

Fourth Industrial Revolution Technologies and Service Delivery in Akwa Ibom State University, Nigeria

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Abstract

The fourth industrial revolution is characterized by the integration of advanced technologies that are reshaping industries, economies and universities worldwide. In Nigerian universities, there is a growing emphasis on incorporating fourth-industrial revolution technologies such as artificial intelligence, internet service and big data analytics into academic programmes and research activities. Although, at Akwa Ibom State University, e-learning and e-administration have been introduced, their applicability is substantially low. It was against this background that this study examined fourth industrial revolution technologies and service delivery at Akwa Ibom State University. The study relied heavily on a structured questionnaire and in-depth interviews with lecturers and non-teaching staff of Akwa Ibom State University. The population of the study was 334 and the sample size was 321 representing 96%. The study adopted the technology acceptance theory, while the Pearson product-moment correlation analysis was applied to test the research hypotheses with the aid of a statistical package for social sciences (SPSS). The study found that integrating fourth industrial revolution technologies such as artificial intelligence and internet service into the academic programmes and research activities of the Akwa Ibom State University would enhance service delivery. Based on the findings, it was recommended that the management of Akwa Ibom State University should incorporate artificial intelligence (AI) and internet services technologies into its system to enhance service delivery, particularly in the areas of research and administration of student records.

Keywords: Fourth industrial revolution, artificial intelligence, internet service, service delivery, Akwa Ibom State University, Nigeria.

1. Introduction

Internationally, there is an increasing focus on incorporating innovations from the fourth industrial revolution into various businesses, economies, and universities. The fourth industrial revolution, sometimes referred to as Industry 4.0, is defined by the integration of technologies that create a seamless connection between the physical, digital, and biological domains. This revolution is transforming our lifestyle, employment, and interaction with the surrounding world. The fourth industrial revolution has produced significant elements such as AI, cognitive systems, data mining, and the Internet of Things (CPSI, 2018 cited in Nel & Masilela, 2020).

Artificial intelligence (AI) is a crucial technology in the fourth industrial revolution. Nigerian universities are already integrating AI into their curricula by providing courses on machine learning, data science, and robotics. The university's research output is enhanced by the extensive and high-quality research undertaken by both lecturers and students on AI-related topics, which includes publications.

One of the primary objectives of artificial intelligence in education is to offer tailored learning guidance or assistance to students based on their learning progress, preferences, or personal traits (Hwang, 2014, Hwang et al., 2020). Internet services is a significant technology in the fourth industrial revolution. Internet services are a promising technology that autonomously records and verifies transactions (Rajasekaran et al., 2022). By documenting educational transactions, such as assignments, examinations, and certifications, on a transparent and unchangeable blockchain, the system can identify and discourage plagiarism and cheating (Jiang and Mok, 2019). The element of the fourth industrial revolution will enable the government to develop and implement proactive public service delivery with the potential for significant, impactful, sustainable, and innovative transformation across public sector institutions; cutting cost, high quality and standardization of public sector goods and service, improved ICT skills (Nel & Masilela, 2020).

Recent research conducted by Alsobhi et al., (2023), Bhaskar, Tiwari & Joshi (2021), David et al., (2022) and Jiang & Mok (2019) has demonstrated that the integration of artificial intelligence and internet services technologies in university systems has the potential to provide substantial advantages in the processing of examination results and the verification of credentials. Akwa Ibom State University (AKSU) has been working towards the digitalisation and digitisation of the institution. The term digitalisation portrays the change, impact and consequences of information and communication technology in the areas of economic, political, cultural and social on the society and its system, while digitisation is a technical process of converting analogue streams of information into digital bits that have discrete and discontinuous values or are based on two separate states (Ovuru, 2022). For international recognition of scholarship, Akwa Ibom State University has adopted a new criteria for the promotion of Academic Staff which compels all academic staff to be visible internationally. Also, meeting with global best practices, AKSU has an E-library section. ICT in the AKSU library has a tremendous influence on promoting national integration and sustainable development in Nigeria (Umoren, 2022). Umoren further indicates that with the use of ICT in Akwa Ibom State University, Akwa Ibom State University librarians are alert to face the challenges of acquisition of printed, and non-printed materials that will foster unity among users.

