

Relevance of Big Data Analytics in Nigerian Academic Libraries: University of Ilorin Library Experience

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Abstract

This paper reviewed the concept of big data with reference to the University of Ilorin, North-Central, Nigeria. In the study that directed this paper, a descriptive design was employed and thematic analysis was done on the information obtained through key informant interviews. The population of this study consisted of the two systems librarians who work in the electronic library (e-library) unit of the university library. The characteristics of big data, based on the V characteristics, were examined, as well as the various types of data sets found in academic libraries. The findings of the study revealed that while big data sets exist in libraries in Nigeria, none of the big data software was available in the library studied. The findings also revealed the various methods used by the University of Ilorin Library in generating big data. Also, the main challenges confronting the management of big data in the University of Ilorin Library include inadequate funding, insufficient infrastructure, and inadequate software tools for managing big data. The need to re-skill library practitioners in this new technology, as a means of surmounting challenges in service delivery in university libraries, was recommended.

Keywords: big data; big data analytics; Nigerian academic libraries; data sets; data digitisation.

Introduction

The 21st century is known as the information age. Data play a vital role in the socio-economic development of the individual and in society at large. Big data are concerned with large digital data which cannot be managed using normal computer storage systems such as hard disc drives. The term “big data” was coined to explain the explosive increase of data and was mainly used to describe these enormous data sets. Big data analytics can be defined as the often times very complex process of examining large and varied data sets (or big data) to uncover information such as hidden patterns, unknown correlations, market trends and customer preferences that can help organisations make informed decisions or very educated projections about their business (Hariri, Fredericks, and Bowers 2019; Ren et al. 2019; Sahal, Breslin, and Ali 2020; Zhan and Tan 2020).

Favaretto et al. (2020) define big data as a term commonly used to describe a range of different concepts: from the collection and aggregation of vast amounts of data, to a plethora of advanced digital techniques designed to reveal patterns related to human behaviour. Considering the characteristics of big data, based on the definitions of various parameters described by Favaretto et al. (2020) and Hussein (2020b) as Vs, (see below), one may ask, “are data collected in academic libraries, especially in developing countries like Nigeria where some data are still kept in analogue, part of big data?” In answering this, Bieraugel (2017) emphasises that the size of the data depends on the institution. Therefore, university libraries’ data can fit into big data, especially in developing countries like Nigeria. Such data include the number of users that visited the library, collection development list, inventory of answered and unanswered reference questions, and circulation data.

On the other hand, libraries in Nigeria that have repositories are contributing to big data since institutional repository data are in digital form and freely accessible. Apart from this, library users also provide big data content by leveraging on Information and Communications Technology (ICT) and by extension, social media tools such as Twitter, text messages, Facebook, blogs, among others, also yield substantial volumes of data, especially when the population in these institutions is considered.

Looking at the attributes of big data, as it concerns the library, in terms of volume, big data volumes are relative and vary and can be affected by such factors as time and type of data. Hussein (2020a) agrees that velocity characteristics of big data could be found in the library in terms of files on the servers. Accumulated data sets in the library (over the years) are big data. These data sets, when analysed, should give valuable insight into the decision making of the library. This could be in terms of who is using the library, how are they using it and what resources are mostly used. In other words, the analysis of library big data can be of assistance to the library in developing and maintaining effective and efficient library services. It behoves scholars in Library and Information Science (LIS) to understand these newly evolving trends and leverage on ICT for placing libraries at a vantage position.

Driven by specialised analytics systems and software, as well as high-powered computing systems, big data analytics offers various business benefits to those who make use of it. These opportunities include new sources of revenue generation, more effective marketing, better customer service, improved operational efficiency and competitive advantages over rivals. The present challenge is that Nigeria has grabbed the short end of the stick, as current national challenges of underdevelopment have resulted in a country that has to seek alternative sources of power supply and this is a drag on all forms of ICT-driven activities, such as big data that require a steady supply of power to ensure constant content generation.

