ARTIFICIAL INTELLIGENCE INVOLVEMENT IN RESEARCH ACTIVITIES: EXPLORING ITS ENHANCEMENT IN RESEARCHES CARRIED OUT BY POST GRADUATE STUDENTS IN AKWA IBOM STATE TERTIARY INSTITUTIONS

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ABSTRACT

This study examined the roles of artificial intelligence involvement in research activities, exploring its enhancement in researches carried out by post graduate students in Akwa Ibom State tertiary institutions. In the context of carrying out this research, numerous subheads were taken into consideration, some of which included the concept of artificial intelligence, the concept of research activities, and the concept of data collection. In carrying out the study, a descriptive survey design was adopted. The study was carried out in Akwa Ibom State. The targeted population for the study comprised all post graduate students in Akwa Ibom State. Simple random sampling technique was used to select 60 post graduate students in University of Uyo and 60 post graduate student in Akwa Ibom State University making it a total of 120 respondents used for the study. The instrument used for data collection was a structured questionnaire titled "Artificial Intelligence in Research Activities Questionnaire (AIRAQ)". Face and content validation of the instrument was carried out by an expert in test, measurement, and evaluation in order to ensure that the instrument has the accuracy, appropriateness, and completeness for the study under consideration. The reliability coefficient obtained was 0.91, and this was high enough to justify the use of the instrument. The researcher subjected the data generated for this study to appropriate statistical technique such percentage analysis to answer research questions. The result of the data analysis showed that the extent of artificial intelligence involvement in research activities carried out by post graduate students in tertiary institution in Akwa Ibom state was very low. It also showed that data collection and analysis was the most prominent roles of artificial intelligence performance in enhancing research process carried by post graduate students in tertiary institution in Akwa Ibom State. The study concluded that artificial intelligence (AI) has transformed research by introducing innovative tools that enhance efficiency, accuracy, and scalability in data collection. One of the recommendations made was that researchers and organisations should develop and adhere to ethical guidelines that prioritise data privacy, security, and fairness.

KEYWORDS: Artificial Intelligence, Research Activities and Data Collection Process

INTRODUCTION

Artificial Intelligence (AI) has revolutionised the research landscape, introducing innovative tools and methodologies that enhance efficiency, accuracy, and scalability in data collection processes. By -leveraging machine learning algorithms, natural language processing, and predictive analytics, AI enables researchers to navigate complex datasets, automate mundane tasks, and achieve unprecedented levels of precision (Eziefule, Adelakun, Okoye & Attieku, 2022). This paradigm shift in research activities is particularly relevant in an era where data-driven decisions are central to societal advancement. AI's role in research, therefore, transcends traditional methods, offering dynamic solutions to challenges in data acquisition and analysis.

The integration of AI into research activities has redefined the boundaries of human capabilities, bridging gaps in real-time data processing and improving accessibility to diverse datasets. Tools like AI-powered web crawlers, chatbots, and image recognition systems have made data collection faster and more efficient. For instance, AI-driven web scraping technologies allow researchers to harvest relevant information from the internet within minutes, a task that could otherwise take weeks (Weerasinghe, Maduranga, and Kawya, 2024). This technological advancement reduces human error while ensuring that datasets are both comprehensive and relevant to specific research objectives.

Furthermore, AI's ability to analyse patterns and extract insights from unstructured data enhances the credibility of research findings. Many industries have adopted AI techniques to collect and interpret data more effectively. These AI applications underscore the importance of strategic steps to optimise the data collection process for better research outcomes. However, the integration of AI into research is not without its challenges. Ethical concerns regarding privacy, bias in algorithmic decisions, and the potential for misuse of sensitive data require careful consideration. Researchers must develop frameworks that address these concerns while promoting transparency and accountability in AI applications (Cheong, 2024). Such strategic measures are crucial for fostering trust and ensuring that AI's involvement in research remains aligned with ethical standards and societal values.

The involvement of artificial intelligence in research activities marks a transformative era for data collection. By exploring strategic steps to enhance data acquisition processes, researchers can leverage AI's potential to unlock new possibilities, address existing limitations, and contribute to the advancement of knowledge across various disciplines. This study aims to investigate the methods and strategies that maximise AI's impact on research, emphasising the importance of ethical and innovative approaches to data collection.