Despite the documented advantages of both artificial intelligence (AI) and internet services technology, Akwa Ibom State University seems to continue to rely on some old ways of computing test results and verifying credentials. This outdated approach results in higher expenditures for the university. The manual methods of learning and verification procedures are both time-consuming and arduous for the university system, leading to subpar service delivery. This study proposes the integration of fourth industrial revolution technologies, specifically artificial intelligence (AI) and *internet service*, into Akwa Ibom State University. The objective is to improve the quality of research output, teaching, and credential verification inside the university.

1.2 Statement of Problem

During the last five years, the scientific research conducted by Akwa Ibom State University has yielded numerous favourable outcomes. In the 2023 rating, the University was ranked as the 60th best university in Nigeria and the 6818th best university globally. It received a score of 60 in research subjects, had 1,024 academic publications, and received 4,077 citations (eduranking.org/uni/akwa-ibom-state-university/rankings). In addition to its traditional administrative techniques, the institution has also implemented e-administration and e-learning. The empirical evidence demonstrates that the linkage between technologies associated with the fourth industrial revolution, such as artificial intelligence and blockchain, in the realm of research, including publications and administrative practices, remains tenuous. The manual procedure of preparing students' results and verifying academic qualifications has proven to be arduous, especially when dealing with a high number of students. The current process is both time-consuming and prone to errors, leading to inefficiencies in administrative procedures and delays in graduation rates. This study investigates the implementation of fourth industrial revolution technologies and service delivery in Akwa Ibom State University, Nigeria, taking into account the prevailing circumstances.

1.3 Objectives of the Study

The main objective of this study was to examine the Fourth Industrial Revolution Technologies and Service Delivery in Nigerian Universities using Akwa Ibom State University as the focus. Thus, the specific objectives include:

1. to determine the relationship between artificial intelligence and research output in Akwa Ibom State University.
2. to investigate the extent to which internet services technology relates to the administration of academic credentials and computation of examination results for students in Akwa Ibom State University.

2. Literature Review

2.1 Conceptual Framework

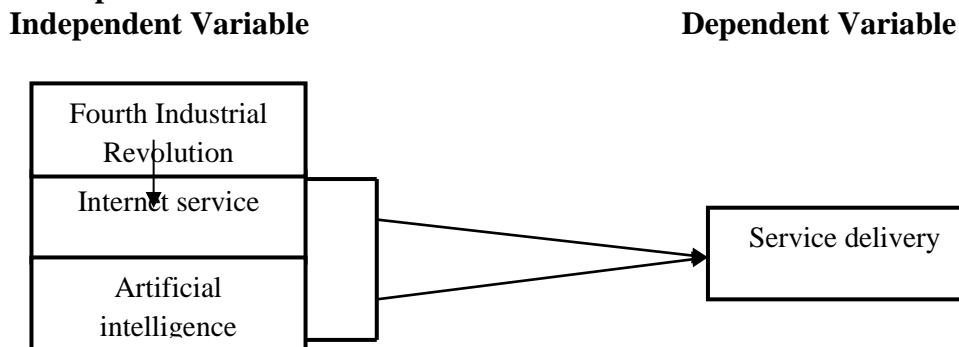


Figure 1: Conceptual Model showing the relationship between Fourth Industrial Revolution Technologies and service delivery in Akwa Ibom State University

Figure 1 demonstrates the position of this study in terms of building organizational performance by integrating Fourth Industrial Revolution Technologies such as artificial intelligence and internet service into Akwa Ibom State University system for effective and efficient service delivery.

2.2 Fourth Industrial Revolution

Pitsis et al., (2020) assert that the fourth industrial revolution is characterized by the advanced adoption of radical technologies and the co-existence of the virtual and real world, while David et al., (2022) define it as a period that changes the world radically through new technological advancements while

uniting digital, physical and biological domains and implementing shifts in workplaces, wealth, power and knowledge (Xu *et al.*, 2018).

Qazi *et al.*, (2020) and Anshari *et al.*, (2022) maintain that the fourth industrial revolution has been conceptualized as a new way of living, communicating, working, and using technology. It is found in every aspect of human endeavour which controls the value chain. Every society is looking for how to improve and develop its technological base.

