

Assessing the Utilization of Machine Intelligence in University Libraries: Benefits and Constraints

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Abstract

Machine Intelligence (MI) is transforming the way information flows, accesses, and delivers it, especially in university libraries particularly in higher education. The application of technologies such as machine learning, natural language processing, and machine intelligence powered chatbots has transformed university libraries, resulting in simplified cataloging, automated metadata generation, better user experiences, or personalized information services. The implementation of these innovations can significantly enhance the efficiency and service delivery of university libraries in Tanzania. However, the implementation of machine intelligence technologies is not a simple task. Libraries encounter several obstacles, such as expensive implementation costs, inadequate staff technical expertise, limited infrastructure, ethical and privacy concerns, and apprehension of change within institutions. The limitations of machine intelligence make it difficult to use in optimal situations and hinder its transformative potential in library contexts. The study explores both the opportunities and barriers of implementing machine intelligence in university libraries in Tanzania. A descriptive survey was conducted involving 120 library professionals across ten public and private universities. The results show a strong awareness of machine intelligence's benefits, particularly in enhancing user satisfaction and automating routine tasks. However, the respondents also identified major obstacles, such as lack of training, insufficient funding, and organizational inertia. The study emphasizes the need for strategic policy formulation, capacity building, and infrastructural investments to support machine intelligence integration. By identifying both enabling factors and constraints, this research contributes to significant understanding into how academic libraries can harness machine intelligence technologies to foster innovation and sustainability in higher education environments. It provides a framework for institutions aiming to navigate the evolving landscape of digital librarianship in the Global South.

Keywords: *Machine Intelligence, Academic Libraries, Information Services, Library Innovation.*

I. INTRODUCTION

University libraries have historically played a pivotal role in facilitating access to knowledge, supporting research, and enhancing learning (Corrall, 2019). With the rise of the digital era, these libraries are under increasing pressure to innovate and provide services that align with evolving user expectations (Tenopir et al., 2020). AI has become a revolutionary field that could revolutionize library operations, from automated classification to intelligent reference services (Tait, 2021).

The advent of AI technologies such as chatbots, recommendation systems, and automated indexing has

allowed libraries to optimize workflows, reduce redundancy, and improve the user experience (Zhang et al., 2021). AI-driven solutions can assist users in locating resources, provide tailored information services, and even analyze user behavior to improve service delivery (Ying & Wang, 2020). These innovations present exciting opportunities for academic libraries in developing countries like Tanzania (Kipanga & Mutula, 2022).

Still, there are some obstacles to adopting AI. The absence of technical know-how, inadequate infrastructure, budget constraints and moral concerns concerning data confidentiality and algorithmic bias are major limitations for many academic libraries (Ghosh, 2021; Cox et al,

2019). By recognizing these obstacles and prospects, academic libraries can make optimal usage of AI to enhance their relevance in the 21st century (Scholltz et al, 2020).

➤ *Statement of the Problem*

While the promise of machine intelligence (MI) in university libraries is substantial, its implementation in Tanzanian university libraries remains limited and underexplored. Libraries face numerous barriers that hinder the adoption of machine intelligence technologies, despite the potential benefits. There is a need to critically assess how machine intelligence is currently being utilized, the challenges faced by library professionals, and the steps needed to promote effective integration.

➤ *Objectives of the Study*

- To study the current usage and progress of MI in academic libraries at university level in Tanzania.
- To identify the opportunities MI presents for improving library services.
- To investigate the obstacles that university libraries encounter when attempting to utilize AI machinery.
- To recommend ways to integrate MI into university libraries framework.

II. REVIEWED LITERATURE

Alemneh and Hastings (2019) emphasize the importance of training library staff on AI technologies. Without proper knowledge and skills, even well-funded AI projects may fail to achieve their intended outcomes. According to Cox et al. (2020), AI has the potential to transform library operations by automating repetitive tasks such as cataloging, indexing, and user query handling. Libraries in developed countries are increasingly adopting these technologies to provide efficient and user-centered services. Fazel-Zarandi et al. (2021) argue that AI raises ethical issues such as data security, surveillance, and algorithmic bias. Libraries must establish guidelines to ensure that user privacy is respected during AI system implementation. Chigwada (2022) noted that while AI adoption in African university libraries is still in its infancy, institutions are becoming increasingly aware of its potential. However, the lack of adequate funding and trained staff remains a significant barrier.

