Artificial Intelligence Teamwork for Agricultural Information Service Delivery in a Changing World: a Paradigm Shift

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Abstract

As the global agricultural landscape faces unprecedented challenges driven by climate change, population growth, and shifting consumer demands, there is a pressing need for innovative solutions to ensure food security and sustainable agricultural practices. This paper explores the transformative potential of Artificial Intelligence (AI) in reshaping how agricultural information is developed, disseminated, and utilized to enhance service delivery. AI-powered technologies, including machine learning, data analytics, and automation, are revolutionizing agriculture by providing real-time insights, optimizing resource allocation, and improving decision-making for farmers, policymakers, and stakeholders across the agricultural value chain. This research delves into the multifaceted applications of AI in agriculture, the benefits it offers, and the challenges that must be addressed to harness its full potential. It also emphasizes the importance of collaboration and teamwork among AI developers, researchers, farmers, and information providers to navigate this paradigm shift successfully and create a more resilient and sustainable agricultural future.

Keywords: Artificial Intelligence, Agriculture, Service Delivery, Information Development, Climate Change, Sustainability, Collaboration, Paradigm Shift.

1. Introduction

In ensuring the sustainable economy of a country, agricultural processes and products play a vital role. The development of this requires information that meets their needs either for the production of animals or crops. Since man relies so much on agriculture for food and sustainability hence, it is important to identify information that is essential for their decision-making. In Nigeria, farm practices are mostly carried out by rural dwellers because of the expanse of land available to carry out farm activities and other reasons. This facilitated the production and exportation of products like cocoa, rubber and some others in the early 70s when agriculture occupied 70% of the occupational distribution in Nigeria before the oil boom. However, the drastic change of globalisation and industrialisation has brought new interventions and innovations. Agricultural production practices that are handled manually have significantly grown to computerised production, automated machines and simulating machines (Mahibha & Balasubramanian, 2023)

Recently, food has been one of the most complex economic, political and moral issues of our time, (Melissa, Nicholas, Lídia, Jody, Naomi & John, 2020) and information is one of the necessary ingredients for actualising it. Sources of farmers' information were identified to be farmers meeting, cooperative society, extension agent, print and non-print media through the librarian, fliers, village meeting, village leaders, books, seminars, agricultural shows, neighbours

and friends (Ibegwuam, Anasi & Uzuegbu, 2016; Olaniyi & Ogunkunle, 2018; Mubofu & Malekani, 2020; Adamu, Alkali & Tijani, 2022). Farmers rely heavily on different sources of information and it is worth noting that their social economic characteristics also determine the extent and type of information they can get. (Ogunyemi&Ajayi, (2016);Nikam, Kumar, Kingsly, & Ray (2020 Augustine, Faruk, Abubakar&Kyaru (2021).The related information on agricultural practices like pest control, yield maximization, soil treatment, weather forecast risk and other production factors to remain competitive and achieve income advantage are needed by farmers to make the right choice (VinayakArath, & Suresh (2022) with the librarian at the centre of the information provision.

The concept of library services is the ability of librarians to position information such that the users will have quick access to same. The shift from manual service delivery to hybrid has taken the library from the traditional way of rendering services thereby embracing the change through information communication technology. In ensuring an increase and sustainable farm and animal produce/products, the relevant information on all aspects of agricultural products and services must be available and accessible. Farmers need different information and if this goes unmet, it will negatively affect both their input and their output (Sigigaba, Yusuf, Bitso & Popoola (2022).

The advent of technology has impacted greatly human society across the globe. Information communication (ICT) has changed the mode of communicating information to end users. The developments and application of ICT in library operations have enhanced positively the dissemination of information, access and all other aspects of information management (Essien, Lu, Abredu & Zotoo, 2022). The technological approach has been recognised as the best way to promote efficiency and effectiveness. Modern technology and the internet are appealing to accessing information and this has been seen in improving the products and services of the library to other sectors of the economy including agriculture (Food and Agriculture Organisation of the United Nations (FAO) (2022). The library is one of the most influential institutions by technology and they are making an effort to use these tools to meet the information demand of their clients which has translated to the digitization of library resources (Essien, Lu, Abredu & Zotoo, 2022). The use of information communication technology (ICT) and artificial intelligence (AI) lately, has drastically arm all industries to enhance production and reduce the level of loss.

