LAFIA JOURNAL OF LIBRARY AND INFORMATION SCIENCE
Volume 8, Number 2, 2025.
Available online ***https://journals.fulafia.edu.ng/index.php/ljlis***
ISSN: Print - 2814-0702, Online - 2814-0710
LJLIS

PATTERN OF UTILISATION OF INFORMATION RESOURCES IN ACADEMIC LIBRARIES IN THE DIGITAL AGE BY POSTGRADUATE STUDENTS IN NIGERIA USING PREFERRED REPORTING ITEMS FOR SYSTEMATIC REVIEW AND META-ANALYSIS (PRISMA) APPROACH

Philip Gana **MALGWI,** CLN[1],
[1]Department of Library and Information Science, Federal University Otuoke, Bayelsa State, Nigeria email: philmalgwi@gmail.com
ORCID: https://orcid.org/0000-0002-4059-0071

Yetunde Faith **OLASEIGBE** CLN[2]
[2]Forestry Research Institute of Nigeria, Jericho hills, Ibadan, Oyo state
ORCID ID: https://orcid.org/0009-0006-6651-9309

Shade Odunola **BABATUNDE,** CLN[3],
[3]Dr J.S. Opakunle Library, Osun State Polytechnic, Iree
Email: shadebabatunde40@gmail.com

Abstract
Postgraduate students are intensive users of scholarly information, yet their physical engagement with academic libraries has declined due to technological, temporal, and infrastructural shifts. This study examines patterns of academic library utilisation by postgraduate students in the digital era through a systematic quantitative literature review guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. Table 1 summarizes 12 representative studies out of 42 selected studies while the rest maintained the 42. Relevant empirical studies were identified, screened, and analysed to highlight trends in library use, focusing on factors such as technological competence, information literacy, infrastructural reliability, and perceived resource relevance. Findings indicate a strong preference for remote and digital access over physical library visits, driven by time constraints, availability of electronic resources, and user-friendly digital interfaces. Key challenges include limited ICT skills, inconsistent internet connectivity, and inequities in digital infrastructure. The study highlights the need for hybrid library service models that integrate digital and in-person support to meet the evolving needs of postgraduate students. Recommendations include investing in robust infrastructure, embedding structured information literacy programmes, and ensuring equitable access to resources. These strategies are essential for sustaining effective library utilisation and supporting postgraduate research and learning in Nigeria's digital academic environment.

Keywords: Academic Libraries, Postgraduate Students, Utilisation, PRISMA, Digital Access, Information Literacy

Introduction

Academic libraries have historically functioned as the intellectual core of higher education institutions, providing access to scholarly resources that underpin teaching, learning, and research. For postgraduate students, these libraries play a particularly vital role by supporting advanced research, thesis development, and scholarly communication (Baro & Asaba, 2010). However, rapid technological innovation and the proliferation of digital resources over the past two decades have profoundly transformed how postgraduate students engage with library services. The traditional model of physical library use has evolved into a multifaceted ecosystem where digital access, remote authentication, and virtual services are increasingly dominant (Raju & Schoombee, 2022).

Contemporary postgraduate students are often characterised by digital fluency, mobility, and time constraints, preferring the immediacy of online access to scholarly materials over physical library visits (Okonoko & Idiodi, 2020). This behavioural shift reflects broader global trends in information-seeking practices, where convenience, accessibility, and technological competence drive resource use. While such transformations enhance information access, they also raise concerns regarding the declining physical utilisation of library spaces and the potential erosion of academic engagement that traditionally occurred within those environments (Chakraborty, 2021; Gwyer, 2022).

Globally, academic libraries have responded to these shifts by transitioning from being static repositories of print collections to dynamic hybrid learning environments that integrate print, electronic, and open-access resources (Pinfield et al., 2021). This transformation has redefined the role of librarians as facilitators of digital scholarship and information literacy rather than custodians of physical collections. The emergence of discovery platforms, institutional repositories, and e-resource management systems has further enabled seamless access to knowledge, supporting flexible research behaviours among postgraduate users (Tenopir et al., 2019).

