

# Big Data Analytic Tools Usage among Academic Libraries in Tanzania

Jaffar Msafiri Ponera<sup>1</sup> and Valeria Kyumana<sup>2</sup>

<sup>1</sup>Librarian, Department of Knowledge Management, Moshi Co-operative University (MoCU), Tanzania

<sup>2</sup>Lecturer, Institute of Finance Management, Tanzania

E-mail: [jaffar.ponera@mocu.ac.tz](mailto:jaffar.ponera@mocu.ac.tz), [asumptavaleria@yahoo.com](mailto:asumptavaleria@yahoo.com)

(Received 14 December 2023, Revised 9 January 2024, Accepted 23 March 2024; Available online 30 March 2024)

**Abstract** - This study examines the implementation of Big Data analytics in Tanzanian University libraries. Employing a qualitative approach within the interpretive paradigm, the study conducted interviews to collect data from 12 library staff across various University libraries in Tanzania. The qualitative data collected was analyzed using Atlas.ti 7, focusing on emerging themes. The findings established that most University libraries in Tanzania utilize social networking sites for marketing their products and services. However, only a few academic libraries employ analytics tools such as Apache Hadoop, MongoDB, Apache Spark, Tableau, Zoho Analytics, Apache Storm, and others due to insufficient skills. The study concludes that library administrators could greatly benefit from integrating Big Data analytics into their daily operations. Recommendations include developing Big Data analytics policies to ensure proper handling of user data and offering training on the use of such analytic tools to librarians to equip them with necessary skills and techniques.

**Keywords:** University Libraries, Big Data Analytic Tools, Social Media Analytics, Tanzania

## I. INTRODUCTION

The introduction of Information and Communication Technology (ICT) has revolutionized human communication, moving away from conventional face-to-face interactions and towards a more sophisticated approach utilizing social media (Asuquo *et al.*, 2023). Kaplan & Haenlein (2016), defined social media as any application or technology that allows online users to communicate and collaborate, thereby creating a community that goes beyond an organization. Because social media platforms have grown in popularity, more institutions, including libraries, are installing them to stay in touch with present and future clients. The usage of such communication outlets in academic libraries became popular after 2005 (Rabat seta *et al.*, 2021). There is a widespread use of social networking sites in libraries worldwide because of their effectiveness in disseminating information to a wider audience. Libraries utilize social media to publicize events and photos, educate people about their many services and resources, highlight their collection, and help other libraries (Devan, 2020).

According to a 2018 report by the United States Public Libraries, 96% of libraries in the United States use social media for marketing (OCLC, 2018). Xin & Yingxi (2021) affirm that Weibo, WeChat, and DouYin are major social networks used by libraries in China to promote their

services. During the COVID-19 epidemic, the Bangladesh National Library continued to provide library services to its users who did not have physical access, with 52% promoting the availability of library services and products via social media platforms (Mabruri & Aisyah, 2022). The application of social networking sites has resulted in the production of enormous volumes of data, necessitating the use of Big Data analytics tools to enable library management to make timely and informed decisions (Ayodeji & Kumar, 2019). For example, about 80 million businesses and 750,000 non-profit organizations have active Facebook pages, making the platform a great platform for interaction (Kordzadeh & Young, 2020). Researchers and professionals in various fields are increasingly devising better ways of automatically collecting, aggregating, and analyzing this important data, one of which is the usage of social media analytics tools (Batinca & Treleaven, 2015). The process of gathering and evaluating data from social media platforms to assist decision-makers in addressing certain issues is regarded as social media analytics. It is one type of Big Data analytics and is used by social scientists, corporate managers, and medical experts, among others (Lee, 2017).