STATEMENT OF PROBLEM

The involvement of Artificial Intelligence (AI) in research activities has transformed data collection, yet challenges persist in optimizing its effectiveness. Many researchers struggle with integrating AI tools due to a lack of technical expertise and inadequate infrastructure. Issues such as data privacy, bias in AI algorithms, and the reliability of AI-generated data further complicate its adoption. Additionally, the cost of advanced AI technologies remains a barrier for researchers in resource-limited settings. Ensuring accuracy, ethical considerations, and seamless automation in AI-driven data collection is crucial for improving research quality. There is also a need for strategic steps to enhance AI’s role in streamlining data gathering, processing, and analysis. Addressing these gaps will improve research efficiency, reliability, and innovation. This study aims to explore strategic approaches for enhancing AI-driven data collection in research activities.

OBJECTIVES

- To find out the extent of artificial intelligence involvement in research activities carried out by post graduate students in tertiary institution in Akwa Ibom State
- To explore the roles of artificial intelligence performance in enhancing research process carried by post graduate students in tertiary institution in Akwa Ibom State

RESEARCH QUESTIONS

- What is the extent of artificial intelligence involvement in research activities carried out by post graduate students in tertiary institution in Akwa Ibom State?
- What are roles of artificial intelligence performance in enhancing research process carried by post graduate students in tertiary institution in Akwa Ibom State?

LITERATURE REVIEW

Concept of Artificial Intelligence

According to Lion and Ekefre (2024), the term artificial intelligence (AI) describes computer programs that are able to carry out sophisticated operations that were previously limited to human performance, such as problem-solving, thinking, and decision-making. According to Copeland (2024), cited in Ikechukwu and Echerenachukwu (2024), artificial intelligence (AI) is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. Artificial intelligence (AI) describes computer programs that are able to carry out sophisticated operations that were previously limited to human performance, such as problem-solving, thinking, and decision-making (Ufot, 2024).

Artificial intelligence (AI) is the study of how the human brain makes decisions, learns new things, and thinks through difficulties. The goal of artificial intelligence is to enhance computer abilities related to human understanding, including language intelligence, learning, reasoning, and problem-solving (Akpan and Clark, 2024). Furthermore, Huge and Godwin (2024) defined artificial intelligence (AI) as the idea and practice of creating computer systems that can do tasks like speech recognition, decision-making, and pattern recognition that traditionally needed human intelligence.

Furthermore, Ikechukwu (2024) mentioned that in contrast to the inherent intelligence of biological things, artificial intelligence (AI) is the broad definition of intelligence displayed by machines, especially computer systems. By utilising clever algorithms integrated into a dynamic computing environment, artificial intelligence mimics human thought processes. A branch of computer science called artificial intelligence studies how computers learn, comprehend data, recognise characters in images, analyse pictures, and simulate how the eyes work. In addition, artificial intelligence refers to the research and programming of computers to carry out intelligence tasks that require human intervention (Udo-Okon and Akpan, 2024).In the same vein, Bassey and Owushi (2023) defined artificial intelligence as the collection of technologies that enable machines to sense, comprehend, act, and perform several functions matching those of humans. Major components of the artificial intelligence bucket are machine learning, big data, natural language processing, decision logic, data visualisation, and data analytics.

CONCEPT OF RESEARCH ACTIVITIES

Research activities are systematic investigations that create new knowledge or use existing knowledge in new ways. They can be formal or informal and can involve a variety of methods, including literature reviews and experiments. Research activities refer to activities that result in the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies, and understandings. This could include synthesis and analysis of previous research to the extent that it leads to new and creative outcomes.

