

Incorporation of Big Data Analytics (BDA) in the Management of Library Operations and Services: Strategies for Way Forward in Nigerian Academic Libraries

Emmanuel Kolawole ADEFILA,

Department of Information and Documentation
Nigerian Stored Product Research Institute
adefilaademidun20@gmail.com

Ganiyu Ojo ADIGUN

Department of Library and Information Science, Faculty of Computing and
Informatics, Ladoké Akintola University of Technology, Ogbomosho, Nigeria
goadigun@lautech.edu.ng

Yusuf Ayodeji AJANI,

Department of Library and Information Science,
Alhikmah University, Nigeria
trustusouph@gmail.com

Naeem Atanda BALOGUN,

Department of Information Technology,
University of Ilorin, Nigeria

naeem.ab@unilorin.edu.ng

&

Ayotola Olubunmi ONANUGA

College Librarian, Osun State University,
College of Education Ipetu Ijesa Campus

ayotola.onanuga@uniosun.edu.ng

Abstract

The study explores the perspectives of Nigerian academic librarians on the incorporation of big analytics (BDA) in the management of library operations and services. To achieve the objective of the study, a qualitative methodology was employed. A purpose sampling method was used to access 21 librarians through the heads of each selected academic library. An open-ended survey was used for the administration of an instrument to access 9 librarians from seven selected federal

universities located in North Central Nigeria. The findings of this research highlight that a significant proportion of librarians are not well-acquainted with the significance of BDA and its potential to positively revolutionize library services. Librarians generally express favorable opinions concerning the significance of BDA, acknowledging its capacity to enhance decision-making, optimize services, and deliver personalized user experiences. The feasibility of implementing BDA reveals the range of awareness, enthusiasm, and practical measures taken by libraries in implementing BDA, exposing challenges and proactive initiatives specific to the Nigerian context. Among the challenges foreseen by librarians are concerns regarding data privacy, the assurance of data accuracy, the demand for adequately trained personnel, the scalability of systems, data security, and the effective integration of data from diverse sources. The study recommends that stakeholders should prioritize ethical data handling and the safeguarding of user privacy while allocating resources for comprehensive librarian training in data management and analytics tools.

Keywords: Big data analytics, management, libraries, librarians, library operations, library services

Introduction

Globally, there has been a significant transformation in the way libraries manage their operations and services, propelled by advancements in digital technologies. These advancements encompass a range of technologies, including cloud computing, blockchain, 3D objects, the Internet of Things, robotics, artificial intelligence, virtual/augmented reality, and big data. Libraries worldwide are increasingly integrating these technologies to deliver pertinent information services to patrons and ensure streamlined operations. Notably, the integration of datasets has become prominent, enabling libraries to track their collections and regularly evaluate the effectiveness of their services. Singh (2020) larger libraries, especially, generate significant volumes of data daily, encompassing circulation

transactions, user information, online database usage, and various other activities within the library. This underscores the growing significance of harnessing data-driven insights to enhance library services and operations in today's digital landscape.

However, it remains essential for libraries to strategically utilize extensive datasets, commonly known as big data, to improve and fully optimize their operations and services (Sheng, 2021). Emphasizing the significance of understanding fundamental data-related challenges before delving into analytics, Mikalef et al. (2018) stress the necessity for libraries to identify datasets relevant to effective utilization. Günther (2017) asserts that library operations should have a genuine understanding of the staffing and infrastructure requirements essential for implementing Big Data Analytics (BDA). The management team must

carefully assess the significant volume of data available to them, ensuring optimal decision-making and resource allocation. Nonetheless, the integration of BDA into library operations signifies a profound shift in perspective, utilizing advanced data processing capabilities to enhance the efficiency, effectiveness, and adaptability of libraries in the digital era.

The integration of BDA into library settings began in the early 2010s, marking a significant surge in interest across both private and public sectors (Reinhalter & Wittmann, 2014). Serving as information hubs, libraries have grappled with the escalating volume, diversity, and complexity of data, prompting the need for innovative solutions in management and utilization. In this context, BDA emerges as a powerful tool capable of extracting meaningful insights from extensive datasets that conventional methods might overlook. Beyond mere data analysis, the impact of BDA extends to influencing decision-making processes, resource allocation, and user engagement strategies within library services (Chen 2021). Through harnessing the capabilities of BDA, libraries can tailor their offerings to align with the evolving needs of patrons, thereby enhancing the overall user experience. Additionally, BDA facilitates evidence-based decision-making, empowering libraries to optimize resource utilization, refine collection development strategies, and enhance operational efficiency.

