

Adoption of Big Data Analytics in Nigerian University Libraries: Perceptions, Competency, and Usage Among Librarians in Osun State

OLATUNJI, Ridwan Olawale

Department of Educational Technology and Library Studies, Obafemi Awolowo University, Ile-Ife, Nigeria.

Corresponding Author: oladaryor@gmail.com

ABSTRACT Big Data Analytics (BDA) has the potential to transform academic library operations by enabling data-driven decisions, yet its adoption in Nigerian university libraries remains underexplored. This study investigates librarians' awareness, perception, competency, and usage of BDA tools in selected universities in Osun State. The research aimed to assess the extent to which librarians are prepared to integrate BDA into library services. A mixed-methods approach was used, combining survey data from 36 librarians with interviews from three chief librarians across federal, state, and private universities. Data were analyzed using descriptive statistics and thematic content analysis. Results showed that while 78% of respondents had high awareness and 76% had a positive perception of BDA, actual usage was limited (only 8% reported very high use). Skill gaps and infrastructure deficiencies were identified as major barriers. The study concludes that despite strong awareness and favorable attitudes, BDA integration is hindered by institutional limitations. Enhancing infrastructure, targeted training, and national policy support are recommended to bridge the gap and unlock the benefits of BDA in academic libraries.

KEYWORDS: Awareness, Big Data Analytics, Competency, Perception, University Libraries.

I. INTRODUCTION

The 21st century has witnessed an exponential increase in the volume, variety, and velocity of data generated across all sectors, including academic libraries [1]. As institutions that manage vast amounts of information, university libraries are positioned to benefit immensely from data-driven approaches such as Big Data Analytics (BDA). BDA refers to the techniques and tools used to analyze large, complex datasets in order to uncover hidden patterns, trends, and correlations that inform decision-making [2]. Globally, libraries in technologically advanced societies have adopted BDA to evaluate service efficiency, understand user behavior, and enhance resource management [3]. However, in the Nigerian context, the integration of BDA into academic libraries is still in its infancy [4]. While digital library systems have become more widespread, the ability to leverage big data for strategic library planning and operations remains limited. This disconnect is not due to a lack of data but rather the absence of analytical infrastructure, expertise, and organizational readiness. Many Nigerian librarians are either unaware of BDA tools or lack the requisite skills to utilize them effectively [5]. According to the International Federation of Library Associations and Institutions [6], modern libraries must adapt to the digital age by embracing technologies that enhance their roles as information providers and knowledge hubs. BDA stands out as one of these technologies due to its potential to improve library efficiency, enhance user engagement, and justify funding decisions through evidence-based practices. Yet, a report by [7] shows that over 65% of libraries in Sub-Saharan Africa, including Nigeria face infrastructural and technical constraints that limit their ability to adopt BDA. This indicates a significant gap between potential and practice. Academic libraries are not just storehouses of books; they are dynamic institutions that support learning, research, and innovation. In Nigeria, university libraries face mounting pressure to evolve amidst budgetary constraints, increasing user expectations, and rapid technological advancements [8]. BDA provides a viable pathway to address these challenges.

By analyzing borrowing patterns and electronic resource usage, librarians can make informed decisions about acquisitions, subscription renewals, and space utilization. Additionally, predictive analytics can help anticipate user needs, thereby enhancing service delivery [9]. Despite the relevance of BDA, the literature reveals limited empirical research focusing on its application in Nigerian university libraries. Most studies in Nigeria have concentrated on general ICT use, digital repositories, or automation, with little attention paid to data analytics and its strategic integration. This oversight poses a challenge to library modernization efforts and creates a gap in both policy and practice. This research is particularly relevant in seeking to address this gap by exploring the perceptions, awareness, competency, and usage of BDA tools among librarians in Osun State, Nigeria. The study is anchored on the belief that understanding these factors is critical to enhancing BDA adoption. Specifically, the study investigates:

- a) the level of awareness of BDA tools among university librarians;
- b) their perceptions regarding the relevance and benefits of BDA;
- c) their self-assessed competency in using BDA tools; and
- d) the extent to which BDA is currently applied in library operations.