There has been a long discussion about libraries collaborating with researchers from other fields of knowledge but little research has been conducted on this. Although there are studies on the same among librarians. Literature is scarce on the collaborative effort of stakeholders in the use of technology and AI to improve agricultural processes concerning librarians, probably because the innovation is new in this clime. Academia, research institutes, information professionals, technology and telecommunication sectors must provide a platform through which a collaborative structure is made available. Librarian(s), and the information provider are expected to collaborate with other major stakeholders to understand the application of AI in improving quality service delivery. The change from traditional library practice to automated practice shows the effort of Librarians to adapt to change when it comes. It is therefore important to carry out this study and discover how the collaborative effort of the librarians and agriculture personnel can impact the farm produce with the use of AI the latest innovation.

Research Objective: The broad objective is to audit the multidisciplinary approach and the nature of collaborative effort between librarians and other agricultural-related researchers on how their synergies affect the farming process.

The specific objectives of this study are to:

1. explore the applications of AI in agriculture and its potential to transform service delivery.
2. emphasize the importance of teamwork and collaboration among AI developers, researchers, policymakers, and farmers in realizing the full potential of AI in agriculture.
3. identify information resources and services in an agrarian community,
4. and assess the benefits and challenges associated with the integration of AI in agricultural information development.

2. Literature Review

2.1. The concept of artificial intelligence

Artificial intelligence is a branch of computer science designed to complete tasks for problem-solving and the same is used by other fields of knowledge. It is the development of computer programs to complete tasks which would otherwise require human intelligence (Ziyad Mohammed (2019). Ersin (2023) defines AI concerning society as the broad range of applications in the field of computer science related to building smart machines, robots, or

sensors that are capable of simulating human actions to achieve tasks on behalf of humans to serve society intelligently. Breana *et al* (2021) perception of AI are that of an agent designed with the ability to achieve a goal, even when given imperfect and incomplete information essential to dynamic environments. These definitions show that AI is an emerging topic in the field of computers (Ersin, 2023). These programs include problem-solving, learning, perception, language understanding and logical reasoning. For AIfunctionality reaction, there are some applications like intelligent retrieval from databases, expert consulting systems, theorem proving, robotics, automatic programming and scheduling problems, and perception problems that must be designed for the input and output response (Jial, 2020). AI in general is capable of predicting and adapting, making decisions on its own, continuous learning, forward-looking, and capable of motion and perception (Ziyad, 2019).

2.2.Teamwork and collaboration in achieving the potential of AI in agriculture

AI is an innovation adopted and used in several fields and agriculture is not an exemption. The applications of information technology in agricultural practices not only change the process but the effective performance of a new approach that utilizes data-intensive techniques and tools to revolutionise agriculture **(**Lakshmi & Corbett, 2020). World Economic Forum (2021) focused on four main broad themes of AI for agriculture which include; intelligent crop planning, smart farming, farm-gate-to-fork and data-driven. Data management is the key to effective decision-making by farmers and other sectors. Sensors, image recognition, radio frequency identification and soil inspecting are used to gather information about soil (Yogesh (2020). However, AI and Machine Learning tools can provide actionable insights on weather, soil, and water conditions. It is ultimately leading farmers to make better decisions on planting, irrigation, and harvesting. In the face of present global food insecurity, climate change, and the growing population, agriculture can only ensure the integration of AI into the sector. Technology can be deployed from soil preparation down to the consumers while manual cultivation of crops and rearing of animals (Tarassevych, 2022) are discouraged. Furthermore, emerging technologies have the potential to transform farm produce and reduction in environmental impact will boost farmers' income (World Economic Forum (2021).

AI is the concept of cognitive computing which imitates the thought process of humans using a computer model (Mahibha&Balasurbramanian, 2023). Its use in agriculture focuses more on acquiring and interpreting data to increase productivity. AI is evident in focusing on precision farming, and the automation of agricultural processes which includes the Internet of Things (IoT), big data, robotics, drones, 3D, satellite, synthetic biology, and blockchain (Rural Industries Research & Development Corporation, 2019) which are the emerging technologies for agriculture in the world today. Researchers according to Liu, (2020) have used these power-driven technologies to provide knowledge and advice regarding crop planning to the food supply process thereby making a shift in agricultural patterns. Although the use of AI is not new in the developed world its use is not popular in developing countries. Digital technological innovation promise food security and safety for farmers if embraced and used. The AI innovation and its probable impact will support agricultural divisions to aid farmers' profitability and productivity in the changing world (Yogesh (2020). World Economic Forum (2021) submitted that AI in agriculture provides a platform for the agricultural ecosystem to understand the complete landscape and provides approaches to engage via collaborative frameworks. Unfortunately, the agriculture sector is slow to embrace these new technologies driven by the fourth industrial revolution (World Economic Forum (2021)). There are bases for this which range from lack of funds, to limited ICT infrastructure and skill, Livina, Ukwoma, & Nwamaka, (2017).