Data from university libraries can be included into Big Data, particularly in low-income countries. The number of patrons who used the library services, the number of responded and non-responded reference inquiries, and circulation. In their study that was conducted in Nigeria, Sani & Oseji (2022) recommended the use of analytic tools to enhance library services. According to a study conducted in Tanzania by Matto (2022), the increased reliance on ICTs, such as the application of social media platforms in undertaking activities in institution of higher learning ecosystems, has resulted in the creation of large volume of data, hence necessitating the use of analytic tools for better visualisation and informed decision-making. Various studies investigated the use of social networks sites in Tanzania, including those by (Kiritia & Mwantimwa, 2021; Mashindano, 2020; Masele & Rwehikiza, 2021; and Malekani & Benard, 2018). But there are inadequate investigations on the use of Big Data analytic tools among University libraries in Tanzania. It is against this assertion that the current study is being undertaken to uncover the existing knowledge gap.

### A. The Technology Organizational Environment Framework

The framework for the technological organization environment (TOE) was proposed by Tornatzky *et al.*, in (1990) to describe a set of elements that determine the adoption of innovation and technology. The three elements included in TOE framework are technology, organization and environment, which are considered to be the main determinants of adopting new technology (Alkhalil, 2020). The framework has been applied to determine technology adoption in a variety of domains, including e-commerce, business resource planning, green IT start-ups, cloud computing, and small and medium-sized businesses (Ahmed, 2020). Higher education institutions, where academic libraries are located, are not left out because they, too, operate in a competitive environment; thus, the adoption of technology in their libraries is critical for them to remain competitive. Because the TOE framework combines internal and external factors that other theories, like the diffusion of innovation DOI (theory), leave out, it is frequently used in studies looking at how new innovations or technologies are adopted in businesses and other types of organizations (Maroufkhani *et al.*, 2020). All technologies that are relevant to organizations and are currently in use are included in the technological aspect. The resources and features of the organization, including its size, quantity of spare resources, internal communication channels, and employee relationships, are all part of the organizational context. Aspects of the environmental setting include the regulatory environment, organizational structure, and the presence or lack of technological service providers (Baker, 2012). Consequently, the framework is thought to be useful in examining how academic libraries in Tanzania use Big Data analytics tools in order to support library managers in making informed decisions for the purpose of improving library services for successful learning, research, and community engagement initiatives.

## II. LITERATURE REVIEW

Faisal (2019) claims that many metrics from social media, such as audience, activity, engagement, referral, and return on investment, can be monitored with built-in analytics tools found on blogs and social media sites like Facebook and Twitter. Ahmad *et al.*, (2019) assert that to thrive in the information age, academic libraries must embrace emerging trends like Big Data analytics. Therefore, academic librarians must be proficient in the use of a variety of data analytic tools. Singh (2017) affirm that many academic libraries have switched from traditional to digital formats as a result of the fact that almost everything related to Big Data is now available digitally.

Because of the rise of Big Data, librarians now need to know how to systematize, organize, and develop taxonomies to increase the visibility, usability, and accessibility of massive datasets by introducing new information visualization tools and systemizing retrieval methods (Sengupta, 2016; Garoufallou & Gaitanou, 2015).

Sonawene (2018) avers that with the use of cutting-edge tools and technology like analytics software, librarians may collect and analyze more internet data to add value to their services. Kamupunga & Chunting (2019) emphasized the fact that Big Data analytics-using libraries produce more and are more productive than those without, and that novel knowledge is produced as a result of using these technologies. Academic libraries can enhance their services and educational quality by implementing Big Data analytics for researchers and other users (Al-Barashdi & Al-Karousi, 2018). According to Panda (2021) academic libraries can use Big Data analytics to online or physically fulfill the changing needs of their patrons. It can assist libraries in making better decisions about usage tracking, space management, and demand-driven collection growth. Li *et al.*, (2021) claim that academic libraries can now completely comprehend and engage with users because of the Big Data era, which enables them to meet user needs better and consistently provide more user resources to their collections.

