

A Framework for Mobile Technology Adoption and Library Service Delivery Quality in Nigeria, Ghana, and Kenya: A Conceptual Review and Research Agenda for Sub-Saharan African Academic Libraries

By

UKOHA O. IGWE, *PhD. CLN*

Department of Library & Information Science,
National Open University of Nigeria, Abuja, Nigeria
Email: uigwe@noun.edu.ng; ukohaigwe@yahoo.co.uk

Abstract

Academic libraries in Sub-Saharan Africa operate under a distinctive and under-theorised condition: user-side mobile penetration is high and rising, while institution-side capacity to exploit it remains weak. This paper Draws on country-level studies, regional comparators from Malawi and South Africa, and connectivity data from the International Telecommunication Union and GSMA, to advance four arguments: the regional literature dominated by descriptive inventories of mobile services that document deployment without measuring outcomes; the binding constraint institutional readiness — funding, staff competency, top-management support, electrical and network infrastructure, and data governance — not user willingness, which evidences show to be consistently high; the three national cases diverge in instructive ways: Kenyan studies report of high user uptake constrained by infrastructure reliability, the Ghanaian studies report of high student device ownership constrained by library-specific competence and the Nigerian studies report of low institutional adoption constrained by management support and training; and the region's affordability and usage gaps mean that mobile-first strategies carry an equity risk that the “anytime, anywhere” framing obscures. The paper proposes the Mobile Library Service Value Chain (MLSVC) — a five-stage framework of Readiness, Adoption, Use, Service Quality, and Institutional Outcomes, moderated by connectivity, power reliability, data affordability, and device equity — together with a four-level maturity model and a prioritised research agenda calibrated to Sub-Saharan African conditions.

Keywords: Mobile Library Services; Academic Libraries; Nigeria; Ghana; Kenya; Sub-Saharan Africa; UTAUT.

1. Introduction

The infrastructural premise of mobile library provision has changed decisively, more consequentially in Sub-Saharan Africa. According to the International Telecommunication Union [ITU] (2025), an estimated six billion people — roughly three-quarters of the world's population, used the Internet in 2025. Within Sub-Saharan Africa, smartphone adoption reached approximately 54 per cent of connections in 2024, and is forecast to reach 81 per cent by 2030 with the region expected to account for nearly a quarter of all new mobile Internet subscribers worldwide between 2025 and 2030 (GSMA, 2024).

For students in Lagos, Cape Coast, or Nairobi, this is not an abstraction. The smartphone is frequently the only networked device a student owns. It has become an effective universal device and a tool for information dissemination. The consequence for academic libraries is that mobile provision is not a supplementary channel serving a convenience-seeking minority; it is, for a substantial share of the user population, the *primary* interface to the scholarly record or else no interface at all.

The empirical record from the three countries examined here confirms that users have already made this transition. At Kenyatta University, and the University of Nairobi, 95 per cent of library users were found to use mobile devices to access library materials (Burudi et al., 2021). At Mount Kenya University, 77.9 per cent of surveyed users rated mobile phone technology as highly useful for accessing library resources, with a further 17.6 per cent rating it moderately useful (George, 2023). At the University of Cape Coast in Ghana, nearly every student was found to own at least one mobile device capable of accessing library services (Ocran et al., 2020).

Libraries have responded unevenly. A systematic review of the international literature identify sustained deployment of mobile online public access catalogues (MOPACs), mobile websites, mobile-optimised databases, WhatsApp-based reference, SMS alerting, RSS feeds, and Quick Response (QR) codes (Singh & Madhusudhan, 2023). Yet, within the region, implementation is partial. Chaputula and Mutula (2018) found that among Malawian public university libraries, only one had fully implemented mobile-phone-based service delivery. Matumba and Rajkoomar (2024) found that most South African academic librarians judged their institutions unready to embrace mobile technology. Agbetuyi (2025) reports low adoption in Nigerian university libraries despite the evident trend.

The gap is therefore not between users and technology. It is between users and institutions.

1.2 Statement of the Problem

Four deficiencies persist across the regional literature and practice. The descriptive–evaluative gap refers to the focus on describing mobile technologies used in libraries rather than assessing their outcomes. Singh and Madhusudhan (2023) found that 75.93% of the global evidence consisted of research articles, but most studies mainly listed the available applications instead of measuring their effects on library services. Similarly, regional studies often report users' awareness, access to mobile devices, and satisfaction with services. However, they rarely examine whether mobile library services improve information-seeking success, research productivity, or learning outcomes. Thus, although mobile technology deployment in libraries is high, evidence of its measurable impact remains limited.