In Nigeria, university libraries play a critical role in supporting teaching, learning, and research. However, the integration of BDA into library operations remains in its infancy. Given the increasing complexity of user needs and the growing demand for accountability and performance measurement, the adoption of BDA becomes not only relevant but essential. Osun State, with its diverse mix of federal, state, and private universities, offers a unique environment for examining the readiness and capabilities of librarians to adopt BDA. The motivation behind this study is twofold. First, it responds to the growing global interest in data-driven librarianship and seeks to situate Nigerian academic libraries within this trend. Second, it aims to generate localized evidence that can inform library development policies, training programs, and investment priorities. As librarians become more aware of the power of analytics, they can take proactive steps to integrate BDA into their daily workflows, ultimately transforming how services are designed and delivered.

II. RELATED WORKS

Big data refers to the massive amounts of information collected, stored, and analyzed by organizations, which often requires advanced technologies like machine learning and artificial intelligence to process and make sense of the vast data volumes. By leveraging big data analytics, businesses can uncover hidden patterns, relationships, and insights that wouldn't be immediately apparent, providing valuable knowledge about customer behavior, market trends, and more [10]. They are typically defined by four key characteristics: volume (the sheer amount of data), velocity (the speed at which data is generated), variety (the diverse sources of data), and veracity (the accuracy and reliability of data) [11].

A. CHARACTERISTICS OF BIG DATA

In the modern digital landscape, big data has become a ubiquitous phenomenon. The term big data describes the enormous quantities of data, encompassing both organized and unorganized forms that are generated from a wide range of sources, including social media platforms, mobile devices, sensors, and many others. Gartner defines Big data as large and diverse sets of information that are generated and processed at a rapid pace, requiring cost-effective and innovative methods to gain deeper understanding and improve decision-making [12]. This definition encapsulates the key characteristics of big data. Big data is characterized by its enormous size, generated by machines, and typically exceeds the capacity of traditional data storage and processing systems. According to a recent study, the total data created, captured, and replicated in 2020 reached an astonishing 64.2 zettabytes, and this number is predicted to skyrocket to 180 zettabytes by 2025 [13]. The sheer scale of data generation is a defining feature of big data.

B. BIG DATA ANALYTICS, LIBRARY, AND INFORMATION SCIENCE

The predominant approach for library services is currently the self-service model [14]. Most colleges and universities continue to employ the traditional library service model, incorporating information services to a certain extent, yet still mainly based on structured data, without delving into the more profound or intricate aspects of data

information. Data literacy encompasses the capacity to identify data, process it, collect it, be sensitive to it, think critically, and make decisions [15]. University libraries employ a variety of strategies when it comes to analyzing information data, such as cluster analysis, data fusion, data mining, integration, and visual analysis [16]. These measures are not implemented simultaneously; instead, one step is completed before the next is initiated. While this approach can be employed, it often results in extended wait times for readers attempting to locate a book, thus reducing the service quality of university libraries [17].

Librarians are increasingly utilizing big data analytics to inform decision-making and improve library services [18]. Big data analytics empowers librarians to harness the power of vast data sets, extracting valuable insights through collection, analysis, and interpretation, and uncovering hidden patterns and trends to inform decision-making and enhance library services. This data can be used to better understand user needs, preferences, and behaviours, and to develop effective library programs and services. Big data analytics serves as a potent tool for librarians, enabling them to comprehend the requirements of library users and enhance library services; by leveraging data in this way, librarians can more accurately and effectively allocate resources, develop more effective services, and respond to user needs. This technology can be used to develop evidence-based insights related to library services, user behaviour, resources, and more. Adopting BDA has become an increasingly relevant and important area of focus for librarians. In recent years, librarians have increasingly been asked to provide data-driven decision support in the form of analytics and data visualizations, and it is important to understand their perceptions, competency, and usage of big data analytics [19]. According to [20], university libraries face a challenge in the lack of practical experience and successful cases that could serve as references, leading to an overall lower application level. Even though many colleges and universities have adopted some information service methods, many of them have only done so based on structured data and have failed to explore the broader context of data information.