Research activities involve systematic and structured efforts to investigate specific problems, generate new knowledge, or validate existing theories. They are central to academic, scientific, and professional development, offering a framework for understanding phenomena, solving problems, and improving practices. Research activities typically begin with identifying a research problem or question, followed by a literature review to contextualise the inquiry. This process ensures that the study is built upon a solid foundation of existing knowledge (Pandey, 2024). The methodology is a critical component of research activities, guiding the processes and techniques for data collection and analysis. Quantitative research employs statistical tools to analyse numerical data, while qualitative research explores non-numerical data to understand underlying meanings and patterns. Mixed methods research, which combines both qualitative and quantitative approaches, has gained prominence for its ability to provide comprehensive insights (Ahmed, Pereira, and Kimberly, 2024). The choice of methodology depends on the research objectives, ensuring alignment with the study's goals.

Ethics is another essential aspect of research activities. Researchers are required to adhere to ethical standards, which include obtaining informed consent from participants, ensuring confidentiality, and avoiding plagiarism. These principles are vital for maintaining the integrity of the research process and protecting the rights of participants (Zhaksylyk, Zimba, Yessirkepov, & Kocyigit, 2023). Ethical compliance not only enhances the credibility of the research but also ensures its acceptance in the broader academic and professional communities.

The outcomes of research activities contribute significantly to knowledge generation and decision-making. They provide evidence-based solutions to societal problems, enhance policy formulation, and support innovation. For instance, research in education has informed curriculum development, while scientific research has led to breakthroughs in technology (Haleem, Javaid, Qadri, and Suman, 2022). Thus, research activities remain a cornerstone of progress across various disciplines, driving sustainable development and global advancement.

CONCEPT OF DATA COLLECTION

Data collection is the process of gathering information to answer questions, test hypotheses, and evaluate outcomes. It's a key part of research in many fields, including business, social sciences, and healthcare. Data Collection. Data collection is the process of gathering and measuring information on variables of interest in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes.

According to Sharma (2023), data collection is the process of collecting and evaluating information or data from multiple sources to find answers to research problems, answer questions, evaluate outcomes, and forecast trends and probabilities. Taherdoost (2021) mentioned that data collection is the process of gathering data for use in business decision-making, strategic planning, research, and other purposes. It's a crucial part of data analytics applications and research projects. Effective data collection provides the information that's

needed to answer questions, analyse business performance or other outcomes, and predict future trends, actions, and scenarios.

Data collection, or data gathering, is the process of gathering and measuring information on targeted variables in an established system, which then enables one to answer relevant questions and evaluate outcomes. Data collection is a research component in all study fields, including physical and social sciences, humanities, and business. While methods vary by discipline, the emphasis on ensuring accurate and honest collection remains the same. The goal for all data collection is to capture evidence that allows data analysis to lead to the formulation of credible answers to the questions that have been posed.

ROLES OF ARTIFICIAL INTELLIGENCE IN RESEARCH PROCESS

Artificial intelligence plays unique roles especially for (predictive analytics) in diverse sectors. For instance, in the health sector as mentioned by Godwin, Awofala and Oni (2023) predictive analytics is transforming the landscape of healthcare by leveraging vast amounts of historical health data to forecast future outcomes. The following are the roles of artificial intelligence in research activities:

- **Data Collection and Analysis:** AI tools are capable of processing and analysing vast amounts of data efficiently. For example, machine learning algorithms can identify patterns and trends in large datasets that may not be evident through traditional methods (Rehman, Wu, Ali, Rasheed, Shaheen, Liu, Luo, and Zhang, 2024). This is particularly useful in fields such as genomics, economics, and social sciences, where data volumes are immense. AI can also automate data cleaning, ensuring that datasets are free from errors and inconsistencies.

- **Automation of Repetitive Tasks:** AI significantly reduces the time researchers spend on repetitive, labour-intensive tasks such as data transcription, coding, and image analysis. Automation allows researchers to focus on higher-order tasks such as hypothesis development and critical analysis.
- **Simulation and Predictive Modelling:** AI-powered simulations and models enable researchers to test hypotheses and predict outcomes without the need for physical experiments. In fields like climate science, AI models can simulate weather patterns and predict climate changes based on historical data. Similarly, in medicine, AI algorithms are used to predict disease progression and treatment outcomes (Khalifa and Albadawy, 2024). This reduces research costs and accelerates the discovery process.
- **Enhancing Collaboration:** AI fosters interdisciplinary collaboration by integrating diverse research areas and facilitating real-time communication. Tools like AI-powered virtual laboratories and collaborative platforms allow researchers from different locations to share data and work together effectively. Additionally, AI-driven recommendation systems suggest relevant research papers, datasets, and collaborators, encouraging knowledge exchange and innovation (Mariani, Machado, Magrelli, and Dwivedi, 2023).
- **Improving Knowledge Accessibility and Dissemination:** AI tools help researchers make their findings more accessible to diverse audiences. For instance, AI can summarise lengthy research papers into concise abstracts or summaries, making the core ideas easier to understand. Translation tools powered by AI also enable research findings to be disseminated across language barriers, promoting global knowledge sharing.