Blummer and Kenton (2019) put forward that data analytics gives librarians the chance to extend their services in order to help faculty and students research. Big Data analytics is another tool that librarians can use to assess and enhance library services. According to Tella & Kadri (2019), academic library management may make critical decisions about operations by using Big Data analytic tools that can reliably forecast outcomes. This approach also helps to minimize risks and maximize operational efficiencies. According to a study done in Pakistan by Islam *et al.*, (2020), Big Data analytics played a crucial role in the infrastructure, services, and resource improvements that improved academic libraries' performance. A study conducted in Nigeria by Tella (2019) showed that such a technology aids government owned libraries in managing their data, enables users to obtain information from the library rapidly, responds swiftly to user information requests, and supports public libraries' decision-making, is something that librarians take into consideration.

According to a study by Zhan & Wideń' (2018), the lack of experience that library managers and directors had with Big Data analytic tools was attributed to their incapacity to manage vast amounts of data quickly and the infrequent generation of value from that data. Kamupunga & Chunting (2019) assert that special skills are required for libraries to use Big Data tools and apply its techniques. Two factors were mentioned by Al-Barashdi & Al-Karousi (2018) that had an impact on the use of analytic tools in University libraries: first, the system's storage and processing needs are rather overwhelming due to the massive volume, selection, and speed of the knowledge involved; second, the complex analytics techniques and algorithms make data analytics a computationally intensive task. According to Anna & Mannan (2020), a shortage of expertise among staff members has resulted in a restricted application of analytic tools in higher education libraries to support innovation and services. According to a study by Hamad *et al.*, (2020), staff



*Participant 6 elucidated that:*

“We normally use social media to reach our potential customers and to assess our library services and gaps for better improvements.”

The study established that librarians have understanding of the uses of social networking platforms in various library activities; therefore, they have been using such platforms to reach their potential customers to update them on new arrivals, inform them of various training activities expected to be undertaken, and for training purposes. The use of social media, therefore, has accelerated the creation of a vast amount of online data.

*Participant 7 mentioned that:*

“I have never heard of the use of Big Data analytics before; we only use social media for marketing our library services, but such data is not analyzed.”

*Participant 8 indicated that:*

“Big Data is not a new concept to me, but this task is usually done by ICT staff and not librarians.”

*Participant 9 had this to say:*

Since we librarians have never received training on the use of Big Data, we are incapable of handling Big Data analytics tasks. This kind of work is being handled by the marketing department at our university.”

*Participant 10 highlighted that:*

“We have social media platforms, but they are not frequently used for marketing purposes; therefore, we are also not doing Big Data analytics at our library.”

*Participant 11 narrated that:*

“Yes, I know of Big Data analytics, and we have been using social media for various activities at our library. Such platforms have very useful data because users normally comment on serious issues, but the only problem is that such data is not analyzed to gain more insights.”

*Participant 12 stated that:*

“I am not sure if Big Data analytics are being done by our library, although I am aware that social media sites are used for various library purposes.”

*Participant 13 claimed that:*

“We usually use social media such as Instagram and Facebook, and data obtained from such platforms is analyzed using a Big Data analytics tool by our experts.”

## VI. DISCUSSION

The results of the study demonstrated that most of Tanzania's University libraries market their services and goods on social media. Facebook and Instagram were the most used social networking platforms because they were mentioned by the majority of the interview participants. Masele & Rwehikiza (2021) affirm that to gain competitive

advantages, higher education institutions should use social media to collect customers' needs in order to improve products and services that will meet customers' expectations. When they were probed to explain how library managers get insights from the data that is generated from social media platforms, most librarians were not able to explain because they were not practicing Big Data analytics in their libraries. The study revealed that Big Data analytics tool such as Apache Hadoop, MongoDB, Apache Spark, Tableau, Zoho Analytics, Apache Storm is used by few academic libraries in Tanzania while other libraries they are not using social media at all in their activities. In most cases, the ICT staff is responsible for doing such analytics because most of the librarians lack competencies in using Big Data analytics tools and techniques. This has left most useful data from library users unused and denied library managers access to gain new insights for making informed decisions.

