ARTICLE

Access Reframed

The Role of Human-Computer Interaction in African Public Library Innovation and Transformation

Asmaa Bouaamri and Fredrick Otike

ABSTRACT

This study critically explores the transformative potential of human-computer interaction (HCI) in reimagining African public libraries as dynamic, user-centered, and culturally grounded spaces. Based on a literature review and comparative analysis of libraries across several African countries, the research investigates how HCI principles can enhance user engagement, usability, and inclusivity, particularly in multilingual, resource-constrained, and postcolonial contexts. The paper situates libraries as sociotechnical infrastructures that mediate between technology, local knowledge systems, and community needs, and argues for the importance of participatory and culturally responsive design approaches in library digitization efforts. The findings highlight significant gaps in current implementations of HCI within library services, including the lack of localized interfaces and limited user involvement in design processes. The study concludes by offering practical recommendations for integrating HCI into library development strategies and advocating for the co-creation of digital public spaces that reflect and empower Africa's diverse knowledge ecologies. In doing so, the paper contributes to the growing discourse on decolonial approaches to technology and the future of public libraries in the digital age.

INTRODUCTION

With the continuous advancement of digital technologies, including software systems, digital assets, and programming tools, the need to critically examine how humans engage with machines has become increasingly imperative. Human-computer interaction (HCI), as a field of study, is well suited to this work. From its initial focus on the usability and functionality of technological systems, it has evolved to encompass a more nuanced exploration of user experience, emphasizing the cognitive, emotional, and contextual dimensions of human interaction with complex technological interfaces.[1] This shift reflects a broader understanding of technology as a tool and an integral component shaping human behavior, perception, and everyday life.

HCI, with its interdisciplinary foundations in computer science, cognitive psychology, design, and librarianship, offers powerful tools for analyzing how users interact with technology in real-world settings.[2] It emphasizes not only usability and efficiency but also the cultural, social, and emotional dimensions of technology adoption. Within this evolving landscape, public libraries, especially in developing countries, emerge as vital mediators of the relationship between communities and digital infrastructures; traditionally viewed as repositories of information and learning, they are now increasingly being reimagined as interactive digital hubs that foster knowledge co-production, civic participation, and technological literacy.[3] As the authors demonstrate in

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"Strengthening Digital Inclusion: The Role of Rural Public Libraries in Fostering Literacy, Collaboration, and Community Engagement in Malaysia," rural public libraries act as critical venues for bridging the digital divide by connecting communities to technology.[4] Another study developed a pilot course in HCI and information and communication technology for development (ICTD) at Michigan State University, foregrounding African perspectives through a Collaborative Online International Learning model.[5] The course specifically engaged students with rural communities in Kenya by focusing on health information access and employing participatory methodologies grounded in human-centered design.[6] The evaluation of this pilot demonstrated that collaborative and participatory learning between US and Kenyan students significantly enhanced mutual understanding, awareness, and pedagogical effectiveness in integrating HCI and ICTD approaches within African contexts. While many African countries continue to face limitations in technological infrastructure challenges that directly shape the development and applicability of HCI, this study illustrates how partnerships between institutions in the Global North and Global South can foster innovation, promote contextually grounded design, and strengthen the integration of HCI principles into educational curricula. Such collaborative frameworks not only support capacity building but also form the conceptual backbone of this paper, which argues for the critical importance of human-centered, culturally situated approaches in shaping the future of HCI in Africa.

The paradigm of digital inclusion has undergone a fundamental shift in recent years. While earlier efforts in technology policy and development often focused on the provision of access, measured in terms of hardware distribution or internet connectivity, contemporary discourse increasingly recognizes that access alone is insufficient to foster meaningful and equitable digital participation. This transition from a model of *mere access* to one of *active engagement* underscores the critical importance of HCI as a framework for understanding and designing inclusive, context-sensitive, and user-centered digital experiences.[7] In *Where the Action Is: The Foundations of Embodied Interaction*, Dourish demonstrates that HCI offers far more than simple access to digital systems by emphasizing the fundamentally embodied and situated nature of interaction.[8] The author argues that HCI should be understood as an active, meaningful engagement in which users interpret, act within, and shape their technological environments rather than merely retrieve information or operate interfaces. Through his exploration of embodied interaction, Dourish shows that technology becomes part of how people perceive the world, coordinate with others, and construct meaning, thereby positioning HCI as a field concerned with the depth and richness of human activity rather than passive access alone.

