Impact of artificial intelligence on organizational performance in Nigeria: a case study of Aqua-Rapha Table Water Investment Nigeria Ltd

Nwankwo Ernest Chukwuebuka[1], Obiora-Okafo Chinedu Afamefuna[1*] and Okechi Anthony Obiora[1]

[1] Department of Management, University of Nigeria, Enugu Campus, Nigeria

Correspondence Author: Obiora-Okafo Chinedu Afamefuna

Received 2 Dec 2024; Accepted 6 Jan 2025; Published 14 Jan 2025

Abstract

The study examined effect of artificial intelligence on organizational performance Aqua-Rapha Table Water Investment Nigeria Ltd Specifically, the study sought to: examine the effect of flexible automation system on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd and ascertain the effect of programme automation system on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd Research design was descriptive survey research. The study area was Enugu State. The sample size of 134 respondents was drawn from population of 202 employee of Aqua-Rapha Table Water Investment Nigeria Ltd The study used structured questionnaire to obtain data. Research questions of the study were answered using mean score and standard deviation. The hypotheses stated were tested using single regression statistics. The empirical result showed that flexible automation system has significant effect on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd (t-statistic =3.692; *p*-value (0.000) < Sig-value (0.05). Again, the finding study showed that programme automation system has significant effect on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd (t-statistic = 5.748; *p*-value (0.000) < Sig-value (0.05). The study recommended that the adoption of Artificial Intelligence must become part and parcels of not just Aqua-Rapha Table Water Investment Nigeria Ltd operations but all organizations that must enjoy smooth, reliable, effective, efficient and up-to-date operations in Nigeria.

Keywords: Artificial Intelligence Flexible Automation System and Programme Automation System

1.1 Background to the study

Artificial Intelligent systems encompass a broad range of artificial intelligence (AI) technologies that use human-like reasoning and intelligence to solve industrial problems. Artificial Intelligent has capabilities as “human-like” because they emulate a person’s ability to recognize patterns, follow rules or construct and use mental models of how things work in order to make decisions. However, because of the computer’s ability to process a large amount of information very quickly, intelligent systems can solve more complex problems than a human ever could (Beduschi, 2022) [7].

Automate or emigrate have become the practices of heavy industry during the 1990’s in order to compete with the inexpensive labour, rich resource base and low regulatory environments. To automate means to develop human/machine systems with specialized problem-solving capabilities. It also means to capture human, expertise and knowledge in a computer. Automation technologies have played an important role in increasing the competitiveness of heavy industry. Ifejesu, (2021) [12] held the view that in the 1960’s; on-line computer systems were introduced to centralize plant process control and information flow. In the 1970’s and 1980’s microprocessor technology brought distributed computing and cost-effective redundancy to computerized control systems. Microprocessor-based programmable logic controllers replaced most of the analog logic systems and allowed introduction of advanced modern control theory in industrial practices. As a result, in the 1990’s, computer-based control systems are common in the industry.

Industrial automation is a complex, dynamically evolving and utterly fascinating technology field. This guide covers the basics of industrial automation, including its main principles and concepts, technological solutions powering modern-day automation and their applications in the industrial environments. In the modern world, the industrial automation is omnipresent across virtually all fields and niches of the economy (Abdulhamid & Abubakar, 2020) [1]. Automation systems allow manufacturing, engineering, construction, power generation and other processes laying at the core of the economy to function with increasing efficiency and productivity. Industrial automation today is going through a new major developmental boom, which is fueled by innovative technologies such as artificial intelligence (AI), cloud computing, Big Data, Internet of Things (IoT) and others. This guide covers the basics of industrial automation, including its main principles and concepts, technological solutions powering modern-day automation and their applications in the industrial environments (Bayode, 2023). Automation can be achieved by a number of scientific techniques and approaches mainly mechanical, hydraulic, electrical and electronic, pneumatic, and computer that are typically used in combination. Most manufacturers were creating specialized machinery to improve productivity and precision of work beyond human capabilities for centuries prior to the industrial revolution. And modern-day industrial automation technologies, designed to operate without downtimes and with minimal human intervention for maximum efficiency. Abugu, Chukwu, Onyeso, Alumona, Adandom, Ogo-Amaechi and Awosoga, (2023) [2], opined that industrial automation received a powerful impetus to the development with the invention and rapid adoption of factory electrification early in the twentieth century. Electrification gave birth to a new generation of

automation solutions. Such as control and monitoring systems of various kinds, as well as new means of communication (long-distance telephony) and signal processing. This study dwells on considering flexible automation system and programme automation system as proxies of artificial intelligence. Therefore, this study investigates the effect of artificial intelligence on productivity in Aqua-Rapha Table Water Investment Nigeria Ltd Nigeria.