Tella (2021) affirms that in addition to creating rich data for the library, academic libraries are now using Big Data to make well-informed decisions. Big Data is currently being used for gathering and analyzing user attribute data, including likes and dislikes. Another study conducted in public libraries by Tella (2019) established that Big Data utilization facilitates efficient client service delivery, lowers costs because most libraries use it to serve funds, and allows users to obtain information quickly and with the least amount of stress. Thus, the use of Big Data analytics by librarians can enable academic libraries in Tanzania to provide better services, which may ultimately enable them to meet customers' expectations. Therefore, librarians should strive to acquire skills and knowledge on the use of Big Data analytics to enable library managers to gain insights from that data for informed decision-making. Sonawene (2018) avers that Big Data can be employed to plan the acquisition of libraries. The collection's category mix can be planned using Big Data technology while keeping financial and physical limitations in mind.

Although the use of Big Data offers various benefits to academic libraries in improving its services and products, the study revealed various challenges encountered by librarians in using Big Data analytic tools. Some of the challenges included lack of skills of using Big Data analytics tools and its techniques. The study conducted in Tanzania by Mwilongo & Kotoroi (2021) found that there is currently pressure on contemporary librarians to acquire a wide range of new competencies for them to remain valid. The finding of the study is in agreement with TOE framework which states that one among the important factor for adopting the usage of new technology is the skills that employees possess. Therefore, the application of Big Data analytics in Tanzania's academic libraries has been hampered by the lack of skills among librarians. This makes it harder for them to manage the massive amounts of data that social media platforms have created online. Anna & Mannan (2020) noted similar results, suggesting that librarians' lack of expertise was the main barrier to the

application of analytic tools in knowledge houses. A study by Ahmad et al. (2019) found that while librarians were aware of Big Data analytics, they were unfamiliar with the various volumes of Big Data because of the volume and proliferation of data so quickly. Another factor from the TOE framework that was examined in this study was the organizational resources. In the context of this study inadequate ICT tools for doing analytics is another serious challenge that affected the adoption and usage of Big Data analytics among librarians. Environmental factor from TOE framework was also observed as most of the academic libraries had no in place policies and guidelines that provide the guidance on the management of Big Data that were generated from social media platforms. Study that was conducted in Tanzania by Matto (2019) found three challenges of using Big Data analytics in higher education institutions, first was lack of frameworks that are meant for doing specific task such as extracting educational data, secondly, was lack of facilities for input data in the available analytical frameworks, thirdly was absence of policies and guidelines on how the Big Data storage resources could be shared amongst different applications.

## VII. CONCLUSION AND RECOMMENDATIONS

Tanzanian University libraries are just beginning to embrace Big Data analytics. The use of such technology promises the bright future of academic libraries in Tanzania because it will enable librarians to generate useful reports that will enable library managers and directors to make better decisions that will improve the quality of library services. However, academic libraries needs to respond to various challenges that are currently encountered by librarians in using Big Data analytics. The study recommends library managers to put in place training to equip librarians with the skills of using Big Data analytics to enable them to manage vast amount of data that are generated from social media to enable the generation of useful reports that will help managers in making useful decisions. The study also makes management recommendations for University libraries to guarantee that sufficient infrastructure is available to support the application of Big Data analytics. Lastly, the study recommends library managers to formulate policies and guidelines that will guide the application of Big Data analytic tools and protect data of the customers.