Public libraries in Africa have long functioned as foundational institutions for the dissemination of knowledge and the promotion of lifelong learning.[9] Historically positioned as gateways to information and educational resources, their role is now being redefined amid the rapidly evolving digital landscape. In an era where access alone is no longer sufficient, these institutions must transition into dynamic, user-centered spaces that foster meaningful interaction with digital technologies. As previously noted, African libraries and other centers of information professionals continue to face significant disparities in access to digital infrastructure and scholarly resources, largely stemming from insufficient funding, limited institutional support, and a lack of regional and international collaboration.[10] This digital divide not only hampers innovation within public library systems but also undermines their potential as equitable platforms for HCI, inclusive knowledge production, and digital cultural engagement.

This paper explores how public libraries across Africa are integrating HCI principles to move *beyond access* and toward the creation of dynamic, culturally resonant spaces for digital

engagement. The central question guiding this study is: *How are African public libraries employing HCI to transform their roles from providers of access to active facilitators of user-centered, community-driven technological interaction?* Through a critical review of the literature and a comparative analysis of select case studies, this research seeks to illuminate the transformative potential of libraries as agents of digital equity and innovation in the Global South.

LITERATURE REVIEW

Public libraries in Africa have long been recognized as critical institutions for knowledge dissemination and community engagement.[11] Traditionally, these libraries have focused on providing access to printed materials, serving as hubs for literacy development and educational support. However, with the advent of digital technologies, their role is rapidly shifting. This underscores the developmental challenges faced by African librarianship, attributing much of its stagnation to deficiencies in visionary leadership and the absence of alignment with long-term, sustainable development frameworks.[12] Expanding on this critique, Lynch et al. contend that many African libraries suffer from a lack of institutional self-awareness, particularly in recognizing their potential to act as agents of social transformation and contributors to local and national development agendas.[13] These critiques highlight an urgent need for a paradigmatic shift, one that positions public libraries not merely as custodians of information but as proactive facilitators of digital inclusion, HCI, and community-centered technological engagement.

Others are of the view that African libraries are transitioning from mere access points to dynamic spaces for digital learning, cultural exchange, and technological engagement.[14] This transformation is driven by the increased penetration of information and communication technology (ICT) infrastructure and the rising importance of digital literacy across the continent.[15] Nevertheless, many libraries still face significant challenges in adopting new technologies due to infrastructural limitations, inadequate funding, and a lack of digital training programs.[16]

Nonetheless, case studies from countries such as South Africa, Ghana, Uganda, and Kenya show promising developments. For instance, Electronic Information for Libraries (EIFL) introduced the Public Library Innovation Programme (PLIP), an initiative designed to help public libraries evolve into vibrant community learning hubs. Rather than remaining traditional book-lending spaces, the program supported libraries in using technology to improve people's lives. Through PLIP, libraries received training, equipment, and guidance to introduce new, technology-enhanced services. Librarians learned how to use computers, the internet, and digital tools to meet real community needs, such as helping job-seekers improve their digital skills, supporting farmers with timely agricultural information, assisting students with online learning, or offering ICT training to youth and adults who had never used a computer before. The program encouraged innovation, so each library could design services suited to its local context. By empowering librarians with skills and confidence, PLIP helped transform public libraries into active community development partners, places where people could access information, learn new skills, and improve their opportunities in an increasingly digital world. This ingenuity highlights successful partnerships between public libraries and technology firms, which have enabled broader access to digital resources and skill-building programs.[17] Such examples illustrate the growing recognition of libraries as key drivers of digital inclusion.

In Kenya, EIFL's collaboration with the Kenya National Library Service transformed libraries into ICT hubs, supplying tablets preloaded with educational content and delivering computer literacy and job-seeking training to under-resourced communities.[18] Meanwhile, in South Africa, EIFL-supported public libraries have implemented sustainable infrastructure, providing free Wi-Fi,

computer lending, eLearning, and digital literacy courses. These include coding instruction, makerspace development, digital tools training, CV writing and employment workshops, and intergenerational mentoring between youth and elders.[19] Such initiatives illustrate how libraries are evolving into vital hubs for digital inclusion, civic engagement, and social empowerment.