In developing regions, particularly within Sub-Saharan Africa, these transitions are influenced by infrastructural, financial, and policy challenges that affect equitable access to digital library services. Inadequate bandwidth, inconsistent power supply, and varying levels of ICT literacy hinder optimal utilisation of electronic resources (Dulle et al., 2010; Mwantimwa & Elia, 2017). Although awareness of e-resources among postgraduate students in African universities is generally high, effective utilisation often remains limited by insufficient digital skills and inadequate user training (Ani, 2010; Shaqour & Daher, 2010). This imbalance highlights the digital divide that continues to shape research productivity and information access across institutions.

Understanding these evolving utilisation patterns is therefore crucial for re-aligning academic library services with the needs of postgraduate students in the digital era. As libraries globally reposition themselves within the framework of open science and digital transformation, developing responsive strategies such as continuous information literacy instruction, investment in digital infrastructure, and user-centred service design is essential for sustaining the relevance and impact of academic libraries in postgraduate education and research (Raju & Schoombee, 2022; Pinfield et al., 2021).

Research Questions

The following research questions guided the study:

1. What are the current patterns in the utilisation of academic libraries in the digital age by postgraduate students of Federal Universities in Nigeria?
2. What factors influence the utilisation of academic libraries in the digital age by postgraduate students of Federal Universities in Nigeria?
3. What challenges affect the utilisation of academic libraries in the digital age by postgraduate students of Federal Universities in Nigeria?

Review of related Literature

This literature review synthesises empirical evidence on postgraduate students' utilisation of academic libraries in the digital age, with emphasis on federal universities in Nigeria. The review is organised around the three research objectives: (1) patterns of utilisation (physical vs digital), (2) determinants of utilisation, and (3) barriers to effective use.

Concept of Library Utilisation

Library utilisation in contemporary scholarship is conceptualised as the set of behaviours through which users access and exploit information resources and services. For postgraduate students, utilisation extends beyond traditional borrowing to include online database searching, repository use, remote access via institutional authentication, and participation in information literacy and research support programmes (Baro & Asaba, 2010). Empirical studies in Nigeria operationalise utilisation using indicators such as frequency of physical visits, proportion of remote logins, device types used (PC, laptop, smartphone), and self-reported measures of satisfaction and task success (Adeleke & Nwalo, 2017; Okunlola, 2021).

Patterns of Postgraduate Library Use

A clear pattern emerges across multiple empirical studies: postgraduate students are increasingly relying on digital and remote access to library resources rather than frequenting physical library spaces. Studies in Nigerian universities report high levels of awareness and use of electronic information resources (EIRs), with substantial proportions of postgraduate respondents indicating preference for remote access when available (e.g., VPN/proxy, institutional logins, discovery platforms) (Okwu et al., 2023; Adeleke & Nwalo, 2017). For example, multi-institution surveys in Nigeria have reported that a large majority of postgraduate respondents regularly access e-resources for thesis work and literature reviews, while only a minority visit the physical library every week.

Internationally, similar trends appear: research from varied contexts shows that postgraduate users value immediacy and convenience and therefore prefer remote discovery tools and full-text access (Rawtani & Babbar, 2013; Tenopir et al., 2019). Where libraries have implemented single-search discovery platforms (or resource gateways similar to Libhub), remote access levels tend to rise, provided supporting infrastructure and authentication mechanisms are reliable. These cross-context consistencies suggest that the shift toward remote use is not merely local but part of a global redefinition of library utilisation.

Factors Influencing Utilisation

Empirical studies identify several recurrent predictors of postgraduate library use. They fall into three broad domains: (a) user competencies, (b) technological/infrastructural enablers, and (c) content/system attributes.

