

Smart Technology and Artificial Intelligence in Libraries: A Synergy for Library Service Optimization

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Abstract

The purpose of this paper is to discuss the application of smart technology and artificial intelligence in optimization of library services and the role they can play in ensuring effective and efficient service delivery in a digitally driven environment. An exploratory approach through extensive review of related literature was adopted for this study. Conceptual framework was developed to understand smart technology and artificial intelligence including the ways they can be applied to ensure enhanced service delivery and relevance of the library as information gatekeepers of the 21st century. This paper found out that smart technologies and artificial intelligence has the potential and capability of taking libraries through the stormy times of library service transformation to ensure that they assist the new generation of patrons effectively and efficiently in addressing their queries. With the accrued benefits of smart technology and artificial intelligence, it is still bedevilled by a number of encumbrances such as: financial uncertainty, emerging skill gaps, technophobia, staff resistance to change, lack of regular maintenance among others. It was recommended that there should be a synergized application of smart technologies and artificial intelligence to better enhance library services as well as keep the library afloat or relevant as information hubs especially in this era of digitization. It was also recommended that there should be an increase in financial allocation by government to the library to encourage the use of smart technologies and artificial intelligence in library operations.

Keywords: Smart technology, artificial intelligence (AI), library, library service, optimization, library service optimization.

Introduction

The emergence of technologies in the 21st century has been a burning topic in contemporary times and libraries are constantly seeking to find their footing and maintain relevance in a new market place filled with unlimited information just at the click-of-a-mouse, the processes of learning, teaching and research techniques are drastically changing and new generation of users are increasingly becoming unaware of the enormous benefits as well as services the library can provide. It is these unfamiliar

grounds that necessitated libraries to embark on a search for new competitive advantage and better ways of providing enhanced or optimized services to library users. Libraries need not focus so much on their unparalleled value and expertise, but rather on identifying opportunities so as to attract and engage new users with high digital fluency mainly through advanced services and user experience. In this digitally driven era, an effective way of achieving those goals is by implementing advanced technologies and artificial intelligence within daily library routines as well as acquiring the requisite digital skills needed to operate them. Just as new advancements, smart technologies and artificial intelligence are transforming various industries including libraries in the aspect of optimizing library services to meet the needs of users in the digital environment efficiently.

Smart Technology in Libraries

A library is the hub or epicentre of knowledge and information. It is a place or virtual space where carefully selected book and non-book resources are acquired, organized, stored, preserved and disseminated based on the information needs of library patrons with the sole aim of meeting those information needs. As an epicentre of knowledge and information, the library houses various resources and services which facilitates the library in bridging the never-ending gap in information effectively and efficiently. The paradigm shift from traditional to digital operations have necessitated the need for libraries to key into current trends in order to provide enhanced or optimized services and at the same time maintain relevance in a digitally driven environment hence the introduction and adoption of smart technology and artificial intelligence in libraries.

Smart technology is a set of electronic devices that are connected to other devices or networks through various wireless protocols i.e. Bluetooth, WIFI, 3G, 4G, 5G or 6G networks which operates

interactively and independently to some extent (Poslad in Azolo, 2019). Also, Bower (2019) defined smart technology as technologies that utilize machine learning and large-data processing to infuse cognitive knowledge to items considered previously to be inanimate. In this context, smart technologies are all modern ICT facilities equipped with computing power and linked to the internet to assist in providing enhanced library services efficiently. They range from small to medium to wearable devices that can be deployed to library services such as document delivery services (DDS), alerting services, acquisition, digital reference services (DRS), cataloguing, and circulation among other services.