C. LIBRARIANS AND BIG DATA

Big data has changed the way librarians organize and access information [21], the ability to collect, store, and analyze data has become an essential part of the librarian's job [22]. Librarians need to be able to sort through and analyze large datasets, and to understand how to use them to identify patterns, trends, and relationships. [23] emphasized that they must also be able to create new tools and techniques to manage and analyze data. To do this, librarians must have a deep understanding of data structures, algorithms, and programming, and be able to use their data to inform decision-making. Librarians must also possess the necessary technical skills to work with big data, including a working knowledge of database management systems like SQL, Skills in data mining, data visualization, and data analysis, a fundamental understanding of computer programming, and familiarity with the latest software and tools used to process and analyze big data [24].

In addition, they should possess the organizational skills needed to effectively manage big data which includes the ability to develop and implement strategies for organizing, storing, and securing the data, as well as the ability to manage large datasets and guarantee that the data is precise and current [25]. Librarians must have the communication skills necessary to effectively communicate with other stakeholders, ability to explain the data in terms that are easily understood by laypeople, as well as the ability to work with other stakeholders to develop strategies for managing the data. Librarians should be informed of ethical implications in big data use and be able to ensure that the data is used responsibly [26].

D. THEORETICAL FRAMEWORK

Big Data Analytics (BDA) represents an advanced technological approach that enables the extraction of meaningful patterns, trends, and relationships from extremely large datasets. In university libraries, BDA offers the potential to revolutionize decision-making processes by providing data-driven insights into user behavior, resource usage, system optimization, and strategic planning. The tools employed in BDA, such as Hadoop, Spark, Tableau, R, and Python support the real-time and predictive analysis necessary for effective library management. To properly frame the understanding and adoption of BDA in Nigerian academic libraries, this study draws on three key theoretical models: the Unified Theory of Acceptance and Use of Technology (UTAUT), the Information Seeking and Use (ISU) Model, and the Innovation Diffusion Theory (IDT). Each framework contributes distinct

yet complementary perspectives that collectively inform the research design, analysis, and interpretation of findings.

- a) **Unified Theory of Acceptance and Use of Technology (UTAUT):** The UTAUT model, developed by [27], explains user acceptance and usage behavior of technology through four major constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. In this context, performance expectancy refers to the degree to which librarians believe BDA will enhance their job performance; effort expectancy relates to the perceived ease of use; social influence considers the effect of colleagues and professional culture; and facilitating conditions involve the availability of infrastructure and institutional support. This framework is especially useful in understanding the behavioral patterns of librarians in Nigerian university libraries, where technology adoption is influenced not just by personal beliefs but also by institutional readiness and peer influence. Studies such as [28] support the applicability of UTAUT in explaining the technology adoption behavior of Nigerian librarians.
- b) **Information Seeking and Use (ISU) Model:** Developed by [29], the ISU model describes how individuals interact with information systems based on cognitive, affective, and behavioral stages. These include stages such as initiation, selection, exploration, formulation, collection, and presentation. In the case of BDA, librarians move through these stages as they become aware of data analytics tools, explore their applications, and incorporate them into professional practice. The ISU model is essential for understanding how librarians transition from passive users of information to active seekers and users of data-driven insights. It also helps contextualize the anxiety, uncertainty, and satisfaction associated with learning and applying new analytical technologies. This understanding informs recommendations for training and capacity building.
- c) **Innovation Diffusion Theory (IDT):** [30] outlines a five-stage process in which innovations are adopted: knowledge, persuasion, decision, implementation, and confirmation. These stages reflect how new ideas—such as BDA—are communicated and embraced within a social system like the library. Rogers also identifies key factors that affect adoption, including relative advantage, compatibility, complexity, trialability, and observability. Within the academic library context, IDT explains why some institutions quickly embrace BDA while others lag behind. The theory is particularly relevant to understanding disparities across federal, state, and private universities in Nigeria, where differences in funding, policy support, and institutional culture shape innovation uptake.