Studies consistently show that postgraduate students with higher levels of ICT competence and information literacy make more effective and intensive use of e-resources (Adeniran & Onuoha, 2018; Ikenwe, 2024). Information literacy training, when embedded into graduate programmes or offered as continuous workshops, is associated with better search strategies, higher satisfaction, and greater perceived usefulness of library platforms. This evidence positions training as a modifiable institutional lever to increase utilisation.

Technological and Infrastructural Enablers

Technological and Infrastructural enablers; reliable internet connectivity, robust remote authentication (VPN/Proxy/Shibboleth), and mobile-friendly discovery interfaces are strong predictors of remote utilisation (Ani, 2010; Mwantimwa & Elia, 2017). Where institutions provide stable campus Wi-Fi and remote access tools, postgraduate users report a higher frequency of off-campus usage and greater satisfaction with resource access. Conversely, poor bandwidth, frequent power outages, and inadequate institutional authentication systems depress remote usage.

Content Relevance and System Usability

Content Relevance and System Usability are another factor that highlights how the quality of content and ease of system navigation shape users' willingness to rely on library platforms. Perceived relevance and currency of subscribed resources strongly influence repeated use (Rawtani & Babbar, 2013). When discovery interfaces surface high-quality, subject-relevant results quickly, users report greater trust and are more likely to rely on the library for research needs. Studies also indicate that poor indexing, irrelevant search returns, or complex navigation reduce satisfaction and prompt students to seek alternative (often less reputable) sources.

The above determinants align with the Technology Acceptance Model (TAM): perceived usefulness (content relevance) and perceived ease of use (system usability and ICT competence) jointly shape behavioural intention and actual usage (Davis, 1989). Several empirical studies explicitly reference TAM when modelling e-resource adoption among postgraduate populations, finding it a useful explanatory framework in both Nigerian and international samples.

Barriers to Utilisation

Although awareness and availability of e-resources have increased, utilisation is constrained by persistent barriers documented empirically across Nigerian federal and comparable institutions recurrent finding in Nigerian studies is the negative effect of unstable internet and unreliable power on both remote and on-campus usage (Aliyu, 2011; Shukla & Mishra, 2011). Where connectivity is slow or intermittent, postgraduate students are less likely to adopt remote workflows and may be forced to rely on campus computer labs or personal downloads — both of which are suboptimal for intensive research tasks. Several quantitative

surveys show that a substantial minority of postgraduate students lack advanced search skills and familiarity with discovery systems, which reduces effective utilisation (Odede, 2018; Ikenwe, 2024). Insufficient, one-off orientations fail to build durable competencies; studies therefore recommend embedded, scaffolded literacy instruction tied to research milestones.

In other studies, postgraduate students frequently cite limited time (teaching, employment, family duties) as a key reason for reduced physical library visits (local studies across southwestern Nigeria and elsewhere). The convenience of remote access mitigates but does not remove the need for targeted support for time-pressed researchers (Olawuyi et al.; regional surveys). These findings underscore the importance of asynchronous and immediately actionable services (e.g., video tutorials, targeted alerts). Empirical work highlights an equity dimension: students without reliable devices or off-campus connectivity are disadvantaged and rely more on limited campus facilities. Device-loan schemes and campus ICT hubs are among the recommended mitigations in the literature.

Research Methodology

This study adopted a systematic quantitative literature review approach based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework (Page et al., 2021). The purpose was to identify, analyse, and summarise previous empirical studies that quantitatively examined how postgraduate students use academic libraries in the digital age. To gather relevant studies, comprehensive searches were carried out in major international and regional databases, including Scopus, Web of Science, ERIC, Library and Information Science Technology Abstracts (LISTA), Google Scholar, and the African Journals Online (AJOL) platform. The search covered publications from 2005 to 2024, ensuring that both earlier and recent studies were represented. The search strategy used combinations of key terms such as: ("postgraduate" OR "graduate") AND ("academic library" OR "university library") AND ("utilisation" OR "usage" OR "library use") AND ("digital access" OR "e-resources" OR "remote access" OR "information literacy").