Simply put, smart technology is a set of technologies that perform day to day work or activities in libraries efficiently with a given set of inputs through wireless connectivity such as Bluetooth and WIFI. These technologies like smart watches, smart locks, smart phones, smart tables, automation etc. handles daily activities efficiently. Making use of sensors, smart technologies capture physical data like light, temperature and presence then delivers the data to be analysed and used. The applications have a limited collection of physical data or components and can be made use of irrespective of geographic location. They usually come in different types as they normally consist of hardware to transmit radio signals, a network for devices to communicate with each other and an application that allows end-user interaction/operation. Smart technologies used for library services optimization according to Azolo (2019) are smart tables, book delivery drones, wearable technologies like Google Glass and smart watches, smart phones, computers, easy-to-read books, assistive listening systems (for the physically challenged), radio-electronic copiers, smart security gates and doors among others. To ensure a more effective and efficient operation, most smart technologies make use of some form of artificial intelligence to an extent.

Artificial Intelligence in Libraries

Artificial intelligence refers to the imitation of human intelligence using neural networks in order to make humane decisions. Akugizibwe (2020) defined artificial intelligence as a computer software or program embedded with the ability or mechanism to learn. It then utilizes what has already been learnt and apply it in making decisions in new or complex situations, just like human beings do. Artificial intelligence mimics or simulates human emotions, intelligence and behaviour and are programmed to take decisions in-line with human behavioural patterns with or without supervision. Kumar and Kumar (2019) opined that artificial intelligence is the evolution of computer frameworks that are capable of carrying out day-to-day activities which typically requires the intelligence of humans such as visual discernment, recognition of speech, decision making and language translation. Artificial intelligence often depicts images of advanced robotics and audio-enabled (talking) computers. It is a variety of programming techniques, styles and devices. In a nutshell, artificial intelligence involves infusing intelligent simulated behaviour in modern ICT facilities. Intelligent behaviour deals with learning, reasoning, perception, communication and decision making in complex situations.

The standard characteristic of artificial intelligence is its capability of being rational and undertaking actions that have a high chance of achieving a particular goal (Jake, 2021). According to Jake, a sub-category of artificial intelligence is the machine learning which refers to the notion that computer software has the ability of learning from and adapting to new data automatically without the assistance of humans. Deep learning which is also a sub-set of artificial intelligence, enable this automatic learning through the process of absorbing large amounts of unstructured data such as text, video or images. The author further submitted that artificial intelligence can be broadly classified into two categories namely narrow or weak AI and general or strong AI. Narrow artificial intelligence are designed to carry out a particular job i.e. Apple's Siri, Google Assistant, Amazon's Alexa etc. you ask a

question, and the assistant provides answers. General artificial intelligence carry out tasks considered to be human-like. They are programmed to handle situations in which they may be required to solve problems without human intervention. These kinds can be found in self-driving cars or in hospital operating facilities.

In essence therefore, the main goal of artificial intelligence in libraries specifically is to enhance library services by mimicking or simulating librarian's cognitive activities such as daily shelving and shelf-reading, resources retrieval, circulation, reference, cataloguing and classification etc. in order to solve user queries in the most efficient and effective way possible. Libraries in this part of the world use mainly the narrow artificial intelligence in form of reference chatbots or cleverbots, keyword recognition through electronic databases, search engines, Radio Frequency Identification Devices (RFID) among others to meet the needs of users in the digital space irrespective of time and location while enhancing overall service delivery.

Benefits of Smart Technology and Artificial Intelligence in Libraries

Smart technologies and artificial intelligence are of enormous benefits to librarians and libraries in enhancing library services with respect to the digital environment. Some of these benefits according to Odeh and Akpohmeie (2015) are highlighted below:

- **Interconnectivity:** From smart security system and speakers to lighting and TVs linking, these connected devices are capable of improving or enhancing overall library productivity. Integrating smart technology and artificial intelligence make library services easy and swift. The security of library materials will be guaranteed.
- **Remote Monitoring:** When connected to a mobile device, laptop or desktop computer, smart technologies can be monitored and managed from any place at any time through remote

monitoring. This enables real-time checking in and checking out of the movement of staff and students as well as the resources of the library.

