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IMPACT OF BIG DATA FOR SMART LIBRARY IN KASHIM IBRAHIM LIBRARY, AHMADU BELLO UNIVERSITY, ZARIA, KADUNA STATE

UGWU, Kosisochukwu Judith
Ahmadu Bello University, Zaria, Kaduna State
Kosiugwu4@gmail.com

Umma Abdulhamid Garba
Ahmadu Bello University Zaria Kaduna State
ummagarba44@gmail.com

Faruk Yusuf
Ahmadu Bello University, Zaria, Kaduna State
yusuffaruq2016@gmail.com

ABSTRACT

This study explores the awareness, use, and impact of Big Data in improving library management at Kashim Ibrahim Library, Ahmadu Bello University, Zaria. As academic libraries face increasing pressure to adapt to digital transformations, Big Data emerges as a pivotal tool for enhancing library management, improving resource accessibility, and optimizing user experiences. The study adopts a quantitative research method with a descriptive design to gather data from 100 librarians at the Kashim Ibrahim Library through structured close-ended questionnaires. The study's findings reveal that while Big Data has positively impacted decision-making, cataloging, tracking borrowing habits, and resource accessing, a significant proportion of librarians have limited understanding, which impedes full adoption. Results show that 48% of respondents have moderate levels of confidence in using big data tools for library functions, 61% recognize its role in improving cataloging efficiency, and the extent in which big data integrated with automated library systems for efficient service delivery is 36%. The study concludes that while Big Data holds considerable promise for transforming library services, its implementation in Kashim Ibrahim Library is still in its infancy. Targeted training, increased awareness, institutional commitment, and strategic implementation are required for the development and full realization of a smart library.

Keywords: Academic Libraries, Big Data, Data Utilization, Kashim Ibrahim Library, Library Management, Smart Libraries.

Background to The Study

Libraries have long served as vital centers of knowledge and intellectual growth, playing a crucial role in the academic development of students, researchers, and faculty members. As the world becomes

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increasingly digital, libraries must evolve from traditional spaces that house physical books and journals into dynamic, technology-driven environments capable of supporting modern learning and research needs (Mellon, 2017). In recent years, the concept of the "smart library" has emerged as a transformative solution for this evolution. A smart library integrates advanced technologies like Big Data, Artificial Intelligence (AI), Internet of Things (IoT), and Automation to enhance service delivery, improve user experiences, and optimize library operations (Gorman, 2018).

At the forefront of this transformation in Nigeria is the Kashim Ibrahim Library, located within the Ahmadu Bello University (ABU) in Zaria, Kaduna State. This library serves as the academic heart of the institution, providing essential resources to over 40,000 students, academic staff, and researchers (ABU, 2021). The library houses a diverse collection of academic resources, including print and digital books, journals, and periodicals, and serves as a hub for research and scholarly collaboration. However, like other academic libraries, Kashim Ibrahim Library faces challenges related to resource management, user engagement, and technological infrastructure.

Big Data, characterized by large volumes of structured and unstructured information, offers a promising solution to these issues. It enables the automation of processes, personalization of services, and optimization of library spaces and resources by analyzing user behavior and demand patterns (Eze, 2019; White, 2020). For example, insights from borrowing and usage data can help tailor services to user needs and enhance overall satisfaction (Anderson & Johnson, 2021). The potential benefits of utilizing Big Data in a smart library setting go beyond operational efficiency; they extend to enhancing the learning and research experience for users. By analyzing data on student and faculty usage patterns, the library can tailor its services, improve user satisfaction, and ensure that academic resources align with the needs of the community it serves (Anderson & Johnson, 2021).

Despite its potential, implementing Big Data in Nigerian libraries presents significant challenges. These include limited funding, insufficient technical expertise, data privacy concerns, and inadequate infrastructure (Afolabi, 2022). Additionally, successful integration must consider local cultural and institutional contexts to ensure that such technological transitions are both sustainable and impactful (Mogaji, 2021).