III. METHODOLOGY

A problem with the research was its descriptive survey design, which aims at conducting thorough investigations of Machine Intelligence (MI) in university libraries that were integrating Tanzanian. This design was appropriate because it facilitated the gathering of quantitative information on the existing practices, perceptions and experiences related to the use of MI within the library. In order to ensure a broad representation of findings and generalize conclusions, the sample size was selected from ten libraries across the country and all geographical regions, with 120 library professionals including librarians, ICT officers, and library administrators chosen as based on their composition. All the domains to be investigated concerning the integration of Machine Intelligence technologies in university libraries in Tanzania were surveyed using a descriptive survey design. It was fitting to adopt this design, as it would allow for the collection of quantifiable data about practice and perceptions on how MI is used within a given library context. In order to achieve a high level of representation and generalization of results, ten national universities conducted statewide research with the participation of 120 library professionals, including librarians, ICT officers, libraries, and administrators. To make analyses easier and standard answers more accessible, the questionnaire considered a combination of open-ended questions. The coding and analysis of quantitative data were carried out using descriptive statistical analysis tools, including frequencies and percentages, which were generated using SPSS software in 25 versions.

IV. FINDINGS AND DISCUSSIONS

➤ *Uses of MI in University Libraries*

The concept of Machine Intelligence (MI) is changing the face of university libraries by making information retrieval, automation of most routine activities, and more personalized user service. These MI-based tools facilitate effective cataloging, smart search engine, and 24/7 chatbots that can assist in providing reference services. The technology further helps in user behavior data analytics, refines the use of resources, and enriches digital preservations, and overall encourages access, efficiency, and customer satisfaction in academic library services.

Table 1 Uses of MI in University Libraries

Particular	f	%
Chatbots for reference	28	23.3
Automated cataloging	24	20.0
Recommendation systems	20	16.7
Plagiarism detection tools	30	25.0
Not using MI	18	15.0
Total	120	100