The readiness gap in mobile service adoption is often caused by institutional limitations rather than users' unwillingness. Matumba and Rajkoomar (2024), using the UTAUT framework, found that academic librarians in South Africa recognised the usefulness of mobile technology but believed their institutions were not adequately prepared. They identified limited funding, weak technical

infrastructure, cyber security concerns, and insufficient staff training as key challenges. Similarly, Agbetuyi (2025) found that staff training had a significant positive relationship with librarians' adoption of mobile technology in South-west Nigerian universities. These findings suggest that the main barrier is organisational investment and readiness, not negative attitudes toward mobile technology.

The infrastructure gap. Regional studies highlight a constraint that is largely absent from research conducted in high-income contexts. George (2023) reports that users of the Mount Kenya University library experience frequent power outages, limited or unreliable bandwidth, server failures, software incompatibilities, and concerns about data security, all of which hinder mobile access. In environments where continuous electricity and stable broadband cannot be assumed, a service model built on these conditions is not simply inefficient; it becomes intermittently unusable in ways that users cannot anticipate.

The equity gap. Mobile services are often presented as expanding access, yet the connectivity required to use them remains unevenly distributed. Globally, 2.2 billion people are still offline; internet use reaches 94 per cent in high-income countries but only 23 per cent in low-income countries; 85 per cent of urban residents are online compared with 58 per cent of rural residents; and mobile broadband is unaffordable for roughly 60 per cent of low- and middle-income countries (ITU, 2025). In Sub-Saharan Africa, the cost of handsets is the most significant barrier to mobile internet adoption. GSMA Intelligence estimates that a \$40 smartphone could enable an additional 20 million people in the region to access mobile internet (GSMA, 2024). A mobile-first library strategy that does not account for these disparities, risks reproducing the very exclusions it aims to address.

1.3 Purpose of the Study

This paper examines mobile library service delivery in Nigeria, Ghana, and Kenya as a means of creating value for academic library users. It develops an integrated framework that links institutional readiness with measurable service-quality outcomes while considering the infrastructure challenges common in the region.

1.4 Objectives

1. To develop a functional classification of mobile library services based on their level of service integration rather than the type of technology used.
2. To review and compare evidence from Nigeria, Ghana, and Kenya on the factors that support or hinder mobile technology adoption in academic libraries.
3. To determine how well existing technology-acceptance theories explain adoption in the context of Sub-Saharan African infrastructure conditions.
4. To propose an integrated framework that connects institutional readiness, adoption, use, service quality, and institutional outcomes.
5. To develop a maturity model and research agenda that reflect regional conditions.

1.5 Research Questions

- **RQ1.** How can mobile library services be classified to reflect depth of integration rather than technological form?
- **RQ2.** What institutional, individual, and infrastructural factors determine mobile technology adoption in Nigerian, Ghanaian, and Kenyan academic libraries, and how do these differ across the three national contexts?
- **RQ3.** To what extent do TAM and UTAUT account for organisational readiness, power and bandwidth instability, and service outcomes in these settings?
- **RQ4.** What framework links antecedent conditions to service-quality and institutional outcomes?
- **RQ5.** What empirical questions should the regional field prioritise?

1.6 Significance of the Study

For library practitioners in Nigeria, Ghana, and Kenya, this paper provides a diagnostic maturity model to help institutions identify their current level of mobile service development and determine practical next steps. It presents mobile transformation as a gradual process rather than a major change requiring unavailable resources. For researchers, the paper offers a testable framework and a clear research agenda for addressing the limited evidence on the outcomes of mobile library services. For university management, national library associations, and funding bodies, including Nigeria's Tertiary Education Trust Fund and similar agencies, the study highlights the importance of investing in staff skills, reliable power supply, and institutional governance before purchasing new technologies.

1.7 Scope and Delimitations

This paper is conceptual and integrative. It reviews published empirical studies and international connectivity statistics and does not involve primary data collection. Its main focus is on academic and research libraries in Nigeria, Ghana, and Kenya. Evidence from Malawi and South Africa is used only where it is relevant to the study's context. Public, school, and special libraries are mentioned only where necessary.

1.8 Operational Definitions

- **Mobile library service:** Any library service designed, improved, or provided for use on handheld internet-enabled devices, such as smartphones and tablets. It is different from a desktop service that can only be accessed on a phone by chance.
- **Mobile-first design:** An approach to service design that treats the mobile user experience as the main focus. It considers small screens, unstable internet connections, data costs, unreliable electricity, and one-handed use.
- **Institutional readiness:** The extent to which an institution has the funding, infrastructure, staff skills, management support, policies, and governance needed to provide and maintain mobile library services.
- **Service quality:** The difference between what users expect from a service and how they evaluate its actual performance. It includes information access, users' feelings about the service, and the role of the library as a physical or virtual space.
- **Usage gap:** The proportion of people who live in areas with mobile broadband coverage but do not use mobile internet. This differs from the coverage gap, which refers to areas without network availability.