Problem Statements

The challenges faced in integrating BDA in managing library operations and

services are substantial, largely due to the complexity of data, and these issues are effectively mitigated by utilizing cloud storage as a cost-effective solution (Reinhalter & Wittmann, 2014). Notably, a review of existing literature reveals a significant research gap concerning the application of BDA in the management of library operations and services within Nigerian libraries. This gap could result from a potential lack of adequate knowledge among librarians regarding the practical applications of BDA or perhaps a hesitancy within Nigerian libraries to recognize the feasibility of BDA in their systems. These thought-provoking observations have spurred the initiation of this study, which aims to explore the perspectives of academic librarians regarding the integration of BDA in managing library operations and services in Nigeria. The study not only seeks to address this research gap but also aims to provide valuable insights and recommendations to encourage the successful implementation of BDA in Nigerian academic libraries, thereby contributing to advancements in library science and information management.

Objectives of The Study

The broad objective of the study was to explore academic librarians' perspectives on the integration of BDA in managing library operations and services in Nigeria.

The specific objectives of the study were to;

1. explore the perspective of academic librarians regarding the knowledge of incorporation of BDA for the management of

- library operations and services;
2. explore the perspective of academic librarians concerning the significance they attributed to BDA in the management of library operations and services;
 3. explore the perspective of academic librarians regarding their intention of incorporating BDA in improving the management of library operations and services; and
 4. explore the potential challenges academic libraries may encounter when incorporating BDA into the management of library operations and services.

Literature Review

In the contemporary digital era, the extensive integration of information communication technologies has led to a significant proliferation of data across various facets of life (Liu et al., 2018). Effectively managing the challenges posed by the substantial and unstructured growth of data has become increasingly complex, given the surge in data generation, consumption, and evolution. The global prevalence of Big Data is a noteworthy concern affecting corporate, commercial, educational, and governmental sectors. Ongoing research and development methodologies actively engage with the challenges and opportunities presented by analytic applications in the realm of Big Data (Cuzzocrea, 2014). Libraries are progressively turning to datasets for the management of collections, spatial utilization, and service evaluation.

Chen et al. (2021), supported by Olendorf and Wang (2017), contend that traditional library processes generate

significant amounts of data, especially for larger libraries, encompassing circulation transactions, user information, online database usage, and various other library-related activities. The genuine value of employing datasets to enhance and fully leverage library operations is underscored by Günther et al. (2017). Rane (2023) underscores the necessity for libraries to understand the fundamental scope of data challenges before delving into data utilization, emphasizing the importance of identifying relevant datasets. Günther and colleagues (2017) additionally assert that library operations should grasp the specific requirements for staffing and infrastructure development essential for implementing BDA. The management team must carefully deliberate on the substantial volume of data.

Al-Barashdi and Al-Karousi (2019) propose that BDA can manifest in two forms—an intermittent initiative or an established service within libraries. They observe that the impact of either form is substantial, with an established service requiring more robust data storage, while an intermittent initiative may utilize less concentrated data stores. One-off project activities are considered suitable for addressing specific issues that require attention on a singular occasion.

Applications and Benefits of Big Data Analytics in Library Management
BDA offers libraries novel ways to optimize their operations, understand user behaviors, and make informed decisions. Libraries harness big data for collection development, user engagement, and resource allocation

(Luo et al., 2017). Data-driven insights aid in identifying high-demand materials, curating collections, and predicting usage patterns. Also, BDA could be applied in the following areas of the libraries such as for superior search results mining and text analytics on the past loan records and book bibliographies could enhance search results and recommendations, Demand Analysis would help in forecasting demand for new existing titles, Planning library collection-The technology used would optimize to plan the category mix in the collection by taking into consideration the space and budget constraints. Big data empowers libraries to offer personalized services.