Source: Field Data, 2025; Note: F - Frequencies, % - Percentage; n=120

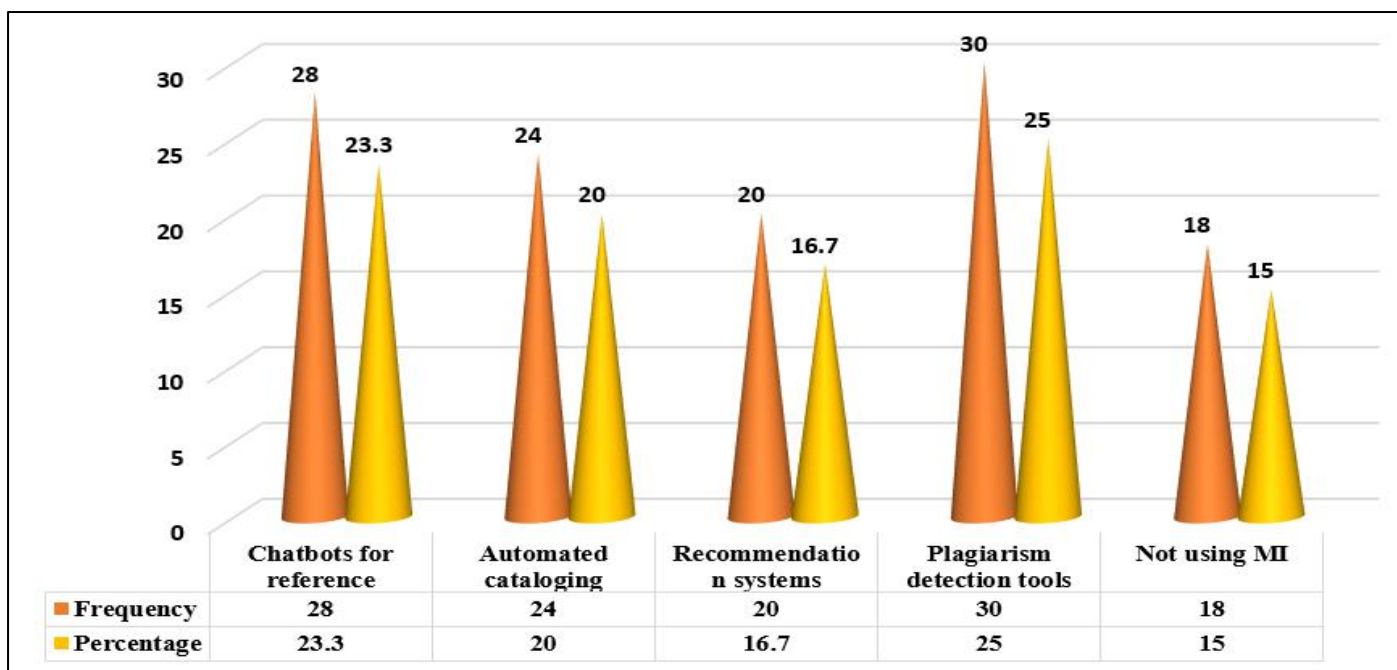


Fig 1 Uses of MI in University Libraries
Source: Field Data, 2025

➤ *Opportunities of MI in University Libraries*

Machine Intelligence (MI) offers a lot of opportunities to university libraries as it improves the delivery of services, facilitates access to information and makes operations more efficient. The MI-driven tools would assist in delivering personalized information retrieval, automated cataloging and metadata creation, and advanced user experience with chatbots, as well as support

advanced data analytics to assist in the decision-making process. Also, MI has the potential to contribute to digital preservation, plagiarism detection and research support, which will help libraries to support learning, teaching and scholarly communication in the more digitalized environment. These developments make academic libraries as progressive centers of knowledge and innovativeness.

Table 2 Opportunities of MI in University Libraries

Particular	f	%
Improved service delivery	32	26.7
Faster resource discovery	30	25.0
Personalized user experience	28	23.3
Enhanced decision making	30	25.0
Total	120	100