By integrating UTAUT, ISU, and IDT, this study develops a holistic understanding of the factors influencing BDA adoption among librarians. UTAUT provides insights into individual and institutional determinants of technology use, ISU sheds light on librarians' information behavior, and IDT explains the broader innovation diffusion process. Together, these frameworks help to contextualize the variables examined in this research: awareness, perception, competency, and usage. This integrated approach also enables the study to align its empirical focus with established theoretical foundations, thereby enhancing the validity and relevance of its findings. It ensures that the adoption of BDA is not viewed merely as a technical process but as a dynamic, human-centered, and context-specific phenomenon.

III. MATERIALS AND METHODS

A. SURVEY DESIGN

A structured questionnaire titled “Adoption of Big Data Analytics Questionnaire (ABDAQ)” was developed to collect data from librarians. The instrument comprised 25 items grouped into four key sections: awareness, perception, competency, and usage of BDA tools. Responses were measured using a 5-point Likert scale ranging from “Strongly Disagree” (1) to “Strongly Agree” (5). The questionnaire was validated through expert review and pilot testing to ensure clarity and relevance.

B. DATA COLLECTION

The survey was administered to librarians in three selected universities in Osun State: one federal, one state, and one private institution. A total of 36 librarians participated in the survey. Questionnaires were distributed both physically and electronically to ensure broad participation and timely response. Additionally, semi-structured interviews were conducted with chief librarians from each of the three institutions to provide qualitative insight.

C. DATA ANALYSIS

Quantitative data collected from the questionnaire were analyzed using descriptive statistics, including frequencies, percentages, and mean scores. Statistical analysis was conducted using SPSS software (version 25). Qualitative data from interviews were transcribed and thematically analyzed to identify emerging patterns and narratives.

D. RESEARCH QUESTIONS

The following research questions were used to evaluate the objective of the research:

- What is the level of awareness of Big Data Analytics tools among librarians in Osun State?
- What are the perceptions of librarians regarding the usefulness of Big Data Analytics in academic libraries?
- How competent are librarians in the use of Big Data Analytics tools?
- To what extent are Big Data Analytics tools being used in university libraries in Osun State?

IV. RESULTS AND DISCUSSION

The results of the study are presented in accordance with the four major variables that guided the research: awareness, perception, competency, and usage of Big Data Analytics (BDA) tools among university librarians in Osun State. This section highlights both the quantitative data collected from the structured questionnaire and qualitative insights drawn from interviews with selected chief librarians. The findings are organized thematically to provide a comprehensive understanding of the state of BDA adoption within the selected institution.

- Awareness:** The analysis revealed that 17% of respondents had very high awareness of BDA, 61% had high awareness, while 22% demonstrated low awareness as shown in Figure 1. Respondents noted that their awareness came from webinars, academic conferences, online tutorials, and peer interactions. Commonly mentioned tools included Microsoft Power BI, Tableau, and Turnitin.

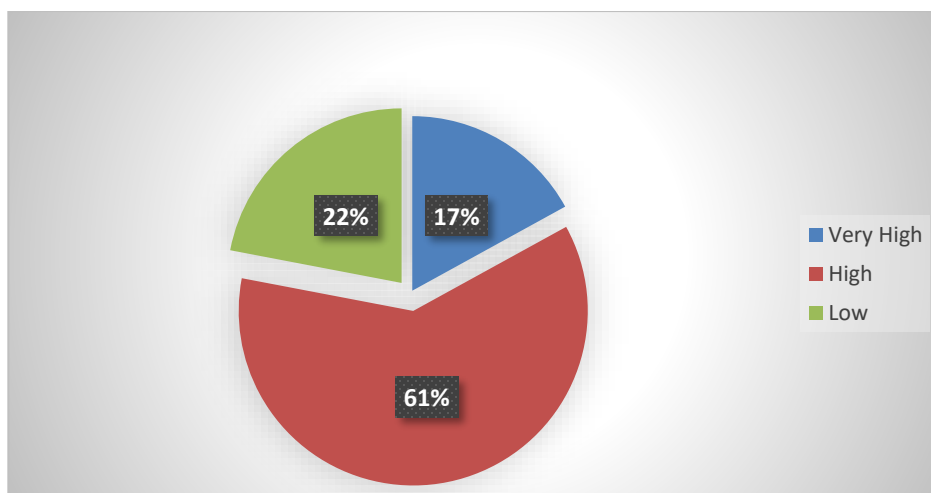


Figure 1: Librarians Level of Awareness of BDA

- Perception:** The majority (76%) of respondents had a positive perception of BDA as shown in Figure 2. They agreed that BDA enhances library services, facilitates resource planning, and improves user engagement. However, 24% expressed concerns related to data privacy, ethical issues, and institutional readiness. Some librarians feared that increased reliance on analytics could marginalize traditional professional roles.

