I. A. Ahenkorah and M. A. Sarfo, "Assessing the adoption and impact of cloud computing services on operational efficiency in SMEs," 2020, doi: 10.13140/RG.2.2.32488.24320.

[8] B. T. Assaye *et al*., "Readiness of big health data analytics by TOE framework in Ethiopian health sectors," *Heliyon*, vol. 10, no. 19, 2024.

[9] T. Omwansa and M. R. Tufail, "Towards a cloud readiness assessment framework and index for Africa," in *Proc. IEEE ES*, 2015, doi: 10.1109/ES.2015.24.

[10] P. K. Senyo, J. Effah, and E. Addae, "Preliminary insight into cloud computing adoption in a developing country," *Journal of Enterprise Information Management*, vol. 29, no. 4, pp. 505–524, 2016, doi: 10.1108/JEIM-09-2014-0094.

[11] D. J. Tetteh-Agblakah, "Evaluation of the readiness of the Ghanaian construction industry for Construction 4.0," *International Journal of Advanced Network Systems*, vol. 2, no. 2, 2024, doi: 10.61424/ijans.v2.i2.183.

[12] A. Kuzior, L. Hrytsenko, M. Trojanek, and J. Oláh, "GovTech as a 'technological-institutional-human' system: Non-linear effects on social progress and human well-being," *Human Technology*, vol. 22, no. 1, pp. 198–218, 2026, doi: 10.14254/1795-6889.2026.22-1.10.

[13] E. D. Armah and I. S. Ali, "A comprehensive analysis of faculty adoption of cloud computing e-learning in Ghanaian technical universities," *International Journal of Engineering Pedagogy*, vol. 14, no. 5, 2024.

[14] E. Entsie, F. K. F. Aidoo, and A. Vaz, "Systematic review of cloud computing adoption in the public sector," *Multidisciplinary Reviews*, 2025.

[15] A. Adolph SedemYaw *et al*., "Cloud computing framework for e-health in Ghana," *International Journal of Computer Applications*, vol. 118, no. 17, 2015.

[16] A. K. Alhazmi, "Cloud adoption in HEIs: A multi-theoretical framework integrating TOE, TRA, and FVT," *Journal of Systems and Technology*, vol. 29, no. 1, 2024.

[17] L. F. Tshoba and T. S. Adeyelure, "Framework for assessing the readiness of South Africa's platinum mining industry for cloud ERP," in *Proc. ACM*, 2025, doi: 10.1145/3759023.3759112.

[18] M. Skafi *et al*., "The confluence of big data and cloud computing in SME adoption strategies," *IEEE Access*, vol. 13, pp. 37789–37811, 2025, doi: 10.1109/ACCESS.2025.3543265.

[19] F. O. Ampratwum, Educational Approaches Using Emerging Computing Technologies in Ghana, Ph.D. dissertation, 2025.

[20] J. D. Cooper, Factors Affecting Cloud Computing Adoption in Sierra Leone: TOE & HOT-Fit, Ph.D. dissertation, 2022.

[21] E. K. Agbemafle *et al*., "Enhanced TAM for evaluating adoption of cloud computing in colleges of education in Ghana," in *Proc. IEEE SmartBlock4Africa*, 2024, doi: 10.1109/SmartBlock4Africa61928.2024.10779531.

[22] W. Ngobeni *et al*., "Assessing the readiness of South African financial enterprises for cloud-based mobile money," *African Journal of Information and Education*, vol. 4, no. 3, 2025, doi: 10.1109/ICONDBTM64135.2024.11122838.

[23] S. Subuhpoto, G. Liu, W. Su, and F. Aziz, "Research on the factors influencing the adoption of artificial intelligence technology by university librarians," *The Electronic Library*, vol. 44, no. 2, pp. 408–432, 2026, doi: 10.1108/EL-03-2025-0077.

[24] J. Nterful *et al*., "An assessment of critical success factors in information security implementation in organizations in Ghana," *Information & Computer Security*, vol. 32, no. 5, 2024, doi: 10.1108/ICS-11-2022-0174.

[25] R. Teh, A. Subramaniam, J. A. Ho, and N. K. Basha, "The mediation role of top management support in the adoption of cloud computing in Malaysian SMEs," *International Journal of Management and Enterprise Development*, vol. 23, no. 1, pp. 73–96, 2024, doi: 10.1504/IJMED.2024.10063221.