Source: Field Data, 2025; Note: F - Frequencies, % - Percentage; n=120

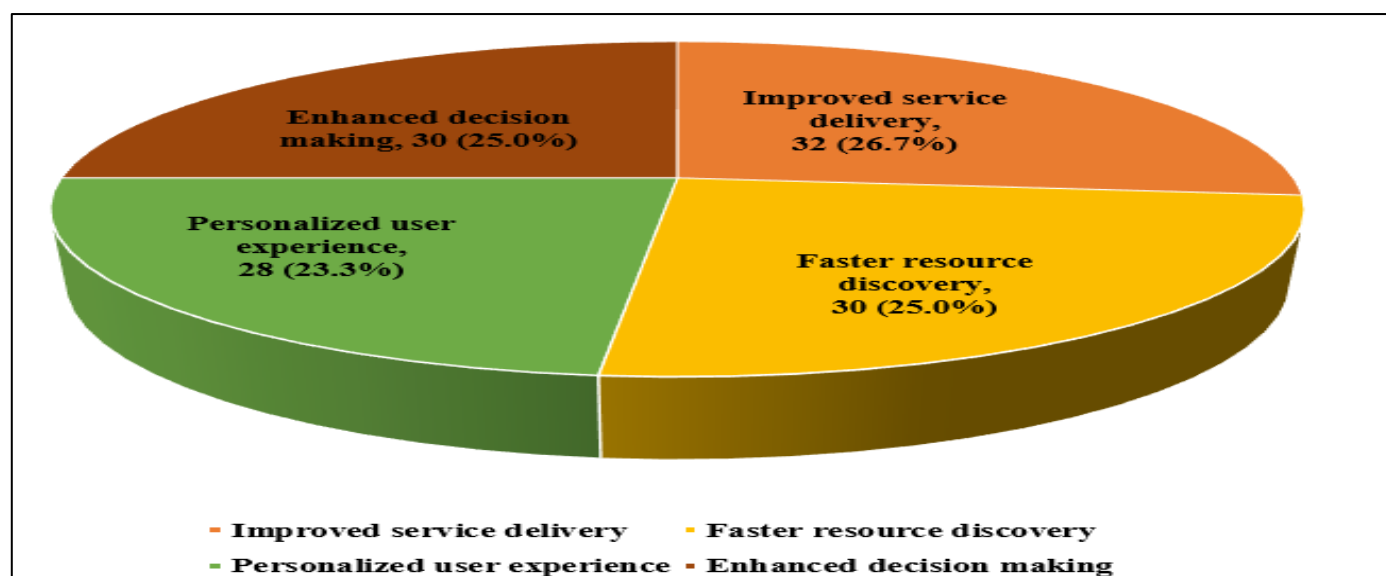


Fig 2 Opportunities of MI in University Libraries
Source: Field Data, 2025

➤ *Barriers in MI Adoption*

A number of barriers persist with the implementation of Machine intelligence (MI) in university libraries, including inadequate funding, infrastructure shortcomings, and inadequate scholars trained to develop and maintain MI systems. Moreover, the integration is complicated due to various ethical considerations,

including data privacy and algorithmic bias. Effective implementation is hindered by the lack of understanding of MI potential, and staff are also resistant to change in a library. The barriers of digital transformation in university libraries are all too familiar, despite the potential advantages of MI for improving information retrieval, user services, and operation efficiency.

Table 3 Barriers in MI Adoption

Particular	f	%
Lack of technical skills	34	28.3
Inadequate ICT infrastructure	30	25.0
Limited funding	26	21.7
Ethical and privacy concerns	30	25.0
Total	120	100

