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Strategies for the Application of Geographic Information Systems (Gis) In Library Planning, Resources Enhancement and Usage in Nigeria

By

Akintoye, Oluyemi Ayorinde
https://orcid.org/0000-0002-9597-7361
Email:oluyemi.akintiye@unical.edu.ng
Department of Environmental Management,
Faculty of Environmental Sciences,
University of Calabar, Calabar, Nigeria

Asuquo Edung Etim
https://orcid.org/0000-0002-8352-5034
Department of Environmental Education,
University of Calabar, Nigeria

Ubong, Edet Harrison
https://orcid.org/0009-0002-3423-0384
Nigeria Erosion and Watershed Management Project,
Uyo Akwa Ibom State

Akintoye, Taiwo Adesola
https://orcid.org/0009-0008-9355-1157
Email:taiwo.adesola@unical.edu.ng
Department of Special Education, Faculty of Education,
University of Calabar, Nigeria

Onuoha, Edwin
https://orcid.org/0009-0005-4113-0826
onuohaedwin@unical.edu.ng
Department of Environmental Management,
Faculty of Environmental Sciences,
University of Calabar, Calabar, Nigeria

Awan, Obianuju Emmanuella
https://orcid.org/0000-0002-5756-542X
Email:awanobianuju@unical.edu.ng
Department of Environmental Management,
Faculty of Environmental Sciences,
University of Calabar, Calabar, Nigeria

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Akintoye, Oluyemi Ayorinde, Asuquo Edung Etim, Ubong, Edet Harrison
Akintoye, Taiwo Adesola, Onuoha, Edwin & Awan, Obianuju Emmanuella

Abstract

In Nigeria's knowledge-driven society, libraries remain critical to educational and informational development. However, library accessibility and usage are challenged by spatial distribution, inadequate planning, and resource misallocation. Geographic Information Systems (GIS) present a viable technological intervention for optimizing library planning and usage. This article explores the application of GIS in library development, resource management, and service delivery in Nigeria. Drawing on three conceptual frameworks, the Diffusion of Innovation Theory, Spatial Accessibility Model, and the Socio-Technical Systems Theory, this study integrates scholarly evidence and library-related geospatial insights to recommend a structured approach to GIS adoption in Nigerian libraries.

Key Words: GIS, Library Planning, Library Usage, Nigeria, Spatial Analysis, Educational Development

Correspondence Email: oluyemi.akintoye@unical.edu.ng

Introduction

Libraries are essential institutions in national development, especially in educational, social, and cultural contexts. In Nigeria, however, spatial and infrastructural inequalities impede equitable access to library services (Egunjobi, 2013; Nwalo, 2018). The integration of Geographic Information Systems (GIS) in library planning offers a powerful tool to address these disparities through spatial analysis, location-allocation modeling, and data visualization (Alabi, 2020). As libraries transition into the digital era, the role of GIS in enhancing planning accuracy and user accessibility becomes indispensable (Olatunji & Akinyemi, 2021).

The increasing demand for equitable access to educational resources in Nigeria has placed libraries at the forefront of national development agendas. Libraries, particularly public and academic ones, are not only repositories of information but also serve as community hubs for literacy, research, and lifelong learning. However, disparities in the spatial distribution, accessibility, and utilization of libraries across Nigeria continue to hinder the realization of their full potential (Aina, Mutula, and Tiamiyu, 2008; Ifidon and Ahiauzu, 2005). In response to this challenge, Geographic Information Systems (GIS) have emerged as powerful tools for enhancing library planning, location analysis, and resource allocation. The integration of GIS into library science offers a data-driven approach for visualizing spatial relationships, optimizing facility placement, and improving user access, particularly in underserved rural and peri-urban communities (Onyenedum, Nwachukwu, and Emoh, 2012; Yusuf, 2020).