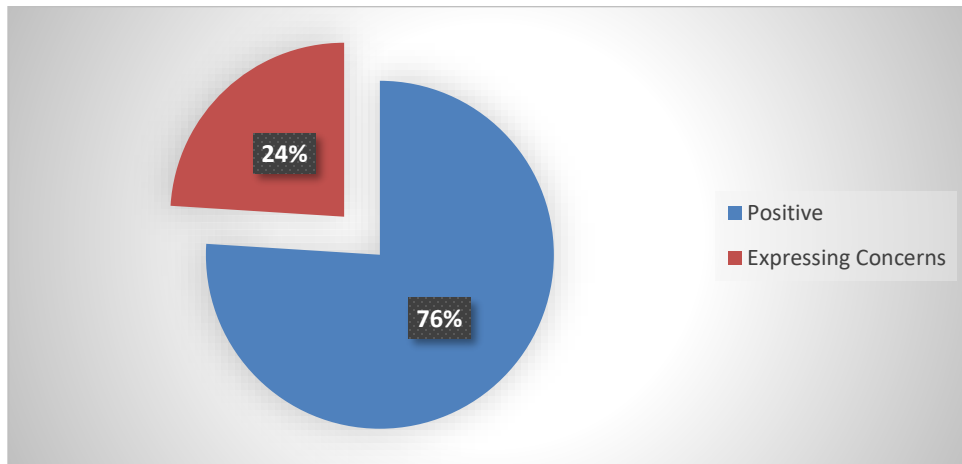


Figure 2: Librarians Perception of BDA

c) **Competency:** While 14% of respondents rated their BDA competency as very high, 64% indicated high competency, and 22% reported low competency as shown in Figure 3. Librarians with ICT backgrounds or recent postgraduate training showed better technical skills. Competency areas included data collection, basic analysis, and report generation. Areas of weakness included advanced statistical analysis, coding in R/Python, and dashboard creation.

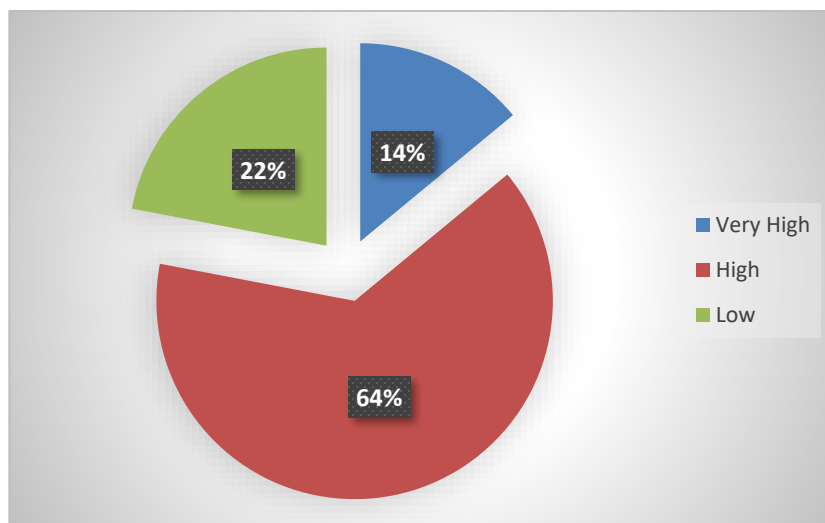


Figure 3: Librarians Competency in Performing BDA

d) **Usage:** Only 8% of respondents indicated a very high level of BDA usage in their institutions as shown in Figure 4. The majority (81%) reported moderate use, while 11% had low or negligible use. Federal universities reported the highest BDA application, often in performance reporting and e-resource management. Usage was hindered by lack of tools, inadequate training, and poor ICT infrastructure.