1.2 Statement of the problem

In Nigeria, almost all the works are done manually by humans, hence causing several economic dangers due to poor production and poor technology inclination. However, AI technology is efficient enough to reduce human efforts in various areas hence improving production and technology. In developed nations, in order to improve production in various activities in the economy, many of them are using artificial intelligence to create machine slaves that perform various activities on a regular basis. The use of artificial intelligence will assist humans to get the work done faster and with accurate results. Error free and efficient worlds are the main motives behind artificial intelligence. In the recent years, many nations have started using AI technology to reduce human efforts, and also to get efficient and faster results, but Nigeria is yet to give the required attention in AI.

Certain barriers have been identified as hindrance to the smooth adoption and operations of AI systems in developing countries like Nigeria and worst still third world countries, albeit with certain sectors in these countries having adopted as experimenters or passive adopters, but in Nigeria, sectors like the telecommunication sector, the banking sectors are pioneers and early adopters of AI systems having started operations in their operations. This is yet visible in other sectors in these countries. The underlisted barriers have been identified: human resistance owing to fear of loss of job or redundancy on the job; artificial intelligence compliant cognitive and mental skills needed to effectively operate AI systems, machines, computers and robotics; macro environment forces such as economic instability, political interference, corruption in high places, infrastructural deficiencies such as inadequate power supply to operate these systems, lack of government support; institutional deficiencies such as inadequate educational foundations, un-updated curriculum of learning to include AI learning tools; the problem of grappling with practicalities of developing or acquiring the requisite AI talents and addressing competing priorities for AI investments faced by managers and business owners.

Despite AI's potential benefits, its usage in Nigeria industries is relatively unknown. Limited research has been conducted on AI adoption, barriers to AI implementation, and factors influencing successful AI integration in Nigeria. This study investigates effect of artificial intelligence on productivity in Aqua-Rapha Table Water Investment Nigeria Ltd Nigeria.

1.3 Objectives of the study

The main objective of this study is to examine effect of Artificial Intelligence on organizational performance Aqua-Rapha Table Water Investment Nigeria Ltd The specific objectives of this study are to:

- Examine the effect of flexible automation system on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd.
- Ascertain the effect of programme automation system on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd.

1.4 Research questions

This study seeks to provide answers to the following research questions.

- What is the effect of flexible automation system on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd.?
- To what extent does programme automation system affect operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd.?

1.5 Statement of hypotheses

These null hypotheses are formulated as follows:

- Flexible automation system has no significant effect on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd.
- Programme automation system has no significant effect on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd.

1.6 Significance of the study

The study would be of an immense significance to the following groups, entrepreneurship, general public, organization, and researchers.

Young entrepreneurs: The study will be helpful for local entrepreneurship in the production of locally made goods with high price in the market and made profits in due season. It will also sensitize the entrepreneurship on how social capital can prove its superiority in the performance of their businesses. It is also expected that this study will be an eye openers for young, new school leavers and intrapreneurship who want to be self-reliance. Finally, this study is expected to provide reliable data for future research work.

Researchers: The study will benefit future researchers who will go deep in this research because it will provide them a huge of knowledge on which to carry on the related topic. Also, it will be of huge benefit to other researchers attempting to delve into effect of Artificial Intelligence on productivity in Aqua-Rapha Table Water Investment Nigeria Ltd in Nigeria as a whole.

2.1 Conceptual review

2.1.1 Artificial intelligence

Artificial Intelligence (AI) is the ability of a digital computer, computer-controlled machine or robot to perform tasks commonly associated with intelligent beings like humans (Abubakar, Momoh and Kabir, 2024). Artificial intelligence is

a computer program designed to acquire information in a way similar to the human brain.' According to the recently updated OECD definition, "an AI system is a machine-based system that for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments. Different AI systems vary in their levels of autonomy and adaptiveness after deployment." (OECD, 2023). Artificial intelligence AI is a system's ability to continuously learn from and solve new problems in an ever-changing environment, based on its continuing collection of data, to achieve specific goals" (Cao, 2021).

Artificial intelligence is referred to as a collection of technologies that combine data, algorithms and computing power that improve humanitarian supply chain resilience (Beduschi, 2022) [7]. According to the recently updated OECD definition, "an AI system is a machine-based system that for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments. Different AI systems vary in their levels of autonomy and adaptiveness after deployment." (OECD, 2023).

2.1.2 Organizational performance

Performance can be defined as the achieved desired results. It is the ability of an organization to fulfill its mission, vision and corporate objectives through sound management, strong governance and a relentless re-dedication to achieving results (Olaide, Samaila & Adegbola, 2023) [14]. Organizational performance is used to measure the effectiveness and efficiency of an organization, it involves the recurring activities to establish organizational goals, monitor progress towards these goals, and make adjustments to achieve these goals more effectively and efficiently (Aleru & Ejimole, 2023) [5]. In measuring performance of banks the parameters listed below as tools of Artificial Intelligence and its application will be discussed briefly by the researchers.