This study aims to investigate the impact of Big Data in advancing the smart library initiative at the Kashim Ibrahim Library. It will assess the current state of technological integration and explore how Big Data can improve library efficiency. The research contributes to the broader discourse on the transformation of academic libraries in Nigeria and serve as a model for other institutions in similar contexts (Adamu, 2022).

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STATEMENT OF THE PROBLEM

The integration of Big Data into library systems has emerged as a key factor in enhancing operational efficiency, improving user experiences, and creating dynamic learning environments. Through data analytics, libraries can track user behaviors, identify resource usage patterns, and predict future needs, which allows for more targeted acquisition of resources and more effective service delivery (Pinto & Resende, 2018).

However, despite the potential benefits of integrating Big Data into library systems, many academic and public libraries struggle to leverage data-driven solutions effectively. Traditional library management systems often lack advanced analytics needed to track usage patterns, predict resource demands, and personalize user experiences. As a result, libraries face significant challenges in resource allocation, user engagement, and accessibility.

This gap limits the ability of libraries to track user behavior, predict resource demand, and deliver tailored services, which in turn affects user satisfaction and academic outcomes. Thus, there is a pressing need to explore the missed opportunities associated with the limited adoption of Big Data in academic libraries, and to propose actionable strategies that can facilitate smarter, more adaptive and data-driven library systems that support educational advancement in the digital age.

RESEARCH OBJECTIVE

1. To examine the level of awareness among librarians at Kashim Ibrahim Library about the relevance of big data for library management.
2. To examine the extent to which big data is utilized in Kashim Ibrahim Library to enhance library operations and user experience.
3. To examine the impact of big data for a smart library in Kashim Ibrahim Library, Ahmadu Bello University, Zaria, Kaduna State.

LITERATURE REVIEW

LEVEL OF AWARENESS AMONG LIBRARIANS ABOUT THE RELEVANCE OF BIG DATA FOR LIBRARY MANAGEMENT

The integration of Big Data into university systems, particularly libraries, is becoming essential for advancing education and institutional growth. Universities produce vast amounts of data, and when effectively analyzed, this information can support strategic decision-making, improve operational

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efficiency, and enhance student outcomes. Big Data, which involves complex datasets beyond the capacity of traditional processing tools, has the potential to transform educational methods, boost institutional performance, and strengthen resilience.

In libraries, Big Data can personalize user experiences, optimize resource management, and improve service delivery. However, awareness and adoption among librarians, especially in developing areas like Rivers State, Nigeria, remain limited. Many librarians lack the technical skills and training required to utilize Big Data tools effectively. Chigwada and Kasiroori (2021) observed that librarians are often unaware of Big Data applications, while Anwar and Manzoor (2019) noted significant skill gaps due to inadequate training and resources. These findings underscore the need for comprehensive capacity-building programs focused on data analytics.

Although Big Data was initially limited to corporations and government agencies due to cost, however, open-source tools and affordable technologies have made it more accessible to academic libraries. Libraries can now analyze user behavior, borrowing trends, and content engagement to tailor services and improve resource alignment. Despite these opportunities, challenges such as high integration costs, technological complexity, and lack of trained personnel persist. To fully realize Big Data's benefits, libraries must invest in infrastructure and staff development, ensuring they stay competitive and relevant in the digital age.

EXTENT TO WHICH BIG DATA IS UTILIZED IN TO ENHANCE LIBRARY OPERATIONS AND USER EXPERIENCE

Big Data analytics is transforming library operations by enabling data-driven decision-making and personalized services. Libraries now leverage Big Data to enhance collection development, user engagement, and resource management. By analyzing borrowing histories, search queries, and user behavior, libraries can identify high-demand materials, optimize acquisitions, and align collections with user needs (Luo et al., 2017; Asim et al., 2023). Text mining and historical data analysis also improve search results and content recommendations.

Personalized services improve through the analysis of user demographics and behavior, enabling targeted reading lists and tailored offerings (Al-Daihani et al., 2020; Tella, 2021). Academic libraries use learning analytics to identify students' struggles and create support strategies that improve learning outcomes (Albergaria & Jabbour, 2020).