Source: Field Data, 2025; Note: F - Frequencies, % - Percentage; n=120

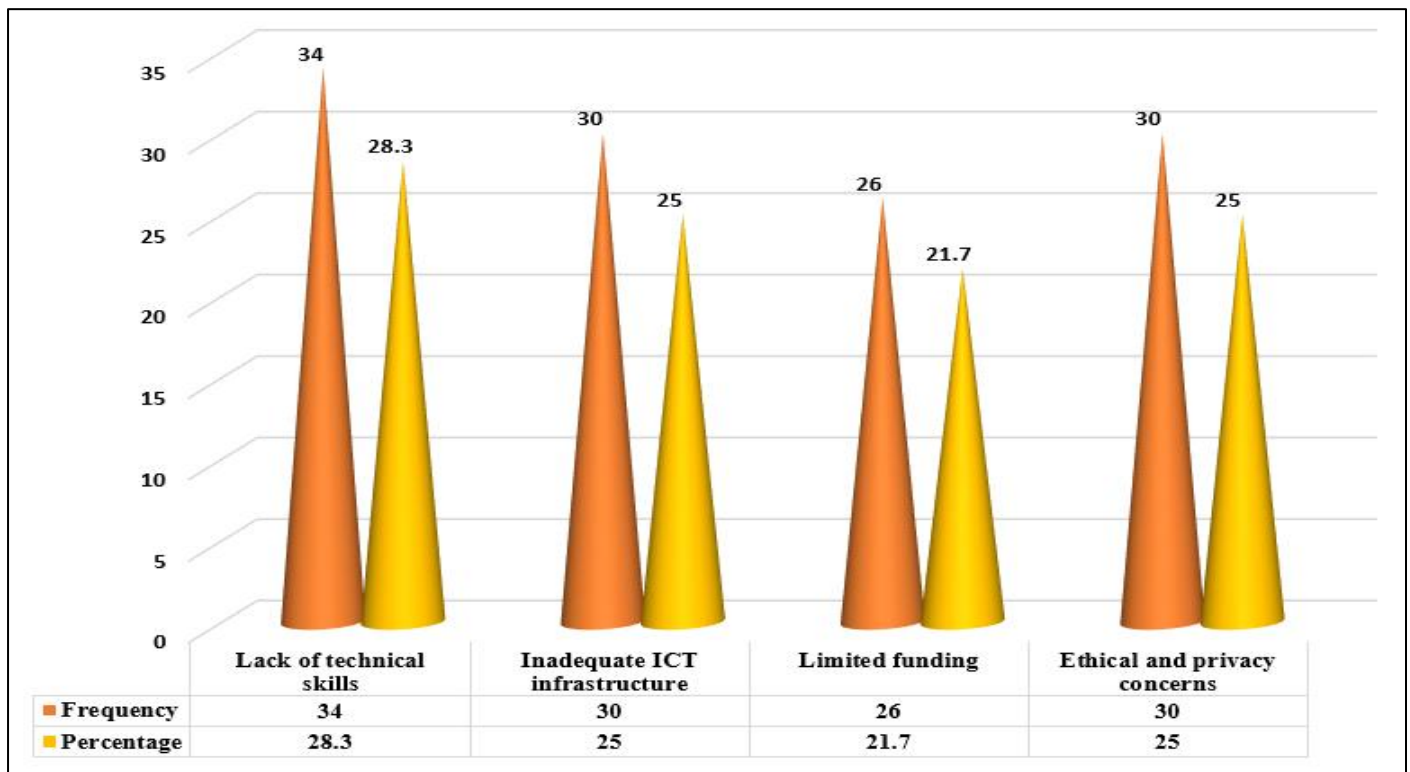


Fig 3 Barriers in MI Adoption

Source: Field Data, 2025

➤ *Recommendations for MI Integration*

In order to make the best use of MI in university libraries, it is suggested that the institutions should invest on staff education and skills formation to develop digital literacy and MI proficiency, conducive ethical use and privacy of data, and utilization of MI tools that are

consistent with the aims of the library enhance information retrieval, consumer experience and resource management. Having IT departments work with them, constantly reviewing the MI tools, and formulating policies to influence the MI implementation responsibly and fully utilize its improvement to libraries are also essential.

Table 4 Recommendations for MI Integration

Particular	f	%
Regular staff training	36	30.0
Invest in infrastructure	30	25.0
Develop MI policy and ethics guide	28	23.3
Promote collaboration and research	26	21.7
Total	120	100