GIS, as a spatial analysis and decision-support technology, has been widely adopted in fields such as urban planning, environmental science, and health systems (Goodchild and Janelle, 2010; Abubakar and Doan, 2010). In the context of library development, GIS can be leveraged to analyze population demographics, proximity to educational institutions, transportation infrastructure, and other socio-spatial factors to inform planning decisions (Ojokoh and Asaolu, 2011; Fadeyibi, Okesipe, and Adetimirin, 2019). For instance, location-allocation models within GIS can determine optimal locations for new library branches by minimizing travel distance for users, maximizing service coverage, and ensuring equitable distribution across a region (Sule, Ibrahim, and Oloyede, 2021). Moreover, GIS mapping of library usage patterns can guide the reallocation of library resources, identification of service gaps, and formulation of outreach strategies aimed at increasing patronage and engagement (Obinyan, Aidenojie, and Udem, 2020).

Despite the proven utility of GIS in planning and infrastructure development, its application in Nigerian library systems remains nascent and underutilized. Several barriers, including inadequate technical expertise, limited institutional investment, and lack of data infrastructure, have slowed the integration of GIS in library science curricula and planning initiatives (Ogbomo and Ogbomo, 2008; Dada and Igbokwe, 2014). However, recent government initiatives on digital inclusion and education reform, alongside global trends in spatial technologies, present opportunities for reimagining library services through GIS-enabled frameworks (National Information Technology Development Agency [NITDA], 2021). Given these developments, this article explores the application of GIS in library planning and usage in Nigeria, examining its potential to address disparities, optimize service delivery, and support evidence-based decision-making.

One of the suitable conceptual frameworks that can adequately explain this analysis is the Diffusion of Innovation Theory (DOI). Developed by Everett Rogers, the DOI theory explains how innovations spread within a social system over time (Rogers, 2003). Applying DOI to GIS adoption in library systems enables understanding of how awareness, interest, evaluation, trial, and adoption stages occur among stakeholders such as government agencies, librarians, and users (Oni & Ajayi, 2021). Another conceptual framework is the Spatial Accessibility Model. This model evaluates the ease with which populations can access services based on distance, transportation, and infrastructure (Guagliardo, 2004). In the Nigerian context, GIS aids in identifying underserved areas and optimizing library siting to improve spatial equity (Olajide et al., 2022). Lastly, it is possible to utilize the Socio-Technical Systems Theory. This framework posits that organizational performance is a function of the interplay between social and technical systems (Trist & Bamforth, 1951).

For effective GIS implementation, Nigerian libraries must balance technological capacity with human resources, training, and organizational culture (Bamidele & Abiodun, 2021). Consequently, this article is designed to provide an integrated insight into the Application of Geographic Information Systems (GIS) in Library Planning and Usage in Nigeria. It

GIS and Library Site Selection and Enhancing Library Accessibility in Nigeria

GIS supports objective site selection for library development by evaluating multiple criteria such as population density, proximity to schools, land availability, and infrastructure (Adebayo et al., 2021). In Lagos State, GIS tools have been used to identify optimal locations for new community libraries based on service gaps and accessibility (Adetunji & Olanrewaju, 2020). Similarly, in Kano, a GIS-based assessment revealed uneven distribution of academic libraries relative to student populations (Garba & Sani, 2019).

Poor accessibility remains a barrier to library use in Nigeria, especially in rural and underserved communities (Nwokocha, 2015). GIS-based network analysis can map travel time, public transport routes, and walking distances to libraries, aiding planners in mitigating geographic barriers (Eze & Emeh, 2020). For example, a GIS study in Enugu demonstrated how terrain and road network data were used to reduce access time to public libraries (Ibe & Okoro, 2022).

GIS for Resource Allocation and Management, Users Behavior and Library Policy Formulation

Effective resource allocation in libraries is crucial for equitable service delivery. GIS enables visualization of library resources, books, ICT tools, staff distribution, and helps in monitoring usage trends (Onyebuchi et al., 2021). In Cross River State, GIS helped local authorities identify and redirect underutilized resources to high-demand areas (Ekong & Edet, 2021). Such practices not only reduce redundancy but also enhance user satisfaction and operational efficiency. GIS facilitates spatial tracking of user behaviors and preferences, allowing libraries to tailor services to community needs. Heatmaps and spatial clustering techniques reveal high-use zones and peak periods (Oladele & Afolabi, 2020). This can inform decisions about library hours, mobile library routes, and digital resource deployment, especially in tertiary institutions (Yakubu et al., 2023).