Big Data also supports efficient resource management. Usage data helps libraries phase out underused materials, allocate budgets wisely, and plan staffing and space utilization based on user behavior (Gregory, 2019; Corrall & Pinfield, 2022). It further aids in research support by revealing citation patterns and scholarly trends, allowing libraries to better serve students and researchers (Tenopir & King, 2013; Wang et al., 2016).

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Additionally, Big Data informs strategic planning by uncovering user interests, service usage trends, and satisfaction levels, fostering continuous service improvement (Wu et al., 2013). AI-powered tools like virtual assistants and chatbots, which evolve through user interaction, enhance service accessibility (LiSEdu, 2023). Moreover, shared data allows libraries to collaborate, expand access, and build strong networks (Kamupunga & Chunting, 2019). Ultimately, Big Data enables libraries to move from reactive to proactive, user-centered service models.

THE IMPACT OF BIG DATA FOR SMART LIBRARY IN KASHIM IBRAHIM LIBRARY, AHMADU BELLO UNIVERSITY, ZARIA, KADUNA STATE

The digitization of society has resulted in an unprecedented surge in data generation, driven by technologies such as high-speed internet, mobile devices, cloud computing, and the Internet of Things. According to Reinsel et al. (2018), global data volume is projected to exceed 160 zettabytes by 2025, up from approximately 25 zettabytes in 2018. Libraries, especially academic institutions, are increasingly harnessing this growing data landscape through Big Data analytics.

Big Data offers libraries the opportunity to enhance decision-making, personalize user services, and support research. As Sugimoto et al. (2012) observed, libraries already offer services like data management, collection, curation, and archiving. These services can be aligned with the DataONE data life cycle, allowing libraries to contribute at specific stages depending on their capacity. Despite appearing outside traditional library roles, libraries can support data collection by acquiring datasets or collaborating with high-performance computing units to offer technical support (Panda, 2021).

Big Data in libraries is often unstructured and varies widely in format, including books, maps, images, audio, social media, and research data (Wang et al., 2016). Ball (2019) noted that these diverse materials constitute Big Data due to their volume, variety, and velocity. Examples include WorldCat, which aggregates cataloguing data globally, and digital repositories storing large research datasets. However, most repositories still struggle with large-scale data due to technical limitations (Martin, 2011).

Libraries worldwide are beginning to explore Big Data applications. Projects include the Library of Congress's Twitter archive, Harvard University's metadata initiatives, and JISC's Library Data Labs. These efforts demonstrate Big Data's potential to improve decision-making, collection development, and user engagement (Wu, Su & Deng, 2013; Koltay & Sándor, 2018). Additionally, analyzing usage patterns helps libraries identify user needs, improve services, and allocate resources efficiently.

Moreover, Big Data supports academic research by enabling the analysis of citation patterns, scholarly trends, and user behavior (Tenopir & King, 2013). Libraries can also promote inter-institutional collaboration through shared data usage and resource sharing (Bamigbola, 2023). As Manaseer, Alawneh, and Asoudi (2019) argue, Big Data offers libraries a strategic advantage, enhances service

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relevance, supports research, and fosters innovation. Ultimately, Big Data is reshaping libraries into more adaptive, user-centered, and data-driven institutions.

RESEARCH METHODOLOGY

This study adopted a quantitative research method to examine the relationship among variables related to the adoption and utilization of Big Data in Kashim Ibrahim Library, Ahmadu Bello University, Zaria. A descriptive research design was used to gather and organize data, allowing for a detailed understanding of how Big Data is perceived and used in the library.

The target population comprised of librarians at Kashim Ibrahim Library, who manage resources and facilitate digital innovations. A sample size of 100 respondents was selected using simple random sampling to ensure a representative sample. Data was collected using a closed-ended questionnaire designed in three sections: This article assesses the impact of big data in smart libraries.