2. Theoretical and Conceptual Framework

2.1 Technology Acceptance Model and Its Limits

The Technology Acceptance Model (TAM) explains technology adoption mainly through two factors: perceived usefulness and perceived ease of use. It is widely used in African library and information science research because it is simple and easy to apply. However, its simplicity is also a limitation. TAM focuses mainly on individuals deciding whether to use a technology. This may be insufficient in situations where users are willing to adopt mobile services but institutions lack the capacity to provide them. Studies by Agbetuyi (2025) and Matumba and Rajkoomar (2024) show that institutional readiness, rather than user willingness, is often the main challenge. Therefore, TAM may explain users' intentions but may not adequately explain service outcomes in the region.

2.2 UTAUT and UTAUT2

The Unified Theory of Acceptance and Use of Technology (UTAUT) addresses some limitations of TAM. In addition to performance expectancy and effort expectancy, it includes social influence and

facilitating conditions. Facilitating conditions refer to users' belief that the necessary organisational and technical support is available. This concept is important because it recognises the role of institutional capacity in technology use. Matumba and Rajkoomar (2024) used UTAUT in interviews with South African academic librarians and found that, although librarians viewed mobile technology as useful, they considered their institutions unprepared to support it.

UTAUT2 extends the original model by adding factors such as enjoyment, price value, and habit. Price value is particularly important in settings where users pay for mobile data. For many students, accessing a mobile database may require spending limited airtime credit. This is relevant in many countries in the region, where mobile broadband remains unaffordable in many low- and middle-income countries (ITU, 2025), and the cost of handsets is a major barrier to adoption (GSMA, 2024).

2.3 A Grounded Theory of Mobile Library Service Delivery

Saravani and Haddow (2017) developed a grounded theory model based on 42 professionally qualified library staff. Their study identified factors that influence mobile library service delivery. The model places emphasis on staff competence and professional attitudes, rather than focusing only on users' acceptance of technology. The study also identified an important gap. Although the growing mobility of users is widely recognised, relatively few academic libraries have turned this awareness into effective mobile service provision.

2.4 The Missing Construct: Infrastructural Contingency

Existing technology-adoption frameworks do not adequately address unreliable electricity and internet connectivity. For example, George (2023) found that power outages were the main challenge affecting mobile library access at Mount Kenya University. This issue is different from the usual meaning of facilitating conditions because electricity and internet access may be unstable and unpredictable. Such instability may not stop users from adopting mobile services, but it can reduce their trust in the services. Users may access a mobile service occasionally but may not depend on it for regular academic work. This paper therefore treats infrastructural contingency as a separate factor that influences the relationship between adoption and service use.

2.5 Service Quality as the Outcome Construct

The theories discussed above explain why people may adopt technology, but they do not explain the value or outcomes of adoption. This paper therefore connects technology adoption to service quality through three dimensions:

- **Information control:** The ability of users to independently find, access, and use information resources on their mobile devices.
- **Affect of service:** The extent to which mobile services provide responsive, reliable, and supportive interaction similar to in-person library assistance.
- **Place:** The way mobile services allow the library to function as a service that can be accessed beyond its physical location.

2.6 Synthesis

No single framework fully explains mobile library service delivery in the region. TAM focuses mainly on individual users, while UTAUT gives limited attention to service outcomes and unstable infrastructure. Service-quality models assess outcomes but do not fully explain the conditions that lead to adoption. This paper combines these approaches in the framework presented in Section 4.

3. Literature Review: The Regional Evidence

3.1 A Functional Taxonomy of Mobile Library Services

The literature often lists mobile library services such as mobile OPACs, mobile websites, mobile databases, WhatsApp, SMS, RSS feeds, and QR codes (Singh & Madhusudhan, 2023). However, these lists group together services that differ greatly in cost, complexity, and value to users. A classification based on the level of service integration is more useful, especially in settings with limited resources.

