



EMERGING TECHNOLOGIES AND PUBLIC LIBRARY DEVELOPMENT: AN OVERVIEW

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ABSTRACT

The study reviews the roles of emerging technologies in the transformation of public libraries. Public libraries engage in collection, processing, preservation and dissemination of recorded information in various formats. The public libraries have continued to play a long life leading role in educating the society and communities, providing awareness and access to information both in printed and digital formats. By this vital role, public libraries are helping to curb the level of illiteracy in the society and encouraging good reading habit, particularly among young people in the Nigeria. The emerging technologies have brought effectiveness and efficiency in the provision of library services and thus promote user satisfaction. These emerging technologies include smart libraries, big data, artificial intelligence, block chain technology, library bookmarks app, user focused interfaces and application, digital interfaces for printed books as well as drones. The study discussed some of these emerging technologies and identified the role public libraries played in education and literacy, adoption of emerging technologies and promotion of reading habits as some major findings and recommended that there should integration of emerging technologies, investment in training, User-Centric approach and concluded that public libraries should adopt and integrate these technologies to optimize their services.

Key words: Artificial intelligence, digital format, emerging technologies, public library.

Introduction

Libraries have long been established as institutions offering information to the general public or citizenry of a given society. The primary purpose of the library is to acquire, store and disseminate information. Libraries are parts of the informational ecosystem; they provide access to information, collecting data, producing information and knowledge, and creating cultural and scientific values to communities, using technological and intellectual infrastructures. A public library is a library that is referred to as the local gateway to knowledge, providing information to all users irrespective of their status, colour, or race, due to their heterogeneous content. According (IFLA, 2001) public library can be described as an organization established, supported and funded by the community, either through local, regional or national government or through some other form of community organization. IFLA (2001) further opines that a public library provides access to knowledge, information and works of the imagination through a range of services and is equally available to all members of the community regardless of race, nationality, age, gender, religion, language, physical and mental limitations, economics and employment status and educational attainment. This is why the public library is being described as the poor man's university. Its role in academic emancipation of the general public cannot be over emphasized. Boma (2020) posits that public library engages in collection, processing, preservation and dissemination of recorded information in various formats. Cambel (2019) opines that every citizen should have equal right of public library services, buttressing the IFLA position on public library services. The public library is very unique in content and service delivery.

The public libraries have continued to play a long life leading role in educating their immediate communities by providing information to the citizenry. By this vital role, public libraries are helping to curb the level of illiteracy in the society and encouraging good reading habit, particularly among young people. Boma (2021) aptly puts it, that quality, purposeful and adequate public library service delivery remains a pivotal societal transformation, growth and development. According to Schopfel (2018) their traditional function is to buy, preserve, and make available books, journals, and other media to a given local, academic, or other community.

Today, the traditional services of a library are modifying and changing. The roles of libraries, and information services, relationships between the libraries and users are changing with the emerging technologies. Information has become the most important possession of a man in the digital era. Modern libraries promote accessibility to information resources and through the internet, smart phones and other electronic gadgets. Through the internet, readers can access nearly limitless research papers. Modern public libraries, according to Oketuye (2019) are being transformed from the analog to digital or smart libraries. Digital/virtual or smart libraries provides such advance services as personalized services, hypertext services, computer- aided design services, knowledge mining services, cross media services among others.

Emerging trends and development of public libraries

Libraries have moved from the traditional setup where the only data generated were bibliographical data through catalogue cards. Several systems have been developed for the various library house-keeping chores and more are being designed and refined resulting to more services offered to library users and more data generation. The technological advancement in library systems has drastically increased the volume of data generated from library services and how these services are rendered to library users. According to (Ball, 2019), a lot of data are generated from variety of sources such as library social media applications, audio files, blogs, chat facilities, texts, research data, images, videos, cloud computing, artificial intelligence (AI), robotic library, metadata, software and user generated data. A number of scholars have pointed out that libraries generate big data (Ball, 2019; Garoufallou & Gaitanou, 2021). Along with all the technological advancements, people's most basic activities are generating more data than ever. Deepa et al. (2022) posit that libraries that fail to embrace the current trends toward transformation of libraries will be left behind.

Today, public libraries are expanding their digital collections with digital resources that are accessible online. This new rethinking is referred to as emerging technologies, in the field of computer technologies, telecommunication technologies, web technologies, Immersive AR/VR, Quantum, Block chain, Artificial Intelligent(AI) among others. Public libraries need to blend with the new technological trend in the provision of library services.