- **Customization:** Depending on the device, smart products can adjust to match a specific user's customized preferences or needs. A smart thermostat for instance can modify the library's temperature based on local weather conditions making the space more comfortable for its occupants.
- **Enhanced Safety:** Through the interconnectivity of smart technology, real time surveillance and monitoring, librarians can be acquainted with current happenings in different sections of the library and receive alerts in real-time as regards any questionable occurrences.
- **Motion Detection:** Activating only when a motion signature is detected, this technology can save time, storage, and energy, regardless of whether you are at home or in the library. It notifies the librarians of any suspicious movements or activities within or around the library.

Others according to Abram (2018) include: taking on stressful and complex jobs that humans may struggle to do or cannot do; completing tasks faster than a human can; discovering unexplored things; make fewer errors/defects and having an infinite function.

Application of Smart Technology and Artificial Intelligence for Library Service Optimization

A service generally is an intangible activity or assistance in which one party can provide or offer to another with the aim of meeting a particular need or solving a particular challenge. In this context, library service is an assistance rendered to library patrons that are essentially intangible with a clear intention of solving a particular query or meeting an information need. According to Prytherch (2015), library services are the facilities made available by the library for the utilization of books and other non-book resources as well as the dissemination of information. Haruna (2017) defined library services as a

set of activities that a library performs with the aim of satisfying the information needs of library patrons. To achieve the aim for which library services are rendered to patrons, libraries offer a wide range of services to include reference services, circulation services, document delivery services (DDS), current awareness services (CAS), indexing and abstracting, cataloguing services, selective dissemination of information (SDI), alerting services, translation services, information consultancy services, help desk services among others. Libraries in contemporary times seek to provide timely, accurate, relevant, reliable, authentic and current information to their patrons as this form the basis upon which they were established. To do these efficiently as well as key into the demands of the digital environment, the adoption, application or synergy between smart technologies and artificial intelligence in providing optimized services becomes paramount.

Smart technologies like computers provide the ideal medium for the application of artificial intelligence in this present dispensation. Artificial intelligence performs better at intellectual tasks such as computer based games and proving theories than perceptual tasks. Most times, these computer software are intended to simulate human behaviour and they are built for technological applications also such as Computer Aided Instruction (CAI). In many cases, the main objective is to find any technique that does the job effectively and efficiently. Library services which relate to reading materials, users and staff such as reference service for instance is a core activity of any library which involves the use of expert systems like REFSEARCH, POINTER, Online Reference Assistance (ORA), AMSWERMAN and PLEXUS to help librarians in providing optimized or enhanced reference services to patrons (Mogali, 2014). REFSEARCH is a system that supplies users with recommended sources to lookup as well as teach students reference skills. POINTER is a computer assisted reference program that directs users to reference resources. Online Reference Assistance (ORA) simulates the services of an academic

librarian by making use of several technologies like databases, computer assisted instruction modules, and knowledge based system. Online Reference Assistance (ORA) consist of Directional transaction like library locations, services and policies. AMSWERMAN is a knowledge based system that provides answers to reference questions dealing with agricultural topics. It can also function as a consultation system. PLEXUS is a tool used in public libraries which includes knowledge about reference processes, information retrieval as regards certain subject areas, reference sources and library users. Kumar and Kumar (2019) opined that libraries also make use of smart technology and artificial intelligence to provide knowledge-based services to library patrons and staff.

Robots such as the wheeled, legged or humanoid robots can also be used in the human environment to provide reference services and a host of other services to users. In the area of cataloguing and classification which is one of the prime crafts in the library, according to Kumar attempts have been made to automate cataloguing using expert systems which have had success only on descriptive cataloguing considered to be rule-based (AACR II). Approaches for applying artificial intelligence techniques to cataloguing include – A human-machine interface with intellectual effort divided between the intermediary and the support system; and an expert system with full cataloguing capability that is linked to electronic publishing system. Though there have been some issues or problems in every attempt to convert AACR II into highly structured rules necessary to run the expert system. Classification on the other hand is an important activity needed for the organization of knowledge in libraries. Applying expert system in the area of classification in libraries includes – Coal SORT, BIOSIS and EP-X. Coal SORT is a conceptual browser which is designed to perform the function of a search or an indexing tool. BIOSIS makes use of a knowledge base with a high amount of procedural knowledge to auto assign documents to categories. It is designed to aid indexing. EP-X