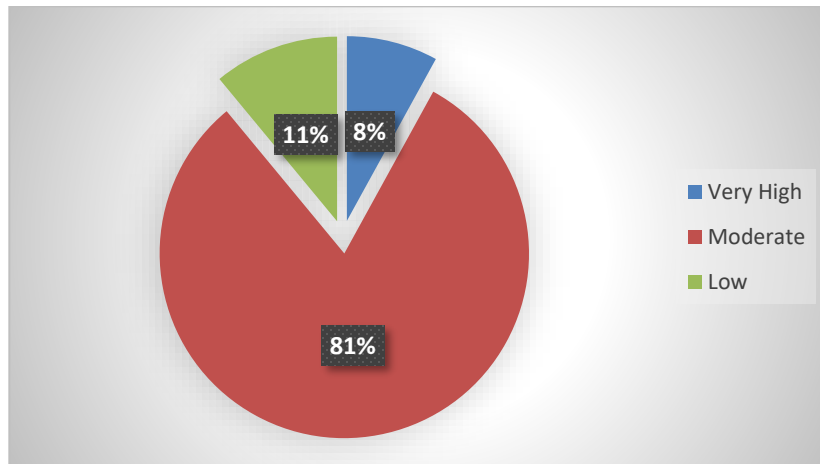


Figure 4: Librarians Level of Use of BDA

The results suggest that university librarians in Osun State have a generally favorable disposition toward BDA. Their awareness and perceptions reflect a readiness to explore data-driven practices. However, actual usage remains limited, highlighting a significant implementation gap. This pattern echoes the findings of [31], who reported similar trends among academic librarians in Pakistan. The study confirms that awareness and perception do not automatically translate into adoption and utilization.

Consistent with the UTAUT model, facilitating conditions such as availability of resources, institutional support, and access to training—play a pivotal role in determining whether librarians adopt BDA. Similarly, the ISU model's emphasis on individual skill levels and experience is relevant in explaining competency disparities observed in this study.

Barriers identified include limited funding, unreliable internet connectivity, lack of strategic vision, and resistance to change. As observed by [32], infrastructural deficits and administrative bottlenecks remain major obstacles in the Nigerian academic library landscape.

The qualitative findings underscore a need for capacity building and leadership advocacy. Respondents suggested that institutional policies should mandate the use of data analytics for strategic planning and performance assessment. Librarians emphasized the importance of peer learning, mentorship, and exposure to international best practices.

The study has several practical implications for library development in Nigeria:

- Professional Development:** There is a critical need for targeted training programs that build technical competencies in BDA tools. These should include workshops on Python, R, and data visualization.
- Policy Formulation:** Institutional policies should promote the integration of BDA into library operations, with clear guidelines on data governance, privacy, and ethics.
- Infrastructure Enhancement:** Universities must invest in high-speed internet, modern hardware, and licensed analytical software to support BDA activities.
- Collaboration:** Partnerships between libraries, ICT departments, and LIS schools can facilitate knowledge exchange and resource sharing.
- Curriculum Review:** Library and Information Science (LIS) programs should revise their curricula to include BDA as a core module, combining theory with hands-on experience.

V. CONCLUSION

This study concludes that while librarians in Osun State have high levels of awareness and favorable perceptions of BDA, actual usage remains low due to institutional, infrastructural, and technical limitations. Competency levels are generally moderate, with gaps in advanced data analysis and interpretation. To promote the adoption of BDA in Nigerian academic libraries, stakeholders must invest in infrastructure, capacity building, and policy development. The future of librarianship in Nigeria lies in its ability to harness the power of data for improved decision-making, service innovation, and academic excellence. It is therefore recommended that:

- a) librarians should periodically undergo training to stay updated and improve their skills on how best to utilize BDA.
- b) there is need for university libraries to collaborate with technology experts to gain more proficiency in the use of BDA tools.
- c) there is still need to attend seminar and conference to update their knowledge about emerging issues in BDA.

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