Policy development benefits from evidence-based planning, and GIS provides the data-driven insights needed to influence national and state library policies (Akinyemi & Oduwole, 2020).

For instance, the National Library of Nigeria can use GIS to advocate for increased funding and decentralized library services based on mapped literacy rates and library-to-population ratios (Chukwuma & Ukaoha, 2022). Despite its potential, GIS adoption in Nigerian libraries faces several challenges, including lack of skilled personnel, high costs of GIS software and hardware, and limited institutional support (Okonkwo & Obi, 2019). Moreover, poor data quality and inadequate internet connectivity hinder real-time spatial analysis and sharing (Bassey et al., 2021).

Capacity Building, Training Librarians and Planners in GIS Skills and Data Management

One of the most critical prerequisites for the successful adoption of Geographic Information Systems (GIS) in library planning and usage is the development of human capital. In many Nigerian libraries, there exists a significant gap in both awareness and technical proficiency among librarians and planners in relation to GIS tools, spatial data interpretation, and database management. As Oduwole, Sowole, and Oyesiku (2003) observed, although technological infrastructure may gradually improve, the human element remains the most significant bottleneck in harnessing geospatial technologies for library development. Similarly, Onifade, Oyeniyi, and Ikuenomore (2013) emphasized that without sustained training, the adoption of GIS in information science fields may stagnate, especially within public institutions struggling with budgetary and staffing constraints.

The relevance of GIS to library science extends beyond mere spatial mapping; it encompasses areas such as data visualization, demographic analysis, infrastructure distribution, and predictive analytics. However, as noted by Okunlaya, Ajayi, and Fakolujo (2016), Nigerian librarians are often excluded from technical capacity-building programs that focus on GIS and digital literacy. This gap results in a situation where the potential for spatial technologies to inform resource allocation and community outreach in libraries remains untapped. A study by Alhassan, Musa, and Olaniyi (2020) highlighted that most library staff in tertiary institutions lack exposure to open-source GIS platforms such as QGIS or ArcGIS, thereby limiting their involvement in planning processes that require geospatial data.

In order to bridge this knowledge gap, institutions must invest in structured training programs that are tailored to librarians and library managers. As identified by Adedokun, Akinade, and Ogundare (2022), such training should incorporate hands-on experience in spatial database management, map interpretation, and integration of GIS into library management systems. Moreover, the inclusion of GIS courses in library and information science curricula is vital. Aina, Mutula, and Tiamiyu (2008) advocated for the redesign of LIS programs in African

universities to include GIS modules, emphasizing that the future of librarianship lies in digital and spatial literacy.

Capacity-building efforts should not only focus on initial training but also emphasize continuous professional development.
As shown by the work of Yusuf, Olalekan, and Idowu (2019), librarians who engaged in periodic GIS workshops were better equipped to contribute to location analysis, community engagement, and digital resource dissemination. They noted that collaborative partnerships with GIS experts, government agencies, and NGOs can further enhance the technical competence of librarians and information planners. Similarly, national policy frameworks, such as those advanced by the National Information Technology Development Agency (NITDA), call for the establishment of technical training hubs to improve geospatial literacy across disciplines, including library science (NITDA, 2021).

Beyond technical skills, capacity building must also address data management practices. According to Obinyan, Aidenojie, and Udem (2020), effective GIS usage is not possible without robust data curation practices—something that many Nigerian libraries still struggle with. Librarians must be trained not only to collect and clean spatial data but also to analyze and interpret such data within the context of service delivery. This would require a paradigm shift in how library professionals view their roles, from custodians of static collections to active participants in community planning and knowledge dissemination.

Ultimately, the sustained integration of GIS into library services in Nigeria hinges on a national commitment to capacity building. Government agencies, academic institutions, and professional associations must work collaboratively to equip library personnel with the technical and analytical skills required in a spatially aware world. Without such investments, the vision of equitable and intelligent library planning using GIS will remain aspirational rather than actionable.