ARTIFICIAL INTELLIGENCE AND DATA COLLECTION

Artificial Intelligence (AI) has made significant strides in transforming research methodologies, particularly in data collection processes. Traditionally, data collection in research activities involved manual processes, which were time-consuming, prone to human error, and often limited by the scale and complexity of data. With AI, researchers can now automate, enhance, and expedite data collection, leading to more efficient and accurate results.

- **Automating Data Collection:** AI-powered tools, such as web scraping software, sensors, and IoT devices, enable researchers to collect data autonomously in real time (Verma and Kaur, 2024). For example, in fields like environmental research, AI-driven sensors can collect vast amounts of data on air quality, temperature, and pollution levels continuously. In social science studies, AI can assist in collecting large-scale survey data through chatbots, which can converse with participants and gather responses quickly. This automation reduces the burden on researchers and allows for the collection of data at a scale and speed previously impossible.
- **Enhancing Data Accuracy:** AI technologies, such as machine learning algorithms, can be applied to clean and process data during collection. By identifying and removing outliers, correcting errors, and filling in missing data, AI ensures that the data researchers collect is accurate and reliable (Encord, 2023). This is particularly important in fields where precision is crucial, such as medical or engineering research, where minor errors could have significant impacts on results and conclusions.
- **Improving Data Analysis:** AI not only supports data collection but also enhances how data is analysed. AI models can sift through large datasets much faster than traditional statistical methods, detecting patterns, trends, and correlations that might otherwise go unnoticed. This capability is particularly useful in research areas like genomics, market research, and even social media analysis, where datasets are so vast that traditional analysis techniques are inadequate. By providing deeper insights into the data collected, AI helps researchers make more informed decisions and generate more meaningful conclusions (Soori, Arezoo, and Dastres, 2023).
- **Real-time Data Processing and Feedback:** AI systems can provide real-time feedback during the data collection process, enabling researchers to monitor the quality of the data being collected continuously. For instance, in clinical trials, AI can analyse patient data in real time to ensure that no critical errors are made in data input. Similarly, AI-driven systems in field research can alert researchers to any inconsistencies or anomalies in data, allowing them to address issues immediately (Adelakun, Antwi, Fatogun & Olaiya, 2024).
- **Ethical Considerations and Challenges:** While AI enhances data collection in many ways, it is essential to consider the ethical implications of its use. AI can introduce biases into the data collection process if not properly monitored, leading to skewed or inaccurate results (Hanna, Pantanowitz, Jackson, Palmer, … and Rashidi, 2024). Researchers must also ensure that AI systems comply with privacy laws, especially in areas like healthcare and social science research, where sensitive personal data is often involved. Additionally, the use of AI in data collection requires transparency to ensure that the methodology is clearly understood and accessible to all stakeholders.

CHALLENGES OF ARTIFICIAL INTELLIGENCE IN PERFORMING DATA COLLECTION

The following are the challenges AI faces in performing data collection:

- **Data Quality and Bias:** AI systems rely heavily on high-quality and unbiased datasets for accurate data collection and analysis. However, poor-quality data—such as incomplete, irrelevant, or inconsistent datasets—can lead to flawed results. Bias in datasets, such as over-representation of certain demographics, can further skew AI models, resulting in discriminatory or inaccurate outcomes (Hanna, Pantanowitz, Jackson, Palmer, Visweswaran, Pantanowitz, Deebajah, and Rashidi, 2024).
- **Data Privacy and Security:** AI often requires access to sensitive personal data, which raises serious privacy concerns. Collecting data without adequate privacy safeguards can violate user rights and expose organisations to legal challenges under global regulations like the General Data Protection Regulation (GDPR) (Ye, Yan, Li, and Jiang, 2024). Additionally, AI systems are vulnerable to cybersecurity threats, including data breaches and unauthorised access, which can compromise sensitive information. Balancing effective data collection with compliance to privacy laws is a critical challenge for AI developers.
- **Algorithmic Transparency and Interpretability:** Many AI models, especially those using deep learning techniques, function as "black boxes," meaning their internal processes are difficult to understand or interpret. This lack of transparency creates challenges in verifying the accuracy and reliability of AI-driven data collection. In fields like healthcare and criminal justice, the inability to explain AI decisions undermines trust in the system and raises ethical concerns (Rai, 2020). Researchers face the dual challenge of making AI systems both interpretable and effective.
- **Infrastructure and Resource Limitations:** AI systems require substantial computational resources, such as high-performance hardware, reliable internet access, and large-scale storage facilities. These requirements pose challenges, particularly in resource-limited environments like developing countries or small organisations. Moreover, the high costs of implementing and maintaining AI systems can restrict their adoption by smaller research teams or businesses, limiting the scalability of AI-driven data collection (Haefner, Parida, Gassmann, and Wincent, 2023).

MITIGATION OF THE CHALLENGES OF ARTIFICIAL INTELLIGENCE IN PERFORMING DATA COLLECTION

Artificial intelligence (AI) in data collection faces significant challenges, but implementing strategic mitigation measures can enhance its efficiency and reliability. Below are ways to address these challenges effectively:

- **Ensuring Data Quality and Reducing Bias:** To mitigate issues of data quality and bias, organisations must adopt rigorous data preprocessing techniques, including data cleaning, normalisation, and validation, to ensure datasets are accurate, complete, and consistent. Additionally, strategies such as diversifying data sources and employing fairness-aware algorithms can help reduce biases in AI systems. Mariani et al., 2023). Continuous monitoring and auditing of AI systems are crucial for identifying and addressing biases that may arise during real-time data collection.

- **Enhancing Data Privacy and Security:** Implementing robust data encryption, anonymisation, and secure access controls can mitigate privacy and security concerns (Olabiyi, Frank, Owen, and Olaoye, 2024). Technologies like federated learning allow AI systems to analyse decentralised data without transferring it to a central server, ensuring privacy while maintaining performance. Compliance with global data protection regulations, such as the General Data Protection Regulation (GDPR), and adopting ethical AI frameworks can further safeguard user data and enhance public trust in AI systems.

- **Improving Algorithmic Transparency and Interpretability:** To address the "black box" problem in AI, researchers and developers should focus on creating explainable AI (XAI) models that provide clear insights into their decision-making processes. Techniques like model-agnostic interpretation methods, including Local Interpretable Model-Agnostic Explanations (LIME), can help users understand AI predictions. Incorporating interpretability as a core design principle ensures accountability and fosters trust in AI systems.

- **Addressing Infrastructure and Resource Limitations:** Organisations can leverage cloud computing and AI-as-a-Service (AIaaS) platforms to reduce infrastructure costs and enable access to high-performance computing resources. Open-source AI frameworks like TensorFlow and PyTorch provide cost-effective tools for small organisations and researchers to build and implement AI systems. Governments and international organisations can also play a role by investing in digital infrastructure and providing subsidies to support the adoption of AI in resource-limited settings.

METHODOLOGY

In carrying out the study, a descriptive survey design was adopted and the study was carried out in Akwa Ibom State. The targeted population for the study comprised all post graduate students in tertiary institutions in Akwa Ibom State. Simple random sampling technique was used to select 60 post graduate students in University of Uyo and 60 post graduate student in Akwa Ibom State University making it a total of 120 respondents used for the study. The instrument used for data collection was a structured questionnaire titled “Artificial Intelligence in Research Activities Questionnaire (AIRAQ)”. Face and content validation of the instrument was carried out by an expert in test, measurement, and evaluation in order to ensure that the instrument has the accuracy, appropriateness, and completeness for the study under consideration. The reliability coefficient obtained was 0.91, and this was high enough to justify the use of the instrument. The researcher subjected the data generated for this study to appropriate statistical technique such percentage analysis to answer research questions.