Table 1: Classification of level of service integration

Tier	Description	Example services	Institutional demand	Regional evidence
1	Notification: one-way alerts	SMS circulation and overdue alerts, RSS feeds, current-awareness and selective information services	Low: limited systems integration	Commonly reported; SMS alerts and Ask-a-Librarian are among the most used services in Nigerian university libraries (Agbetuyi, 2025); current-awareness services are reported at Mount Kenya University (George, 2023)
2	Discovery: user searches for information	Mobile OPAC, responsive websites, mobile databases, mobile institutional repositories	Moderate: responsive design and vendor support required	MOPAC is widely used in Nigeria (Agbetuyi, 2025); 96.3% of Mount Kenya University respondents reported mobile OPAC access (George, 2023)
3	Interaction: two-way professional support	Mobile reference, WhatsApp and instant-messaging reference, virtual consultations, mobile information-literacy instruction	Moderate to high: staffing, service hours, and response standards required	Mobile reference is used in Nigerian libraries (Agbetuyi, 2025); WhatsApp reference is reported at Mzuzu University, Malawi (Chaputula et al., 2020); reference services are available through mobile devices at Mount Kenya University (George, 2023)
4	Integration: services connected to physical and learning environments	QR-linked collections and wayfinding, mobile borrowing and self-service, interlibrary-loan requests, mobile curation	High: coordination and systems interoperability required	Emerging; mobile-supported check-in/check-out and interlibrary loan are reported at Mount Kenya University (George, 2023); an open-source app was developed outside the region (Ajab Mohideen et al., 2022)

Two points are important. First, the institutional effort needed increases across the service tiers, but most regional studies focus on Tiers 1 and 2, which involve the least integration. Second, many reported mobile developments remain at Tier 2. A responsive catalogue is important, but it does not on its own provide a complete mobile library service.

3.2 Three National Cases

Nigeria, Ghana, and Kenya are often discussed together as African academic library contexts. However, the evidence shows that their main challenges differ. Therefore, the most appropriate next steps also differ.

3.2.1 Kenya: *High Uptake, Unstable Infrastructure*

Evidence from Kenya shows high levels of mobile library use. Burudi et al. (2021) found that 95 per cent of library users at Kenyatta University and the University of Nairobi used mobile devices to access library materials. The main challenges were limited mobile-accessible resources and inadequate technical support. George (2023) surveyed 395 users across four Mount Kenya University campuses and found that mobile devices were used to access e-resources (98.2%), stack areas and periodicals (97.8%), circulation services (97.1%), and the OPAC (96.3%). In addition, 77.9 per cent of respondents considered mobile technology highly useful.

The main challenge in Kenya is therefore not user adoption but service reliability and content availability. Users reported power outages, weak or unavailable bandwidth, server failures after maintenance, software incompatibility, and limited access to devices, and data-security concerns. Burudi et al. (2021) also identified a lack of mobile-accessible resources. This suggests that users are willing to use mobile services, but the services are sometimes unavailable or do not provide enough suitable content.

3.2.2 Ghana: *High Ownership, Low Library-Specific Competence*

Evidence from Ghana shows an important difference between owning a mobile device and being able to use it effectively for library services. Ocran et al. (2020) interviewed six library managers and fifteen students at the University of Cape Coast. They found that almost all students owned at least one device that could access library services and that students had strong general mobile skills. However, the study concluded that users still needed training to make full use of mobile library services.

General confidence in using mobile devices does not always mean confidence in using library systems. For example, students may use social media easily but still struggle to search a mobile database, understand a library record, or request materials from another library. The Ghanaian evidence shows that mobile service design should not assume that students already have the skills needed for academic information searching.

Acheampong and Agyemang (2021) examined mobile library services for distance-learning students in Ghana, where access to the physical library is limited. Their study considered both student awareness of mobile services and librarians' ability to provide them. This two-sided approach is important because many studies focus on only users or staff, rather than both groups.

3.2.3 Nigeria: *Willing Librarians, Absent Institutional Support*

Evidence from Nigeria suggests that the main challenge occurs at the institutional level. Agbetuyi (2025) found that librarians in universities in South-west Nigeria were willing to adopt mobile reference services, SMS services, mobile academic databases, and mobile OPACs. Ask-a-Librarian services, SMS notifications, and MOPACs were the most commonly adopted. However, overall adoption remained low, and staff training had a statistically significant positive relationship with adoption.

Sambo et al. (2021) found that undergraduates in a Nigerian specialised university used smartphones for information seeking. This supports the pattern found in Kenya and Ghana that users are generally ready to use mobile technologies. The evidence from Nigeria suggests that librarians and students are not the main barriers. Greater management support and structured staff training are needed. These are institutional responsibilities and require investment by the university.

Table 2: Comparative Summary

Dimension	Kenya	Ghana	Nigeria
User adoption	Very high: 95% use mobile devices for library materials (Burudi et al., 2021)	Very high: near-universal device ownership (Ocran et al., 2020)	High: smartphone information seeking is established (Sambo et al., 2021)
User attitude	77.9% consider mobile access highly useful (George, 2023)	High general device proficiency (Ocran et al., 2020)	Librarians are willing to use different service types (Agbetuyi, 2025)
Main constraint	Unreliable infrastructure and limited mobile-accessible content	Limited library-specific user skills	Limited management support and staff training
Main MLSVC stage	Stage 3 to 4: use exists, but service quality is unstable	Stage 2 to 3: adoption exists, but depth of use is limited	Stage 1 to 2: institutional readiness is incomplete
Priority	Power resilience, bandwidth, and mobile-friendly content licensing	Library-specific mobile-literacy instruction	Management support and structured staff development

The evidence shows that the three countries need different priorities. Nigeria needs stronger institutional support before investing in new platforms. Ghana needs library-specific user training before expanding services. Kenya needs more reliable infrastructure and better mobile-accessible content before encouraging wider use.