Analyzing user preferences and search behaviors allows libraries to recommend relevant materials, enhancing user satisfaction and engagement (Al-Daihani et al., 2020). Furthermore, big data aids in evidence-based decision-making for strategic planning, budget allocation, and resource management. However, their certain things that must be put in place when you want to embark on big data in management; Libraries have a unique opportunity to leverage Big Data for managerial purposes and offer library services related to BDA. Some libraries are already providing research data services, including data management planning, data collection, data curation, and data archiving (Cox et al., 2017). However, the extent of these services is contingent on user needs and the library's current situation. This discussion explores potential services that libraries can offer using the Data ONE data life cycle framework.

Libraries can play a significant role in certain stages of this life cycle

while being less relevant in others, necessitating careful selection and allocation of resources for the services they provide. In the planning phase of an organizational-level research project, libraries can act as research assistants and support researchers in enhancing their data analytics skills. This assistance involves aiding researchers in conceptualizing efficient data searches through various search terms and leveraging librarians' expertise in database design and development for Big Data organization and mining processes (DDS, 2021). Academic libraries commonly offer assistance with Data Management Plans (DMPs), with Big Data projects requiring specific adjustments compared to standard DMPs.

Big Data Analytics Readiness

As the volume of data within libraries continues to expand, demanding innovative methods and approaches (Anirban, 2014), there is a widespread acknowledgment across industries that big data brings escalating potential, profitability, and diverse impacts across various sectors (Kaisler et al., 2013). However, a significant challenge arises from the deficiency of tools and skilled personnel to proficiently manage BDA. Addressing this challenge, Salman et al (2018) underscore the importance of libraries developing BDA analytics strategies. Mokgadi Motau and Kalema (2016) point out that establishing precise data quality standards is intricate due to the sheer volume and dynamic nature of data sources. Technology obstacles present a genuine challenge for decision-makers, emphasizing the need for top

management to comprehend the essence of their data and BDA technologies. This comprehension facilitates more effective processing and analysis, contributing to strategic planning and decision-making.

Challenges of Big Data Analytics in Libraries

While the integration of BDA in libraries brings transformative benefits, it is not without significant challenges. A primary hurdle is the vast volume, diversity, and complexity of data encountered in library settings, where information hubs generate substantial data through circulation transactions, user interactions, and online database usage (Reinhalter & Wittmann, 2014). Effectively managing this flood of unstructured data demands sophisticated tools and strategies for extracting meaningful insights. Another substantial challenge is presented by staffing and infrastructure requirements. Günther et al. (2017) emphasize the importance for library operations to comprehend the genuine resource needs for implementing BDA. Sufficient staffing with expertise in data analytics and the development of appropriate infrastructure are essential for the successful deployment of BDA solutions. Libraries often grapple with constraints related to budget and technological readiness, impeding their ability to fully unlock the potential of Big Data.

Moreover, the intricate nature of analytical processes involved in BDA can be daunting. Before delving into data analytics, libraries must grasp the fundamental scope of data-related challenges, as highlighted by Goldberg et al. (2014). Identifying and understanding

the relevant datasets for effective utilization is pivotal, requiring a profound understanding of both library operations and data analytics methodologies.

Empirical Studies

Chigwada and Kasiroori's (2021) study offers valuable insights into the awareness and application of big data among Zimbabwean librarians, contributing significantly to the field of librarianship. Focused on the relatively new concept of big data, the research not only identifies potential applications but also documents implementation challenges, providing practical solutions. The study, which employed a qualitative approach and an online questionnaire administered to twenty librarians in Zimbabwean research institutions, reveals that while awareness exists, librarians have not fully harnessed available tools for data mining and analysis. The findings stress the urgent need to build capacity among librarians, emphasizing the transformative potential of fully leveraging big data for revolutionizing library services, decision-making, and scholarly contributions.

In Hamad et al.'s (2022) exploration of big data opportunities and challenges in Jordanian Academic Libraries, a pilot survey conducted with IT department staff in three Jordanian university libraries highlights the potential benefits and challenges of big data methods. While staff demonstrated a good understanding of big data, challenges in transportation, transformation, storage, searching, and sharing were identified. The paper underscores the importance of careful

planning and implementation to fully harness big data's potential for enhancing library services, calling for additional research in the Arab world, specifically in Jordan. Ahmad, Meng, and Rafi's (2019a, 2019b) proposed model, combining S.R. Ranganathan's library science philosophy with the lean startup methodology for guiding BDA implementation, aims to identify essential roles and competencies for library professionals. Using a multi-stage methodology involving feedback from librarians, a literature review, and a competency assessment questionnaire, the study reveals high comprehension in areas like data privacy and significant relationships between competencies such as digital data curation and policy oversight. The research offers valuable insights into crucial skills for effective BDA.