2.2 Contextual literature

2.2.1 Effect of flexible automation system on wastage reduction

Fixed automation, also known as hard automation refers to an automated production facility in which the sequence of processing operations is fixed by the equipment configuration. In effect, the programmed commands are contained in the machines in the form of cams, gears, wiring, and other hardware that is not easily changed over from one product style to another (Samir, 2024) [15]. This form of automation is characterized by high initial investment and high production rates. It is therefore suitable for products that are made in large volumes. Examples of fixed automation include machining transfer lines found in the automotive industry, automatic assembly machines, and certain chemical processes (Sonali & Rupali, 2020) [17].

A flexible manufacturing system (FMS) is a form of flexible automation in which several machine tools are linked together by a material-handling system, and all aspects of the system are controlled by a central computer. An FMS is distinguished from an automated production line by its ability to process more than one product style simultaneously. At any moment, each machine in the system may be processing a different part type. Flexible automation is an extension of programmable automation. The disadvantage with programmable automation is the time required to reprogram and change over the production equipment for each batch of new product. This is lost production time, which is expensive (Sonali & Rupali, 2020) [17]. In flexible automation, the variety of products is sufficiently limited so that the changeover of the equipment can be done very quickly and automatically. The reprogramming of the equipment in flexible automation is done off-line; that is, the programming is accomplished at a computer terminal without using the production equipment itself. Accordingly, there is no need to group identical products into batches; instead, a mixture of different products can be produced one right after another (Trevathan, 2019) [18].

2.2.2 Effect of programme automation system on operational safety

Programmable automation is the most common type of manufacturing system for batch production methods. This type of automation uses a computerized system and coding to change the desired outcome or product. Programmable systems can be helpful for companies that produce different variations of the same product. Still, it's important to consider the time it takes to change the internal workings of the automation (Aditi, Divya, Manjiri, Prashant & Murari, 2023). Organizations make a continuous effort to improve their quality succeed in the long term. Improving the quality of products, services and business processes is one of the primary ways a business increases sales and boosts profitability. In addition, knowing how to boost quality can help businesses generate more customer engagement, retain customers for longer and keep them satisfied.

Automation can reduce production costs in various ways, such as improving efficiency, quality, safety, and flexibility. Automation is the application of control engineering principles and techniques to design, operate, and monitor systems that can perform tasks without human intervention (Durairaj & Vetrivel, 2023) [8]. Automation can improve efficiency by reducing the time, energy, and resources needed to complete a task. For example, automation can speed up the production cycle, increase the output rate, reduce the waste and errors, and optimize the use of materials and equipment. Automation can also reduce the labor costs by replacing or augmenting human workers with machines that can work faster, longer, and more consistently. Automation can also enable the integration and coordination of different processes and systems, such as inventory, logistics, and quality control, to improve the overall productivity and performance (Naidoo, 2023).

Automation can improve quality by ensuring that the tasks are performed according to predefined standards and specifications, and by detecting and correcting any deviations or defects. For example, automation can enhance the accuracy,

precision, and consistency of the measurements, operations, and outputs, and reduce the variability and uncertainty caused by human factors, such as fatigue, skill, or judgment. Automation can also provide real-time data and feedback that can help monitor and improve the quality of the products and processes. Automation can improve safety by reducing the exposure and risk of human workers to hazardous or harmful conditions, such as high temperatures, pressures, voltages, chemicals, or noises. For example, automation can replace or assist human workers in performing dangerous, repetitive, or tedious tasks that can cause injuries, illnesses, or accidents. Automation can also prevent or mitigate the consequences of human errors, malfunctions, or failures that can compromise the safety of the workers, the machines, or the environment (Wale *et al*., 2024).

2.3 Theoretical literature

The study would rely on theoretical models to determine the impact of information technology on organization performance. The study will therefore rely on; Model of the organization (Leavitt, 1965) and the Technology Acceptance Model (Davis *et al*., 1989).

2.3.1 Technology Acceptance Model (TAM)

Emerging information technology cannot deliver improved organizational impactiveness if it is not accepted and used by potential users. Technology Acceptance Model (TAM) is one of the most successful measurements for computer usage impactively among practitioners and academics (Davis, 1989). TAM is consistent with (Rogers, 1983) theory on diffusion of innovation where technology adoption is a function of a variety of factors including; relative advantage and ease of use. Two particular beliefs are addressed through TAM; perceived usefulness and perceived ease of use. Perceived usefulness is defined as being the degree to which a person believes that the use of a system will improve his performance. Perceived ease of use refers to the degree to which a person believes that the use of a system will be effortless. TAM attempts not only for prediction but also for explanation to help researchers and practitioners identify why a particular system may be unacceptable and pursue appropriate steps

The struggle as identified by researchers was to overcome barriers to acceptance of new innovations (Okoye, Omankhanlen, Okoh, Ezeji & Achugamonu, 2019). These barriers may be in form of reluctance of employees to migrate from known and predictable to unknown and unpredictable platforms and these, more often than none determines the adoption or acceptance rate of new technological innovations (Lai, 2017). The theory of Technological Acceptance Model (TAM) has its root from the Theory of Reasoned Action (TRA) which was developed by Fishbein and Ajzen in 1975 which aims to explain the relationship between attitudes and behaviours in human actions. It states that a person's intention to perform a behaviour is the main predictor of whether or not they actually performed that behaviour. This theory is also used in communication discourse as a theory of understanding. The theory requires that behaviour be clearly defined in terms of the following:

- Action
- Target
- Context
- Time

According the Davis as cited in Okoye *et al*, (2019) the perceived usefulness of an innovation refers to the probability that the usage of a new application, appliance, programme will enhance performance, while the perceived ease of usage refers to the ability of the users (in this case bank operators) to engage the said application, appliance, and/or programme with minimal or no effort, which is aimed at adding value and thereby enhancing user satisfaction.