Policy Integration through Institutionalizing GIS Use in Library Development Policies
The integration of Geographic Information Systems (GIS) into library development policies is essential for the modernization and relevance of library services in Nigeria. For libraries to effectively support national development, especially in the context of the information economy, their planning and operations must be guided by spatial data. Yet, this requires deliberate policy efforts to institutionalize GIS use as part of library development frameworks.

As stated by Adeniran, Omotayo, and Agboola (2017), while GIS tools offer transformative opportunities for optimizing library locations, collections, and services, their deployment remains sporadic due to the absence of comprehensive institutional policies. They argue that without such policy-level support, the technological benefits of GIS are unlikely to be systematically realized.

Policies on library development in Nigeria have historically focused on book acquisition, physical infrastructure, and cataloguing standards, but have largely ignored spatial analysis as a strategic tool for equitable resource distribution. According to Ezeani, Onuoha, and Igwesi (2012), one reason for this oversight is the lack of synergy between national ICT policies and educational planning. Their study found that GIS applications were more likely to be adopted in sectors like urban development and agriculture than in libraries, primarily due to the non-inclusion of GIS in library and information science policy agendas. This policy gap reflects a broader neglect of libraries as essential development infrastructure that require geospatial planning.

Integrating GIS into library policy would require collaboration between multiple stakeholders such as library associations, educational regulators, GIS experts, and government agencies. Its thus not surprising, that Alhassan, Musa, and Olaniyi (2020) has recommended the creation of a national framework that mandates the use of GIS in library needs assessments and infrastructure expansion. They emphasized that the National Library of Nigeria and the Nigerian Library Association should lead the policy drive by articulating guidelines that embed GIS into library planning protocols. Such policies would not only enhance service delivery but also ensure spatial equity by helping decision-makers identify underserved populations and optimize library locations.

Moreover, institutional policy integration would help address the persistent issue of rural–urban disparity in library access. Akinade, Ogunniyi, and Salawu (2021) stressed that current library development policies tend to favor urban and peri-urban centers, leaving rural areas without adequate library facilities. GIS, when embedded in policy, can offer real-time spatial data to guide government investments in library infrastructure based on community needs and population distribution. They argue that policies that require spatial analysis in budget allocation and project siting would make library development more evidence-based and inclusive.

In international contexts, the incorporation of GIS into library planning policy has already demonstrated significant success. For instance, the United States Library of Congress and several European library systems utilize GIS for population-based planning, ensuring that

libraries are accessible within walkable distances and aligned with public service corridors (Goodchild, Kemp, and Rejeski, 2000). In their study on policy integration, Chan, de Vries, and Korfmacher (2016) argued that embedding GIS into library and information policies has led to improved service coverage, efficient budget use, and community engagement in many Western nations. These examples provide a model for Nigerian policymakers to adopt and adapt GIS into national and institutional library planning documents.

In conclusion, institutionalizing GIS within Nigerian library development policies is not just a technical adjustment but a strategic imperative. It requires the enactment of guidelines, budgetary support, staff training policies, and inter-agency collaboration. As Uhegbu, Iheanacho, and Agbanu (2014) rightly noted, any policy that seeks to make libraries more responsive to national development goals must also make them more spatially intelligent—and this begins with the deliberate inclusion of GIS in all planning and evaluation activities.

Funding and Collaboration, Leveraging Public-Private Partnerships and Donor Funding to Support GIS Infrastructure

The implementation of Geographic Information Systems (GIS) in library planning across Nigeria is often hindered by limited funding and weak institutional support. Developing the infrastructure and technical capacity required for GIS adoption demands consistent financial investment, which many public libraries, particularly those in underserved regions, cannot afford. As Okon, Edem, and Akpan (2020) argue, public funding for libraries in Nigeria has remained low and unstable, making it difficult for them to invest in innovative technologies like GIS. This fiscal constraint necessitates the exploration of alternative funding mechanisms such as public-private partnerships (PPPs) and donor collaborations.

Public-private partnerships provide a pragmatic pathway for bridging the technological and financial gaps in public library systems. Through PPPs, private entities can contribute resources, technical, financial, and managerial—in exchange for social impact returns, branding opportunities, or tax incentives. According to Adeyemi, Ogunyemi, and Ibrahim (2019), successful PPP models in Nigerian education have demonstrated that private involvement can fast-track ICT deployment when clearly defined legal frameworks and mutual accountability structures are in place. Applying similar models to the library sector could catalyze the introduction of GIS tools for collection development, service mapping, and user engagement analytics.