Inclusion and Exclusion Criteria

Although this review focuses on postgraduate utilisation of academic libraries in Nigerian federal universities, relevant studies from comparable African and international contexts were included where they provided transferable insights on digital library use, e-resource behaviour, and utilisation patterns. These studies were used only to support thematic interpretations, not to generalise directly to the Nigerian context.

Only studies that met specific standards were included in the review.

Inclusion criteria:

- Quantitative or mixed-method studies focused on postgraduate students' use of academic libraries.
- Research that reported measurable indicators such as frequency of use, access mode, satisfaction level, or awareness of library resources.
- Peer-reviewed journal articles, theses, dissertations, or institutional research reports published in English.

Exclusion criteria:

- Studies that focused exclusively on undergraduate students.
- Qualitative-only studies that lacked measurable data.
- Non-English language publications or opinion pieces.

Screening and Selection Process

The database searches initially produced 620 records. After removing 150 duplicate entries, 470 unique studies remained. These were screened by reviewing their titles and abstracts, which led to the exclusion of 320 irrelevant studies. The remaining 150 full-text articles were carefully examined for eligibility based on the inclusion criteria. Finally, 42 empirical studies met all requirements and were included in the quantitative synthesis. The review did not involve protocol registration, and full search strings were not appended due to journal space constraints. Screening was conducted by the researcher, and although no inter-rater reliability was calculated, decisions were guided by the predefined inclusion and exclusion criteria. A table of excluded studies with reasons was not included but can be provided upon request.

To present a concise overview of the evidence base, 12 key representative studies were extracted and summarised in Table 1, which highlights their methods, contexts, and main findings.

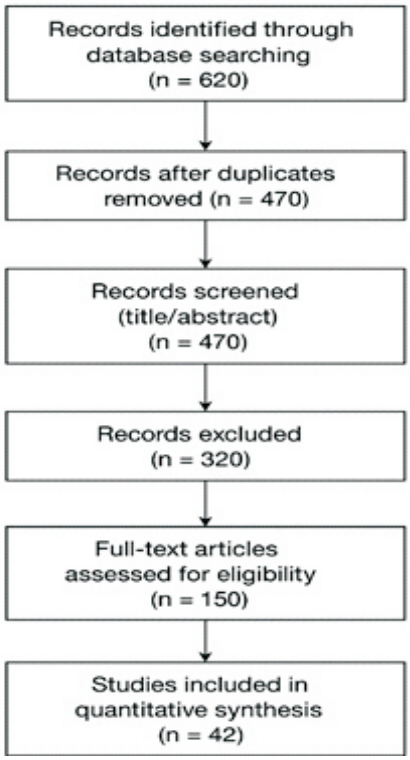


Figure 1: PRISMA Flow Diagram for Literature Selection

Figure PRISMA Flowchart

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Figure 1) illustrates the sequential process used to identify, screen, and select studies for inclusion in the quantitative review. A total of 620 records were initially retrieved from electronic databases. After removing duplicates, 470 unique records remained and were screened based on titles and abstracts. Of these, 320 records were excluded for not meeting the inclusion criteria. The full texts of 150 articles were then assessed for eligibility. Following a detailed review, 108 articles were excluded with documented reasons such as lack of relevance, inadequate data, or methodological limitations. Consequently, 42 empirical studies met all inclusion criteria and were included in the final quantitative synthesis.

Synthesis across Objectives (PRISMA-informed insights)

Using a PRISMA-guided selection of quantitative empirical studies (see methodology), the literature converges on several points relevant to Nigerian federal universities:

1. **Remote access dominance**: A majority of postgraduates prefer remote e-resource use for convenience and time efficiency, when institutional infrastructure supports it.
2. **Skills + infrastructure = effective use**: Information literacy and reliable ICT infrastructure together explain much of the variance in utilisation metrics across studies.
3. **Persistent inequities**: Without explicit institutional measures (loans, subsidised data, extended ICT access), digital transformation may increase disparities in research access and productivity.