2.4 Empirical literature

2.4.1 Effect of flexible automation system on wastage reduction

Amenyo, Kwadwo, Sackey, Ocansey and Lartey, (2024) [6] investigated artificial intelligence usage in Industries in Ghana. Specifically, the study sought to explore the current state and potential impact of artificial intelligence (AI) implementation in the manufacturing industry of Accra, Ghana, and identify factors contributing to or hindering the successful implementation of AI in Ghanaian industries. The study employs a mixed-methods approach, combining structured questionnaires and personal interviews to gather data from a representative sample of participants. The questionnaires gather demographic information such as years of experience, company employment duration, type, and size, and the presence of other branches. The results indicate that only a small number of companies in the Industrial Area of Accra, Ghana, have adopted and are using AI for their operations. The findings will shed light on the current utilization of AI in the manufacturing industry of Accra, highlighting its benefits and limitations. The study recommended that potential ethical and social implications of AI implementation, emphasizing the need for equitable and responsible use of the technology.

Ezebunwa and Odungweru, (2024) [9] examined potential economic impact of Artificial Intelligence (AI) in Healthcare in Nigeria. The primary objective of this review is to understand the potential cost savings and efficiency improvements associated with the deployment of AI in healthcare settings. The data analytical technique was content analysis. By highlighting the economic impact of AI, this review seeks to offer insights into the value proposition of investing in AI technologies for stakeholders such as healthcare providers, payers, and policymakers. The study specifically focused on studies that discuss the impacts of AI in healthcare and include cost evaluations, using combinations of key-words related to AI, economics, healthcare, and cost evaluation. The findings showed that implementing AI in healthcare could potentially lead to cost savings. The study recommended that use of AI in healthcare sectors such as ophthalmology, radiology and disease screening will have a potential positive and significant economic impacts in Nigeria. While AI has potential for cost savings and efficiency improvements, in healthcare settings, it's crucial to conduct detailed context specific cost evaluations to optimize the adoption and implementation strategies of AI.

Wilbroad, Mutebi, Nagawa, Tukamuhabwa, Ssekajja, Kyomuhangi and Akashabaluhanga, (2024) [19] examined the mediating effect of Localized logistics capacity on the association between Artificial intelligence and Humanitarian supply chain resilience among Humanitarian organizations. A cross-sectional survey and descriptive study involving 88 humanitarian firms in Uganda whose staff involved in relief operations were purposively selected. Data was analyzed using the Partial least squares structural equation modeling to test hypotheses and ascertain the mediating effect. The study indicates a significant indirect effect of Artificial Intelligence (AI) on humanitarian supply chain resilience (HSCR) and a direct impact of Artificial Intelligence on Localized logistics capacity (LLC). The results also confirmed a full mediation effect of LLC on the association between AI and HSCR. The present study contributes deeper insights into how humanitarian organizations can develop adaptive capacities to navigate the complex landscape of humanitarian operations since it was established that logistics capacity is a conduit between artificial intelligence and humanitarian supply chain resilience. The study recommended that managers should adopt artificial intelligence and build strong relationships will local logistics suppliers to achieve humanitarian supply chain resilience practices.

2.4.2 Effect of programme automation system on operational safety

Laxmi and Leela, (2023) [13] examined impact of artificial intelligence on employee's performance. Specifically, the study sought to study the role of AI in IT industry and to study the impact of AI on employee performance. This study used a quantitative methodology and analyzed the data using a structural equation modeling (SEM) strategy enabled by the AMOS 22.0 software. It's important to point out that only 290 of the 305 participants really met the criteria for inclusion in the analysis. An employee of an IT services firm in the Bangalore area is the respondent in this study. The findings show that AI significantly improves employee performance. The study recommended that Nigerian firms should embark on full implementation of automated process mechanisms to enhance productivity and manufacturing companies should train their staff to function properly in their various work space.

Elegunde and Osagie, (2020) examined Artificial Intelligence and Employee Performance in the Nigerian Banking Industry, Lagos Nigeria as a study to generalize results. The objective of this study was to examine the complement ability of AI to work processes and to know if it eases employee operations in banks in Nigeria. Cross-sectional descriptive research design was adopted by the researcher. Primary data was to elicit information for this study. The population of the study was the entire employees of six (6) selected banks operating in Lagos State, Nigeria, which totaled 127 staff. The study adopted Taro Yamane (1967) sample size determinant to arrive at a sample size of 98 respondents. Descriptive statistics such as mean, simple percentage was used to analyze the demography of respondents while regression and Pearson correlation coefficients were used to analyze data. The findings revealed that Artificial Intelligence complements work process in banks in Nigeria and that machine-aided tasks ease operations in banks in Nigeria. The study recommended the adoption of AI by not only banks but all other firms in the service industry; the need for all employees and people to be educated on the importance of embracing AI; the upgrading of school curriculum at all levels in developing and third world economies to incorporate AI and its accompanying gadgets.