The University of Ilorin is one of the second-generation Nigerian federal universities established in 1975, with a student population of over 50 000, and 3 000 staff and faculty members. These patrons make use of library facilities, generating substantial big data content in the process. The data to be generated are a veritable mine of jumbled information containing varieties of staff, faculty members' and students' patterns and data that can be harnessed and mined. The mining of this data is to bring out useful information for future use, if the concerned professionals are well-informed of its relevance and how to use it optimally. Literature has shown that in developing nations, few studies have been carried out on big data research, particularly in the context of Nigerian libraries. Therefore, the need to fill the identified gap necessitated the present study. It is on this note that this study examined the role of big data analytics in Nigerian libraries.

Objectives of the Study

The study examined the relevance of big data analytics in a Nigerian academic library, with reference to the University of Ilorin in North-Central, Nigeria.

Specifically, the study sought to:

1. Identify the types of data sets available at the University of Ilorin Library.
2. Determine the methods used for generating big data at the University of Ilorin Library.
3. Identify the software tools used in managing the University of Ilorin Library.
4. Determine the challenges of big data on service delivery at the University of Ilorin Library.

Research Questions

1. What are the types of data sets available at the University of Ilorin Library?
2. What are the methods used in generating big data at the University of Ilorin Library?
3. What are the software tools used in managing big data at the University of Ilorin Library?
4. What are the challenges of big data on service delivery at the University of Ilorin Library?

Literature Review

Ball (2019) maintains that in the most simplistic terms, big data can be defined as the storage, management and evaluation of vast quantities of data, which might be available in a wide variety of forms, such as structured and/or unstructured data, and in diverse file formats. Bresciani et al. (2021b) opine that big data are concerned with large-volume, complex, growing data sets from multiple, autonomous sources. Big data are a generic term used to describe data sets that are so large or complex, that they render conventional data processing applications inadequate. Big data are high volume, high velocity, and/or a wide variety of information assets that constantly require new forms of processing to enable enhanced decision making, insight discovery and process optimisation (Bresciani et al. 2021a; Yakubu, Camble, and Maryam 2021). Challenges of big data analytics include the analysis, collection, capture, arrangement, search, sharing, storage, transfer, visualisation, and information privacy issues. The term “big data analytics” can be simply explained as the use of predictive analytics or other certain advanced methods to extract value from data, and seldom to a particular size of data set.

According to Favaretto et al. (2020) and Hussein (2020b), big data can be described by using the following parameters (called the Vs):

- **Volume:** The quantity of generated data is important in this context. The size of the data determines the value and potential of the data under consideration, and whether it can be considered big data or not. The term “big data” itself infers size.
- **Variety:** This is the category of big data and an essential fact that data analysts must know. This helps people who analyse the data and is associated with effectively using the data to their advantage and thus upholding the importance of big data.
- **Velocity:** Velocity in this context refers to the speed with which data are generated and processed to meet the demands and challenges that lie in the path of growth and development.
- **Variability:** This refers to inconsistency that the data can show at times, which hampers the process of handling and managing the data effectively.
- **Veracity:** Sometimes, the quality of data that are captured can vary greatly. An accurate analysis of this data is a factor of the veracity of source data.
- **Visualisation:** This is how data are made easily understandable.
- **Value:** In this context, value is how big data can be harnessed or used in a way to make it have monetary or financial gain for the benefit of the organisation, either by operational efficiency or knowledge creation.

Liu et al. (2020) maintain that the quality of some types of data—to be used in solving operational challenges and increasing the effectiveness of an organisation—is of significant importance regarding its value to the focal firm. Though, while proprietary data may in and of itself provide value for consumption or to be sold, the interaction

with analytical tools and capabilities allows data to become increasingly useful and valuable.

There are different types of data sets available in libraries. Adam and Kaur (2021) mention library renewal and registration data, circulation and collection development data, institutional repositories and grant proposal data from faculties. Okafor et al. (2018) opine that library registration and renewal data can be analysed to provide predictive information relating to enrolment trends within and across the academy, while the collection development data can be analysed to aid the library in making decisions relating to weeding, the introduction of new services and collection development. Libraries employ various methods in acquiring big data. Okafor et al. (2018) also maintain that big data can be acquired in libraries through log files, sensors, network, zero-copy, mobile and eye-tracking equipment. Accepting data from all fields is common to institutional repositories in universities in Nigeria.