Tella's (2021) exploration of librarians' perceptions of opportunities and challenges associated with big data in public libraries in Nigeria, employing self-administered interviews, identifies opportunities for improved services and data-driven decisions. Challenges include a lack of expertise and resources, infrastructure needs, and privacy/security concerns. The study recommends recruiting more data experts, investing in staff training, and ensuring alternative power generation and strong internet connectivity. Zhan and Widen's (2018) mixed-method approach to studying the roles of public libraries in big data, involving surveys and interviews, identifies eight distinct roles, including data development and advocacy. Findings reveal that many librarians have a limited comprehension of the practical applications of big data.

While Li et al.'s (2017) study serves as a relevant starting point, our current research in Nigeria addresses a significant geographical gap. Existing research predominantly focuses on academic libraries, particularly in regions like America, the United Kingdom, and China. Our study aims to fill this gap using a qualitative approach, with interviews providing insights into challenges and opportunities associated with big data implementation in African libraries, particularly in Nigeria. The research aims to contribute to the evolving body of knowledge on big data in library management, advocating for its meaningful integration into library operations.

Methodology

This section offers a comprehensive insight into the employed research methodology, delineating aspects such as the research design, population, sample size, data collection instrument, administration procedure, data analysis, and result presentation. A qualitative method, utilizing an open-ended questionnaire, was chosen for data collection, providing the flexibility for in-depth exploration and allowing additional probing based on respondents' input to gain a nuanced understanding of their motivations and feelings. The selection of a qualitative method was aligned with the study's goal, aiming to uncover the perspectives of librarians in academic libraries regarding the incorporation of BDA in the management of operations and services in Nigeria. This method proves suitable for exploring the intricate aspects of participants'

insights.

The study focuses on professional librarians in seven chosen federal universities in Northcentral Nigeria, acknowledging the total of 49 Federal Universities in Nigeria across six geopolitical zones (National University Commission, 2022). Targeting system librarians responsible for the management of information communication technologies and data management, a purposive selection process identified three librarians from each library, resulting in a total of twenty-one participants. The crafted open-ended survey, aligning with the study's four objectives, aimed to capture pertinent data. Clear instructions and a precise definition of the big data analytical concept were provided to ensure a comprehensive understanding among participants. To enhance the efficiency of data collection, the researcher initiated communication with each university's library head to acquire the email addresses of the designated system librarians. Employing Google Forms, the digitized survey was

administered from October 23 to November 29, 2023.

Following the reception of participants' informed consent forms, weekly reminders were sent to ensure their ongoing commitment to the study. Although fourteen participants initially committed to full participation, eventual responses were obtained from nine participants. Throughout the survey dissemination, participants were expressly instructed to promptly complete the online survey. The substantial responses provided by all nine actively engaged participants facilitated a thorough analysis. The study prioritized ethical considerations, with dedicated efforts to obtain valid data from participants. Participants willingly communicated their intent and readiness to participate, with a transparent provision allowing them to withdraw from the study if any concerns about their involvement emerged. This commitment highlighted the ethical integrity integral to the entire research process.

Table 1: Survey Administration

| SN | North-central Region | University Libraries | Surveyed Received | Participant Code |
|--------------|----------------------|--|-------------------|------------------|
| 1. | Ilorin | Federal University of Ilorin Library | 2 | P1, P2 |
| 2. | Abuja | University of Abuja Library | 1 | P3 |
| 3. | Niger | Federal University of Technology Minna Library | 1 | P4 |
| 4. | Jos | University of Jos Library | 2 | P5, P6 |
| 5. | Nasarawa | Federal University Lafia | 1 | P7 |
| 6. | Benue | Federal University of Agriculture Makurdi | 1 | P8 |
| 7. | Kogi | Federal University Lokoja Library | 1 | P9 |
| Total | 7 | 7 | 9 | 9 |

Source: Field Survey, (2023).