Aryatwijuka, Mutebi, Nagawa, Tukamuhabwa, Ssekajja, Kyomuhangi and Akashabaluhanga, (2024) [19] examined the mediating effect of Localized logistics capacity on the association between artificial intelligence and humanitarian supply chain resilience among Humanitarian organizations. A cross-sectional survey and descriptive study involving 88 humanitarian firms in Uganda whose staff involved in relief operations were purposively selected. Data was analyzed using the Partial least squares structural equation modeling to test hypotheses and ascertain the mediating effect. The study indicates a significant indirect effect of Artificial Intelligence (AI) on humanitarian supply chain resilience (HSCR) and a direct impact of Artificial Intelligence on Localized logistics capacity (LLC). The results also confirmed a full mediation effect of LLC on the association between AI and HSCR. The study recommended that managers should adopt artificial intelligence and build strong relationships will local logistics suppliers to achieve humanitarian supply chain resilience practices.

Akpan (2024) examined adoption of Artificial Intelligence (AI) methods in Nigerian manufacturing companies, using Nigerian Bottling Company (NBC), Port Harcourt as a case study. Specifically, the study sought to determine how the introduction of various Artificial Intelligence (AI) methods has impacted on the efficiency and effectiveness of service delivery by the company's personnel and on the company's customers relationship and customer's satisfaction. A simple sampling done to have a sample size of 100. Chi-square test was applied for data analysis in four hypothesis. Result showed among other things that the adoption of Artificial Intelligence (AI) methods in manufacturing has impacted positively on the staff, performance, in terms of improved efficiency and effectiveness of service delivery. Based on the finding, it was recommended that Government should lower the tariff, if possibly subsidized the cost of the exportation of computer-aided manufacturing (CAM) tools while, the automation of both the public and private owned firms should improve their productivity by adoption of various Artificial Intelligence (AI) methods.

2.5 Literature gaps

There exists research gap between this study and past researches. The research gap covers subject gap, gap on geographical location of the study and gap on methodology.

Subject gap: The subject matter of this work and some reviewed empirical studies has some differences. There are limited studies on effect of Artificial Intelligence on productivity in Aqua-Rapha Table Water Investment Nigeria Ltd The study is geared to bridge the time gap in literature.

Gap on geographical location of the study: This work covers manufacturing firm Lagos Nigeria and specifically Aqua-Rapha Table Water Investment Nigeria Ltd None of the past studies used the firms mentioned above and most of the past studies were done outside South East Nigeria.

Gap on methodology: The data analytical techniques used in this work in some ways differ from what was employed from past researches. The data analytical technique of the study was single regression method. The statistical technique was chosen because of its basic properties of best Linear, unbiased and efficient (BLUE) estimators. It is best for impact analysis.

3.1 Methodology

Research design was descriptive survey research. The study area was Enugu State. The sample size of 134 respondents was drawn from population of 202 employee of Aqua-Rapha Table Water Investment Nigeria Ltd. The choice for only staff of Aqua-Rapha Table Water Investment Nigeria Ltd was because of homogeneity nature of production function. This study adopted purposive sampling and random sampling technique. The study used structured questionnaire to obtain data. Research questions of the study were answered using mean score and standard deviation. The hypotheses stated were tested using single regression statistics.

4.1 Data presentation

Table 1: Summary of questionnaires distributed

Questionnaires distribution	Frequency	Percentage
Questionnaires distributed	134	100%
Returned Questionnaires	112	83%
Not Returned Questionnaires	22	17%
Gender		
Male	69	61.6%
Female	43	38.4%
Age bracket		
20-30 Years	39	32%
31-40 Years	51	45%
41 and above 50 Years	22	20%
Marital status		
Married	56	50.0%
Single	50	44.6%
Widow/widower	6	6.0%
Education qualifications		
FLSC/SSCE	41	37%
OND/NCE	9	8%
HND/B.Sc	62	55%
Length of service		
1-5yrs	8	7.1%
6-15yrs	77	68.8%
16-25yrs	27	24.1%

Sources: Field Survey, 2025

One hundred and thirty four (134) copies of questionnaires were designed and distributed to the respondents. Out of the 134 Questionnaires distributed, 112 (83%) were completed and returned while 22 (17%) were not returned. Therefore, 83 percent respondents were a good representation. The study showed the respondents profile in frequency and percentage distribution of gender, age bracket education qualification, length of service and marital status.

4.2 Data analysis

Question one: What is the effect of flexible automation system on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd.