Table 1

Descriptive Statistics of the Extent of Artificial Intelligence Involvement In Research Activities Carried Out By Post Graduate Students In Tertiary Institution In Akwa Ibom State

EXTENT OF AI INVOLVEMENT	FRQ	%
VHE	9	7.5*
HE	15	12.5
LE	37	30.83
VLE	59	49.17**
TOTAL	120	100

**** The highest percentage**

*** The least percentage**

VHE = Very Low Extent**; HE**= High Extent; **LE=** Low Extent; **VLE=**Very Low Extent

SOURCE: FIELD SURVEY

The above table indicates the extent of involvement of Artificial Intelligence (AI) in research activities carried out by postgraduate students in tertiary institutions in Akwa Ibom State. In this context it was recorded that a remarkable portion of postgraduate students (49.17%) reported the level of involvement to be of very low extent (49.17) while the least (7.5%) of post students reported the involvement to be very high extent and these results reveals that AI is still minimally integrated into research activities by the majority of postgraduate students in Akwa Ibom State's tertiary institutions. This result aligns with the opinion of Verma and Kaur (2024) who mentioned that AI-powered tools, such as web scraping software, sensors, and IoT devices, enable researchers to collect data autonomously in real time.

Table 2

Descriptive Analysis of the Roles of Artificial Intelligence Performance in Enhancing Research Process Carried by Post Graduate Students in Tertiary Institution in Akwa Ibom State

PROCESS	FRQ	%
Data Collection and Analysis	36	30**
Automation of Repetitive Tasks	29	24.17
Simulation and Predictive Modelling	17	14.17
Enhancing Collaboration	16	13.33*
Improving Knowledge Accessibility and Dissemination	22	18.33
TOTAL	120	100

**** The highest percentage**

*** The least percentage**

SOURCE: FIELD SURVEY

The above table outlines the various roles AI plays in the research process carried out by postgraduate students in tertiary institutions in Akwa Ibom State. The categories represent different aspects of the research processes where AI is having an impact. In this context the highest respondents of the respondents (30%) indicated that AI plays a key role in data collection and analysis, this suggests that AI is most often used for automating and enhancing data analysis. On the other hand, the least percentage of the respondents (13.33%) noted that AI enhances collaboration among researchers. This suggests that, while AI is aiding individual research tasks, it is not yet a dominant tool in facilitating collaboration between researchers. This result corroborates with the opinion of Rehman, Wu, Ali, Rasheed, Shaheen, Liu, Luo, and Zhang, (2024) who mentioned that AI tools are capable of processing and analysing vast amounts of data efficiently.

CONCLUSION

Artificial Intelligence (AI) has transformed research by introducing innovative tools that enhance efficiency, accuracy, and scalability in data collection. The result of the data analysed data concluded that the extent of artificial intelligence involvement in research activities carried out by post graduate students in tertiary institution in Akwa Ibom state is very low. It also showed that data collection and analysis is the most prominent roles of artificial intelligence performance in enhancing research process carried by post graduate students in tertiary institution in Akwa Ibom State. It enables researchers to navigate complex datasets, automate tasks, and achieve high precision, redefining traditional methods and offering dynamic solutions. AI-powered tools like web crawlers and image recognition systems streamline data acquisition, reducing human error and improving accessibility to diverse datasets. By analysing patterns and extracting insights from unstructured data, AI enhances research credibility across various industries. However, ethical concerns regarding privacy, bias, and transparency require strategic frameworks to foster trust and ensure AI-driven research aligns with societal values.

RECOMMENDATIONS

- Researchers and organizations should develop and adhere to ethical guidelines that priorities data privacy, security, and fairness. Implementing frameworks for compliance with data protection regulations and employing privacy-preserving AI techniques, such as data anonymization and federated learning, can enhance trust and transparency in AI-driven data collection processes.
- Ensuring the use of high-quality, unbiased, and diverse datasets is essential for improving the accuracy and reliability of AI systems. Researchers should employ rigorous data validation methods, expand data sources, and continuously audit AI models to minimize biases and inaccuracies during the data collection process.
- The adoption of explainable AI (XAI) models is crucial for improving trust and accountability in research activities. Developers should priorities creating AI systems with transparent decision-making processes, enabling researchers and stakeholders to understand how data is collected, analyzed, and utilized to inform conclusions.