Agriculture is at the forefront of global challenges in a rapidly changing world. Climate change, population growth, resource constraints, and evolving consumer preferences are reshaping the agricultural landscape. To address these challenges and ensure food security and sustainable practices, a paradigm shift is needed in the way agricultural information is developed and delivered. Artificial Intelligence (AI) has emerged as a transformative force capable of revolutionizing agriculture by providing data-driven insights, enhancing service delivery, and fostering collaboration among stakeholders.

The impact of climate change has affected the precision of the weather which is key to the process of the agricultural food production cycle. The breakdown has a negative impact on the availability of crops and animals thereby endangering the regular supply of food to the people Reliance on rainwater, sun and old weather prediction is not and may not help farmers achieve food security in 2025. According to Diogo *et al* (2022)intensified food insecurity and macroeconomic effects are part of the consequences of climate change and the same translates to

poor nutrition that affects children's growth and undernourished people (Vershhuur, Wolski& Otto, 2021). The increase in population and the dwindling rate in the expanse of farmland available in the rural area is another challenge. There is more demand for crops and animals for human consumption and many are migrating to the city in search of greener pastures. There is also a shortage of manpower (Mahibha & Balasubramanian, 2023). Presently, the government of Nigeria is emphasizing agriculture due to poor economic access and physical availability of food especially after the COVID-19 pandemic (FAO, 2020). Achieving this is assumed to be by deploying AI tools to agricultural processes.

AI involves different fields of knowledge, and sectors need to align and collaborate to ensure a sustainable AI process. The process and adoption of this innovation cannot be achieved using an intra-disciplinary approach. World Economic Forum (2021) affirms that the composition of the working group to achieve this initiative must be multi-disciplinary. The complex and dynamic society calls for a collaborative effort in tackling the challenges facing information service providers. Librarians as information professionals cannot be untouched in this collaborative process. With the changes in handling information and data, librarians have installed and deployed devices and software to improve their operations (Essien, Lu, Abredu & Zotoo, 2022).

2.3.Agricultural Information:

Information is power and knowledge necessary for interactive communication with and among farmers as a way to deal with increments in productivity. Agricultural data system empowers farmers with adequate information and knowledge to make perfect decisions that will boost their agricultural productivity. One of the major challenges farmers and agriculture research institutions in Nigeria are facing is a lack of information, (Asadu, & Festus, &Asadu, 2019). Tukur and Kannan, (2021) Nigerian rural farmers are yet to be in the limelight when it comes to the latest technologies in various areas of farming practices and information relating to the same (FAO, 2022). Agricultural information is meant to get to farmers via extension workers, community libraries, radio, television, film shows, agricultural pamphlets, and state government agricultural agencies. These are agencies and mediums through which information can get to farmers (Vinayak, Arathy& Suresh, 2022).

Lack of information is known to have affected farmer's productivity (Yusuf, Adio&Suberu (2021), Phiri, Chipeta & Winner (2018) &Asadu, *et al*, 2019). Deficiency in

accessing agricultural information was found to be a key factor that has incredibly restricted agricultural headway in Africa (Kelil, Girma & Hiruy, 2020). The emergence of AI has brought a shift from the traditional phase to globalisation and industrialisation. Also, the information society has changed in the way information is handled. Erlangga and Nugraha (2020) mention that mobile learning platforms and mobile cloud communication can be used to provide interactive communication and information that will be useful for farmers which shows that information is a significant aspect of agriculture. Libraries are established mainly to deal with agricultural information and are mostly attached to agricultural research institutes or universities. The place of the library is important in meeting the information needs of farmers. There are studies show the involvement of librarians in some agrarians' communities and the same has affected agricultural productivity in the areas concerned (Electronic Information for Libraries, 2015, Yusuf *et al*, 2021 & Obidike, 2011).

Furthermore, the establishment of libraries in all agricultural institutes has confirmed the importance of information from librarians to farmers. These libraries however are having some challenges, making it difficult for them to function and render quality services to their patrons information from such is reliable and current, but the above-mentioned problems were highlighted facing these libraries. The agricultural process generally is labour intensive even though the product is essential in any given country to attain agenda 2 (two) of the United Nation's Sustainable Development Goals of zero hunger by 2030 (Lakshmi & Corbett (2020). The high risk of inclement weather, insects and pests destroying crops and diseases killing animals still characterised the process of agriculture despite industrialisation in developing countries (FAO, 2021). Therefore farmers need information relating to the issues mentioned for the country to have food security.