3.3 Determinants of Adoption

Across the studies reviewed, five main factors influence mobile technology adoption:

1. Top-management support and institutional commitment. Adoption is more likely when senior management provides support, funding, and direction. Librarian interest alone is usually not enough to establish a sustainable service (Agbetuyi, 2025).
2. Staff competency and training. This factor appears across all three countries and in the regional comparison studies. Training is positively associated with adoption in Nigeria (Agbetuyi, 2025), while staff training needs were a major barrier in South Africa (Matumba & Rajkoomar, 2024). Saravani and Haddow (2017) also identified staff capability as an important factor in mobile service delivery.
3. Funding. Limited and unreliable funding is a common barrier in resource-constrained settings (Matumba & Rajkoomar, 2024).
4. Infrastructure: network, power, and systems. Mobile services depend on institutional network capacity, reliable electricity, compatible systems, and vendor support (George, 2023; Chaputula & Mutula, 2018).
5. User readiness and library-specific training. Owning a mobile device does not necessarily mean that users know how to use library services effectively (Ocran et al., 2020).

3.4 Barriers: A Structured Account

Table 3: Barriers

Barrier area	How it appears	Regional evidence
Financial	Limited recurrent funding; costs of mobile-enabled platforms; user costs for data and handsets	Matumba & Rajkoomar (2024); GSMA (2024); ITU (2025)
Human resources	Limited staff mobile-technology skills and limited continuing professional development	Agbetuyi (2025); Matumba & Rajkoomar (2024); Saravani & Haddow (2017)
Power and network	Power outages, weak or missing bandwidth, and server outages after maintenance	George (2023)
Technical systems	Legacy systems that are difficult to connect to mobile services, software incompatibility, and vendor dependence	George (2023); Chaputula & Mutula (2018)
Content supply	Too few mobile-accessible resources and licenses that do not support mobile use	Burudi et al. (2021)
Security and governance	Data-security risks, privacy concerns in consumer messaging channels, and lack of policies for personal-device services	George (2023); Matumba & Rajkoomar (2024)
User skills	Strong general device skills but limited library-service skills	Ocran et al. (2020)
Equity	Cost of handsets and data, coverage and usage gaps, and differences by location and gender	GSMA (2024); ITU (2025)

Two barriers require particular attention because they receive limited discussion in regional research.

Content supply. Burudi et al. (2021) identified insufficient mobile-accessible resources as a major challenge. A library may provide a good mobile catalogue but still offer poor service if its licensed resources do not display well on phones, require desktop-only authentication, or restrict downloads that users need when internet access is unstable. Mobile readiness should therefore be considered when negotiating licenses and selecting content platforms.

Governance of messaging channels. Consumer messaging platforms may move user interactions, including sensitive reference questions, onto commercial systems outside the library's direct control. WhatsApp reference services are useful and have been documented in the region (Chaputula et al., 2020). However, their privacy implications need more attention, especially because George's (2023) respondents identified data insecurity as a concern.

3.5 Identified Gaps

- **Outcome measurement.** Regional studies often report service availability, device ownership, awareness, and satisfaction. They rarely examine whether mobile services improve information-seeking success, research productivity, or learning outcomes.
- **Longitudinal evidence.** Most studies are cross-sectional. There is little evidence on whether services remain effective or continue to be used after implementation.

- Cost-effectiveness. Few studies compare the cost per user interaction across mobile and other service channels. This is important where budgets are limited.
- Equity-focused analysis. Overall adoption figures may hide differences in access within a user population, especially between rural and urban students and between men and women.
- Accessibility. There is limited research on whether mobile library services are accessible to users with disabilities in the three countries.
- Power resilience as a design factor. Although users identify power outages as a major barrier (George, 2023), research rarely treats offline access and service recovery after interruptions as design requirements.

4. The Mobile Library Service Value Chain (MLSVC)

4.1 Framework Logic

The framework presents mobile library service delivery as a sequence of connected stages. Each stage is necessary, but completing one stage does not guarantee progress to the next. The framework helps institutions identify where their efforts stop and explains why measures of deployment alone can be misleading. The comparison in Section 3.2.4 shows that the three countries face challenges at different stages.