REFERENCES

Adelakun, B. O., Antwi, B. O., Fatogun, D. T. & Olaiya, O. P. (2024). Enhancing audit accuracy: The role of AI in detecting financial anomalies and fraud. *Finance & Accounting Research Journal*, 6(6), 1049-1068.

Ahmed, A., Pereira, L. and Kimberly, J. (2024). *Mixed Methods Research: Combining both qualitative and quantitative approaches*.

Akpan, E. E. and Clark, J. L. (2024). Artificial Intelligence: An Emerging Technology for Service and Production Enhancement in the 21st Century. *Global Academic Journal of Library and Information Science (GAJLIS)*, 3(1), 63-74.

Bassey, M. M. and Owushi, E. (2023). Adoption of Artificial Intelligence in Library and Information Science in the 21st Century: Assessing the Perceived Impacts and Challenges by Librarians in Akwa Ibom and Rivers States. *International Journal of Current Innovations in Education*, 6(1), 75-85.

Cheong, B. C. (2024). Transparency and accountability in AI systems: safeguarding wellbeing in the age of algorithmic decision-making. *Frontiers in Human Dynamics*, 6(1). https://doi.org/10.3389/fhumd.2024.1421273.

Encord (2023). Mastering Data Cleaning & Data Preprocessing. Available at: https://encord.com/blog/data-cleaning-data-preprocessing/#:~:text=Outlier%20Detection: %20Outliers%20are%20data,clustering%20or%20anomaly%20detection%20algorithms.

Eziefule, A. O., Adelakun, B. O., Okoye, I. N. & Attieku, J. S. (2022). The Role of AI in Automating Routine Accounting Tasks: Efficiency Gains and Workforce Implications. *European Journal of Accounting, Auditing and Finance Research*, 10(12), 109-134.

Godwin, O. S., Awofala, T. B., & Oni, O. PREDICTIVE ANALYTICS FOR EARLY DETECTION OF DIABETES IN LOW-RESOURCE SETTINGS.

Haefner, N., Parida, V., Gassmann, O. and Wincent, J. (2023). Implementing and scaling artificial intelligence: A review, framework, and research agenda. *Technological Forecasting and Social Change*, 197(1). https://doi.org/10.1016/j.techfore.2023.122878.

Haleem, A., Javaid, M., Qadri, M. A., and Suman, R. (2022). Understanding the Role of Digital Technologies in Education: A Review. *Sustainable Operations and Computers*, 3(1), 275-285.

Hanna, M., Pantanowitz, L., Jackson, B., Palmer, O., Visweswaran, S., Pantanowitz, J., Deebajah, M. and Rashidi, H. (2024). Ethical and Bias Considerations in Artificial Intelligence (AI)/Machine Learning. *Modern Pathology*, 16(1), https://doi.org/10.1016/j.modpat.2024.100686

Huge, K. C. and Godwin, O. E. (2024). Adoption of Artificial Intelligence in Curbing Fraud in Public Organisation: Assessing Fraud Detection and Control. *GASPRO International Journal of Eminent Scholars*, 11(1), 44-54.

Ikechukwu, I. B. (2024). An Evaluation of the Challenges Encountered by Businesses in the Adoption and Implementation of Artificial Intelligence in Imo State: An Academic

Discourse. *International Journal of Advancement in Education, Management, Science and Technology*, 7(1), 50-60.

Ikechukwu, I. G. and Echerenachukwu, O. (2024). Assessment of Artificial Intelligence Roles in Teaching and Learning (ICT) for Problem Solving in Secondary School in Imo State: Investigating the Prospect and Challenges. *GASPRO International Journal of Eminent Scholars*, 11(1), 108-123.