Other data sets that can be found in academic libraries include library catalogue transactions, which are an important source of big data in libraries (Hamad, Fakuri, and Jabbar 2020; Pradhan and Hiray 2021). Also, data from social networks give insight into group activities. Log files are commonly used to collect data by automatically recording files through a data source system. Data captured through sensors are known as sensory data. There are various categories of sensory data. These include sound wave, vibration, voice, chemical, automobile, current, pressure, weather and temperature. Network data capture is yet another method of capturing big data. Mobile equipment such as the smartphone, iPad, camera, positioning systems, microphones and tablets can be used in generating big data of various types. Eye-tracking is another means of capturing data (Gaurav et al. 2018).

University libraries generate large volumes of data stored in hard copy (paper document) form. However, this paper documentation may also be put in a digitised form, thus being digitised. Big data, when analysed, can assist library management in making informed decisions and facilitating the research process (Tella 2021; Tella and Kadri 2021). Wang et al. (2020) emphasise that the rise of big data makes data collection tasks easier and faster. Besides, it enables libraries to move beyond simple counting to compiling statistical measures and to engage in complex data analysis like learning analytics and research performance analysis. Big data analytics affects service delivery in university libraries by providing value-added information services and access to wide digital information (Tella 2021). It could be argued that the added value of big data lies in the identification of useful data, as well as analysing it. Analysing this data makes it become useful information that will facilitate service delivery in different sections of the library, such as circulation, cataloguing, special collections and reference. This shows that big data are useful in universities, especially in libraries where it could be utilised in all areas of library services.

The collection and application of big data in libraries are faced with different challenges. McCoach et al. (2020) emphasise that the different forms in which big data exist, pose a challenge to data management. Li et al. (2019) note that rapid data growth, transfer speed, diverse data and security are some of the challenges encountered in collecting and analysing big data. Alazzawe, Pal, and Kant (2020) maintain that fast growth of volume, variety, velocity, value, complexity, management, security, data inconsistency and completeness, scalability, timeliness and lack of developed policy for authors' privacy, leakage of data, a large amount of data in the cloud platform, all constitute challenges of collecting and applying big data in libraries.

One of the greatest stumbling blocks or limitations in the implementation of big data, is the high cost of infrastructure (Sivarajah et al. 2017). These authors observe that hardware equipment is not affordable, even with the introduction of cloud computing technology. They also maintain that the lack of an adequate workforce affects big data analytics negatively. Others challenges are techniques in capturing, integrating, transforming, selecting the right modelling for analysis and providing results of data (Gupta, Modgil, and Gunasekaran 2020; Kumar and Babu 2019).

Inadequate funding is another challenge encountered by libraries in managing and analysing big data. Pramanik et al. (2021) note that inadequate or insufficient funding and lack of funding opportunities hinder the management of big data. Bogoro (2021) notes that the major source of funds for academic institutions in Nigeria is through government grants. From these yearly grants, a fraction of the total recurrent grant of each academic institution is allocated to university library operations. From the above, it is evident that the library votes cannot cater for resources needed for managing and analysing big data.

Methodology

A descriptive design was employed for the study. A qualitative approach was adopted. The instrument of data collection was a key informant interview, which was carried out to explore the relevance of big data analytics globally, and based on that to draw vital inferences for Nigerian Academic Libraries. The interviews were conducted in person on June 9, 2021 with two interviewees, who comprise the systems librarians, whose schedule of duties is ICT driven in the electronic library unit of the university library. The conversation was electronically recorded and interviewee responses were saved and analysed based on thematic analysis.

Results and Findings

Research Question 1: What are the types of data sets available at the University of Ilorin Library?