These initiatives also illustrate how HCI can be applied to understand digital transformations in specific contexts. HCI has evolved as a field that examines the interactions between people and technology, focusing on user experience, interface design, and the sociocultural impacts of digital systems. HCI goes beyond usability to explore how people's interactions with technology can be optimized to enhance productivity, learning, and overall satisfaction.[20] In the context of public libraries, integrating HCI principles has become essential in ensuring that digital resources are accessible, equitable, and culturally relevant. In African libraries, however, the adoption of HCI practices has been slower compared to other regions, often constrained by limited funding, lack of training, and inconsistent access to updated technology.[21] As community-centered institutions, libraries can tailor digital tools to the local contexts of their users, ensuring that technology serves the needs and preferences of diverse populations.[22] These tools include educational applications, digital learning platforms, e-resources, online catalogs, and multimedia content tailored to literacy levels, language preferences, or regional curricula. Rather than offering one-size-fits-all technologies, they can design local information platforms that highlight community resources, preserve local history, and provide multilingual access for diverse populations.[23] They can create digital literacy and learning tools that match the skill levels and daily realities of their users, whether that means teaching residents how to navigate local government services, supporting students with school-aligned learning resources, or helping job seekers prepare résumés that meet the expectations of nearby employers.[24]

Public libraries are increasingly adopting HCI-driven approaches to transform their spaces into digital cultural hubs, including makerspaces, coding labs, multimedia learning centers, and collaborative digital labs—where users can access technology, learn new skills, and engage in creative production, shifting away from the traditional model of providing mere access to digital content. This entails offering immersive media labs and makerspaces equipped with tools such as 3D printers, audio-video studios, and virtual reality creation stations, alongside interactive learning environments that use projection walls, mixed-reality exhibits, and gesture-based interfaces. In "Examining Librarians' Practices of Facilitating Learning in Makerspaces," Li emphasizes that librarians in makerspaces are more than just facilitators; they act as mentors, educators, and community builders.[25] By providing hands-on experiences with digital tools such as 3D printers, coding platforms, and multimedia equipment, these spaces encourage experiential learning that extends beyond traditional classroom settings. Libraries are also developing digital heritage centers where communities can record oral histories, digitize personal archives, and explore interactive cultural collections, as well as innovation and civic tech hubs that support co-design workshops, data exploration, and collaborative problem solving.[26] Through these interactive, participatory, and technologically rich spaces, libraries are evolving into vibrant community venues for creativity, learning, and cultural engagement.

Swist argues that libraries should actively involve users in the design of digital tools and services by having them help shape app features, catalog interfaces, virtual reference tools, makerspace platforms, learning hubs, community archives, and event systems so that these tools reflect real community needs and preferences.[27] Examples include participatory development of mobile library apps, local-language e-learning modules, and interactive online catalogs, in which user feedback informs interface design, navigation, and functionality. This approach aligns with the

broader goals of HCI to democratize technology and make it more inclusive.[28] For instance, the integration of user feedback loops and iterative design processes in Kenyan and South African libraries has proven successful in creating user-friendly interfaces, systems that are simple, clear, and easy to navigate, ultimately boosting engagement with digital services, such as library websites, integrated library system catalog interfaces, and mobile applications, and making them more intuitive, accessible, and engaging.[29] Thus, the utilization of HCI principles in library design helps to bridge the digital divide by addressing issues of accessibility, usability, and literacy.[30] By combining participatory approaches with tailored technology, libraries can serve as inclusive community hubs that foster learning, creativity, and digital empowerment.

The literature on public libraries in Africa highlights the transformative potential of HCI in creating inclusive, interactive, and culturally relevant digital environments. While many challenges remain, particularly in terms of infrastructure and digital skills development, as well as a high level of illiteracy and lack of awareness, successful case studies in countries like Kenya and South Africa illustrate how HCI can be leveraged to enhance user engagement, promote digital literacy, and transform libraries into vibrant cultural hubs. Moving forward, a more sustained effort to integrate HCI principles across the continent is essential to ensuring that African libraries can continue to serve as engines of digital inclusion and cultural innovation.

METHODOLOGY

This study employs a qualitative research methodology, combining a comprehensive literature review with contextualized comparative case studies to examine the evolving role of public libraries in Africa through the lens of HCI. The aim is to understand not only the current state of digital engagement in African libraries but also the strategies employed to move beyond access and toward culturally attuned, user-centered technological integration.