Source: Field Data, 2025; Note: F - Frequencies, % - Percentage; n=120

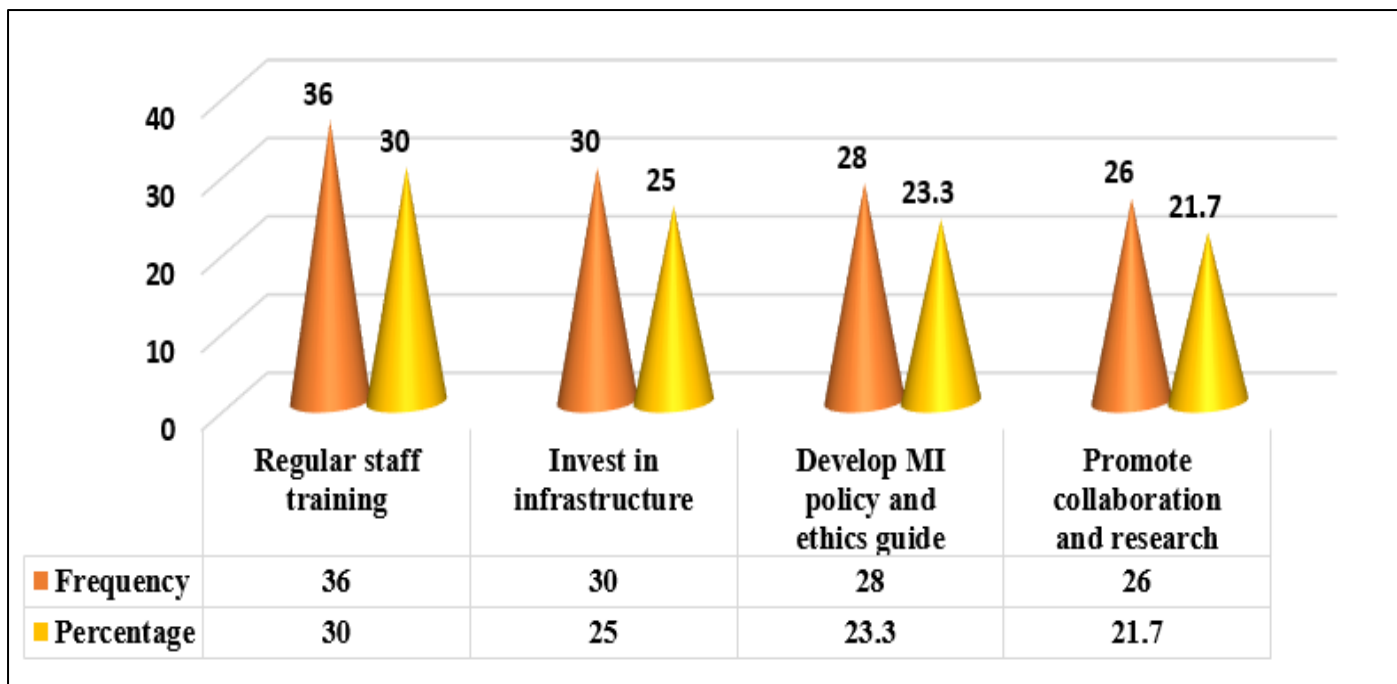


Fig 4 Recommendations for MI Integration
Source: Field Data, 2025

V. DISCUSSION

The results show that although in some Tanzanian universities, chatbots that support users and plagiarism detection programs are gradually being integrated into library premises, a broader scale of integration and use is still at the initial stages. The workforce in libraries and library administrators, in general, recognizes the potential of the transformative power of MI, particularly in improving service delivery, automation in various monotonous tasks, ease of information search and retrieval as well as providing customized user experience with respect to user behavior and preferences. Nevertheless, there are a few reasons that are impeding the large-scale use. Top on the list is the fact that the technical skills of the library staff are lacking, the training opportunities are also limited, there is a problem of internet bandwidth, and computing infrastructure in most institutions is wanting. Besides, ethical issues in the form of data privacy, algorithmic bias, and widespread opaque decision-making mechanisms have yet to be overcome and act as impediments to trust and deployment. The results are similar to those conducted in earlier studies that note the need to build the institutional technical capacity in question as well as the establishment of ethically minded governance structures in order to warrant responsible and beneficial use of AI within academic contexts (Alemneh & Hastings, 2019; Fazel-Zarandi et al., 2021). The key barriers that are required to be addressed with targeted investment, training programs and development of clear policies will include the need to integrate AI in Tanzanian university libraries.

VI. RECOMMENDATIONS

The priorities in establishing machine intelligence (MI) in academia libraries in universities should focus on assisting librarians to continuously develop and lead to the

integration of artificial intelligence and other competencies/knowledge in libraries by, among others, conducting a series of training programs that provide librarians with the requisite artificial intelligence skills, such as data analysis, machine learning uses, and digital literacy. It is also important to upgrade the technological basis, as it should be provided with stable internet connection, modern computing devices and MI capable software tools that will help to implement everything with ease. It is also the obligation of institutions to develop a well-shaped MI policy so that they can ensure ethical standards and guidelines with principles of transparency, accountability, user privacy, and data security to be able to develop trust and make the MI usage responsible. Also, it is highly recommended to collaborate with technology firms, universities, and library consortia to gain better results in the field of MI adoption by exchanging knowledge, developing innovations, and providing access to best tools and platforms in the area, which can significantly enhance library services and user experience.

VII. CONCLUSION

University libraries in Tanzania can benefit from the use of Machine Intelligence (MI) to improve their services delivery, as it promises to streamline repetitive processes, provide more user-friendly services and decision-making. This is especially significant in the universities library sector. Still, the successful implementation of MI technologies is still impeded by some of the major challenges. These are the weaknesses of the technical skills of those working in libraries, poor digital infrastructures like the unreliable internet and old computer systems, and the absence of articulate policies that can be used to track ethical application of MI, particularly in issues to do with privacy of data and transparency of algorithms. University libraries already have the expertise and the strategic capabilities and

therefore in order to maximize the potential of MI, continuous professional development programs that would enable the librarians to develop relevant skills in MI, data literacy and so on should be emphasized. Also, institutions need to come up with strong policies to facilitate responsible implementation of MI so that it meets international standards. As well, strategic partnerships with universities, technology providers, and consortia have the ability to accelerate the MI integration through resource sharing and working in collaboration to come up with new ideas. With such problems targeted, Tanzanian academic libraries will prove to be transformative, MI-empowered establishments that would make powerful contributions to teaching, research and lifetime learning in the digital age.

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