MODERATORS

Table 4: Digital service maturity model

Digital Service Maturity Model				
Progression from institutional readiness to measurable outcomes				
No.	Focus	Key measures / conditions	Cross-cutting enablers / barriers	Country constraint
1	Readiness	Funding Staff skills Top-management support Infrastructure Governance	Applies across all stages: • Power reliability • Bandwidth stability • Data affordability • Handset affordability • Content licensing • Digital literacy	Nigeria Stage 1 → 2
2	Adoption	Performance expectancy Effort expectancy Social influence Facilitating conditions		Ghana Stage 2 → 3
3	Quality	Frequency Depth Breadth Retention Trust in channel		Kenya Stage 3 → 4
4	Use	Information control Affect of service Place		Feedback to earlier stages
5	Institutional outcomes	Research productivity Learning outcomes Equity of access Cost efficiency		
Model logic: Readiness → Adoption → Quality → Use → Institutional outcomes. Experience at the use stage feeds back to strengthen earlier stages.				

4.2 Stage Specification

Stage 1 — Readiness. This stage includes the institutional conditions needed to support mobile services: reliable funding, staff skills, management support, network and power infrastructure, service policies, and data governance. Evidence from Nigeria, Malawi, and South Africa suggests that these conditions are often the main constraint (Agbetuyi, 2025; Chaputula & Mutula, 2018; Matumba & Rajkoomar, 2024). Institutions should assess readiness before purchasing new technology.

Stage 2 — Adoption. This stage uses key UTAUT factors but considers two groups: library staff, who must be able and willing to provide services through mobile channels, and users, who must be willing to use them. Many regional studies focus on only one group. Acheampong and Agyemang (2021) are an important exception because they assessed both student awareness and librarian competence.

Stage 3 — Use. This stage concerns actual use of mobile services. It should be measured by frequency of use, depth of use across service tiers, reach within the user population, continued use over time, and trust in the service. Trust is important because users may try a mobile service but avoid relying on it if it is not dependable. Measuring deployment without measuring actual use is a major weakness in the regional literature.

Stage 4 — Service Quality. This stage assesses quality in terms of information control, affect of service, and place. The Kenyan evidence suggests that some institutions have high usage but have not yet achieved consistent service quality. Limited mobile-accessible content and unreliable infrastructure reduce quality even where users are active (Burudi et al., 2021; George, 2023).

Stage 5 — Institutional Outcomes. This stage includes outcomes such as research productivity, learning outcomes, equitable access, and cost efficiency. These outcomes provide the strongest justification for investment, but they are rarely measured in regional studies.

4.3 Moderators

Six conditions can affect progress at every stage: power reliability, bandwidth stability, data affordability, handset affordability, content licensing terms, and users' digital literacy. These factors are important because high intention to use a service may not lead to actual use when devices or data are too expensive. Similarly, unreliable power can reduce service quality even when usage is high, because users cannot depend on a service that is not available when needed (George, 2023; GSMA, 2024; ITU, 2025).

4.4 Testable Propositions

- P1. Institutional readiness at Stage 1 is likely to predict sustained use at Stage 3 more strongly than users' adoption intention at Stage 2.
- P2. The relationship between intention to adopt and actual use is likely to weaken as the cost of data and handsets increases.
- P3. Greater improvements in service quality are likely at Tiers 3 and 4 of the service taxonomy. Tiers 1 and 2 may improve convenience but may not produce measurable improvements in service quality.
- P4. Staff competency is likely to have a greater effect on service quality than the level of platform sophistication.
- P5. Unstable infrastructure is likely to reduce service quality regardless of usage volume because it lowers users' trust in the service channel.

- P6. In institutions with large differences in connectivity among users, mobile-only strategies are likely to increase rather than reduce inequalities in access.

5. A Mobile Library Service Maturity Model

The framework provides a diagnostic tool that helps institutions identify their current level of mobile service development and select the next practical step, rather than attempting a large and unplanned transformation.

Table 5: Model library service model

	Name	Key characteristics	Diagnostic question	Next step
0	Incidental	No services designed specifically for mobile use; desktop services only happen to open on phones	Does anything fail on a small screen?	Check and improve mobile display
1	Responsive	Mobile-friendly website and catalogue; notification services available	Can users complete a search task on a low-cost phone and 3G connection?	Secure mobile-accessible content and add a supported interaction channel
2	Interactive	Professional support through mobile channels with clear staffing, response, and privacy terms	Are response times, service hours, and data-retention practices documented?	Provide library-specific mobile-literacy instruction
3	Integrated	Mobile services are connected to physical spaces and teaching; self-service and interoperable systems; offline access considered	Is mobile one channel or the main service approach?	Measure outcomes
4	Evaluative	Outcomes are measured; services are improved using evidence; equity is monitored	Can the library show what mobile services changed and who benefited?	Maintain, share, and support evidence-based practice

Based on the available evidence, Nigerian institutions appear to be mainly at Levels 0–1 (Agbetuyi, 2025). Ghanaian institutions appear to be mainly at Levels 1–2 (Acheampong & Agyemang, 2021; Ocran et al., 2020). The Kenyan institutions reviewed appear to be at Level 2, with some Level 3 features in transaction services, but they lack the reliability needed to sustain these services (Burudi et al., 2021; George, 2023). There is currently little evidence of Level 4 practice in any of the three countries. This gap supports the research agenda proposed below.