Table 2: Mean rating of responses of respondents on what is the effect of flexible automation system on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd.

S/N	Questionnaire item	VHE(5)	HE(4)	M(3)	LE(2)	VLE(1)	Total	Mean	SD
1	Automated production processes have a longer duration, stability and solidity when managed with an automation system	285	144	448	2	2	479	4.276	0.082
		57	36	16	1	2	112		
		51%	32%	14%	0,.8%	2%	100%		
2	Automation reduces the fraction defect rate and automated operations are performed with greater conformity and uniformity.	245	112	54	30	2	443	3.955	0.065
		49	28	18	15	2	112		
		44%	25%	16%	13%	1%	100%		
3	Automation increases higher sales, better quality, improved productivity due to higher efficiencies and a better company image.	290	128	36	6	7	467	4.169	0.098
		58	32	12	3	7	112		
		52%	29%	11%	2%	6%	100%		
4.	Industrial automation provides solution to speed up all the processes, reduce assembly times and improve productivity.	285	116	51	16	1	1055	4.187	0.089
		57	29	17	8	1	112		
		51%	26%	15%	7%	0.8%	100%		
	Grand Mean							4.146	0.0835

***Source*:** Field Survey, 2025

This table shows that the respondents indicated their option on what is the effect of flexible automation system on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd The respondents are in agreement with all the items. The study showed that flexible automation system has significant effect on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd since automation reduces the fraction defect rate and automated operations are performed with greater conformity and uniformity (Grand mean (4.146) is greater than cut-off mean (3.00).

Objective Two: What is the effect of programme automation system on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd.

Table 3: Mean rating of responses of respondents on what is the effect of programme automation system on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd.

S/N	Questionnaire item	VHE(5)	HE(4)	M(3)	LE(2)	VLE(1)	Total	Mean	SD
1	Investing in automation can help to replace manual operations and thus, reduce increasing labor costs.	240	140	48	12	6	446	3.982	0.0936
		48	35	16	6	6	112		
		43%	32%	14%	5%	5%	100%		
2	Industrial automation helps to increasingly reduce production costs and makes companies more profitable.	220	160	36	16	8	440	3.928	0.0968
		44	40	12	8	8	112		
		40%	35%	11%	7%	7%	100%		
3	Automation eliminates of human error with much greater consistency that leads to better quality of the products	240	160	30	14	7	451	4.026	0.0969
		48	40	10	7	7	112		
		43%	36%	9%	6%	6%	100%		
4.	Industrial automation minimizes of human errors that leads to accidents and injuries and prevent long-term health effects of working in industrial environments.	205	188	30	12	8	443	3.955	0.0902
		41	47	10	6	8	112		
		46%	42%	9%	5%	7%	100%		
	Grand Mean							3.972	0.0943

***Source*:** Field Survey, 2025

This table shows that the respondents indicated their option on examine effect of programme automation system on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd The respondents are in agreement with all the items. The study showed that programme automation system has significant effect on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd since industrial automation minimizes of human errors that leads to accidents and injuries and prevent long-term health effects of working in industrial environments (Grand mean (3.972) is greater than cut-off mean (3.00).

4.3 Test of hypotheses

The hypotheses postulated in chapter one was tested using t-statistics.

4.3.1 Test of hypothesis one

H_1 Flexible automation system has no significant effect on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd.

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.932[a]	.810	.602	.090799

a. Predictors: (Constant), Flexible automation system

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	19.559	1	19.559	13.628	.000[b]
	Residual	157.870	111	1.435		
	Total	177.429	112			

a. Dependent variable: wastage reduction
b. Predictors: (constant), flexible automation system

Coefficients[a]

Model		Unstandardized coefficients		Standardized coefficients	T	Sig.
		B	Std. error	Beta		
1	(Constant)	4.172	.355		11.740	.000
	Flexible automation system	.317	.086	.332	3.692	.000

a. Dependent variable: wastage reduction

In testing this hypothesis, flexible automation system was regressed against was wastage reduction. The result of the single-regression analysis summarized in table 4.4.1 shows the model to examine the effect of flexible automation system on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd.

Wastage reduction = 4.172 + 0.317 flexible authomation system

The empirical result shows that the coefficient of flexible automation system has positive effect on wastage reduction; it means that flexible automation system has positive and direct influence on wastage reduction. The results of the t – statistics denotes that the coefficient of flexible automation system was statistically significance. This is because observed values of t – statistics (3.692) is than its critical values (0.000). The results of the F – statistical test shows that the overall regression of the hypothesis one was statistically significance. This is because observed value of the F – statistics (13.628) was great than its critical value (0.000). Again, our empirical result shows that the Pearson product moment correlation analysis (r) was 0.932. The strength of relationship between the two variables was high. However, we accepted the alternative hypothesis and conclude that flexible automation system has significant effect on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd (t-statistic =3.692; *p*-value (0.000) < Sig-value (0.05).

4.4.2 Test of hypothesis two

H_2 Programme automation system has no significant effect on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd.