Teamwork mostly used interchangeably with collaboration is the joint work, learning and sharing process that focuses on the activities of teaching; learning and researching among educational participants, where their knowledge can be activated and transferred accomplishing a common goal (Hue & Kerry, 2015). Collaborative research requires each field to seek how best they can contribute and see the meeting point that best addresses the concerned issue. The study of Livina, *et al*, (2017) targeted interdisciplinary collaboration and has been viewed as being productive and richer because it brings researchers from different fields of knowledge to contribute their ideas to enable the research team to view the problem holistically.

As knowledge increases, it is convincing that collaborative research will best solve societal problems and provide a lasting solution to same. Researcher in recent times has changed their approach to collaborative research, which means the sharing of knowledge, and ideas and working as a team to solve a problem, complete a task and share one's thinking (Livina, Ukwoma & Nwamaka, 2017). Teamwork in this concept is the use of AI tools for all agricultural processes to advance farmers' knowledge and practice. It is believed that this collaborative effort will enhance information detection, analysis and use among farmers. The design of AI must be such that intersects with different disciplines. Mark *et al* (2023)submitted that there are many interwoven and complex challenges from various disciplines that need to be addressed holistically when developing and using AI in the agricultural sector.

Innovative agricultural practices will leverage the technology of AI and Machine Learning to overcome all challenges facing the agriculture process and produce. There are literature on collaboration among librarians with common knowledge focusing on the author's exposition and the same includes engaging joint authors (Adegbaye, Okunlaye, Funom & Mahahu (2017), Janet & Joseph, 2023). Chigwada (2020) submitted that the part played mostly by Librarians when collaborating is usually in literature search. Although this was referred to as involvement in the research life cycle, hence the recommendation from the study was for the Librarians to develop themselves to render quality service to researchers. Librarians are therefore expected to be devoted to an ongoing quest to improve client services and as a growing organism, also adapt quickly to new technology that can enhance their service delivery.

This will lead to data-intensive techniques and tools to change the narrative (Lakshmi & Corbett, 2020). Some studies resulted from interdisciplinary research on agriculture and this has led to agricultural automation. Unmanned farming, the use of artificial intelligence, big data, internet of things, and robotic (Wang, Xianboa, Cong, Zhen &Daoliang (2021), Elbehri & Chsetnov (2021), FAO (2022) & Mark, Gohar&Bedir, (2023) are new trending invention in agriculture which are as a result of collaborative research among different disciplines; these innovation has greatly enhance agricultural practices, solving most prevalent problems. Agriculture is an important discipline that needs multiple insights to provide a lasting solution to its trending concerns. This has brought innovation to agricultural practices, thereby seeking the best practice to increase their produce, ensure food security and thrive even in the face of labour shortage.

Every phase of the agricultural process needs information to thrive and have an effective farm process. The works of Krause, Scott, Smisterva&Koski (2021) revealed Uganda's collaborative initiative was a practical way of sharing information with farmers. It was submitted that this experience and knowledge has greatly affected farmer's production and increased their income generation. This experience was also introduced in their secondary schools and it became a wake-up call for the school librarians. Librarians can easily collaborate with extension workers to ensure the packaging of experience and knowledge in digital format for quality service delivery to farmers who mostly cannot access web-based information delivery(Rexwhite, Enakrire&Tella, 2020; Sigigaba, Yusuf, Bitso&Popoola, 2022; Jial (2020). They are to collaborate by repackaging information which could be effectively utilised by farmers.

Social structure is another narrative for collaboration between farmers and librarians that is influenced by time and space. The traditional way of handling data in the library has changed with the emergence of technology using some AI applications. Internet of Things (IoT) for instance is an application that can transfer data among computing devices, mechanical machines and various objects that are interrelated (Jial, 2020). Librarians can leverage on this opportunity and ensure a synergy between other disciplines working towards maximum productivity for farmers. Data from farmers by the researchers are best managed and disseminated to end users by information managers. The coverage of library services covers all subject areas and disciplines; therefore, collaborative research is very important to librarians (Livina*et al*, 2017).