Donor funding also plays a crucial role in expanding access to GIS technologies, especially in developing contexts. International organizations like the World Bank, UNESCO, and the Bill & Melinda Gates Foundation have supported digital literacy and library development programs globally, including in Africa. As highlighted by Nwokocha, Ezeokoli, and Agbo (2016), donor-funded interventions have enabled several Nigerian libraries to access digital infrastructure and training, which could be further extended to include GIS-specific projects. For instance, in Kenya, a partnership between the EIFL (Electronic Information for Libraries) and local governments facilitated the deployment of GIS for mapping library reach and identifying underserved communities (EIFL, 2018). Such examples suggest that Nigerian libraries could benefit from similar collaborations by aligning project proposals with donors' priorities in education, digital inclusion, and public information access.

Moreover, cross-sectoral collaboration between libraries, universities, research institutes, and civil society organizations can serve as a resource pool for GIS adoption. Oladapo, Ismaila, and Bassey (2022) emphasize that library science schools in Nigerian universities can act as innovation hubs by offering GIS training, conducting community mapping, and generating spatial data in partnership with public libraries. These collaborations reduce costs and build local expertise. Similarly, government ministries and parastatals that use GIS in urban planning and environmental monitoring can share infrastructure and data platforms with libraries under a national information-sharing protocol. This integrated approach fosters sustainability, avoids duplication, and enhances the overall spatial data ecosystem in the country.

However, to attract donor and private investment, libraries must first demonstrate institutional readiness and articulate the developmental impact of GIS in library operations. As asserted by Chukwuemeka, Adebanjo, and Anozie (2021), proposals seeking external support for digital library infrastructure must present credible data on anticipated outcomes, such as improved access equity, resource optimization, and enhanced service delivery. The authors argue that impact evaluation frameworks, especially those tied to the Sustainable Development Goals—can significantly boost the appeal of GIS projects to donors focused on inclusive education, innovation, and community development.

In essence, sustainable GIS adoption in Nigerian libraries requires strategic collaboration and diversified funding models. Government should play a facilitative role by creating policy frameworks and incentives for partnerships, while library administrators must actively pursue joint ventures and funding opportunities aligned with their service objectives. Such an ecosystem of support could usher in a new era of data-driven library development in Nigeria, transforming access, equity, and literacy across both urban and rural communities.

Data Infrastructure, Developing Centralized Geospatial Databases on Libraries and User Demographics

Robust data infrastructure is foundational to the effective application of Geographic Information Systems (GIS) in library planning. At the heart of GIS lies the availability and accessibility of accurate, consistent, and geospatially referenced data. For libraries in Nigeria, the lack of centralized geospatial databases detailing library locations, user demographics, and service reach has remained a critical bottleneck in deploying data-driven strategies. According to Ugboma, Chima, and Aghedo (2019), many public and academic libraries in Nigeria operate in data silos, with minimal coordination among institutions, leading to poor decision-making and inefficient resource distribution.

Establishing a centralized geospatial database can significantly enhance planning, equity, and outreach in library services. For example, centralized mapping systems allow policymakers and librarians to visualize underserved regions, population densities, and educational profiles, facilitating evidence-based expansion of services. Adebayo, Yakubu, and Ogundipe (2021) contend that with a harmonized GIS database, library development can move from intuition-based to intelligence-led planning, ensuring resources are directed where they are most needed. In Kenya, similar systems have enabled local governments to identify literacy deserts and prioritize mobile library deployments accordingly (Mbithi, Nyambura, and Kamau, 2017).
Furthermore, user demographic data, when integrated with spatial datasets, enhances service customization and responsiveness. Okojie, Ayeni, and Ezeani (2020) explain that demographic segmentation based on age, literacy level, income, and language can be mapped geospatially to tailor library programs, such as multilingual collections or children's reading clubs. They emphasize the role of real-time demographic updates via community surveys and mobile apps in keeping GIS databases relevant and actionable.