The questionnaires were administered with the help of a research assistant to ensure accurate completion and a high response rate. For analysis of the data, frequency and percentage analysis was performed using Microsoft Excel, and the results were presented in tables for easy interpretation.

LEVEL OF AWARENESS AMONG LIBRARIANS AT KASHIM IBRAHIM LIBRARY ABOUT THE RELEVANCE OF BIG DATA FOR LIBRARY MANAGEMENT

Table 1

Level of Awareness	**High**	%	**Moderate**	%	**Low**	%
How would you rate your knowledge of big data concepts and their application in libraries?	23	27%	35	42%	26	31%
How would you rate the importance of big data in improving library services and operations?	26	31%	37	44%	21	25%
To what extent do you believe that big data can enhance decision-making in library management?	27	32%	36	43%	21	25%
How accessible do you think big data resources and tools are within Kashim Ibrahim Library?	20	24%	31	37%	33	39%

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What is your level of confidence in using big data tools for library functions?	20	24%	40	48%	24	29%

Source: Field Survey, 2025

The findings from table 1 above reveal that librarians at Kashim Ibrahim Library have varying levels of awareness about the relevance of Big Data in library management. Specifically, 42% reported moderate knowledge, 31% low knowledge, and only 27% high knowledge, indicating a significant gap in deep understanding. In terms of perceived importance, 44% see Big Data as moderately important for improving services, 31% highly important, and 25% less important. Similarly, 43% believe it moderately enhances decision-making, 32% strongly agree, while 25% remain skeptical.

Accessibility to Big Data tools is another concern, with only 24% of respondents rating them as highly accessible, 37% as moderately accessible, and 39% as difficult to access. This points to infrastructural or training-related challenges. Confidence in using these tools also varies: 48% feel moderately confident, 29% have low confidence, and 24% are highly confident, highlighting the need for further skill development.

Overall, the results suggest that while there is a general acknowledgment of Big Data's relevance among librarians, both knowledge and practical application remain moderate. Limited access to tools and varying confidence levels further hinders full implementation. These findings are consistent with Adamu et al. (2024), who also observed that university librarians possess basic awareness of Big Data but lack advanced understanding and technical proficiency. Addressing these gaps through training and improved infrastructure is essential to fully harness the potential of Big Data in library management and service delivery.

EXTENT TO WHICH BIG DATA IS UTILIZED IN KASHIM IBRAHIM LIBRARY TO ENHANCE LIBRARY OPERATIONS AND USER EXPERIENCE

Table 2

Extent	**Great extent**	%	**Moderate**	**%**	**Low extent**	**%**
To what extent is big data utilized in cataloging and classifying library resources at Kashim Ibrahim Library?	31	37%	41	49%	12	14%

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To what extent is big data used for tracking and analyzing library users' borrowing patterns?	28	33%	37	44%	19	23%
To what extent is big data applied to enhance user experience through personalized recommendations and services?	30	36%	31	37%	23	27%
To what extent does big data contribute to improving digital resource management within the library?	31	37%	32	38%	21	25%
To what extent is big data integrated with automated library systems for efficient service delivery?	30	36%	33	39%	21	25%
To what extent does big data improve the efficiency of library staff in managing library operations?	28	33%	33	39%	23	27%

Source: Field Survey, 2025

Table 2: The survey results from Kashim Ibrahim Library highlight a moderate use of Big Data in several aspects of library operations. For cataloging and classifying resources, 49% of respondents reported moderate use, while 37% indicated a great extent of application, and 14% noted low usage. Similarly, 44% of respondents saw moderate use of Big Data for tracking borrowing patterns, with 33% reporting a great extent of use. Big Data's impact on user experience through personalized recommendations was rated as moderate by 37% and great by 36%. The management of digital resources benefited moderately (38%) from Big Data, with 37% indicating significant use. The integration of Big Data with automated systems was moderate for 39% of respondents and great for 36%. Additionally, 39% of respondents felt Big Data moderately improved staff efficiency, while 33% believed it had a great impact.