The primary data sources for this research include peer-reviewed academic journals, institutional and governmental reports on public library policies, publications from international organizations (such as IFLA and UNESCO), and analyses of regional technology infrastructure. These sources were accessed through academic databases such as JSTOR, Scopus, and Google Scholar, as well as public repositories and open-access digital libraries.

To capture a nuanced and diverse regional perspective, the study conducts a comparative analysis of selected African countries chosen for their varied sociocultural contexts, differing levels of technological infrastructure, and evolving library ecosystems, specifically Kenya, South Africa, Morocco, and Nigeria. Each case is examined to identify unique approaches to integrating HCI principles in public libraries, alongside shared challenges and opportunities.

The study acknowledges several limitations. These include disparities in access to open data, the scarcity of region-specific HCI research, and linguistic barriers that may limit engagement with non-English academic literature and localized library documentation. Furthermore, infrastructural variability across countries can complicate direct comparisons. Despite these constraints, the methodology offers a robust framework for critically engaging with the transformative role of HCI in shaping African public libraries as dynamic, participatory spaces.

FINDINGS AND DISCUSSION

A number of comparative studies have explored the varying levels of HCI integration in African public libraries. In Kenya, for example, the Kenya National Library Service has made significant strides in incorporating technology through public-private partnerships, providing users with

access to computers, internet services, and digital literacy programs.[31] Similarly, South African libraries, particularly in urban centers, have embraced technology to facilitate user-centered interactions with digital resources. The City of Johannesburg Libraries' "Digital Library Hubs" initiative offers a case study of how HCI principles can be leveraged to create interactive, multimedia-rich learning environments.[32] Such environments not only enhance user engagement but also support deeper conceptual understanding by integrating intuitive interfaces, adaptive feedback mechanisms, and learner-centered navigation. In doing so, they demonstrate the potential of HCI-driven design to transform digital education into a more immersive, accessible, and effective learning experience.

In contrast, Morocco and Nigeria present different challenges and opportunities in their efforts to integrate HCI into public libraries. While Morocco has made progress in urban areas, particularly in the development of digital libraries and smart technology spaces such as tech hubs, innovation parks, smart-city projects, and digital-innovation environments, rural areas remain underserved, with limited access to advanced digital infrastructure.[33] In Nigeria, the adoption of HCI practices in public libraries has been hindered by inconsistent government support and regional disparities in infrastructure, resulting in uneven access to digital resources and services, particularly between urban and rural communities. This has limited the effectiveness of public libraries as inclusive digital hubs, constraining their ability to implement user-centered technologies and deliver equitable information services.[34] Consequently, many libraries struggle to fully leverage HCI principles such as usability, accessibility, and participatory design, thereby reinforcing existing digital inequalities instead of mitigating them.[35]

HCI in African Libraries

HCI in African public libraries varies widely, influenced by factors such as infrastructure, funding, and staff expertise.[36] In some regions, libraries have embraced smart digital technologies, a focus away from the traditional physical spaces and collections, integrating them into their services to enhance user engagement and experience.[37] For instance, the University of Botswana's library automation has led to improved information services and user satisfaction.[38] However, challenges persist, including limited digital literacy among staff and users, hindering the effective implementation of HCI principles.[39]

Accessibility and inclusiveness are critical considerations in designing user interfaces for African public libraries.[40] A lack of standardized usability evaluations often results in interfaces that are neither user-friendly nor culturally relevant. Tembo et al. investigated the usability of university library portals in Zambia and identified several challenges that could negatively impact how students and faculty interact with digital resources.[41] The research highlighted issues such as complex navigation structures, inconsistent interface design, limited accessibility features, and inadequate search functionalities. According to the authors, these usability shortcomings discourage users from fully engaging with library portals, reducing the effectiveness of these platforms in supporting research and learning. Moreover, multilingual support is essential to cater to diverse linguistic communities, ensuring equitable access to information.[42]

The digital literacy of library staff significantly impacts the mediation of technology use.[43] Staff with higher digital competencies can better assist users in navigating digital resources.[44] However, a study on the perceptions of HCI curriculum developers in African higher education institutions highlighted challenges in integrating HCI principles into library services, partly due to gaps in staff training.[45] Addressing these gaps is crucial for effective technology mediation.