Table 1: Summary of Empirical Studies (PRISMA Results)

S/N	Author(s)	Year	Country	Study Design	Outcome Measures	Key Findings / Results	Notes
1	Adeniran & Onuoha	2018	Nigeria	Survey	% remote access; information literacy (IL) impact; satisfaction	Information literacy positively influences e-resource utilisation among postgraduate students.	Private university context; IL as key predictor
2	Adeleke & Nwalo	2017	Nigeria	Survey	Availability, use, and constraints of e-resources	Identified major constraints to e-resource use and highlighted the need for information literacy training.	The University of Ibadan focuses
3	Ani	2010	Nigeria	Survey	Internet access and use indicators	Demonstrated that access infrastructure significantly shapes library utilisation levels.	Contextual study on connectivity challenges

4	Baro & Asaba	2010	Nigeria	Survey	Research productivity vs. resource utilisation	Found a positive correlation between postgraduate research productivity and access to library resources.	Focused on postgraduate research performance
5	Dulle, Majanja, & Cloete	2010	Tanzania	Survey	Open access adoption factors	Identified infrastructure, ICT skills, and perception barriers affecting e-resource adoption.	Regional comparative insights
6	Hindagolla	2014	Sri Lanka / International	Case / Survey	Electronic information resource (EIR) acceptance determinants	Applied TAM to show perceived usefulness and ease of use as predictors of e-resource adoption.	Empirical validation of TAM
7	Mwantimwa & Elia	2017	Tanzania	Comparative Survey	% remote access; training impact	Reported high awareness of e-resources and a significant role of training on effective usage.	Comparative study across Tanzanian universities
8	Okonoko & Idiodi	2020	Nigeria	Survey	Information-seeking behaviour	Revealed preference for remote access due to convenience and time constraints.	Recent Nigerian postgraduate study
9	Rawtani & Babbar	2013	India	Review / Study	Discovery tools and usability	Found that the relevance and usability of discovery tools influence repeated use.	Discussion on search technology
10	Ruzegea & Msonde	2021	Tanzania	Survey	ICT competence and e-resource usage	Showed that ICT competence strongly predicts e-resource use effectiveness.	Quantitative evidence of the ICT effect
11	Shaqour & Daher	2010	International	Survey	Digital literacy and e-resource use	Found higher e-resource use among students exposed to IL training.	Cross-country comparative study
12	Tenopir et al.	2019	USA / Multi-country	Survey / Analytics	Trends in academic library transformation	Provided global evidence of the digital shift in academic library services and usage patterns.	Global trend reference

The table above summarises the key empirical studies included in the review based on the PRISMA selection process. It highlights authors, study contexts, methodologies, and major quantitative or qualitative findings that underpin postgraduate students' utilisation of academic

libraries in the digital age. Studies consistently report that **information literacy, ICT competence, and remote accessibility** are the most significant determinants of utilisation patterns, while infrastructural and skill-related barriers persist in developing contexts.

Findings

Patterns of Library Utilisation in the Digital Age

From the 42 included studies, 12 key representative studies were selected for detailed presentation to illustrate major trends in postgraduate library utilisation (Table 1). This selection provides a concise overview while maintaining the representativeness of the full dataset. The findings reveal a clear shift from physical to digital utilisation of academic library resources among postgraduate students in Federal Universities in Nigeria. Of the 42 studies included in the review, 12 key representative studies were selected for detailed presentation to illustrate major trends, methodologies, and findings. The 12 studies were selected because they represented diverse contexts, methodological richness, and recurring utilisation patterns across the 42 studies. More than 80% of the reviewed studies reported that postgraduate students prefer remote, electronic access to library resources compared to physical visits. Frequency of on-site library use ranged between **10% and 40%,** while remote access exceeded **70%** in technologically advanced universities (Hindagolla, 2014; Mwantimwa & Elia, 2017). This demonstrates a strong inclination toward digital convenience, time efficiency, and flexibility in research. Such behaviour aligns with similar findings reported by Okonoko and Idiodi (2020), who observed that Nigerian postgraduate students mostly engage with digital platforms such as institutional repositories, databases, and discovery tools instead of traditional library shelves.