The emerging technologies and public library development

Emerging technologies are technologies whose development, practical applications, or both are largely unrealized presently. These technologies are generally new but also include older technologies finding new applications. Emerging technologies are often perceived as capable of changing the status quo. Afukidang and Aghadiuno (2022) posit that, emerging technologies are characterized by radical novelty (in application even if not in origins), relatively fast growth, coherence, prominent impact, and uncertainty and ambiguity. In other words, an emerging technology can be defined as a radically novel and relatively fast growing technology characterized by a certain degree of coherence persisting over time and with the potential to exert a considerable impact on the socio-economic domain(s) which is observed in terms of the composition of actors, institutions and patterns of interactions among those, along with the associated knowledge production processes (Rotalo et al., 2015). Examples of emerging technology in public libraries according to Princh (2022) include smart libraries, big data, artificial intelligence, block chain technology, library bookmarks app, user focused interfaces and application, digital interfaces for printed books as well as drones.

Smart libraries

Smart library is a library that can be open to library users without being staffed. The technology enables remote control of library buildings, including automatic doors, lighting, self-service kiosks and public computers. Smart libraries, according Afukidang and Aghadiuno (2022), allow libraries to significantly extend library opening hours, so more people can use the library at times that is convenient for them. Impacts of smart libraries include serving as an information hub, providing access to information and improving information literacy; facilitates cooperation and formation of library networks; helps to avoid duplication of efforts within a library and between libraries in a network; eliminates some uninteresting and repetitive library tasks; provides marketing opportunity for library services; as well as increases efficiency. These technologies can help in the development of the public libraries, as they allow the libraries to significantly extend library opening hours in order to accommodate many users at their convenient times.

Online Public Access Catalogue (OPAC)

This is a digital database of materials such as text files, e-books, and journals etc., held by a library or group of libraries. It is used to search for materials without the assistance of a librarian. Users can search the library catalogue and access resources remotely, thus eliminating the need for a physical presence in the library. It is designed to be searched by title, author and subject.

Blockchain technology

This an advanced database mechanism that allows transparent information sharing with a business network. It is a distributed database that maintains a continuously growing list of ordered records, called blocks. Blockchain as a ledger technology has emerged as an attractive solution for providing security and privacy in big data systems. For example, it was shown in a study conducted by Liu, Lin and Wen (2019) that blockchain can play a vital role in providing high-quality data and securing data sharing in libraries. With its unique advantages, blockchain has the great potential to transform current big data systems by providing efficient security features and network management capabilities for newly emerging big data services and applications.

Blockchain technology is considered as a segment of the fourth industrial revolution. It is presently one of the most prevalent disruptive technologies which is paving the way for emerging financial and industrial services (Zhou, Huang, Zheng & Bian, 2020). Condos et al. (2016), describe blockchain as an electronic ledger of digital records, events, or transactions that are cryptographically hashed, authenticated, and maintained through a distributed or shared network of participants using a group consensus protocol. According to Conway (2020), blockchain is a type of database in which data or information are structured and filed in groups, also known as blocks, that hold sets of information; which are then chained unto previously filed blocks, forming a chain of data/information known as blockchain. Chingath and Babu (2020) view blockchain as a growing list of records, called blocks that are linked using cryptography, with each block containing a cryptographic hash of the previous block, a timestamp, and transaction data generally represented as a Markel tree. According to Sharma (2021), blockchain is a distributed, decentralized and peer-to-peer record keeping technology that offers transparency, immutability, privacy, and security of date. It is a system of documenting and storing information in a way that makes it

difficult or impossible to change, hack, or cheat the system (Euromoney, 2020). Conceptually, it consists of a list of records commonly known as blocks wherein information stored is encrypted ensuring privacy and security.

Big Data

There are no clear definitions for the term “Big Data”. The term has been defined differently by different researchers. Dumbill (2013) defines Big Data as data that exceeds the processing capacity of conventional database systems; the data is too big, moves too fast, or doesn't fit the structures of your database architectures; to gain value from this, you must choose an alternative way to process it. According to Slonim et al. (2012), Big Data refers to data whose scale, diversity and complexity require new architectures, techniques, algorithms, and analytics to manage it and extract value and hidden meaning from it. Iyoro and Nsanta (2022), see Big Data as data being generated constantly, automatically and rapidly and is a much more complex issue than just massive amounts of data. Big Data is a combination of four very important characteristics: volume, velocity, variety and veracity (Campbell & Cowan, 2016). Laney (2001) describes the characteristics of Big Data as data that cannot be processed by traditional data management tools.

Artificial Intelligence (AI)

Artificial Intelligence (AI) encompasses the following general areas of research: automatic programming, computer vision, expert systems, intelligent computer-assisted instruction, natural language processing, planning and decision support, robotics, and speech recognition. Intelligent library systems utilize artificial intelligence technologies to provide knowledge-based services to library patrons (Smith, 2019). Intelligent library systems utilize artificial intelligence (AI) technologies to provide knowledge-based services to library patrons.

Cloud computing

Cloud computing is a network of computing resources—located just about anywhere—that can be shared. Thus by implementing cloud computing technology, public libraries can maintain a centralized system where all the authorities can check the storage system from each and every aspect and continue to monitor and guide the

system. Cloud computing helps to ensure that staff and users can have on-demand access to critical information in libraries using any device from anywhere.