From the above table, nine copies of open-ended survey responses were properly filled. The data obtained from the survey were sorted, collated, and manually transcribed by the researcher and reported accordingly.

Data Analysis

This section presents the results derived from the analysis and transcription of data collected through an open-ended survey. The results are organized thematically.

The perspective of academic librarians regarding the knowledge of incorporation of BDA for the management of library operation and services: Librarians were questioned about their knowledge of incorporation of BDA for the management of library operation and services.

The responses gathered depict a varied landscape concerning librarians' familiarity with BDA for overseeing library operations and services. There is a divergence wherein certain librarians exhibit a solid comprehension of BDA, while others seem to lack knowledge. P1 provided valuable insights, expressing a knowledgeable perspective of BDA. P1 recognizes BDA as a transformative influence with considerable potential advantages. However, despite acknowledging these benefits,

P1 emphasizes that: the actual implementation of BDA into library operations has not been realized in their libraries. P2 expressed enthusiasm, stating, "I have gained a profound understanding of BDA in enhancing the management of library operations and services. My knowledge has been cultivated through active participation in seminars and workshops. I am well

aware that libraries in more advanced regions have effectively utilized BDA to extract valuable insights and significantly improve their operations and services. Despite my deep understanding of how to incorporate BDA in libraries, my library has yet to implement it. However, there is definite interest and ongoing discussions underway regarding its potential integration. So hopefully, my library should do something about it soonest"

In line with the preceding perspective, P3 remarked, "Yes, I have a partial understanding of BDA within the library landscape. I've also learned that this technology opens up exciting possibilities, offering libraries the potential to revolutionize and personalize their operations. While it has not been implemented in my library, I am optimistic about its future integration and the opportunities it will bring to enhance the library experience for librarians and library users. BDA is a term that has been frequently mentioned, but its precise relevance to library management isn't entirely clear to me. Regarding its integration into our library, we haven't taken concrete steps yet. It's something we may need to delve into further in the future."

Moreover, P4 and P6 also acknowledged their understanding of BDA integration in libraries across more advanced nations. They emphasized the crucial role BDA can play in library management. P4 specifically mentioned that his library has initiated some pilot projects to incorporate big data into library processes. He noted that the initial results are promising, and they are optimistic about its potential. On the contrary,

P5 honestly stated, "I've only recently started learning about BDA and its relevance to management of library operations and services. My library hasn't officially implemented it, but there's growing interest among our team members. We are aware of the benefits in our operations and the challenges in implementing it."

P7 conveyed a nuanced perspective, expressing, "In my role, I've engaged in discussions regarding BDA, recognizing its growing significance in library management. While I may not possess an in-depth understanding, the potential to enhance services is apparent. However, the direct integration into our operations remains unexplored. We are contemplating future initiatives to explore the practical applications and benefits it could bring to our library services." Similarly, P8 offered insights, stating, "I've been monitoring the advancements in BDA within the library field. It's evident that there is transformative potential, and many libraries in the advanced nation are effectively leveraging it. In my library, there exists a basic awareness, but the practical steps for implementation are in the early stages. We are actively exploring training programs to equip our staff and considering a gradual integration in the upcoming months." P9 provided a reflective perspective, expressing, "While I've encountered discussions on BDA, I acknowledge that my understanding is still evolving. The relevance to library management appears promising, and awareness is present. However, specific efforts to incorporate it into our operations have not been initiated. It's an area of interest, and we are contemplating potential pilot projects to gain a better

understanding of its implications for our library services."

These findings shed light on the perspectives of academic librarians regarding their knowledge of the integration of BDA for the management of library operations and services. It is important to note that the widespread adoption of BDA in library management services is somewhat limited within Nigerian academic library contexts. The comments provided by the participants offer diverse perspectives on BDA and the different stages of adoption, revealing a growing awareness of the analytical relevance of big data in library management services. The participants' responses indicate the various phases libraries are undergoing as they contemplate the implementation of big data. These outcomes are consistent with the research conducted by Chigwada and Kasiroori (2021), suggesting that librarians are cognizant of the utilization of BDA. Furthermore, their findings imply that the concept of BDA is relatively new, prompting librarians to actively enhance their capacity to align with the current trends in librarianship.