2.3 Artificial Intelligence and Research Output

Artificial intelligence (AI) refers to a computer programme that can handle functions such as adapting, learning, synthesising, correcting, and utilising diverse data needed for processing difficult tasks (Stefan *et al.*, 2017). AI is very useful in governmental businesses as it has contributed greatly to service delivery. It is a new way to drive public and private sectors effectively and efficiently.

On their part, Akgun & Greenhow (2021) and Miao *et al.*, (2021) have elucidated that artificial intelligence (AI) applications hold great potential in aiding teachers and students in various ways. These include delivering instruction in classrooms with students of different abilities, offering students comprehensive and timely feedback on their written work, alleviating teachers from the pressure of possessing all knowledge, and allowing them to focus on supporting students during observation, discussion, and collaborative knowledge-building activities.

According to Kim *et al.* (2019) and Krutka *et al.*, (2019), social networking sites facilitate the connection between students and professors by utilising social media platforms like Facebook. Integrating social media can enhance students' engagement in learning, foster their ability to work together, and facilitate their links with external communities. Chatbots are present on social media platforms as a result of the many artificial intelligence systems.

Akgun & Greenhow (2021) state that personalised learning systems, usually referred to as adaptive learning platforms or intelligent tutoring systems, are common and valuable applications of artificial intelligence that provide support to students and teachers. These applications provide students with access to a wide range of educational resources tailored to their individual learning requirements and academic areas.

Owocet *et al.*, (2019) confirm that adaptive learning is a highly promising advantage of artificial intelligence in the field of education. Although the standard classroom education approach remains uniform for all students, adaptive learning solutions driven by artificial intelligence are specifically developed to optimise learning efficiency.

According to Cheng *et al.*, (2022), although there are several benefits, there are also valid drawbacks. A major problem is privacy. The infringement of privacy and the ambiguity presented by artificial intelligence are important concerns regarding the adverse aspects of incorporating technology in ridesharing.

2.4. Service Delivery

According to El-Rufai (2006), service delivery is the degree of an organisation and/or employee performance, output and productivity in the discharge of their responsibilities within the available time, money and other resources towards the achievement of overall goals of the organisation. Davidson (2016) sees service delivery as an organised process of ensuring that client, consumers or customers' needs, expectations and satisfaction are fulfilled. Effective service delivery relies on the mode and manner members of staff handle the constitutionally assigned functions and responsibilities given to them (Ataire, 2022).

Service delivery in the government sector is the provision of services and benefits to citizens by government agencies and departments. This encompasses a broad spectrum of services, including healthcare, education, social services, public safety, infrastructure, and other related areas.

The objective of service delivery in the government sector is to fulfil the requirements and anticipations of citizens proficiently and productively, while simultaneously adhering to the values of transparency

and accountability. Efficient service provision in the government sector necessitates several essential elements, such as proficient and skilled personnel, unambiguous regulations and protocols, sufficient resources and infrastructure, and efficient interagency and interdepartmental communication and cooperation. In an institution like Akwa Ibom State University, improvement of service delivery through the use of technology has been the trend, so that the institution can meet global standards. This is applied to areas like payment of school fees and registration of students, computerized salary payment structure, staff database system as well as computerized accounting system of the institution.

2.5 Internet Services and Service Delivery

Chinwe (2010) evaluated the impact of internet resources and their perceived usefulness in teaching, learning, and research at Nigerian universities, focusing specifically on Obafemi Awolowo University (OAU) in Ile-Ife, Osun State. The study employed a descriptive survey methodology, utilizing questionnaires as the data collection instrument. The respondents consisted of 750 students and 115 academic staff members from OAU. The collected data was analyzed using descriptive statistics, specifically frequency counts and percentages. The findings indicated that the majority of academic staff and students found the Internet to be highly valuable. The most commonly utilized internet resources by both groups were email and the World Wide Web (WWW), with search interfaces being used for research purposes. However, it was discovered that the users lacked sufficient user education to fully utilize the available internet resources. The study emphasized the importance of implementing user education and information literacy programs, as well as providing staff training on information and communication technology resources in the library. The paper contributed to the recognition of the need for these efforts to enhance the effective use of Internet resources in Nigerian universities.

Ani (2010) examined internet access and usage among undergraduate students in three Nigerian universities. The study found that while the internet is widely used, access is primarily through private cybercafés rather than university facilities. Internet infrastructure and connectivity in university libraries and departments are poor. Additionally, there is a low level of utilization of electronic resources such as online databases and journals. The findings highlighted the need for better internet access, infrastructure, and user education in Nigerian university libraries to optimize the use of electronic information sources. Decision-makers should focus on improving internet facilities to support students' academic needs effectively.