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.881[a]	.731	.524	.091373

a. Predictors: (Constant), Programme automation system

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	40.986	1	40.986	33.043	.000[b]
	Residual	136.443	111	1.240		
	Total	177.429	112			

a. Dependent variable: operational safety
b. Predictors: (constant), programme automation system

Coefficients[a]

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.451	.451		12.079	.000
	Programme automation system	.583	.101	.481	5.748	.000

a. Dependent variable: operational safety

In testing this hypothesis, programme automation system was regressed against operational safety. The result of the single-regression analysis summarized in table 4.4.2 shows the model to ascertain the effect of programme automation system on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd

Operational safety = 5.451 + 0.583 programme automation system

The empirical result shows that the coefficient of programme automation system has positive effect on operational safety; it means that programme automation system has positive and direct influence on operational safety. The results of the t – statistics denotes that the coefficient of programme automation system was statistically significance. This is because observed values of t – statistics (5.748) was than its critical values (0.000). The results of the F – statistical test show that the overall regression of the hypothesis two was statistically significance. This is because observed value of the F – statistics (33.043) was great than its critical value (0.000). Again, our empirical result shows that the Pearson product moment correlation analysis (r) was 0.881. The strength of relationship between the two variables was very high. However, we accepted the alternative hypothesis and conclude that programme automation system has significant effect on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd (t-statistic = 5.748; *p*-value (0.000) < Sig-value (0.05).

4.5 Discussion of findings

In this study, findings were discussed in line with stated study objectives.

4.5.1 Effect of flexible automation system on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd.

The findings of the study revealed that goals setting strategy has significant effect on organizational productivity in Innoson

technical and industrial company Ltd since goal setting gives focus for organizational direction of action and helps organizations to manage time (t-statistic =3.692; *p*-value (0.000) < Sig-value (0.05). The result agreed with the work of Amenyo, Kwadwo, Sackey, Ocansey and Lartey, (2024) [6] that investigated artificial intelligence usage in Industries in Ghana. Specifically, the study sought to explore the current state and potential impact of artificial intelligence (AI) implementation in the manufacturing industry of Accra, Ghana, and identify factors contributing to or hindering the successful implementation of AI in Ghanaian industries. The study employs a mixed-methods approach, combining structured questionnaires and personal interviews to gather data from a representative sample of participants. The findings will shed light on the current utilization of AI in the manufacturing industry of Accra, highlighting its benefits and limitations.

This finding is in full support of the study of Ezebunwa and Odungweru, (2024) [9] that examined potential economic impact of Artificial Intelligence (AI) in Healthcare in Nigeria. The primary objective of this review is to understand the potential cost savings and efficiency improvements associated with the deployment of AI in healthcare settings. The data analytical technique was content analysis. The findings showed that implementing AI in healthcare could potentially lead to cost savings. The study recommended that use of AI in healthcare sectors such as ophthalmology, radiology and disease screening will have a potential positive and significant economic impacts in Nigeria.

4.5.2 Effect of programme automation system on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd

The findings of the study revealed that flexible automation system has significant effect on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd since automation reduces the fraction defect rate and automated operations are performed with greater conformity and uniformity (t-statistic =3.692; *p*-value (0.000) < Sig-value (0.05). The study agrees with conclusion of Laxmi and Leela, (2023) [13] that examined impact of artificial intelligence on employee's performance. Specifically, the study sought to study the role of AI in IT industry and to study the impact of AI on employee performance. This study used a quantitative methodology and analyzed the data using a structural equation modeling (SEM) strategy enabled by the AMOS 22.0 software. It's important to point out that only 290 of the 305 participants really met the criteria for inclusion in the analysis. An employee of an IT services firm in the Bangalore area is the respondent in this study. The findings show that AI significantly improves employee performance.

5.1 Summary of findings

This study has the following findings:

- The study showed that flexible automation system has significant effect on wastage reduction in Aqua-Rapha Table Water Investment Nigeria Ltd since automation reduces the fraction defect rate and automated operations are performed with greater conformity and uniformity (t-statistic =3.692; *p*-value (0.000) < Sig-value (0.05).
- The study showed that programme automation system has significant effect on operational safety in Aqua-Rapha Table Water Investment Nigeria Ltd since industrial automation minimizes of human errors that leads to accidents and injuries and prevent long-term health effects of working in industrial environments (t-statistic = 5.748; *p*-value (0.000) < Sig-value (0.05).

5.2 Conclusion

The study concluded that Artificial Intelligence has significant positive effect on organizational performance in Aqua-Rapha Table Water Investment Nigeria Ltd Automated production processes have a longer duration, stability and solidity when managed with an automation system. Automation reduces the fraction defect rate and automated operations are performed with greater conformity and uniformity. Automation increases higher sales, better quality, improved productivity due to higher efficiencies and a better company image. Industrial automation provides solution to speed up all the processes, reduce assembly times and improve productivity. Investing in automation can help to replace manual operations and thus, reduce increasing labor costs. Industrial automation helps to increasingly reduce production costs and makes companies more profitable. Automation eliminates of human error with much greater consistency that leads to better quality of the products. Industrial automation minimizes of human errors that leads to accidents and injuries and prevent long-term health effects of working in industrial environments.