## REFERENCES

- [1] Ahmad, K., JianMing, Z., & Rafi, M. (2019). An analysis of academic librarians' competencies and skills for implementation of Big Data analytics in libraries: a correlation study. *Data Technologies and Applications*, 53(2), 201-216.
- [2] Ahmed, I. (2020). Technology organization environment framework in cloud computing. *TELKOMNIKA (Telecommunication Computing Electronics and Control)*, 18(2), 716-725.
- [3] Al-Barashdi, H., & Al-Karousi, R. (2019). Big Data in academic libraries: Literature review and future research directions. *Journal of Information Studies and Technology*, 2018(2), 13. Retrieved from <https://doi.org/10.5339/jist.2018.13>.
- [4] Alkhalil, A. (2020). An integrated DOI-TOE model for the application of Big Data in higher education systems. *International Journal of Engineering and Information Systems*, 4(7), 124-140.
- [5] Anna, N. E. V., & Mannan, E. F. (2020). Big Data adoption in academic libraries: A literature review. *Library Hi Tech News*, 37(4), 1-5.
- [6] Ayodeji, O. G., & Kumar, V. (2019). Social media analytics: A tool for the success of online retail industry. *International Journal of Services Operations and Informatics*, 10(1), 79-95.
- [7] Asuquo, B., Aliu, I. M., & Mbah, G. (2023). Social media use: A catalyst for service delivery in academic libraries in South-South Nigeria. *Library Philosophy and Practice (e-Journal)*. Retrieved from <https://digitalcommons.unl.libphilprac/7686>.
- [8] Baker, J. (2012). The technology–organization–environment framework. *Information Systems Theory: Explaining and Predicting Our Digital Society*, 1, 231-245. Retrieved from [https://link.springer.com/chapter/10.1007/978-1-4419-6108-2\\_12](https://link.springer.com/chapter/10.1007/978-1-4419-6108-2_12).
- [9] Batrinca, B., & Treleaven, P. C. (2015). Social media analytics: A survey of techniques, tools and platforms. *Ai & Society*, 3, 89-116. Retrieved from <https://link.springer.com/article/10.1007/s00146-014-0549-4>.
- [10] Blummer, B., & Kenton, J. M. (2018). Big Data and libraries: Identifying themes in the literature. *Internet Reference Services Quarterly*, 23(1-2), 15-40.
- [11] Devan, N. (2020). Social media and libraries. Retrieved from <https://www.researchgate.net/publication/340116105>.
- [12] Faisal, S. L. (2019). Social media analytics for academic libraries: A case study. *KLA Journal of Information Science & Technology*, 1(1). Retrieved from <https://doi.org/10.1080/13614533.2016.1152985>.
- [13] Garoufallou, E., & Gaitanou, P. (2021). Big Data: Opportunities and challenges in libraries, a systematic literature review. *College & Research Libraries*, 82(3), 410. Retrieved from <https://crl.acrl.org/index.php/crl/article/view/24918>.
- [14] Guest, G., Namey, E., & Chen, M. (2020). A simple method to assess and report thematic saturation in qualitative research. *PLOS ONE*, 15(5), 1-17.
- [15] Hamad, F., Fakhuri, H., & Abdel Jabbar, S. (2022). Big Data opportunities and challenges for analytics strategies in Jordanian Academic Libraries. *New Review of Academic Librarianship*, 28(1), 37-60.
- [16] Islam, A. A., Ahmad, K., Rafi, M., & JianMing, Z. (2021). Performance-based evaluation of academic libraries in the Big Data era. *Journal of Information Science*, 47(4), 458-471.
- [17] Kamupunga, W., & Chunting, Y. (2019). Application of Big Data in libraries. *International Journal of Computer Applications*, 178(16), 34-38.
- [18] Kaplan, A. M., & Haenlein, M. (2016). Higher education and the digital revolution: About MOOCs, SPOCs, social media, and the Cookie Monster. *Business Horizons*, 59(4), 441-450.
- [19] Kirita, F. F., & Mwantimwa, K. (2021). Use of social media in marketing library resources and services. *University of Dar es Salaam Library Journal*, 16(2), 19-33.
- [20] Kordzadeh, N., & Young, D. K. (2022). How social media analytics can inform content strategies. *Journal of Computer Information Systems*, 62(1), 128-140.
- [21] Lee, I. (2018). Social media analytics for enterprises: Typology, methods, and processes. *Business Horizons*, 61(2), 199-210.
- [22] Li, S., Jiao, F., Zhang, Y., & Xu, X. (2019). Problems and changes in digital libraries in the age of Big Data from the perspective of user services. *The Journal of Academic Librarianship*, 45(1), 22-30.
- [23] Mabruhi, Y. O., & Aisyah, S. N. (2022). Utilization of Instagram social media by national libraries in Southeast Asia during the Covid-19 Pandemic. *Library Philosophy and Practice (e-journal)*, article no. 6859. Retrieved from <https://digitalcommons.unl.libphilprac/6859>.
- [24] Maroufkhani, P., Tseng, M. L., Iranmanesh, M., Ismail, W. K. W., & Khalid, H. (2020). Big Data analytics adoption: Determinants and performances among small to medium-sized enterprises. *International Journal of Information Management*, 54, 102190. Retrieved from <https://doi.org/10.1016/j.ijinfomgt.2020.102190>.
- [25] Matto, G. (2022). Big Data analytic framework for effective higher education institutions. *Tanzania Journal of Engineering and Technology*, 41(1), 10-18. Retrieved from <https://doi.org/10.52339/tjet.vi.768>.
- [26] Malekani, A. W., & Benard, R. (2018). Effective outreach techniques for the promotion of library information resources in academic libraries in Tanzania: A case of Sokoine National Agricultural