Mishra (2009) studied the use of the Internet at the University of Maiduguri, Nigeria. The findings showed that 74.6% of the students use the Internet for research and academic purposes and concluded that necessary facilities should be put in place for faculty and students to make optimal use of information resources available on the Internet. Furthermore, Ani (2010) examined the extent and level of Internet access in Nigerian universities and found that undergraduate students extensively use the Internet. However, the majority of the respondents indicated that they relied on commercial internet services and cybercafés due to poor internet infrastructure in the university. The results showed that most of the students use the Internet for academic purposes.

2.6 Theoretical Framework

Technology Acceptance Theory

This study anchors on the technology acceptance theory propounded by Davis (1989). The technology acceptance theory is an information systems theory that models how users come to accept and use technology. The theory suggests that when users are presented with a new technology, several factors influence their decision about how and when they will use it. These factors are behavioural intentions, attitude and perceived usefulness of the system, perceived ease of use of the system, individual intention and facilitating or organisation condition. Yureva et al., (2020) explained that while the digital transformative power of innovation within the university is leading to positive change, the inability of teaching professionals to use these technologies properly limits the impact recorded.

This theory is suitable to this study because the ability of lecturers and students to accept and use electronic machine devices will ease their usefulness of Digital Information Resources (DIRs) and learning becomes easier for them as well as influences their academic activities in their daily lives. That is, efforts to search for information in traditional ways are reduced automatically with the use of technology. The researcher adopted this theory because of its relationship to the problem under investigation.

3. Methodology

The study adopted a survey research design to investigate the magnitude and direction or nature of the relationship existing between fourth industrial revolution technologies and service delivery in Akwa Ibom State University. A stratified random sampling was used on the identified strata as follows:

Lecturers and non-teaching staff of Akwa Ibom State University formed the sample of the study. It was believed that these categories of respondents in the university are well vested in the knowledge needed to ascertain the presence and extent of the relationship between the two (2) stated variables.

Table 1: Questionnaire Administration

Respondents	Questionnaires administration	Questionnaire retrieved	Percentage retrieved
Lecturers	161	108	96
Non teaching staff	173	166	96
Total	334	321	96

Model Specification

Pearson Product Moment Correlation coefficient was used to find the relationship between factors. The regression equation involves two types of variables, namely: the dependent variable, Y, and the independent variable(s), X or X's as the case may be. The variables of the model are: X and Y

Where Y represents the response (dependent) variable and X is the predictor (Independent) variable. The regression model given below was employed in the regression analysis.

X represents the fourth industrial revolution (FIR), measured by artificial intelligence (AI) and internet services technology (BCT).

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i,$$

Where, $Y_{i's}$ are the service delivery (SD), research output (ROP), verification of academic credentials (VAC) and timelines and efficiency of administrative (TEA) processes to be estimated;

$X_{i's}$ are the fourth industrial resolution (FIR)

β_0 is the intercept to be obtained (constant)

β_1 is the slope (coefficient of the variable X_i to be obtained)

ε_i represents the error term

Using the model;

$$RSD = \beta_0 + \beta_1 FIR + \varepsilon_i \quad - \quad (1)$$

$$ROP = \beta_0 + \beta_1 AI + \varepsilon_i \quad - \quad (2)$$

$$VAC = \beta_0 + \beta_1 BCT + \varepsilon_i \quad - \quad (3)$$

The formulated hypotheses were applied on the model for purpose of data analyses and results were obtained.

4. Results and Discussions

Hypothesis One:

There is no significant relationship between artificial intelligence and research output in Akwa Ibom State University.

Table 2: Pearson Product Moment Correlation analysis of relationship between artificial intelligence (AI) and research output in Akwa Ibom State University

Variables	N	Df	R	r ²	α	Sig	Result
Artificial	321						Significant
		319	0.873	0.76	0.05	0.000	(Reject H ₀)
Research output	321						

Source: SPSS Analysis, 2024

From the analysis in Table 2, the sample size (N) for both artificial intelligence and research output is 321. The relationship coefficient calculated is 0.87 and its square value is 0.76 as stated in the result in Table 2. These values showed that there is an indication that artificial intelligence has a relationship of 0.87 with research output. The r² value indicates that artificial intelligence has a relationship of about 76% with research output. The p-value (Sig) is 0.000 < 0.05 at 319 degrees of freedom. Hence, the Null hypothesis was rejected, indicating that there is a significant relationship between artificial intelligence and research output.