From Access to Transformation

Transitioning from merely providing equipment to creating interactive, user-centered spaces is essential for the transformation of public libraries.[46] The concept of libraries as interactional spaces fosters community engagement and collaborative learning.[47] In the *Proceedings of the 3rd African Human-Computer Interaction Conference*, the solutions that highlight the potential of libraries to bridge the digital divide by functioning as community hubs were well articulated and discussed.[48] Beyond providing access to computers and the internet, libraries offer digital literacy training, foster collaborative learning, and support the inclusion of marginalized groups. This community-centered approach demonstrates that reducing digital inequality requires not only technology provision but also culturally and socially relevant spaces where digital tools can be meaningfully used.

Incorporating participatory technology approaches ensures that community members have a voice in the design and use of technological solutions.[49] In the paper "Using a Participatory Design Approach for Co-creating Culturally Situated STEM Enrichment Activities," the authors argue that participatory technology approaches in which researchers work hand-in-hand with community members to co-create learning activities are essential for developing STEM interventions that are culturally meaningful, sustainable, and effective.[50] This involvement leads to technologies that are more closely aligned with community needs and cultural contexts. A study on data challenges for public libraries in Africa highlights the importance of community engagement in designing information systems that serve diverse populations.[51]

Aligning digital interfaces with cultural contexts enhances user engagement and relevance.[52] For example, integrating oral traditions into digital platforms can make technology more accessible and meaningful.[53] The work of Bibliothèques Sans Frontières demonstrates how culturally tailored digital tools, like the Ideas Box, can effectively deliver educational and cultural resources to underserved communities.[54] The concept of the Ideas Box was initially designed for underserved communities, particularly refugees living in camps or populations affected by war, with the goal of rebuilding cultural and social ties while restoring access to fundamental learning resources.[55] The initiative seeks to uphold individuals' rights to education and information, which are essential for empowering communities to work toward a self-reliant future. The Ideas Box itself is a portable, multimedia toolkit engineered to deliver education, culture, and information to vulnerable groups across the globe. Remarkably, it can be assembled in just twenty minutes and contains all the components necessary to establish a library, a cinema, and a media center in extremely challenging environments. Each unit operates with its own internal network and power system and incorporates integrated furniture within its innovative design. Through this compact yet comprehensive infrastructure, the Ideas Box fosters community resilience, supports social cohesion, and provides a vital public space for knowledge sharing and cultural expression where traditional institutions are absent or have been disrupted.

Decolonizing HCI in Public Libraries

An African-centered HCI approach emphasizes the design of technologies that reflect African languages, cultures, and social practices. This perspective challenges colonial narratives and promotes indigenous knowledge systems. Designing for language, culture, accessibility, and social use involves creating platforms that support local languages and cultural expressions.[56] Libraries can facilitate design justice by involving communities in technology design processes, ensuring that digital tools serve their needs and aspirations.[57] Studies on artificial intelligence (AI) as an enabler of future library services discuss how AI can be utilized to enhance library services, considering the preparedness of librarians in African university libraries.[58]

CONCLUSIONS AND RECOMMENDATIONS

Public libraries in Africa have the potential to evolve from mere access providers to catalysts of digital agency, fostering empowerment and community development. To achieve this transformation, HCI frameworks must be reimagined from postcolonial, community-grounded perspectives. African public libraries must aspire to evolve beyond the traditional paradigm of providing material access and resources by fostering inclusive environments and offering tailored learning programs and workshops that address the specific needs of their local communities. As it has been observed, public and community libraries should be strategically integrated into national development frameworks, particularly by supporting literacy initiatives aimed at eradicating illiteracy in rural and underserved regions across the continent.[59] To achieve these objectives, libraries must strive to do the following:

- Integrate local knowledge and languages into UI/UX research and design: Develop user interfaces that reflect local languages and cultural nuances, enhancing accessibility and relevance.
- Provide training in culturally responsive HCI for library professionals: Equip library staff with skills to design and implement technology solutions that resonate with diverse user groups.
- Foster partnerships with civic tech and educational institutions: Collaborate with tech communities and educational entities to co-create solutions that address local challenges.
- Conduct participatory design research with library users: Engage users in the design process to ensure that technological solutions meet their needs and reflect their cultural contexts.

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