- Library. *Library Philosophy and Practice (e-journal)*. Retrieved from <https://digitalcommons.unl.libphilprac/1694>.
- [27] Masele, J. J., & Rwehikiza, D. P. (2021). Applications of Social Media for Promoting Higher Learning Institutions' Activities in Tanzania. *International Journal of Education and Development using Information and Communication Technology*, 17(2), 37-54.
- [28] Mashindano, A. J. (2020). Utilization of social media for marketing library resources and services in academic libraries in Tanzania. *MA Thesis, Open University of Tanzania*. Retrieved from <http://repository.out.ac.tz>.
- [29] Mwilongo, K., & Kotoroi, G. (2021). Tanzania modern librarians in research and development inquiry: A literature review. *Library Philosophy and Practice (e-journal)*, article no. 6644. Retrieved from <https://digitalcommons.unl.libphilprac/6644>.
- [30] OCLC. (2018). US public libraries: Marketing and communications landscape. Retrieved from <https://www.oclc.org>.
- [31] Panda, S. (2021). Usefulness and impact of Big Data in libraries: An opportunity to implement embedded librarianship. In *Technological Innovations and Environmental Changes in Modern Libraries*. New Delhi: Shree Publishers & Distributors. Retrieved from <https://ssrn.com/abstract=3827528>.
- [32] Rabatseta, B., Maluleka, J. R., & Onyancha, O. B. (2021). Adoption and use of social media in academic libraries in South Africa. *South African Journal of Libraries and Information Science*, 87(1), 20-31.
- [33] Sani, J. O., & Oseji, N. A. (2022). Utilizing the potentials of Big Data in library environments in Nigeria for recommender services. *Library Philosophy and Practice (e-journal)*, article no. 7467. Retrieved from <https://digitalcommons.unl.libphilprac/7467>.
- [34] Sengupta, S. (2016). Big Data: The Next Big Opportunity for Librarians. New Delhi: Modern Rohini Education Society. Retrieved from <http://hdl.handle.net/10760/34349>.
- [35] Singh, V. K. (2017). Big Data technology: A new technological requirement of modern libraries and librarians. *National Conference on Library and Information Management in Digital Environment, February 25-56*. Retrieved from <http://ncsi.iisc.ernet.in/pipermail/listforum/2017-January/020395.html>.
- [36] Sonawane, A. S. (2018). Big Data: Application in libraries. *International Journal of Scientific Research in Multidisciplinary Studies*, 4(1), 22-23.
- [37] Tella, A., & Kadri, K. K. (2021). Big Data and academic libraries: Is it big for something or big for nothing? *Library Hi Tech News*, 38(2), 15-23.
- [38] Tella, A. (2019). Librarians' perception of opportunities and challenges associated with Big Data in public libraries. *Internet Reference Services Quarterly*, 24(3-4), 89-113.
- [39] Xin, C., & Yingxi, L. (2022). Factors influencing intentions to use library social media marketing accounts: Taking the example of WeChat. *The Electronic Library*, 40(4), 376-392.
- [40] Zhan, M., & Widén, G. (2018). Public libraries: Roles in Big Data. *The Electronic Library*, 36(1), 133-145.