Jain, P. (2024). What Is Data Collection: Methods, Types, Tools. Available at: https://www.simplilearn.com/what-is-data-collection-article

Khalifa, M. and Albadawy, M. (2024). Artificial Intelligence for Clinical Prediction: Exploring Key Domains and Essential Functions. *Computer Methods and Programs in Biomedicine Update*, 5(1). https://doi.org/10.1016/j.cmpbup.2024.100148.

Lion, C. J. and Ekefre, A. E. (2024). Risk Control and Management in Banking Sector: Investigating the Work of Artificial Intelligence in Mitigating Risks. *International Journal of Advancement in Education, Management, Science and Technology*, 7(1), 82-92.

Mariani, M. M., Machado, I., Magrelli, V. and Dwivedi, Y. K. (2023). Artificial intelligence in innovation research: A systematic review, conceptual framework, and future research directions. *Technovation*, 122 (1). https://doi.org/10.1016/j.technovation.2022.102623

Olabiyi, W., Frank, E., Owen, S. and Olaoye, G. (2024). Best practices for implementing data encryption and anonymization.

Pandey, G. P. (2024). Doing a Literature Review in English Language Teaching Research: Practical Suggestions. *International Journal of Nepal Library Association*, 3(1), 133-148. DOI: 10.3126/access.v3i1.69429.

Rai, A. (2020). Explainable AI: From black box to glass box. *Journal of the Academy of Marketing Science*, 48(1), 137–141.

Rehman, A. U., Wu, M. L., Ali, Y., Rasheed, S., Shaheen, S., Liu, X., Luo, R. and Zhang, J. (2024). Role of Artificial Intelligence in Revolutionizing Drug Discovery. *Fundamental Research*. https://doi.org/10.1016/j.fmre.2024.04.021.

Robinson, S., Stedman, C., and McLaughlin, E. (2024). Data Collection. Available at: https://www.techtarget.com/searchcio/definition/data-collection

Rodrigues, R. (2020). Legal and human rights issues of AI: Gaps, challenges and vulnerabilities. *Journal of Responsible Technology*, 4(1), https://doi.org/10.1016/j.jrt.2020.100005

Sharma, Y. (2023). Data Collection in Research: Concept, Process and Methods. International *Journal of Creative Research Thoughts (IJCRT)*, 11(10), 27-33.

Soori, M., Arezoo, B. and Dastres, R. (2023). Artificial intelligence, machine learning and deep learning in advanced robotics, a review. *Cognitive Robotics*, 3(1), 54-70.

Taherdoost, H. (2021). Data Collection Methods and Tools for Research; a Step-by-Step Guide to Choose Data Collection Technique for Academic and Business Research Projects. *International Journal of Academic Research in Management (IJARM)*, 10(1), 10-38.

Udo-Okon, T. N. and Akpan, E. E. (2024). The Challenges of Artificial Intelligence in Library Management System. *Intercontinental Academic Journal of Library and Information Science,* 6(1), 96-107.

Ufot, S. I. (2024). Artificial Intelligence and Digital Marketing: Assessing the AI Enhancing Tools for Effective Marketing in Akwa Ibom State. *Global Academic Journal of Library and Information Science (GAJLIS)*, 3(1), 87-95.

Verma, P. K. and Kaur, L. (2024). Research Paper on Role of Data Features and Data Collection Tools in Artificial Intelligence. *IJRASET Journal for Research in Applied Science and Engineering Technology*. https://doi.org/10.22214/ijraset.2024.58693.

Weerasinghe, K., Maduranga, M. and Kawya, M. (2024). *Enhancing Web Scraping with Artificial Intelligence: A Review*. A conference paper presented at the KDU FOC Student Symposium 2024.

Ye, X., Yan, Y., Li, J. and Jiang, B. (2024). Privacy and personal data risk governance fo*r generative artificial intelligence: A Chinese perspective.* Telecommunications Policy, 48(10). https://doi.org/10.1016/j.telpol.2024.102851.

Zhaksylyk, A., Zimba, O., Yessirkepov, M., & Kocyigit, B. F. (2023). Research Integrity: Where We Are and Where We Are Heading. *Journal of Korean medical science*, 38(47), e405. https://doi.org/10.3346/jkms.2023.38.e405.