The perspective of librarians concerning the significance they attributed to BDA in the management of library operation and services: Librarians were questioned to share their perspective concerning the significance they attributed to BDA in the management of library operations and services.

The results indicate a predominantly positive perspective among librarians regarding BDA. System librarians, in particular, expressed a shared belief that BDA represents a powerful technological advancement,

serving as a transformative force in library management services.

P1 enthusiastically expressed, "Big data is a revolutionary technology, reshaping how we handle, interpret, and leverage information resources. It empowers us to make informed decisions, optimize resource allocation, and enhance service quality." Building on this sentiment, P2 highlighted the potential of BDA as a tool capable of unlocking valuable insights for personalized library services while acknowledging the complexities of data privacy and security. P3 emphasized the practical attributes of big data, noting its potential for highly personalized services and data-driven decision-making, along with highlighting the challenges of managing extensive datasets.

P4 and P5 shared the conviction that BDA is increasingly relevant in library management, providing tools to analyze trends, assess service effectiveness, and enhance resource management.

P4 underscored the importance of ethical data handling, stating, "Maintaining a steadfast commitment to ethical data handling is critical." Similarly, P5 emphasized that big data serves as a valuable asset for effective library management, offering deeper insights into user needs and optimizing collections. P6 echoed the sentiment, stating, "BDA is an indispensable tool for modern library management, enhancing decision-making, streamlining operations, and aligning services with patron preferences." However, P6 also emphasized the importance of instituting comprehensive data policies and stringent privacy safeguards.

P7 recognizes the ongoing

discourse surrounding BDA in library management, acknowledging its importance. He noted that the integration of this technology into operations has not been explored, prompting contemplation of future initiatives. Similarly, P8 stays abreast of advancements in BDA, highlighting its transformative potential. Despite possessing a fundamental awareness, the practical implementation is in its initial phases, with ongoing exploration of training programs and gradual integration strategies. P9 reflects on an evolving comprehension of BDA, acknowledging its promising relevance to library management. However, there has been no initiation of specific efforts for its incorporation, with potential pilot projects currently under consideration.

These diverse perspectives from the participants shed light on the significance attributed to integrating big data into library management. Thus, librarians express optimism about the promise of big data to improve operational efficiency and elevate patron satisfaction in library management. These findings align with earlier research, such as the study by Li et al. (2017), emphasizing the feasibility and practicality of implementing big data frameworks in public libraries, outlining its significance across dimensions like human resources, service innovation, infrastructure development, literature resources, and technological support.

The perspective of librarians regarding the feasibility of incorporating BDA in improving the management of library operations and services: Librarians were questioned to share their perspectives regarding the

feasibility of incorporating BDA in improving the management of library operations and services.

Findings reveal that participants indicate several feasibilities of incorporating BDA in improving library services. In the response obtained, P1 shared insightful perspectives on the viability of integrating BDA into library management, recognizing its potential for transformation.

While acknowledging the substantial benefits of BDA, P1 further highlighted the existing gap between awareness and actual implementation in their library. In the Nigerian context, this underscores the challenges faced by academic libraries in acquiring essential resources, such as skilled personnel and necessary technological infrastructure for effective BDA implementation. Likewise, P2, expressing enthusiasm for BDA, revealed that their library is still in the early stages of implementation with ongoing discussions. This aligns with the feasibility aspect, emphasizing the necessity for collaborative efforts and strategic planning among Nigerian libraries to address common challenges and pool resources for a successful BDA integration.

P3's recognition of BDA's potential to revolutionize library operations, despite a lack of concrete steps in their library, reflects a positive yet cautious stance. He noted that: "In the Nigerian context, this indicates a potential need for collaborative training programs or partnerships with educational institutions to enhance librarians' data analysis skills, facilitating the seamless integration of BDA."

Both P4 and P6, acknowledging BDA's relevance, noted that they have initiated pilot projects in their library,

demonstrating a practical approach that could serve as a model for other Nigerian academic libraries. But the fact remains that their libraries are not. This underscores the practical feasibility of adopting BDA through incremental steps and pilot initiatives.

P5 and P7 both recognized the increasing importance of BDA in library management and offered forward-looking perspectives, contemplating potential future initiatives. One illustrative example made by P7 could be the creation of a national consortium or network in Nigeria dedicated to the implementation of BDA.