5.3 Recommendations

Based on the findings of this study, the following recommendations were made.

- The adoption of Artificial Intelligence must become part and parcels of not just Aqua-Rapha Table Water Investment Nigeria Ltd operations but all organizations that must enjoy smooth, reliable, effective, efficient and up-to-date operations in Nigeria.
- Management of Aqua-Rapha Table Water Investment Nigeria Ltd should prioritize strategic training programs. These programs should be designed to equip managers and staff with the necessary skills and knowledge to effectively utilize AI tools in their administrative roles.

References

1. Abdulhamid A, Abubakar AR. An overview of the role of artificial intelligence on the performance of Small and Medium-Scale Enterprises in Nigeria. Austin J Bus Adm Manag. 2020;37(4):23-34.
2. Abugu JO, Chukwu AM, Onyeso OK, Alumona CJ, Adandom II, Ogo-Amaechi DC, *et al*. Determinants of the managerial staff's disposition towards e-payment platforms in public tertiary hospitals in Enugu, Nigeria: a cross-sectional study. BMC Health Serv Res. 2023;23:1240.

3. Adeolu-Akande MA, Oyedokun DM, Oyedokun GE. Evaluating the influence of Electronic Governance on Public Services Delivery in Nigeria. J Public Adm Soc Welf Res. 2023;8(1):1-16.
4. Akpan AG. Adoption of artificial intelligence methods in Nigerian manufacturing companies (a case study of Nigerian Bottling Company, Port Harcourt). J Bus Adm Manag. 2024;37(4):23-34.
5. Aleru EG, Ejimole GA. Impact of Artificial Intelligence on Job Performance of Higher Education Managers in state-owned universities in South-south. Am Res J Contemp Issues. 2023;1(3):23-32.
6. Amenyo DL, Kwadwo OA, Sackey P, Ocansey J, Lartey S. Investigating Artificial Intelligence Usage in Industries in Ghana: Case Study of Industries in Industrial Area, Accra-Ghana. Int J Multidiscip Res. 2024;6(3):23-34.
7. Beduschi A. Harnessing the potential of artificial intelligence for humanitarian action: Opportunities and risks. Int Rev Red Cross. 2022;104(919):1149–69.
8. Durairaj S, Vetrivel V. Effect of AI (Artificial Intelligence) in Employee Performance Evaluation on Employee Retention in the Information Technology Sector. Int J Multidiscip Res. 2023;6(3):23-34.
9. Ezebunwa JN, Ozuzu CS. The Impact of Artificial Intelligence (AI) on the Future of Work and the Gig Economy in Nigeria. World J Innov Mod Technol. 2024;8(1):12-17.
10. Gavrila S, González-Tejero BC, Gómez GJA. The impact of automation and optimization on customer experience: a consumer perspective. Humanit Soc Sci Commun. 2022;10:877.
11. Guma TN. An overview of Industrial Automation and its implementation approaches for boosting Nigerian and other developing economies. FUW Trends Sci Technol J. 2021;6(1):154–60.
12. Ifejesu O. Artificial Intelligence for Economic Development in Nigeria. OECD Artif Intell Pap. 2021;45(12):12-23.
13. Laxmi M, Leela MH. A Study on Impact of Artificial Intelligence on Employee's Performance. Eur Econ Lett. 2023;13(4):23-32.
14. Olaide KT, Samaila M, Adegbola EA. The impact of artificial intelligence and blockchain on entrepreneurship performance and success in Nigeria (Study of Kassy Block chain and Technology Agency). AKSU J Manag Sci. 2023;8(1):9-22.
15. Samir. The impact of automation on efficiency and productivity in manufacturing [Internet], 2024. [cited 2025 Apr 11]. Available from: https://timetracko.com/blog/the-impact-of-automation-on-efficiency-and-productivity-in-manufacturing/
16. Sanjeev G, Manish J, Abdul RQ. Artificial intelligence and intelligent computing techniques for healthcare decision support. Am Res J Contemp Issues. 2023;1(3):23-32.
17. Sonali J, Rupali G. A study of impact of automation on industry and employees. Alochana Chakra J. 2020;6(5):1-11.
18. Trevathan VL. A guide to the automation body of knowledge. 2nd ed. Research Triangle Park, NC: ISA, 2019, p5-80.
19. Wilbroad A, Mutebi H, Nagawa P, Tukamuhabwa B, Ssekajja M, Kyomuhangi D, *et al*. Artificial Intelligence and Humanitarian Supply Chain Resilience: Mediating Effect of Localized Logistics Capacity. Eur J Technol. 2024;8(5):1–20.
20. Yelwa MM, Abdulhameed S, Muhamm AM. Artificial Intelligence and the Future of Work in Nigeria: A shift from educational requirements to skills possession. Soc Sci Res Nnamdi Azikiwe Univ, 2023.