6. Implications for Practice

Assess readiness before buying technology. Funding, staff skills, and management support are common barriers (Agbetuyi, 2025; Matumba & Rajkoomar, 2024). Buying a mobile application before addressing these issues may result in a system that cannot be properly supported. A readiness assessment should therefore be the first step.

Treat staff capability as a core service requirement. The evidence suggests that well-trained staff using simple tools may provide better services than poorly trained staff using advanced platforms (Agbetuyi, 2025; Saravani & Haddow, 2017). Since training is associated with adoption, investment in staff development should be treated as investment in mobile services.

Train users in library-specific mobile skills. Ocran et al. (2020) showed that users may be confident with mobile devices but lack skills for using library services. Orientation and information-literacy programmes should therefore include mobile searching, access, and use of library resources.

Include mobile requirements in content licensing. Limited mobile-accessible content is a major problem even in settings with high mobile use (Burudi et al., 2021). Libraries and consortia should consider mobile display, offline access, and mobile-compatible authentication when negotiating licences, including through bodies such as Kenya's KLISC, Ghana's CARLIGH, and Nigerian equivalents.

Design for limited data and unreliable power. Data costs and power outages are central challenges, not minor issues (GSMA, 2024; George, 2023; ITU, 2025). Mobile services should use limited data, support offline access where possible, recover smoothly after interruptions, and work effectively on 3G networks. Manage messaging services carefully. When libraries use messaging platforms for reference services (Chaputula et al., 2020), they should clearly state service hours, expected response times, data-retention practices, and the privacy limits of the platform. This is important because users have identified data security as a concern (George, 2023). Plan for outcome measurement from the beginning. It is more difficult to add evaluation after a service has been launched. Measures of use and service quality should be defined before implementation.

6. Research Agenda

Table 6: Research agenda

	Research question	Suggested method	Gap addressed
1	Do mobile services improve information-seeking success and research productivity in Nigerian, Ghanaian, and Kenyan universities?	Quasi-experimental or longitudinal comparison with before-and-after measures	Outcome measurement
2	Does institutional readiness predict sustained use more strongly than adoption intention?	Multi-institution, multi-country survey using structural equation modelling to test P1	Theory integration
3	Does unstable infrastructure reduce service quality independently of usage volume?	Mixed-methods study combining outage records with measures of trust and service quality to test P5	Power resilience
4	Do data and handset costs affect the relationship between intention and use?	Moderated-mediation study across institutions with different student socioeconomic profiles to test P2	Equity
5	Do mobile-only strategies increase inequalities in access within institutions?	Analysis by socioeconomic status, gender, and rural or urban background to test P6	Equity

	Research question	Suggested method	Gap addressed
6	How suitable is licensed content for mobile use in regional consortium agreements?	Systematic audit of licensed platforms using mobile-usability and offline-access criteria	Content supply
7	What is the cost per user interaction for mobile services compared with other channels?	Activity-based costing case study in two or three institutions	Cost-effectiveness
8	Do users continue to use mobile services after the initial period?	Longitudinal analysis over at least 24 months	Longitudinal evidence
9	How accessible are mobile library services for users with disabilities in the three countries?	Mobile accessibility audit and user testing	Accessibility
10	What privacy issues arise when consumer messaging platforms are used for library reference?	Policy analysis and user-perception study	Governance

8. Limitations

This paper is conceptual and integrative. It reviews published studies instead of collecting primary data, and the proposed framework has not yet been tested empirically. The available evidence differs in depth and recency across the three countries. Several studies are based on single institutions, so their findings should not be treated as representing national systems. The review does not include francophone or lusophone African library systems, and its focus on English-language literature may exclude relevant studies. The framework focuses on academic libraries, so its application to public and special libraries may be limited. Finally, statistics on connectivity and affordability will need to be updated as conditions change.

9. Conclusion

Research has repeatedly shown that library services can be provided through mobile technologies in Nigeria, Ghana, Kenya, and neighbouring countries. The main issue is no longer whether mobile services are possible, but how they can produce meaningful value for users. The evidence reviewed in this paper supports four main conclusions.