Librarians' expertise is needed in managing the data gathered using AI tools by researchers. As an information broker, the involvement of research librarians will best suggest the implementation of the organisation and dissemination of data. Librarians can also organise literacy campaigns on the use of this technology to enhance their produce. Audio-visual materials can also be used to document practical sessions and the same will be shared with farmers that are far from technology. There is a need therefore for librarians to keep on track in information delivery by working in collaboration with researchers from the study area especially from information technology and engineering. This effort will support the skill acquisition of librarians because a librarian who wants to be relevant in this changing world must be IT compliant as this is a major change that has affected all spheres of life. Dealing with big data, the internet of things etc. will help librarians to render quality service and be able to understand the best way to package information for their users. Librarians cannot afford to work in silos if they

must give quality service to their patrons. More so, the rising cost of conducting this research is high, hence collaborating will also help in tackling this major problem.

The library can assist the farmer to boost their income and socio-economic welfare. nowledge acquisition and sharing through an application results in higher productivity is in line with Ogunyemi and Ajayi (2016). Librarians can assist the farmers in getting the latest technology knowledge by organising workshops and training on how to use data and handle some machines and technology that can easily aid their agricultural process (Hue & Kerry, 2015). This explains why librarians should package information such that it will align with new technology.The library can partner with researchers from technology-related disciplines and package information in such that it will be easily accessible to all, the ease of use of information is key and will determine the extent to which such information will be used. As librarians, information can be packaged such that irrespective of their socio-economic characteristics, farmers should have access to the same information, using innovation and collaborating initiatives to deliver quality service in their domain.

2.4.Paradigm shift-should be conceptualised. Where is the shift going—the role of AI in the changing world is the shift

The growing demand for information by farmers and all stakeholders in the agricultural sectors demands a move away from the traditional model of information dissemination to conventional-based AI and collaborative efforts are needed. The collaborative effort of information providers and agricultural researchers on the use of AI comes with challenges both from the team members and also from external forces. Tukur & Kannan (2021) identified hoarding of the result of current research work, inadequate training and access to current information communication equipment were identified as problems that agricultural libraries are facing in Nigeria. Mahibha, and Balasubramanian (2023) noted different policies and procedures of collaboration, exploitation of weak members, lack of clarity and rationale behind the collaboration, unwillingness to change by members in collaboration, lack of socialisation, the largeness of the group, wrong membership and jettisoning of members ideas which eventually make some members decide on quitting the team. Political and cultural factors were mentioned as part of the challenges of collaboration among scholars Hue & Kerry (2015). The unrest in some parts of the country has affected all phases of human life and movement around these areas is dangerous and security cannot be

guaranteed. Therefore, collaborating with researchers from such geo-political zones may be difficult. Mahibha, & Balasubramanian's (2023)study focused on challenges that members are likely to face as a team, these include reciprocal trust, attitude, and professional hindrances and concept of the research. Understanding the concept of the research is key to gain the commitment and involvement of the team members.

3. Conclusions

AI-driven innovations have the potential to revolutionize agriculture, making it more sustainable, resilient, and responsive to the challenges of a changing world. To fully leverage AI's transformative power, collaboration and teamwork among various stakeholders are imperative. By fostering partnerships, addressing challenges, and promoting ethical AI adoption, agriculture can evolve to meet the demands of the future.

The collaborative approach by most fields of knowledge especially science and technology shows that research problems can be solved by social institutions. This position paper has established that farmers rely greatly on information for all their agricultural processes. It also confirmed the adoption of technology in their practices hence the use of artificial intelligence. Librarians as information brokers are embracing all information technological skills to fit into the digital world and best deliver quality service. Collaboration is one of the approaches that librarians can adopt, to deliver quality service since it is an opportunity to garner insight from other disciplines. The synergy between the librarian and another collaborative team must have have been established over time. Also, collaborations do not occur without mutual trust and respect of the involved parties

4. Recommendation

The recent move by researchers is to use multi-disciplinary approach to ensure food sustainability therefore effort must be made by policy makers to design strategies that will promote collaborative research initiatives that involve AI developers, agricultural experts, and information professionals.

Also, Technological tools are essential in packaging data and the use of smart machines by stakeholders cannot be underestimated in agricultural process. It is therefore suggested that the

government should invest in infrastructure and capacity building to ensure equitable access to AI technologies most especially in rural areas where farming takes place

Human factors like lack of trust, commitment and lack of clarity of the research concept are some of the challenges team members are facing in their effort to adopt multi-disciplinary approach. There is need to establish ethical guidelines and regulations for AI in agriculture to ensure fairness and transparency among team members.

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