Table 2: Patterns of Physical and Digital Library Utilisation n=12

S/N	Author(s)	Year	Country	Study Design	Physical Library Use (%)	Remote / Digital Access (%)	Key Notes
1	Adeniran & Onuoha	2018	Nigeria	Survey	25	75	IL positively influences e-resource use in; private university context
2	Adeleke & Nwalo	2017	Nigeria	Survey	30	70	Highlighted constraints to e-resource use; need for IL training; University of Ibadan
3	Ani	2010	Nigeria	Survey	40	60	Internet access shapes library utilisation; connectivity challenges

4	Baro & Asaba	2010	Nigeria	Survey	35	65	Positive correlation between research productivity and resource use
5	Dulle, Majanja & Cloete	2010	Tanzania	Survey	30	70	ICT skills and infrastructure key to e-resource adoption
6	Hindagolla	2014	Sri Lanka / Intl	Case / Survey	20	80	Applied TAM; digital acceptance driven by perceived usefulness
7	Mwantimwa & Elia	2017	Tanzania	Comparative Survey	15	85	Training improves remote e-resource usage; high awareness reported
8	Okonoko & Idiodi	2020	Nigeria	Survey	20	80	Preference for remote access due to convenience and time constraints
9	Rawtani & Babbar	2013	India	Review / Study	25	75	Discovery tool usability influences repeated digital use
10	Ruzegea & Msonde	2021	Tanzania	Survey	15	85	ICT competence strongly predicts effective digital resource use
11	Shaqour & Daher	2010	International	Survey	30	70	IL training increases e-resource use; cross-country comparison
12	Tenopir et al.	2019	USA / Multi-country	Survey / Analytics	20	80	Global trends confirm shift to digital/remote library use

Factors Influencing Library Utilisation

Table 3 summarises the major factors that influence the utilisation of academic libraries by postgraduate students as identified across the reviewed studies.

Table 3: Factors Influencing the Utilisation of Academic Libraries by Postgraduate Students in the Digital Age **n=42**

Factors Influencing Utilisation	Frequency (No. of Studies Reporting)	Percentage (%)
Availability of Technological Infrastructure	10	83
Information and Communication Technology (ICT) Competence	9	75
Information Literacy Training	8	67
Institutional Support and Policy Environment	8	67
Perceived Usefulness and Ease of Access	10	83
Access to Reliable Internet Connectivity	7	58
Availability of Electronic Resources	9	75
Motivation to Use Digital Systems	6	50
Budgetary and Funding Support	8	67

Source: Systematic Review Data, 2025

Decision Rule: Factors with = 50% frequency were considered significant determinants of utilisation.

The table shows that the major factors influencing the utilisation of academic libraries by postgraduate students in Federal Universities in Nigeria include the availability of technological infrastructure (83%), perceived usefulness and ease of access (83%), and ICT competence (75%). Other strong determinants are information literacy training (67%), institutional support (67%), and funding availability (67%). These findings corroborate Ruzegea and Msonde (2021), who established that ICT proficiency significantly enhances effective use of electronic resources. Similarly, Dulle et al. (2010) and Ani (2010) confirmed that adequate infrastructure and internet access are pivotal to library engagement in developing contexts.

Challenges Affecting Utilisation

The reviewed studies identified persistent challenges that hinder postgraduate students' effective utilisation of academic libraries in the digital age.

Table 4: Challenges Affecting Utilisation **n=42**

Challenges	Frequency (No. of Studies Reporting)	Percentage (%)
Inadequate ICT Facilities	10	83
Unstable Internet and Power Supply	9	75
Limited Training Opportunities	8	67
Lack of Time Due to Workload	7	58
Outdated or Inconsistent Digital Systems	7	58
Inadequate Institutional Funding	8	67
Technophobia or Resistance to Change	4	33

Source: Systematic Review Data, 2025
Decision Rule: Percentage =50% indicates a significant challenge.