A centralized data infrastructure also supports interoperability and long-term policy monitoring. As stated by Alabi, Mustapha, and Enemuo (2022), such databases facilitate the sharing of spatial data between ministries of education, planning commissions, and local governments, thereby integrating libraries into national development plans. In countries like India and Brazil, integrated GIS platforms have helped align public library growth with urban and rural development schemes (World Bank, 2020). Nigeria can replicate this by embedding GIS data collection protocols into library reporting systems and national statistical programs.
However, building and maintaining such a system requires strategic collaboration and standardization. Osagie, Umeh, and Akintola (2022) recommend the adoption of open data

standards and metadata schemas to ensure data quality and compatibility. They also stress the importance of data ethics, privacy, and inclusive design, particularly when handling sensitive user demographic information. This includes anonymizing individual data, obtaining consent for community mapping, and ensuring that marginalized groups are not excluded from data representation.

Capacity is another major consideration. Many libraries lack trained GIS professionals and the digital infrastructure needed to collect, manage, and update spatial datasets. As Okonkwo, Nwosu, and Bello (2021) observed, the absence of a national GIS framework for library services results in fragmented efforts and duplicated mapping initiatives. They propose that the National Library of Nigeria, in collaboration with state library boards and academic institutions, should champion the creation of a national GIS hub for libraries, supported by funding from government and development partners.

In summary, the development of centralized geospatial databases on libraries and user demographics is not just a technical undertaking, it is a strategic necessity for equitable and effective library development in Nigeria. Such infrastructure will allow for better planning, performance monitoring, and user engagement while integrating library systems into broader national goals for digital transformation and social inclusion.

Case Studies and Best Practices

In Ekiti State, a pilot GIS project led to a 30% increase in library visits by strategically siting mobile library services in previously neglected areas (Ogunyemi & Abayomi, 2022). University libraries like that of the University of Ibadan have integrated GIS in campus navigation apps to guide students to resources (Ajayi & Olowu, 2021). These initiatives serve as models for scalable GIS applications across Nigeria.

Conclusion

GIS offers a transformative approach to library planning and usage in Nigeria by enhancing spatial justice, operational efficiency, and user engagement. When aligned with conceptual frameworks such as DOI, Spatial Accessibility, and Socio-Technical Systems Theory, GIS becomes a holistic tool for reforming Nigeria's library system. Embracing this innovation is imperative for achieving inclusive and sustainable educational development.

The integration of Geographic Information Systems (GIS) into library planning and usage in Nigeria presents an invaluable opportunity to revolutionize how library services are conceived, delivered, and evaluated across diverse communities. As this paper has demonstrated, GIS offers powerful spatial tools for identifying gaps in service delivery, optimizing resource

allocation, and visualizing demographic trends to support equitable access. The deployment of centralized geospatial databases on libraries and user demographics forms the bedrock of this transformation. Without structured and accessible data, GIS remains underutilized, especially in regions where literacy gaps and digital exclusion persist (Okonkwo, Nwosu, and Bello, 2021; Adebayo, Yakubu, and Ogundipe, 2021).

A robust, centralized data infrastructure ensures continuity and coherence in policy planning, while enabling institutions to track changes over time. In a country as diverse and geographically complex as Nigeria, where urban-rural disparities in education and digital literacy remain wide, a national GIS framework can provide the intelligence needed to direct investments and design programs that genuinely meet local needs (Alabi, Mustapha, and Enemuo, 2022). This is especially true for underserved regions such as northern Nigeria, where GIS could be used to track learning infrastructure, literacy rates, and population shifts (Ugboma, Chima, and Aghedo, 2019). The ability to link library planning with population data, economic indicators, and educational outcomes enables decision-makers to take a systems-based approach rather than one driven by convenience or political visibility (Mbithi, Nyambura, and Kamau, 2017).

Furthermore, the sustainability of GIS applications in library systems is contingent on institutional commitment, technological investments, and strategic partnerships. Open-data collaborations among educational institutions, government agencies, and civil society will ensure data integrity and relevance. Ethical considerations must also be central, especially when collecting user demographic data in communities with privacy concerns or socio-political sensitivities (Osagie, Umeh, and Akintola, 2022). Training librarians, planners, and local administrators to use these tools responsibly is key to embedding GIS into daily library operations and long-term policy frameworks (Okojie, Ayeni, and Ezeani, 2020).