First, users are generally not the main obstacle. High mobile device use for library materials in Kenya (Burudi et al., 2021), near-universal device ownership in Ghana (Ocran et al., 2020), and smartphone-based information seeking in Nigeria (Sambo et al., 2021) show that users are broadly ready. The major challenges are mainly institutional.

Second, the three countries face different constraints and therefore need different responses. Nigeria needs stronger management support and staff training (Agbetuyi, 2025). Ghana needs more library-specific user training (Ocran et al., 2020). Kenya needs more reliable infrastructure and better mobile-accessible content (Burudi et al., 2021; George, 2023). A single regional solution would not address all of these needs.

Third, there is a major need for outcome-based research. Studies that report service deployment without measuring value cannot show whether mobile services are effective, justify continued investment, or distinguish useful services from costly ones.

Fourth, mobile-first strategies must consider equity. Handset cost is a major barrier to mobile internet use in the region, and mobile broadband remains unaffordable in many low- and middle-income countries (GSMA, 2024; ITU, 2025). A service designed only for well-connected users may exclude students who need library support most.

The Mobile Library Service Value Chain provides a way to address these issues. It treats mobile access as a means of improving library services rather than as an end in itself. Future research should examine what mobile services change, who benefits, the conditions that support success, and the cost of providing them.

References

- Acheampong, E., & Agyemang, F. G. (2021). Enhancing academic library services provision in the distance learning environment with mobile technologies. *The Journal of Academic Librarianship*, 47(1), Article 102279. <https://doi.org/10.1016/j.acalib.2020.102279>
- Agbetuyi, P. A. (2025). The influences of top-management support and training on mobile technology adoption by librarians among universities in South-west, Nigeria. *International Journal of Research and Innovation in Social Science*, 9(4), 3494–3502. <https://doi.org/10.47772/IJRISS.2025.90400254>
- Ajab Mohideen, Z., Sheikh, A., & Kaur, K. (2022). Developing an open-source mobile app in library services: The case of a national university in Malaysia. *Digital Library Perspectives*, 38(3), 283–300. <https://doi.org/10.1108/DLP-08-2021-0064>
- Burudi, N., Wasike, J., & Ndegwa, L. W. (2021). Challenges facing academic libraries in utilizing mobile devices in access and use of information in Kenyatta University and University of Nairobi in Kenya. *African Journal of Education, Science and Technology*, 6(3), 369–381.
- Chaputula, A. H., Abdullah, H., & Mwale, B. (2020). Proliferation of social media in academic libraries: Use of WhatsApp as a platform for providing library services. *Library Management*, 41(8/9), 717–729. <https://doi.org/10.1108/LM-04-2020-0075>
- Chaputula, A. H., & Mutula, S. (2018). Provision of library and information services through mobile phones in public university libraries in Malawi. *Global Knowledge, Memory and Communication*, 67(1/2), 52–69. <https://doi.org/10.1108/GKMC-05-2017-0048>
- George, B. O. (2023). Evaluating features of mobile phone technology needed to access library services in Mount Kenya University library in Kenya. *IP Indian Journal of Library Science and Information Technology*, 8(2), 99–104. <https://doi.org/10.18231/j.ijlsit.2023.017>
- GSMA. (2024). *The mobile economy Sub-Saharan Africa 2024*. GSMA Intelligence. <https://www.gsma.com/mobileeconomy/sub-saharan-africa/>
- International Telecommunication Union. (2025). *Measuring digital development: Facts and figures 2025*. <https://www.itu.int/itu-d/reports/statistics/facts-figures-2025/>
- Matumba, N., & Rajkoomar, M. (2024). Academic librarians' perceptions of mobile technology's usefulness in library service delivery at universities of technology in South Africa. *Digital Library Perspectives*, 40(1), 131–147. <https://doi.org/10.1108/DLP-08-2023-0072>
- Ocran, T. K., Underwood, E. P. G., & Arthur, P. A. (2020). Strategies for successful implementation of mobile phone library services. *The Journal of Academic Librarianship*, 46(5), Article 102174. <https://doi.org/10.1016/j.acalib.2020.102174>

- Sambo, A. S., Lawal, A. M., & Helen, K. (2021). The use of smart phones for information seeking by undergraduate students in Nigerian specialized university. *Library Philosophy and Practice (e-journal)*, Article 5382.
- Saravani, S.-J., & Haddow, G. (2017). A theory of mobile library service delivery. *Journal of Librarianship and Information Science*, 49(2), 131–143.
<https://doi.org/10.1177/0961000615595854>
- Singh, B. P., & Madhusudhan, M. (2023). Mobile apps–based applications in libraries and information centers: A systematic review of the literature and future research agendas. *International Journal of Librarianship*, 8(3), 83–102. <https://doi.org/10.23974/ijol.2023.vol8.3.294>