These findings suggest that while Big Data is moderately utilized, its full potential is not fully realized, particularly in personalized services and operational efficiency. This aligns with Chigwada and Kasiroori (2021), who noted similar findings in Zimbabwe, where librarians were aware of Big Data but had yet to fully exploit its tools and techniques for data analysis. Therefore, improving the adoption and application of Big Data could significantly enhance library operations and user experience.

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IMPACTS OF BIG DATA UTILIZATION IN KASHIM IBRAHIM LIBRARY

Table 3

Impacts	Agree	%	Disagree	%	Undecided	%
Big data helps improve decision-making in library management	48	57%	24	29%	12	14%
The use of big data enhances the accuracy of book acquisition for uses	41	49%	27	32%	16	19%
Big data improves the efficiency of cataloguing and classification	51	61%	23	27%	10	12%
The use of big data reduces waiting time for accessing digital and physical library materials	47	56%	25	30%	12	14%
Big data has made it easier to access and retrieve relevant information from the library's digital resources	50	60%	27	32%	7	8%

Source: Field Survey, 2025

Table 3 survey results from Kashim Ibrahim Library reveal that Big Data has a positive impact on several aspects of library management, though its benefits are not universally recognized. 57% of respondents agreed that Big Data improves decision-making in library management, while 29% disagreed. Similarly, 49% believed it enhanced the accuracy of book acquisitions, though 32% disagreed. A significant 61% felt Big Data improved cataloging and classification, and 56% agreed it reduced waiting times for accessing materials. Additionally, 60% believed it facilitated easier retrieval of digital resources. However, there was a notable level of disagreement on these points, indicating that while librarians recognize the advantages of Big Data, its full potential is not yet realized.

This suggests that although Big Data positively influences decision-making, cataloging, and resource accessibility, its consistent application across all library functions is still evolving. This aligns with Ball (2019), who emphasized that analyzing Big Data can enhance understanding of library users and improve both existing and new services. Therefore, while Big Data's impact is acknowledged, continued development and adoption are necessary to fully harness its benefits in library operations.

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SUMMARY OF THE FINDINGS

From the data collected and analyzed, the following findings were made:

Many librarians have only moderate knowledge of Big Data, with some lacking substantial understanding, which may limit its adoption. In addition, Big Data is moderately applied in decision-making, cataloging, tracking borrowing patterns, and enhancing user experience, but full optimization is yet to be achieved, as some librarians remain skeptical of its effectiveness.

CONCLUSION

Based on the findings, it is evident that while Big Data holds significant potential to transform library operations and enhance user experiences, its full adoption and optimization remain limited due to varying levels of awareness and expertise among librarians. The moderate application of Big Data in areas such as cataloging, tracking user behavior, and decision-making indicates a positive trend; however, the lack of in-depth knowledge and skepticism among some professionals continues to hinder its widespread implementation. To fully leverage the benefits of Big Data, there is a need for continuous professional development, capacity building, and awareness creation among library staff. By equipping librarians with the necessary skills and knowledge, libraries can move toward more data-driven, efficient, and user-centered service delivery.

RECOMMENDATION

To fully leverage Big Data in library operations, targeted strategies are essential. First, continuous professional development for librarians is crucial, with regular training workshops to enhance their technical skills in Big Data analytics. These initiatives will help librarians apply data-driven solutions effectively. Awareness campaigns should also be conducted to highlight Big Data's potential, dispelling skepticism and fostering a positive attitude toward technological adoption.

Additionally, Library and Information Science (LIS) programs should integrate Big Data concepts into their curricula to prepare future professionals for data-driven environments. Collaboration is key; libraries should partner with data scientists and technology experts to share knowledge and resources for successful implementation.

Pilot projects focusing on areas like user analytics and personalized services can help evaluate Big Data's benefits and build confidence among stakeholders. Moreover, libraries must establish policies to ensure ethical data use, addressing privacy and security concerns to maintain user trust and comply with regulations.

By implementing these strategies, libraries can overcome challenges and create an innovative, user-centered environment driven by data, improving their services and responsiveness to user needs.

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