He noted that: this initiative will encourage collaboration and the sharing of insights among libraries, fostering a collective effort to effectively integrate BDA into the library landscape. An example could be the establishment of a task force or working group within the Nigerian library community to explore and assess the feasibility of BDA through pilot initiatives. Together, these diverse perspectives offer a nuanced understanding of the feasibility of incorporating BDA to enhance the management of library operations and services within the Nigerian context.

The insights derived from librarians offer a nuanced understanding of the feasibility of incorporating BDA to improve library operations and services in Nigeria. The responses highlight a range of awareness, enthusiasm, and practical measures taken by librarians in implementing BDA, exposing challenges and proactive initiatives specific to the Nigerian context. This diverse array of perspectives not only brings attention to obstacles but also presents innovative and forward-thinking approaches. Importantly, these findings resonate

with Salman et al.'s (2022) examination of Malaysian libraries, revealing a moderate readiness for BDA adoption and a positive inclination toward embracing new technologies. Additionally, the unanimous consensus among Malaysian libraries regarding the significance of data security finds relevance in the broader context. In Nigeria, librarians' viewpoints converge on the feasibility and practicality of integrating BDA to enhance library management. The embracement of cutting-edge technologies, robust data infrastructure, and effective tools emerges as crucial for the successful integration of BDA into library operations.

The potential challenges academic libraries may encounter when incorporating BDA into the management of library operations and services: Librarians were questioned to share challenges when utilizing big data for library management operations. Findings reveal that respondents indicate several challenges that may hinder BDA for library management. Among the challenges envisaged are data privacy, data quality, skilled personnel, Scalability, data security, and data integration.

Sequel to the aforementioned submissions, other explanations, and the identification of perceived challenges by participants are hereby summarized: There is going to be a challenge for academic libraries in adjusting to the new paradigm shift in library management.

In the response of P1: "In my perspective, one of the anticipated hurdles in the incorporation of BDA for library management is the paramount concern of data privacy. The process of collecting

and scrutinizing substantial user data raises legitimate worries about safeguarding individuals' information and ensuring their privacy remains inviolable." P2 also submitted that: "I foresee the issue of data quality as a significant challenge. Ensuring the precision, comprehensiveness, and relevance of the data we gather can pose intricate difficulties. Errors or biases within the data could potentially lead to incorrect conclusions or flawed decisions."

P3 emphasized a key challenge in incorporating BDA for the management of library operations and services, underscoring the vital requirement for personnel with advanced skills. He highlighted that the effective use of big data demands librarians with proficient data analysis skills, potentially necessitating additional training or the hiring of specialized staff to fulfill this need.

P4 and P8 delved into the discussion, focusing on the scalability challenge and anticipating obstacles as libraries expand and accumulate more data. They analysed similar perspectives noting that the growth in data volume intensifies the resource demands for data management and processing, underscoring the critical need for ensuring seamless scalability within library systems. Meanwhile, P5 raised a significant concern regarding data security, emphasizing the need for robust measures to protect against data breaches and cyber threats, particularly given the sensitive nature of big data.

Additionally, P6 P7, and P9 pointed out data integration as another substantial challenge impeding the effective use of big data in the management library operations and

services. He noted that libraries often contend with diverse systems and databases, complicating the harmonization of data from various sources to create a unified view. Addressing this multifaceted challenge requires thoughtful solutions to achieve successful implementation.

These findings from participants indicated the potential challenges that librarians may encounter when implementing big data in library management, encompassing concerns related to data privacy, data quality, personnel proficiency, scalability, data security, and data integration. The findings support the conclusions drawn by Li et al. (2017), who recognized several challenges in implementing big data in libraries. These challenges include issues related to data accuracy, the big data processing system and technology, data compression, data confidentiality, security concerns, a shortage of experts, and a generally low level of information technology competency. This reaffirms that regardless of the specific location of public libraries, the adoption of big data typically presents similar challenges.