which stands for Environmental Pollution Expert has certain similarities with Coal SORT as both concentrate on enhancing the interface using knowledge based approach. Acquisition or collection of materials is another crucial aspect of library routines. The librarian has a critical role to play in this activity. Several experts systems have been incorporated like the Monograph Selection Advisor used in auto selection of resources based on some specified criteria, entry or requirement. The knowledge base has to be sufficiently broad and the interface aspect must be friendly and easy for the library to get the desired information from the machine.

Challenges Associated with Smart Technology and Artificial Intelligence in Libraries

Smart technologies and artificial intelligence no doubt are indispensable tools that have the potentials of enhancing library and information services in the digital era but in this part of the universe, it has been bedeviled by many problems.

Among the challenges is de-professionalization of professionals. According to Lynch (2015), top scientists and business men such as Stephen Hawking and Bill Gates have warned of mass unemployment due to the use of smart technology and artificial intelligent robots. Financial uncertainty, emerging skill gaps and technophobia can also be considered as hindrances to the effective use of smart technology and artificial intelligence in the library.

McCommon (2016) opined that other challenges are: inability of smart technology to offer sufficient flexibility, insufficient integration of communication technologies, poor technical know-how, financial problem and compatibility status of existing machines with latest requirements of digitization are also challenges. Virus attacks, outdated software or programs, insufficient or unavailable internet connectivity, unstable source of power, poor expertise, poor regular maintenance, poor bandwidth provision, and poor machine calibration among others have been seen to negatively impact the use of

smart technologies and artificial intelligence for enhancing the effective and efficient provision of library services to library patrons.

Recommendations

The following recommendations have been suggested to enhance the use of smart technologies and artificial intelligence in library service optimization:

- Library management should encourage librarians to up-skill themselves through on-the-job training, re-training or re-skilling on effective use of smart technologies and artificial intelligence for optimizing library services.
- There should be an increase in financial allocation by government to the library to encourage the use of smart technologies and artificial intelligence in library operations. Libraries should supplement what government provides through internally generated revenue (IGR) among others.
- The machines should be made compatible with the latest and up-to-date software to meet up with the demands of digitization.
- Antivirus application software should be installed to guard against virus attacks from both external drives and the internet most especially to ensure optimal functionality.
- Regular software updates should be performed as a habit to keep the technologies up and running with latest software versions.
- Sufficient and steady internet connectivity and improved bandwidth provision should be provided as this is the driving force for all smart technologies.
- Alternative sources of power should be made available by the library management to ensure constant power supply at all times.

- Proper machine calibration and re-calibration should be done on a regular basis to maintain accuracy and efficiency.
- For librarians to make effective use of smart technologies and artificial intelligence, a synergized application of both technologies should be made for none can function effectively in isolation without the other. For instance, a technology like the smart table that is devoid of internet connectivity and narrow artificial intelligence will just be referred to as a ‘table, technology or machine’.

Conclusion

Global best practices, advanced technologies, expanding digital landscape, and new learning techniques and habits are only but a few of the phenomena rocking the boat of libraries in contemporary times. To maintain relevance and remain afloat in a dynamic digital landscape, libraries need to shift their focus from traditional practices to an entirely new direction driven by technology which supports a new generation of patrons with evolving information needs. Smart technologies and artificial intelligence has the potential and ability of taking libraries through the stormy times of library service transformation to ensure that they assist the new generation of patrons effectively and efficiently in addressing their queries. Smart technologies and artificial intelligence can act as magnetic tools in attracting funds, ensuring operational efficiency, improving decision-making and saving costs as well. With the deficiency of artificial intelligence alongside smart technologies, libraries may find it difficult reinventing themselves and maintaining their presence in the new information era.

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