Hypothesis Two:

There is no significant relationship between internet services technology and administration of academic records of students in Akwa Ibom State University.

Table 3: Pearson Product Moment Correlation analysis of relationship between internet services technology (BT) and verification of academic credentials in Akwa Ibom State University

Variables	N	Df	R	r ²	α	Sig	Result
Internet services technology	321						Significant
		319	0.633	0.40	0.05	0.000	(Reject H ₀)
Verification of academic credentials	321						

Source: SPSS Analysis, 2024

From the analysis in Table 3, the sample size (N) for both internet services technology and verification of academic credentials is 321. The relationship coefficient calculated is 0.63 and its square value is 0.40 as stated in the result in Table 3. These values show that there is an indication that internet services technology significantly relates to e-administration at Akwa Ibom State University having an r-value of 0.633. The r² value indicates that internet services technology has a significant positive relationship of about 40% with the verification of academic credentials of students in Akwa Ibom State University. The

p-value (Sig) is $0.000 < 0.05$ at 319 degrees of freedom. Hence, the Null hypothesis was rejected, indicating that there is a significant relationship between internet services technology and the verification of academic credentials of students in Akwa Ibom State University.

Discussion and Findings

The findings of this study show the relationship existing between the independent and dependent variables.

Hypothesis 1 was used to find out the relationship between research output and artificial intelligence in Akwa Ibom State University. The obtained coefficient was 0.87 and its square value was 0.76 as stated in the result in Table 3. These values showed that there is an indication that artificial intelligence has a significant relationship (0.87) with research output. The r^2 value indicates that artificial intelligence significantly relates to research output. The p-value (Sig) is $0.000 < 0.05$ at 319 degrees of freedom. Hence, the Null hypothesis was rejected, indicating that there is a significant relationship between artificial intelligence and research output. This is in line with the study conducted by Ouyang & Jiao, (2021) who asserted that artificial intelligence in education creates new opportunities, potentials, and challenges in educational practices.

Hypothesis 2 tested the relationship between internet services and service delivery in Akwa Ibom State University. The relationship coefficient calculated was 0.63 and its square value was 0.40 as stated in the result in Table 3. These values showed that there is an indication that internet services have a relationship with service delivery in Akwa Ibom State University. The r^2 value indicates that internet services have a relationship with service delivery in Akwa Ibom State University. The p-value (Sig) is $0.000 < 0.05$ at 319 degrees of freedom. This conforms with the research conducted by Ani (2010) to examine internet access and usage among undergraduate students in three Nigerian universities. The study finds that while the internet is widely used, access is primarily through private cybercafés rather than university facilities. Internet infrastructure and connectivity in university libraries and departments are poor. Additionally, there is a low level of utilization of electronic resources such as online databases and journals. The findings highlight the need for better internet access, infrastructure, and user education in Nigerian university libraries to optimize the use of electronic information sources. Decision-makers should focus on improving internet facilities to support students' academic needs effectively.

Conclusion and Recommendations

This study examined the Fourth Industrial Revolution Technologies and Service Delivery in Nigerian Universities with particular reference to Akwa Ibom State University. This study argued that the introduction of Fourth Industrial Revolution technologies into Akwa Ibom State University has the potential to transform the system in the areas of research output, accurate and speedy verification of academic credentials of students and examination results.

The population of the study was 334 and the sample size was 321 representing 96%. The study employed technology adoption theory. Correlation analysis using the Pearson Moment correlation coefficient was used. Based on the findings of this study, it was concluded that artificial intelligence and internet services technology significantly relate to research output in terms of quality and administration of records, examinations and other activities of the University system.

Recommendations

Based on the findings of this study it was recommended that:

1. Management of Akwa Ibom State University should integrate artificial intelligence into the university system to boost its research output and capability.
2. The Management of Akwa Ibom State University should ensure that internet services are provided to enhance e-administration of examination results, online learning and teaching in Akwa Ibom State University.

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