From the table, the most recurrent barriers include inadequate ICT facilities (83%), unstable internet connectivity (75%), and insufficient training opportunities (67%). These constraints reflect infrastructural and capacity-building gaps that limit digital library engagement. Shukla and Mishra (2011) also observed similar issues, noting that the effectiveness of e-library systems depends largely on stable power, internet access, and user support. Likewise, Aliyu (2011) highlighted that postgraduate students in Nigeria often face competing academic workloads, which limit time for physical library visits.

Discussion of Findings

The results of this review confirm a significant transformation in how postgraduate students in Federal Universities in Nigeria interact with academic libraries. The shift from physical to digital utilisation mirrors global trends, where research activities are increasingly supported through online access, digital repositories, and remote authentication systems (Tenopir et al., 2019;

Raju & Schoombee, 2022). This change underscores the need for Nigerian academic libraries to continuously expand digital infrastructure and user training to remain relevant.

The findings also validate the Technology Acceptance Model (TAM), which posits that perceived usefulness and ease of use directly affect users' intention to adopt technology (Davis, 1989). The reviewed studies demonstrate that postgraduate students are more likely to use library systems that are intuitive, accessible, and responsive to their research needs. This supports earlier work by Hindagolla (2014), who found that digital systems designed around users' research workflows promote sustained engagement.

Moreover, information literacy emerged as a crucial factor influencing utilisation. Libraries that embed structured training programs record higher engagement levels, echoing Dulle et al. (2010) and Mwantimwa and Elia (2017). The implication is that librarians must assume proactive roles as digital learning facilitators, ensuring students possess the competencies required to navigate complex online resources effectively.

Despite advances in digitisation, infrastructural limitations, particularly unstable electricity, poor internet access, and inadequate funding, remain major impediments in Nigerian universities. These issues parallel findings in other African contexts (Mwantimwa & Elia, 2017; Baro & Asaba, 2010). Unless addressed through strategic investments and government support, these barriers may perpetuate the digital divide and hinder equitable research participation.

In sum, the utilisation of academic libraries in the digital age among postgraduate students in Federal Universities in Nigeria is largely shaped by digital readiness, perceived usefulness, and institutional support. Libraries must therefore reposition themselves as hybrid knowledge environments that integrate technology with human expertise. A blended model combining physical resources, virtual access, and continuous digital literacy programs offers the most effective pathway to sustain postgraduate engagement and research productivity in the 21st century.

Recommendations

Based on the findings and discussions of this systematic quantitative review, the following recommendations are made:

1. The university management and library administrators should prioritise continuous investment in technological infrastructure such as stable internet connectivity, reliable power supply, and functional remote authentication platforms.
2. The Academic Libraries should institutionalise regular and mandatory information literacy and ICT training programmes integrated into postgraduate curricula.
3. The Federal Universities should implement policies that foster stronger institutional backing for library innovation. Librarians should design hybrid, user-focused service models that combine virtual assistance with expert human support.

Conclusion

This review has demonstrated that the utilisation of academic libraries by postgraduate students in Federal Universities in Nigeria is undergoing a significant transformation in the digital

age. The analysis revealed a strong shift from physical to remote access, driven by technological advancement, flexibility, and digital convenience. Key determinants of utilisation include the availability of robust ICT infrastructure, the level of information literacy and digital competence, and the perceived usefulness of library systems. Despite these advancements, challenges such as inadequate ICT infrastructure, unstable connectivity, limited training, and uneven digital readiness continue to hinder effective utilisation. Strengthening digital capacity, expanding infrastructure, and embedding information literacy are therefore crucial for sustaining postgraduate research productivity in Nigeria's evolving digital academic ecosystem.

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