Looking ahead, the success of GIS in library planning in Nigeria depends on a blend of digital infrastructure, local capacity building, sustained funding, and legal backing. Countries that have made strides in this space, such as Kenya, India, and Brazil, have demonstrated that once geospatial data is centralized and shared across institutions, it creates a ripple effect of informed decisions and measurable improvements in literacy and inclusion (World Bank, 2020). If Nigeria can replicate such models, the nation's library sector could be repositioned not merely as repositories of knowledge but as dynamic, location-intelligent hubs that support national development and community empowerment.

Recommendations

The need to institutionalize GIS in National Library Development Policies is unnegotiable. To ensure sustainable integration of GIS in library planning, the Federal and State Ministries of Education and Information should formally incorporate geospatial data use into library policy frameworks. National policies must articulate clear mandates for spatial mapping of libraries, literacy needs, and service coverage, creating a basis for evidence-based decision-making. Countries like India and South Africa have embedded GIS in education infrastructure development with measurable success (Ramalingam, Krishnasamy, and Murugan, 2019; Moyo, Ndlovu, and Ncube, 2021).

Developing Centralized and Open-Access Geospatial Databases is a major panacea in solving observed problems in this analysis. Thus, there is an urgent need to develop and maintain centralized digital repositories of geospatial data related to libraries, population distribution, and literacy rates. These databases should be interoperable, allowing integration with demographic, educational, and socio-economic indicators to support targeted library expansion and resource distribution (Akinyemi, Yusuf, and Folarin, 2021; Tella, Bashorun, and Adeyinka, 2020).

Efforts should be made to improve capacity building through training and professional development. In order to do this, Nigerian librarians and library administrators require structured training in GIS tools such as ArcGIS, QGIS, and spatial analytics software. Tertiary institutions offering Library and Information Science (LIS) should include GIS in their curriculum. Capacity-building programs can also be conducted through public-private partnerships and international knowledge-sharing networks (Igbokwe, Nwachukwu, and Enwereuzo, 2022; Nwafor, Eze, and Ogunyemi, 2021).

Leveraging Public-private partnerships and donor funding will go a long way in providing significant solutions to observed challenges. Given the high cost of GIS infrastructure—hardware, software licensing, training, and data acquisition—collaboration with private technology companies and development agencies is essential. Philanthropic institutions such as the Bill & Melinda Gates Foundation have funded similar ICT-driven library projects in Kenya and Bangladesh (Kabir, Hossain, and Rahman, 2018; Omotosho, Ojo, and Lawal, 2021). Donor funding should be strategically channeled into rural libraries and under-resourced regions.

There is also a necessity to enhance collaboration between Library Information and Science (LIS) institutions and government agencies. Based on this, Academic institutions, public libraries, and national statistical agencies must collaborate in geospatial data sharing and

research. The Nigerian Bureau of Statistics (NBS), the National Library of Nigeria (NLN), and Nigerian universities can jointly produce periodic geospatial audits to guide national planning (Adebayo, Yakubu, and Ogundipe, 2021).

Encouraging community participation and library data Contributions is vital. Librarians and local government councils should involve community members in data-gathering processes. This ensures that local knowledge and spatial patterns of library use are captured accurately. Community-based GIS (CB-GIS) initiatives have proven effective in improving the accuracy of library service mapping in Ethiopia and Tanzania (Abebe, Lemma, and Tegegne, 2018; Shayo, Mwakalinga, and Mbwilo, 2019).

It's inevitably that efforts should be made to prioritize data ethics and privacy regulations. With the rise of digital surveillance concerns, institutions must develop ethical guidelines for collecting, storing, and using demographic and spatial data. This is especially critical in conflict-prone or marginalized communities. Data governance protocols must align with Nigeria's Data Protection Regulation (NDPR) and global best practices (Osagie, Umeh, and Akintola, 2022; Olojede, Abioye, and Ogunbanjo, 2022).

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