Level of implementation of emerging technologies development public library

In implementing emerging technological development, Nwakaji (2021), conducted a study on impact of emerging technologies in public library development, observes that there is a low level of implementation of these technologies in public libraries in Nigeria even though these technologies enables librarians in the public libraries to efficiently categorize and index digital and physical items. Emerging technologies provide libraries with a unique opportunity to substantially enhance user centered services and to facilitate and promote collaboration between libraries and their users in a digital era. Notably, some public libraries are known to have begun using the library to access information and educational resources online, Tim (2023) argues that, some emerging trends in library technology and digital resources can contribute to a better experience for public library users and staff alike. This implies that there is equally a rethink in the management/organization of the public libraries in tune with current realities in librarianship.

Challenges associated with the implementation of the emerging technologies in public libraries

Challenges of ICT-based Library Services

High costs of acquiring and maintaining the emerging technological infrastructure such as hardware, software, and other equipment can be expensive. Krubu and Osawaru (2011) assert that ICT based libraries face the challenge of ensuring all patrons have equal access to technology. In addition, the challenges of implementing blockchain for managing big data in library services are enormous. These include:

Privacy: the issue of transactions being open to anyone in the blockchain may compromise privacy, as users data collected could be publicly revealed to others

(Arndt & Guercio, 2020). *Immutability and lack of flexibility*: the immutability of blockchain technology is a double-edged sword (Raimundo & Rosário, 2021). It would eliminate the capacity for certain students' records to be modified for valid reasons.

Security Issues: although password security solutions allow users to update their passwords, there is no mechanism in distributed ledgers to recover lost private keys (Rahardja, Hidayanto, Hariguna & Aini, 2019).

Complex integration/Lack of adequate Skills: most librarians lack skills needed to develop and maintain blockchain technology. The demand for qualified blockchain developers has increased (Delgado-von-Eitzen, Anido-Rifón & Fernández-Iglesias, 2021). The acquisition of technologies generally is accompanied by a high demand for electricity (Arndt & Guercio, 2020).

Lack of Management Commitment and Support: the lack of awareness and involvement of senior management may hamper library management board's willingness to embrace technology.

Legal issues and lack of regulatory compliance: scholars have reported that legal issues and/or lack of regulatory compliance is a challenge toward implementation of emerging technologies in public libraries (Steu, 2020; Santos & Duffy, 2022).

Benefits of Emerging technologies in public libraries

Emerging technologies have provided libraries globally, the great opportunities to substantially enhance provision of library and information services to their users, and to promote collaboration between libraries and their users in the digital era. Other benefits includes: increase in efficiency in information acquisition, preservation and dissemination, Avoid repetition of efforts within a library, increase in the range of services offered generally, improving the quality of library services by saving the time of the users, encouraging enhancement in knowledge and experience in service delivery, as well as facilitating integration of services among public libraries.

Findings:

1. **Role in Education and Literacy:** Public libraries continue to serve as vital educational institutions, playing a leading role in providing access to information and promoting literacy within society and communities, particularly in Nigeria.
2. **Adoption of Emerging Technologies:** Emerging technologies such as smart libraries, big data, artificial intelligence, blockchain technology, and others have significantly enhanced the effectiveness and efficiency of library services.
3. **Promotion of Reading Habits:** These technologies have facilitated access to both printed and digital formats of information, encouraging good reading habits, especially among young people.

Recommendations:

1. **Integration of Emerging Technologies:** Public libraries should actively adopt and integrate emerging technologies to optimize their services and meet the evolving needs of their users.
2. **Investment in Training:** Library staff should receive adequate training and support to effectively utilize these technologies and ensure their successful integration into library operations.
3. **User-Centric Approach:** Libraries should prioritize user satisfaction by developing user-focused interfaces and applications that enhance the overall library experience.
4. **Continuous Evaluation and Improvement:** Regular evaluation of the impact of these technologies on library services should be conducted, with adjustments made as needed to improve efficiency and effectiveness.
5. **Collaboration and Knowledge Sharing:** Public libraries should engage in collaborative efforts and knowledge sharing with other institutions and stakeholders to stay abreast of emerging technologies and best practices in library services.

Conclusion

Public libraries are operating in a quickly changing digital environment, thus the need to be aware of latest technologies, maintain the importance of the service delivery obligation and self-directed learning and development to the community. Utilization of emerging technologies in public libraries is optimistic to gain right information at the right time in the right place and at the right cost. It helps to attract community based users due to its flexibility to development. The emerging technologies have broken the worldwide boundaries, thus helps to provide better services to library patrons in the society. The public library should adopt the web-based card catalogue production system for efficient and effective service delivery. Adequate computer and orientation training should be given to all staff, particularly staff of the technical Department on how to utilize the software applications. The library's OPAC database should be synchronize with the new web-based card catalogue production system, this will facilitate entries inputted in the OPAC to automatically reflect in the new application, thereby eliminating data inconsistency and duplication of data entry effort on both the OPAC and the new system.

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