Conclusion

The study focused on the incorporation of BDA in the management of library operations and services: strategies for way forward in Nigerian academic libraries. The study examined the knowledge, attributed significance, feasibility, and anticipated challenges regarding the incorporation of BDA in the management of library operations and services. Concerning the perspective of librarians regarding the knowledge of incorporation of BDA for the management of library operation

and services, findings reveal that the majority of librarians are not well knowledgeable about the management of BDA in library operation and services. They acknowledge its potential to transform library services positively. However, it's noteworthy that while The comments provided by the participants offer diverse perspectives on BDA and the different stages of adoption, revealing a growing knowledge of the BDA in library management services, the adoption of big data analytics in Nigerian academic libraries remains limited, with libraries at different stages of considering its implementation. Concerning librarians' perspectives on the significance of BDA in library management are generally positive. They view big data analytics as a potential tool capable of enhancing decision-making, service optimization, and overall library experiences. They recognize its potential to offer valuable insights into user behaviors and trends, enabling more personalized services. Concerning the feasibility of incorporating the BDA in the management of library operations and services, The responses highlight a range of awareness, enthusiasm, and practical measures taken by librarians in implementing BDA, exposing challenges and proactive initiatives specific to the Nigerian context. Nevertheless, they also acknowledge the challenges tied to data privacy, data quality, and ethical considerations that necessitate careful navigation during big data analytics implementation. Participants highlighted that while BDA offers substantial benefits, it also introduces complexities that demand thoughtful planning and strategic approaches. conclusively, this study

underscores the increasing perspective and positive views among academic librarians regarding BDA's significance in library management. It underscores the importance of proactive measures to address the envisaged challenges associated with BDA implementation. These measures include robust data privacy policies, data quality assurance, and investments in staff training.

Strategies for Way Forward

Based on the study's findings, these are the important Strategies for way Forward:

1. There should be encouragement and support for the integration of BDA solutions within libraries. While many librarians are aware of the potential benefits, libraries require practical assistance to transition from awareness to implementation. Policymakers can facilitate this process by allocating funding, resources, and incentives for libraries to initiate pilot projects that showcase the advantages of utilizing big data.
2. Stakeholders should play a pivotal role in emphasizing the ethical handling of data and safeguarding user privacy within libraries' BDA initiatives. Establishing clear guidelines and regulations is essential to guarantee responsible and secure management of user data. This not only protects individuals but also builds trust and confidence among library users.
3. Stakeholders should allocate resources for comprehensive librarian training in data

management and analytics. Furthermore, funding should be provided for the procurement of data analytics tools and technologies. These investments empower librarians with the necessary skills and tools to harness the potential of big data effectively. This support is vital in addressing challenges related to data quality and security.

4. These considerations offer actionable guidance for policymakers to support libraries as they navigate the world of big data, leveraging its capabilities for enhanced library management while addressing ethical concerns and challenges.

Limitations of the Current Study

1. There are several limitations to consider in this study. Firstly, the data collection was conducted online in only seven university libraries in Northcentral, Nigeria. This represents a small sample compared to the total of 49 federal university libraries spread across the six geopolitical zones in Nigeria and the 36 states in the country. Consequently, the findings may not be widely applicable beyond this limited scope.
2. Furthermore, the study exclusively focuses on the Nigerian context, overlooking insights from other African countries. As a result, it may not be possible to generalize the study's findings to the broader African library community.

3. Additionally, the research design, although informative, may not be considered rigorous enough to generate universally applicable results within the library community in Nigeria, across Africa, or globally. It's important to note that this study serves as a "preliminary study," primarily aimed at collecting foundational data to inform future research endeavors.
4. Another limitation is the exclusive focus on university libraries. Future studies should consider including various types of libraries to provide a more comprehensive understanding of BDA incorporation in diverse library settings.
5. Moreover, the use of open-ended questionnaires for data collection, while valuable for qualitative insights, may limit the generalizability of findings to other types of libraries. The incorporation of additional data collection methods, such as in-depth interviews, observations, or document analysis, could have enriched the study's depth and breadth.

Contribution to Advancing Knowledge

In the African Context specifically Nigerian, there is a notable scarcity of studies that have explored the incorporation of BDA in the management of library operations and information services, particularly through qualitative research. As such, this study stands as a significant contribution to expanding our understanding of this topic. It offers in-depth insights into the perspectives held by Nigerian librarians regarding the incorporation of BDA within the context of library management. The data collected, the insights gained regarding the BDS in libraries, and the research methodology employed all serve as valuable references for future studies with similar objectives.

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