Findings from this study showed that there are many big data sets available in university libraries in Nigeria. These data sets exist in both digital and analogue form, emanating from library membership registration, data sets in the form of research data from faculty,

institutional repository, library book renewals, circulation clearance data, collection development data and library catalogue transactions, some of which are available at the University of Ilorin. Others include reference and serials use data, special collections, door counts and clock-in data. These are a result of standard routine activities that take place in all libraries. Also, patron data from staff and students, both postgraduate and undergraduate, are available on the University of Ilorin portal. Library registration and renewal data can be analysed to provide predictive information relating to enrolment trends within and across the academy, while the collection development data can be analysed to aid the library in making decisions relating to weeding, the introduction of new services and collection development. Many libraries have also developed institutional repositories to make research output from their universities visible to the world (Chukwueke, Nnadozie, and Okafor. 2020). This is not limited to universities in Nigeria, but universities globally, like the University of Ilorin, have a store of well-catalogued resources in its repository. Tochukwu and Mary (2020) note that through websites and servers, user activities on the internet are captured and stored in log files.

Research Question 2: What are the methods used in generating big data in the University of Ilorin Library?

Findings from the interviewees revealed that various methods are employed in generating big data in the University of Ilorin Library. These include data harvested from web servers, websites, and social media generated data. Similarly, data generated as a result of routine standard daily operations of the library, which include but are not limited to, are library membership registration and institutional repository data sets in the form of research data from faculty, library book renewals, circulation clearance data, collection development data and library catalogue transactions, among others. Similarly, during the Covid-19 pandemic and the resulting lockdown, the interviewees revealed that the university had to lean heavily on ICT as a means of maintaining contact with patrons and clientele. Three different Telegram (an interactive online messaging platform) accounts were opened for communication with undergraduates, postgraduate students, faculty and staff members, resulting in an unprecedented line of communication hitherto previously unimaginable. These channels still remain open, even after the end of the lockdown.

Research Question 3: What are the software tools used in managing big data in the University of Ilorin Library?

The findings of the study also revealed that big data software tools for analysing big data are not available at the university studied. Big data software tools are useful for analysing and managing large data generated in libraries. Arfat et al. (2020) note that there are several software tools available for analysing big data. The interviewees were fully aware of the existence of the software tools and the concept of big data itself. However, both stated that the non-availability of software for analysis of big data implied that the big data available are not analysed and therefore, not available for decision making. The interviewees were aware that big data analysis would help the

library management to make informed decisions on how to better manage the library. This is consistent with the view of Rani and Rao (2015) who state that big data technologies make it easier to work with large data sets, link different data sets, detect patterns in real-time, predict the outcome, undertake dynamic risk scoring and test a variety of hypotheses.

Research Question 4: What are the challenges hindering big data service delivery in the University of Ilorin Library?

Evidence from the university studied indicated that there are numerous challenges that could hinder the collection and usage of big data in the University of Ilorin library. Such challenges as inadequate funding, inadequate infrastructure, lack of skilled personnel to handle big data and inadequate awareness on the part of users were recognised. This is consistent with the findings of Sivarajah et al. (2017), who note that the lack of infrastructure in the area of hardware equipment, and an inadequate workforce, constitute problems in applying big data techniques in libraries. This agrees with the views of Bogoro (2021) and Chen et al. (2015) on the difficulties posed by insufficient funding in the management of big data in university libraries. Furthermore, the fast growth rate of big data creates the problem of management; the heterogeneous nature of data sets that require different data management technologies and the difficulty in handling unstructured data. Rapid data growth, transfer speed, diverse data and security are some of the challenges encountered in the collecting and analysing of big data. Also, Cave et al. (2020) and Zhu (2020) agree that the heterogeneous nature of the data sets results in the complexity of the data and difficulty in analysing big data.

Other challenges in harnessing, using and harvesting big data obtained from social media and indeed ICT sources, include the following. Majorly, as a new concept, big data are strange, new and unconventional. Infrastructural challenges such as acquiring the necessary hardware and software tools are expensive. Data and broadband charges are also relatively high within the West African sub-continent, as opposed to costs in the more developed countries. Also, the interviewees maintained that there is a great discrepancy between the amount spent on the acquisition of various e-resources and online data bases, and the actual usage of these materials. They stated that there is a need for increased awareness by all patrons to actively use the resources that the university administration had spent millions of naira to acquire.

Implications of the Study

Having a robust big data utilisation programme in place is of immense benefit in academic libraries, as it will lead to increased efficiency of service delivery in the library. There will be sufficient skills in this state-of-the-art technology, thus resulting in additional relevance to the discipline of LIS in the country. Imbibing big data analytics may result in Nigerian universities competing effectively with their international counterparts. Another positive implication is that Nigerian data bases can be securely managed without the need for external interference, thereby protecting the

privacy of the Nigerian populace. This is because there will be no need to outsource any part of the information storage lifecycle.

Recommendations

Stemming from the study, the following recommendations are made:

- Adequate tools should be provided for the organisation and management of big data in libraries. This will lead to the library being better equipped to handle patron requests, leading to an overall enhancement in service delivery and clientele satisfaction. Improving the usage of big data in university libraries in Nigeria can be done by the training of staff through workshops, conferences and seminars to handle big data. Funding and provision of infrastructure and tools such as hardware and software, a steady power supply, and improved internet bandwidth, are of immense importance. If cash inflow from government sources and agencies is insufficient, there may be a need for libraries to devise means of raising funds.
- Library staff should seek ways of upgrading their knowledge to remain current with trends and developments in their field. There is a need to re-skill librarians and allied staff in academic libraries in Nigeria for improved service delivery through workshops, conferences, short courses and collaboration with research institutions, both within and outside of Nigeria. This will result in a more efficient workforce, equipped to render the best services to their clientele.
- The creation of an increased level of awareness for big data among library stakeholders in Nigeria is of utmost importance. This is corroborated by research that shows that the amount of financial resources spent on the acquisition of electronic resources and subscription to online data bases, is not comparable to the actual utilisation of these resources, thus leading to a waste of expended funds. Patrons need to be aware of what each library has and should use such resources to enhance service delivery. Awareness will lead to more use of the library, one of the cardinal laws as postulated by foremost librarian, Dr S.R. Ranganathan.
- There is a need to employ experts in systems librarianship and data analysis to work in the library, to aid in better usage and interpretation of data for better decision making. This, on its own merit, becomes an additional means of employment for LIS graduates who have acquired sufficient training in this area. This will result in a reduction in the unemployment rate, which is of greater advantage to all.
- To ensure that the usage of big data is appropriately monitored to maximise its gains, librarians and libraries should be more involved in offering data advisory services to promote the proper use of data, and in educating data users on the implications of data abuse or breaches, considering a wide variety of ethical issues in ICT usage.

Conclusion

The adoption of big data is beneficial and allows efficiencies in terms of cost, productivity, and innovation. Data must be processed with advanced tools to reveal meaningful information. Librarians have always handled information organisation and management professionally. A librarian does not need to become a programmer; however, a librarian needs basic knowledge of the use of various software tools and how such tools can transform huge amounts of data. Big data have given librarians the opportunity of playing pivotal roles in the management of big data, as they have the skills, knowledge and service skillset to help all patrons and clientele, irrespective of their discipline. In recent years, the interest among libraries on the topic of big data has markedly increased. Obasola (2019) opines that until now, the number of projects and initiatives in which libraries and/or information specialists have been involved in this field, has been negligible.

Many challenges were identified in this study as militating against big data usage in university libraries in Nigeria. Among them are inadequate funding, lack of infrastructure and lack of skilled work-force. These problems notwithstanding, big data technology has come to stay and has much to offer in repositioning academic libraries for better service provision in Nigeria. Nevertheless, the case study presented here and the literature reviews carried out, clearly demonstrate the enormous potential that big data have for libraries. The application possibilities range from improving the libraries' services or creating completely new services to improve marketing measures; developing new data formats for library data for a more effective exchange; providing library data for data analysis for scientists; data standardisation; data modelling; library data visualisation; and studies in user behaviour, thereby rendering data analyses possible at all levels. Also, libraries do not have to restrict themselves to their own data only. They can also process and analyse external data sources. Limiting factors are the lack of qualified skilled staff, the frequent lack of infrastructure, technical challenges such as data formats and tools, data protection and funding problems.

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